TAXONOMIC REVISION OF THE TRIBE *TRITICEAE* DUMORTIER (POACEAE) IN TURKEY

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ABSTRACT

TAXONOMIC REVISION OF THE TRIBE *TRITICEAE* DUMORTIER (POACEAE) IN TURKEY

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The Triticeae is one of the most important tribes of the family Poaceae. It contains wheat (*Triticum* L.), barley (*Hordeum* L.) and rye (*Secale* L.) which are economically the most important cereals. Although the tribe has been the focus of several systematic studies there has not been a universally accepted taxonomic treatment for the tribe.

This research study aiming to revise the tribe Triticeae Dumort. (Poaceae) in Turkey has been carried out by means of collecting specimens from all the localities in Turkey as well as examining the material collected over the years by the other researchers either from Turkey or abroad for a 4 year period starting from June 1th, 2006. All the specimens belonging the tribe were analysed by means of using standart taxonomic methods.

This thesis is divided into four main chapters. In the first and second chapters, an introduction and general information about the tribe Triticeae and the material and methods used in the study are given. In the introduction part different taxonomic treatments on the tribe are explained briefly and the recent studies on the genera included in the tribe such as taxonomical, morphological and cytological are explained breifly.

In the third chapter of the thesis, the significance of the morphological, micromorphological and ecological data which were used as diagnostic features in the taxonomy of the tribe are explained. Especially, SEM surveys of the glumes and lemma parts found to have great taxonomic values for the systematics of tribe. Distribution and habitat preferences of the tribe are discussed and IUCN threat categories of the taxa are reevaluated along with the types of threats so as to guarantee their sustainability of the rare taxa in Turkey.

The fourth chapter covers the revision of the Tribe Triticeae in Turkey. A key for the genera is given. Synonymy, updated descriptions, flowering time, habitat, type citation, general distribution in Turkey, phytogeographical elements, specimen citations on a grid basis and general distribution outside Turkey, are given for each species. Along with general descriptions, keys to species and infraspecific categories are where necessary.

In Tribe Triticeae*,* 18 genera, 79 species, 27 subspecies and 37 varieties have been recognized including **1** new species (***Psathyrostachys narmanica*** Cabi & Doğan sp. nov.), **3** new subspecies (***Psathyrostachys fragilis*** (Boiss.) Nevski **subsp.** ***artvinense*** Cabi & Doğan subsp. nov.; ***P. daghestanica*** (Alex.) Nevski **subsp** ***erzurumica*** Cabi&Dogan subsp. nov.; ***Aegilops triuncialis*** L. **subsp** ***bozdagensis*** Cabi&Dogan subsp nov**.)** and **4 new** varieties (***Agropyron cristatum*** (L.) subsp. ***pectinatum*** (Bieb.) Tzvelev var. ***mucranatum*** var. nov.; ***Eremopyrum bonaepartis*** (Sprengel) Nevski. **var.** ***aristatum*** Cabi & Doğan**;** ***Thinopyrum pycnanthum*** (Godr.) Barkworth **var.** ***aristatum*** Cabi & Dogan var. nov.; ***Hordeum spontaneum*** C. Koch **var.** ***anatolicum*** Cabi & Dogan var. nov. In addition to the taxa new for science, ***Aegilops juvenalis*** (Thell.) Eig. and ***Hordeum spontaneum*** **var.** ***proskowetzii*** Nábělek are recorded for the first time for the Flora of Turkey.

Key Words: Poaceae, Tribe Triticeae, Revision, Turkey.

ÖZ

TRITICEAE DUMORTIER (POACEAE) OYMAĞININ TÜRKİYE'DEKİ REVİZYONU

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Triticeae (Poaceae) oymağı Poaceae familyası içerisinde en önemli oymaklardan birisidir. Bu oymak bünyesinde ekonomik açıdan çok önemli olan buğday (*Triticum* L.), arpa (*Hordeum* L.) ve çavdar (*Secale* L.) tahıllarını içermektedir. Bu oymak birçok sistematik çalışmanın odağı olmasına karşın, bu oymak için henüz herkes tarafından kabul gören bir taksonomik yaklaşım bulunmamaktadır.

Türkiye'de bulunan Triticeae Dumort. Oymağının revizyonuna yönelik bu araştırma, 1 Haziran 2006 tarihinden başlayarak 4 yıl süreyle Türkiye'nin tüm yörelerinden toplanan örneklere ilave olarak gerek yerli ve gerekse yabancı araştırmacılar tarafından toplanmış materyale dayalı olarak gerçekleştirilmiştir. Oymak bünyesindeki bütün örnekler standat taksonomik yöntemler kullanılarak analiz edilmiştir.

Tez esas itibarı ile dört bölümden oluşmaktadır. Birinci ve ikinci bölümlerde, giriş ve Triticeae oymağı ile ilgili genel bilgiler ve çalışmada kullanılan materyal ve yöntemler verilmiştir. Giriş kısmında oymak bünyesindeki farklı taksonomik değerlendirmeler kısaca açıklanmış ve oymak içinde bulunan cinslerle ilgili son zamanlarda gerçekleştirilmiş olan taksonomik, morfolojik ve sitolojik çalışmalar kısaca açıklanmıştır.

Tezin üçüncü bölümünde ise proje esnasında elde edilen oymak taksonomisinde teşhis edici özellikler olarak kullanılan morfolojik, mikromorfolojik ve ekolojik verilerin önemleri

açıklanmıştır. Özellikle gluma ve lemmalar üzerinde yapılan SEM analizleri oymak sistematiğinde önemli taksonomik değerler taşımaktadırlar. Yine bu bölümde oymak bünyesinde bulunan taksonların dağılım ve habitat tercihleri tartışılmış ve "IUCN" tehlike kategorileri, nadir türlerin ülkemizde devamlılığını temin amacıyla, yeniden değerlendirilmiştir.

Tezin dördüncü kısmı Triticeae oymağının revizyonunu içermektedir. Bu kısımda Türkiye için tanınan cinslere ait bir cins anahtarı verilmiş. Her tür için, sinonimleri, güncellenmiş tanımı, çiçeklenme zamanı, tip örnekleri, Türkiye'deki genel dağılımı, fitocoğrafik elementi, grid tabanlı örnek lokasyonları ve Türkiye dışındaki dağılımı verilmiştir. Bununla birlikte cins içi sınıflandırmayı gösteren tür anahtaları ve eğer varsa tür içi taksonlar içinde anahtarlar verilmiştir.

Bu oymak bünyesinde, 18 cins, 79 tür, 27 alttür ve 37 varyete belirlenmiş ve bunların arasında **1 yeni tür** (***Psathyrostachys narmanica*** Cabi & Doğan sp. nov.), **3 yeni alt tür** (***Psathyrostachys fragilis*** (Boiss.) Nevski **subsp. *artvinense*** Cabi & Doğan subsp. nov.; ***P. daghestanica*** (Alex.) Nevski **subsp *erzurumica*** Cabi&Dogan subsp. nov.; ***Aegilops triuncialis*** L. **subsp *bozdagensis*** Cabi&Dogan subsp nov**.) ve 4 yeni varyete** (***Agropyron cristatum*** (L.) subsp. ***pectinatum*** (Bieb.) Tzvelev var. ***mucranatum*** var. nov.; ***Eremopyrum bonaepartis*** (Sprengel) Nevski. **var. *aristatum*** Cabi & Doğan**; *Thinopyrum pycnanthum*** (Godr.) Barkworth **var. *aristatum*** Cabi & Dogan var. nov.; ***Hordeum spontaneum*** C. Koch **var. *anatolicum*** Cabi & Dogan var. nov. ilk kez tanımlanmıştır. Bilim dünyası için yeni olan taksonlara ek olarak, ***Aegilops juvenalis*** (Thell.) Eig. ve ***Hordeum spontaneum* var. *proskowetzii*** Nábělek taksonları Türkiye Florası için ilk kez kayıt edilmiştir.

Anahtar Kelimeler: Poaceae, Triticeae oymağı, Revizyon, Türkiye.

To my wife and daughter

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LIST OF ABBREVIATIONS

µ ..... micron
µm ..... micrometer
c. ..... ca. circa (about)
C ..... central
cm ..... centimeter
D ..... P. H. Davis
DNA ..... Deoxrybonucleic acid
E ..... East
km ..... kilometers
m ..... meter
mm ..... milimeter
N ..... North
S ..... South
SEM ..... Scanning Electron Microscope
sp ..... Species
Subsp ..... subspecies
Syn ..... Synonym
var ..... Varyete
W ..... West

CHAPTER 1

1. INTRODUCTION

1.1. The Poaceae family

The family Poaceae or Gramineae is one of the most important plant family of the flowering plants. Poaceae comprises over 10,000 species representing 600 to 700 genera (Watson and Dallwitz 1992; Kellogg 2001). In terms of the number of species and genera included in the family, it comes after Compositae, Leguminosae, Orchidaceae and Rubidaceae (Clayton & Renvoize 1986). In Turkey, the family consists of 494 species included in 134 genera. (Davis 1985; Davis et al. 1988; Güner et al., 2000).

The members of this family are commonly named as grasses. Grasses are of immense importance for human, because they comprise a large proportion of the food needed for the survival of humans. The family is economically important for agriculture and includes many crops, such as wheat, corn and rice. In Turkey it includes staple food plants in the following genera: *Zea* L., *Oryza* L., *Avena* L., *Triticum* L., *Hordeum* L., *Secale* L., *Sorghum* Moench, and *Saccharum* L.. It also provides most valuable forage for domestic animals. According to Harlan & Zohary (1966) some of these cereals were cultivated as early as 7000 B.C. by early settlers in the S.E. and C. Anatolia. The members of this family constitute the most important component of grassland biomes, covering roughly 20% of the Earth's surface (Kellogg 2001).

The family consists of important advantageous features: the members of the grasses can adapt easily to changeable environments; have an ability to coexist with grazing herbivores and with man; posses distinctive life form (Clayton & Renvoize 1986).

1.2. The tribe Triticeae Dumort.

The Triticeae is one of the most important tribes of the family. It contains wheat (*Triticum* L.), barley (*Hordeum* L.) and rye (*Secale* L.) which are economically the most important cereals. Wild relatives of these cereal species form a rich gene pool for breeding activities. The tribe also includes man made crops such as × *Triticosecale* (Triticale), and *Tritordeum* (an amphiploid of *Triticum aestivum* × *Hordeum chilense*).

After the recognition of the tribe for the first time by Dumortier in 1823, lots of changes has been accomplished on the basis of its taxonomy. Barkworth (1992) gave a detailed historical account of its taxonomy. There is a widespread hybridization and polyploidy within the tribe Triticeae. There are still lots of disaggrements on its taxonomy and phylogeny. Connor (1994) also indicated that a genarally acceptable taxonomy of the Triticeae remained unsolved despite various efforts.

Genetic diversity is the prerequisite in breeding efforts for crop improvement. The genetic base of wheat cultivars in world production is narrowing. When this genetic variation is exhausted, the breeders must look for variations in alien species. It has become necessary to collect, evaluate, and utilize wild germplasm for wheat breeding. Turkey is one of the major distribution areas of the tribe Triticeae. In the Flora of Turkey (Davis 1985) and its' supplements (Davis et al 1988; Güner et al 2000) , the tribe was represented with 74 species included in 16 genera (Table 1). Among these genera ***Elymus* L.** was the largest genus containing **19** species. On the basis of species number ***Aegilops* L. (15)** and ***Triticum* L. (11)** constitute the second and third largest genera in the tribe. Since the publication of the flora and its supplements, one more species, *Elymus hoffmanni,* has been described from Turkey (Jensen and Asay 1996).

Table 1. The genera of Tribe Triticeae naturally distributed in Turkey

	Genus	Species numberı
1	*Agropyron* Gaertner	1+(1)
2	*Elymus* L.	19+**(1)***
3	*Eremopyrum* (Ledeb.) Jaub. &Spach	4
4	*Heterantelium* Hochst. Hochst	1
5	*Crithopsis* Jaub. & Spach	1
6	*Amblyopyrum* (Jaub. & Spach) Eig.	1
7	*Aegilops* L.	15
8	*Triticum* L.	10+(1)
9	*Dasypyrum* (Coss. & Durieu) T. Durand	1
10	*Secale* L.	5
11	*Leymus* Hochst.	2
12	*Psathyrostachys*	1
13	*Hordeum* L.	8
14	*Hordelymus* (Jess.) Harz	1
15	*Taeniatherum* Nevski	1
16	*Henrardia* C. E. Hubbard	1
16	Totally	**74+1**

The number of species mentioned in the table given according to Flora of Turkey (Davis 1985; Vol 9) and its supplements Davis et al. (1988; Vol 10) and Güner et al. 2000 (Vol 11). *Since the publication of the flora and its supplements, one more species, *Elymus hoffmanni,* has been described from Turkey (Jensen and Asay 1996).

1.3. Taxonomic treatments in Tribe Triticeae

As tribe Triticeae Dumort. consists of many natural and artificial intergeneric hybrids the generic concepts of this tribe show taxonomic complexity. (Stebbins 1956; Dewey 1982; Barkworth & Dewey 1985; Kellogg 1989). It has been suggested by different authors that the tribe consists of a single genus (Stebbins 1956) or up to 39 genera (Löve 1984).

Different criteria has been used by different workers for generic delimitations most of them were based primarily on morphological and phytogeographic studies. Table 2 presents only a few different treatments starting from Linnaeus (1753) *Species Plantarum.* Over the last decades genome analysis has played an increasing role in investigating the relationships in the tribe. Recently a radical solution has been proposed which is based on genome relationships (Löve 1984; Dewey 1984). According to this concept in which species with the same genome are united into a single genus and similarly species with the same combination of genomes are united

The formal genetic history of the tribe started with the Linnaeus' (1753) *Species Plantarum* in which, he recognized 5 genera (three cereal genera *Secale, Triticum, Hordeum* and two others, *Aegilops* and *Elymus*) now be included in the tribe. On the basis of his artificial classification, the genus *Elymus* included members of both *Leymus* Hochst. and *Taeniatherum* Nevski*;* the genus *Secale,* members of both *Dasypyrum* (Coss & Durieu) T. Durand and *Eremopyrum* (Ledeb.) Jaub & Spach; the genus *Triticum*, members of *Elytrigia* and *Elymus* characterized with one spikelet at each node; the genus *Aegilops*, a member of another tribe *Parapholis incurva* (L.) C. E. Hubbard. He also placed *Agropyron cristatum* under the genus *Bromus*.

The second significant revision of the tribe was accomplished by Bentham (1882). In his treatment he included the genera such as *Lepturus* R. Br., *Nardus* L. and *Lolium* L. (now excluded from the tribe). In 1887, Hackel published a treatment of the tribe which was nearly identical to Bentham's differing only in recognition of *Heteranthelium* Hochst. and *Haynaldia* as distinct genera.

Nevski (1934) was the first to adopt an explicitly phylogenetic approach to the taxonomy of the Triticeae as a part of Flora of USSR project. He took into account not only

morphological data and phytogeography, but also the cytological information gathered by the cytologists. He divided the whole tribe to three large groups of genera on the basis of evolutionary trends including a change from grouped spikelets to solitary spikelets, from tough rachises to disarticulating rachises and from adaptation to mesic conditions to adaptation to arid conditions. Nevski added new genera (*Aneurolepidium*, *Malacurus*, *Psathyrostachys* and *Taeniatherum*) to tribe. *Psathyrostachys* and *Taeniatherum* have been commonly accepted but the Although Pilger (1954) recognized *Malacurus* as a distinct genus and Baum (1979) recognized *Aneurolepidium,* these two genera are generally evaluated under the genus *Leymus*.

Tzvelev (1976) treatment of the tribe was similar to Nevski's one. Tzvelev treated the genus *Leymus* including the genera *Aneurolepidium* and *Malacurus* contrary to Nevski. Melderis (1978) indicated that much of the difficulties in the delimitation of some genera found under *Elymus* sensu lato arose from lack of clear-cut morphological generic characters between them. The treatment of Melderis (1980) in *Flora Europeae* differ from the Tzvelev (1976) expanding the genus *Elymus* including the *Elytrigia*.

Among the various views on generic delimitation in *Triticeae,* the treatments by Stebbins (1956) and Löve (1984) represent opposite extremes. Stebbins argued for the lumping of all species into a single genus, and Löve split the *Triticeae* into 37 genera.

Löve (1984) implemented his recommendation in his 'Conspectus of the Triticeae' which he described as providing "a taxonomical and nomenclatural survey of the more than 500 biological taxa of the tribe of grasses in a system of 37 genomically defined genera based on twenty three single-haplome taxa as recently validated elsewhere." Löve (1984) established 13 new genera, five of which were "status novus" based on genomic constitution. Because some of the species in Löve's list had not been cytogenetically studied, he placed them in genera based on their morphological characteristics. Löve divided the *Aegilops-Triticum* complex into 16 genera. However, most taxonomists continue to recognize the genera, *Aegilops* and *Triticum*.

Baum et al. (1987) made an assessment of these genomic based treatments and recommended that for the assessment of taxonomic circumscriptions and for the inference of relationships among circumscribed taxa all available tools should be used without attributing supremacy to genome.

Table 2. Genera included in tribe Triticeae by various morphological taxonomists.

Bentham (1882)	Hackel (1887)	Nevski (1934)	Pilger (1954)	Keng (1965)	Tzvelev (1976)	Melderis et al (1980)
Agropyrum	***Agropyrum***	***Aegilops***	***Aegilops***	***Aegilops***	***Aegilops***	***Aegilops***
Asperalla	***Asperalla***	***Agropyron***	***Agropyron***	***Agropyron***	***Agropyron***	***Agropyron***
Elymus	***Elymus***	***Aneurolepidium***	***Amblyopyrum***	***Aneurolepidium***	***Amblyopyrum***	***Crithopsis***
Hordeum	***Haynaldia***	***Anthoscahne***	***Crithopsis***	***Asperalla***	***Dasypyrum***	***Dasypyrum***
Kralikia	***Heteranthelium***	***Asperalla***	***Dasypyrum***	***Clinelymus***	***Elymus***	***Elymus***
Lepturus	***Hordeum***	*Brachypodium*	***Elymus***	***Elymus***	***Elytrigis***	***Eremopyrum***
Lolium	*Jouvea*	*Clinelymus*	***Eremopyrum***	***Elytrigia***	***Eremopyrum***	***Festucopsis***
Oropetium	*Kerinozoma*	*Crithopsis*	***Heteranthelium***	***Eremopyrum***	**Henrardia**	***Hordelymus***
Psilurus	*Kralikia*	*Cuviera*	***Hordelymus***	***Hordeum***	***Heteranthelium***	***Hordeum***
Secale	*Lepturus**	*Elymus*	***Hordeum***	*Lepturus*	***Hordelymus***	***Leymus***
Triticum	*Lolium*	*Elytrigia*	***Hystrix***	*Lolium*	***Hordeum***	***Psathrostachys***
	Monerma	*Eremopyrum*	***Leymus***	*Parapholis*	***Hystrix***	***Secale***
	Nardus	*Haynaldia*	**Malacurus**	***Psathrostachys***	***Leymus***	***Taeniatherum***
	Oropetium	*Heteranthelium*	***Psathrostachys***	***Roegneria***	***Psathrostachys***	***Triticum***
	Pariana	*Hordeum*	***Secale***	***Secale***	***Secale***	
	Psilurus	*Malacurus*	***Sitanion***	***Triticum***	***Taeniatherum***	
	Scribneria	*Psathrostachys*	***Taeniatherum***		***Triticum***	
	Secale	*Roegneria*				
		Sitanion				
		Taeniatherum				
		Terrella				
		Trachynia				
		Triticum				

Names in the bold belong in the tribe; names in plain font are no longer included in the tribe. *Only one of the two species previously treated in *Lepturus* belongs in the Triticeae. It is known as *Henrardia persica* After Dewey 1984. (Yen & Yang 2009)

1.4. Cytological Studies in the tribe Triticeae

Chromosomes in the tribe Triticeae seem to vary in number and size. Base chromosome numbers in the tribe is *x*=7 (Hilu 2004). Autopolyploidy, allopolyploidy, and aneuploid losses and gains occurred frequently and these events contributed to the high variability within the tribe (Hunziker and Stebbins 1987). Cytogenetically the tribe shows high differentiation into various foreign genomes, and about two thirds of the species whose chromosome numbers known are polyploids, and even in a single genus certain species i.e ***Thinopyrum pycnanthum*** (Godr.) Barkworth (EStP) may include foreign genomes (Helfgott & Mason-Gramer 2004).

There have been many cytological studies on the tribe Triticeae especially the cultivated species and close relatives of them, such as studying chromosome pairing in their hybrids at different ploidy levels, karyotype analysis based on chromosome measurements, chromosome banding patterns (Giemsa C Banding and N banding), in-situ hybridization with specific probes and restriction enzyme analysis of the chloroplast, mitochondrial or nuclear DNA (Sakamoto 1974; Jauhar & Crane 1989; Friebe et al. 1992a,b; Linde-Laursen & Baden 1994; Linde-Laursen et al 1999; Landjeva & Geneva 2000). There have been a number of publications concerning the cytology of the Poaceae as a whole, particularly the cultivated ones. Unfortunately only very few of these cytological studies were based on Turkish material. Most of the taxa found in the revised genera have a cosmopolitan origin so many of which have been investigated in a cytological manner. It is obvious that a great deal of cytological work still needs to be done on the Turkish material in particular chromosome counts of endemic species of Turkish grasses need to be analysed as soon as possible in relation to their alleles.

The Triticeae has been the subject of extensive biosystematic, genetic and cytological research. Crossing experiments and studies of chromosome behaviour in meiotic metaphase have played an important role in the elucidation of the genomic content, phylogeny and taxonomy among the genera. Despite considerable progress in the understanding of the taxonomy and phylogeny of the tribe, still more research is needed. The taxonomic position of many members of the Triticeae remains uncertain, and the genomic constitution of many species and even genera remains unknown (Assadi 1995).

1.5. The genera in the Tribe Triticeae

Agropyron Gaertner

The taxonomy of *Agropyron* was studied in different ways by various researchers. In a broad sense it was once thought to be one of the largest genus encompassed more than 100 species in the tribe Triticeae (Dewey 1983). Nevski (1934) treated *Agropyron* as a small genus consisting only the species with keeled glumes. The other remaining taxa were placed in *Elytrigia* Desv*, Roegneria* C. Koch and *Elymus* L. *Agropyon* has been restricted to the species with **P** genome composed of three ploidy levels **(2*n* = 14, 4*n* = 28, 6*n* = 42)** (Dewey & Asay 1975; Dewey 1983; Melderis 1978; Assadi 1995; Jensen et al. 2006). This narrow concept of *Agropyron* has been accepted by many authorities. The major Eurasian floras (Tsvelev 1976; Melderis 1980, 1985) have followed the generic concept of Nevski. Based on the intergeneric crossing experiments, Assadi and Runemark (1995) stated that generic delimitation of *Agropyron* was clear enough.

Much confusion prevailed in regard to the number of species included in this genus . Dewey and Pendse (1967) considered all the crested wheatgrasses, regardless of ploidy level, as a single breeding population. Tzvelev (1976) recognised 10 species in *Agropyron* and nine subspecies in *Agropyron cristatum*. In 1993, he recognised one more species *A. incanum* (Nábělek) Tzvelev in the genus *Agropyron*. In recent years Bing Cao shu (2006), in his revisional account, recognized 15 species, 5 of them were present in China.

Cytogenetic observations upon the hexaploid crested wheatgrasses were very limited because of relative rarity of the hexaploid taxa. The hexaploid taxa were rarely reported and found primarily in Turkey and Iran (Dewey 1961, 1983; Jensen et al. 2006).

In the Flora of Turkey, Melderis (1985) recognized only one species, *A. cristatum* s.l in *Agropyron* and subdivided it into two subspecies (subsp. *incanum* and subsp. *pectinatum).* According to this account, the first subspecies was confined to the high mountain steppes of East Anatolia and the second one was found throughout Turkey. Subsp. *pectinatum* was further splitted into two varieties, one of which was var. *imbricatum* having pilose spikelets and the other one was var. *pectinatum* having glabrous spikelets (Melderis 1985).

Löve (1984) recognized an another species named as *A. deweyi* from Turkey. The seeds of this species were collected by J.R. Harlan in 1948 and cultivated in Evans Farm, Utah, U.S.A. He noted that this species might be a variant of *A. cristatum* arisen under cultivated

conditions far from its native habitat. Neotypification of this species was accomplished by Baum et al. (2008).

***Elymus* L.**

Elymus was first described as a genus by Linnaeus (1753). Hitchock & Green (1929) designated *E. sibiricus* as the type species of the genus. Since Linnaeus (1753) described the genus *Elymus* L. covering six original taxa, (*E. arenarius* L., *E. sibiricus* L.*, E. canadensis* L., *E. virginicus* L., *E. caput-medusae* L. and *E. sitanion* L.), numerous transfers have been made between *Elymus* and other closely related genera. Although the genus was recognized by many Triticeae workers such as Bentham (1882), Hitchcock (1951), Nevski (1934), Tzvelev (1976), Melderis et al (1980), Dewey (1984) and Löve (1984), the circumscription of the genus varied significantly. For instance, *Elymus caput-medusae* L. described under the genus *Elymus* was transfered to the *Taeniatherum* by Nevski (1934). *Elymus arenarius* L and its close species were transfered to the genus *Leymus* and *E. arenarius* was chosen as the type species of the genus *Leymus* by Hochsteter (Tzvelev 1976).

The taxonomy of *Elymus* is extremely complex because of the huge morphological variation within and between species. There are also lots of controversies on its generic delimitation. These controversies have resulted in different treatments in different floras. Bor (1968, 1970) included *Elymus* species in *Agropyron* in his Flora of Iraq and Iran.

Elymus is the largest genus in the tribe Triticeae and includes about 180 taxa, most of which are caespitose, linear spiked, perennial species which were formerly treated as *Agropyron* Gaertn. sensu lato (Assadi 1996). Melderis (1978, 1985) followed the treatment of Runemark & Heneen (1968) and expanded the genus *Elymus* by subsuming the genera *Roegneria* K. Koch, *Elytrigia* Desv., *Clinelymus* (Griseb) Nevski within it. Melderis, in his treatment excluded the *Agropyron* s. str. as a small genus consisting only the species with keeled glumes.

The last revision of *Elymus* in Turkey was made by Melderis (1985) in Davis' Flora of Turkey and the East Aegean Islands, volume 9, in which 19 species were recognized. Since the publication of the flora, one more species, *Elymus hoffmanni,* has been described from Turkey (Jensen and Asay 1996).

Löve (1984) presented a new generic system for the *Triticeae,* based on genomic constituents. He used a narrow generic concept and the perennials referred by Bentham (1882) to *Agropyron* and *Elymus* were split into 14 genera.

Helfgott & Mason-Gramer (2004) stated that 75 % of the about 350 Triticeae species whose chromosome number is known has a polyploidy origin. *Elymus* has its origin through natural hybridization of a few related genera in the *Triticeae* tribe (Dewey 1984, Löve 1984), and thus it has close genetic similarities with *Leymus, Agropyron,* and *Hordelymus*.

***Thinopyrum* Á. Löve**

Thinopyrum was first described as a genus in 1980 by Löve with the type species hexaploid *Th. junceum*. Later on six species from the *Agropyron junceiforme* complex transferred to the genus *Thinopyrum.* Dewey (1984) expanded the generic limits of *Thinopyrum* by transferring the species of *Lophopyrum* and part of *Elytrigia* into this genus and the species number reached to about 20 species, most of which are alkaline tolerant. The members of this genus are native from the Mediterranean region to western Asia. The genus is sometimes included in *Elytrigia* Desv. or *Elymus*. *Thinopyrum* differs from other *Triticeae* in its thick, stiff glumes and lemmas (Jarvie 1992).

***Pseudoroegneria* Á. Löve**

Pseudoroegneria is a genus in the Triticeae (Poaceae) with *Pseudoroegneria strigosa* (M. Bieb.) Á. Löve as the type species. This genus includes 15-20 species most of which have an Eurasian or Asian origin worldwide. Morphologically, the species in this genus are caespitose, long-anthered and cross-pollinating perennials. The species in the genus *Pseudoroegneria* are distributed in the Northern Hemisphere, and occurred on open rocky hillsides from the Middle East and Transcaucasia across Central Asia and Northern China to Western North America. *Pseudoroegneria* was built around one genome designated St, which is one of the most important basic genomes (St, H, P, W, Ns and E) in perennial Triticeae. The St genome is the donor genome of the species in the polyploid genera *Roegneria* (StY), *Douglasdeweya* (StP), *Elymus* (StH, StYH and StYW), *Kengyilia* (StYP), *Elytrigia* (EeSt and EbEeSt) and *Pascopyrum* (StHNsXm) (Dewey 1984; Löve 1984; Yen & Yang 1990; Yen et al. 2005a,b). The members of this genus are exceptionally drought tolerant and have excellent forage quality (Dewey 1984). Löve (1984) and Dewey (1984)

suggested that the taxonomic treatment for Triticeae species should be based on genomic constitutions and this view has been widely accepted (Lu 1994;Wang et al. 1994; Zhou et al. 1999; Yen et al. 2005b). The cytogenetic studies indicated that there are St, StSt, StP and EeSt genomic constitutions in *Pseudoroegneria* and all of them are diploids or tetraploids (Dewey 1984; Wang et al. 1986; Jensen et al. 1992; Liu &Wang 1993). Yen et al. (2005a) established a new genus *Douglasdeweya* C. Yen, J.L. Yang & B.R. Baum, and the species with StP genomes in *Pseudoroegneria* were transferred to *Douglasdeweya* (Chen et al. 2005).

***Eremopyrum* (Ledeb.) Jaub. & Spach**

Eremopyrum (Ledeb.) Jaub. & Spach is a well circumscribed genus having an annual habit and oblong to orbicular fragile spike like inflorescence that is used in wheat improvement (Clayton and Renvoize 1986). It was first recognized as a taxon by Ledebour (1829), who treated it as *Triticum* sect. *Eremopyrum.* Bentham and Hooker (1883) transferred it to *Agropyron* Gaertn., leaving it as a section. It was Jaubert and Spach (1851) who first recognized *Eremopyrum* as a genus, distinguishing it from *Agropyron* on the basis of its annual habit. Since then 18 species and many infraspecific taxa have been described, but the number of species currently accepted varies from 4 (Tzvelev 1976; Sakamoto 1979; Frederiksen, 1991) to 9 (Löve 1984).

Eremopyrum consists of the species with F genome (Löve 1984). Intergeneric hybridizations including *Eremopyrum* shows that there are strong sterility barriers between *Eremopyrum* and the species included in crossing efforts (Sakamoto 1967, 1968, 1972, 1974; Frederiksen & Bothmer 1989; Frederiksen 1993)

In Flora of Turkey, Melderis (1985) recognized four species and two subspecies, namely, *E. distans*, *E. orientale*, *E. triticeum, E. bonaepartis* subsp. *bonaepartis* (Spreng.) Nevski, and *E. bonaepartis* subsp. *hirsutum* (Bertol.) Melderis. According to Melderis, *E. bonaepartis* covered diploid (2n=14) and tetraploid taxa (2n=28) which showed huge variability regarding their spikelet characters, such as size of spikelets, indumentum, shape of glumes and length of lemma awn. He treated diploid and tetraploid taxa as different subspecies in Turkey (Melderis 1985).

***Heteranthelium* Hochst**

The genus *Heteranthelium* Hochst. is one the monotypic genera in the tribe Triticeae. This genus is represented with the annual, diploid (2n=2x=14, **QQ**) *Heteranthelium piliferum* (Banks & Sol.) Hochst. which is native to middle and west Asia (Watson and Dallwitz 1992). With respect to its characteristic features, it has a special place in the tribe. The spike of this species includes two spikelets one of which fertile the other one is sterile. Both of them are different in outline (Sakamato, 1974). In the manner of disarticulation of spikelets, *Heteranthelium* remotely resembles the genus *Eremopyrum*, in the structure of awns it resembles *Aegilops* and in the structure of glumes the genus *Hordeum* (Chennaveeraiah and Sarkar, 1965).

***Crithopsis* Jaub. & Spach**

The annual species, *C. delileana* (Schult.) Roshev., is the only member of the genus *Crithopsis* Jaub. & Spach (Poaceae; Triticeae). It is distributed from western Afghanistan and Baluchistan to Morocco (Frederiksen, 1993). According to Love (1984) it carries the K genome. Sakamoto and Muramatsu (1965) were the first to report 2n = 14. This number was confirmed by Sakamoto (1973) in material collected in Syria and by Frederiksen (1993) in populations from Iraq, from the island of Crete, Greece, and from Palestine. Traditionally, the diploid genera *Crithopsis, Taeniatherum* Nevski and *Psathyrostachys* Nevski, and *Hordeum* L. have been considered rather closely related (e.g., Bothmer et al. 1995), sharing a similar spike morphology (2-3 spikelets per node). Recent phylogenetic analyses based on morphology support a close relationship as all four genera are included within the same, albeit not fully resolved clade (Frederiksen and Seberg 1992).

***Amblyopyrum* (Jaub. & Spach) Eig**

The genus *Amblyopyrum* was described by Eig in 1929. *Aegilops mutica* was evaluated under the genus *Aegilops* before transferring it to the genus *Amblyopyrum*. *Ae. mutica* was thought to be an intermediate form between the genera *Aegilops* and *Agropyron* when it was described by Boissier. This genus has a limited distribution is a monotypic genus found naturally in Turkey. Besides Turkey it is only known from Armenia. This monospecific genus occurs only in Central Anatolia of Turkey and Armenia. Its distribution nearly fits the Hammer model that the origin of this group has been in Transcaucasia with mainly westward migration. The ecology of *Amblyopyrum* is being also typical representative Sakamoto's Mediterranean group in the Triticeae occurring frequently on roadsides edge of cultivation, dry hillsides and grassy steppes and tolerating a degree of disturbance.

Aegilops L.

The genus *Aegilops* L. consists of more than 20 annual species and constitute the secondary gene pool for the cultivated wheats (van Slageren 1994). Species in this genus are mainly distributed in the Southwest and Central Asia and throughout the Mediterranean Basin. A primary center of diversity of the genus *Aegilops* is considered to be the 'Fertile Crescent', because more *Aegilops* species are found there than the other areas (van Slageren, 1994).

The genus includes diploid and polyploid taxa containing genome D, S, C, N, U, M, and combinations of them. Furthermore the genus is divided into six sections based on the combination of genome types and morphological data. Two sections, *Vertebrata* and *Cylindropyrum*, include D-genome species.

In the Flora of Turkey, Davis (1985) recognized fifteen species among which *Aegilops vavilovii* (Zhuk.) Chennav and *Aegilops juvenalis* were not encountered.

Triticum L.

The genus *Triticum* is economically important and has always been the focus of taxonomic and biosystematic attention. Allopolyploidy along with natural and artificial hybridization, as well as nomenclatural debates, have blurred both biological and taxonomic concepts of the species in this and closely related genera (Morrison 1993; Gupta 1997; Morrison and Raupp 1999). Morrison (1993) pointed out, that "many current treatments of *Triticum*, including the floras for the regions of western and central Asia where the wheats are endemic, are lacking in consistency and informational content."

Although the wild germplasm of *Triticum* in Turkey, which is one of the important centers of origin and diversity for different ploidy levels of cultivated wheats (Vavilov 1992), is of immense importance, the taxonomic status of the genus in this country has not been studied adequately. Tan (1985), in her treatment in Flora of Turkey, mentioned 10 species of which eleven were recorded in Iran itself.

It is known that the genus *Triticum* consist of polyploid series including hexaploid, tetraploid and diploid levels in ploidy. The hexaploid *T. aestivum* (genomes AABBDD) was originated via hybridization of tetraploid wheat, *T. turgidum* (genomes AABB), with the diploid goatgrass *Aegilops tauschii* (genomes DD) (Kihara 1944; McFadden and Sears 1946).

***Dasypyrum* (Coss. & Durieu) T. Durand**

The genus *Dasypyrum* (Coss. & Durieu) T. Durand (Poaceae) is important in breeding experiments as a genetic source, due to its close phylogenetic relationship with *Triticum* L. and *Secale* L. particularly its cultivated species. The genus is represented with two species, *D. villosum*. (L.) P.Candargy and *D. breviaristatum* (H.Lindb.) S.Frederiksen. The former one is an annual diploid species distributed naturally in Turkey. The latter perennial one consists of diploid and tetraploid cytotypes and is distributed only in a restricted area over the 1000 m altitude in Morocco and Greece. Morphologically, this genus is quite distinct from the other genera included in Tribe Triticeae (Dumort.) by having two-keeled glumes (Frederiksen 1991b; Galasso et al. 1997; Ohta & Morishita 2001).

***Secale* L.**

Secale L. is a small but agronomically important genus. Identification of many taxa has, however, been difficult due to lack of diagnostic characters. There have been made three recent reviews of the taxonomy of *Secale.* Roshevitz (1947), whose monograph was almost entirely based on material from Russian herbaria, recognized 14 species in addition to more than 20 infraspecific taxa, most of which varieties. Hammer et al. (1987), besides a hybrid taxon, recognized four species, two of which had five subspecies.

***Leymus* Hochst.**

Leymus Hochst. is a perennial genus found in the tribe Triticeae (Poaceae). Hochstetter (1848) separated it from traditional *Elymus* L. using the morphological and habitat characteristics. *Leymus arenarius* (L.) Hochst. was chosen as the type species for the genus *Leymus*. The genus is characterized with the following features such as a primarily rhizomatous, cross-pollinating with long anthers, subulate to lanceolate glumes, unawned or shortly awned lemmas, and single to multiple spikelets per node (Löve 1984; Atkins and Barkworth 1984, Yen et al 2009).

Yen et al (2009) recognized 61 species in their synopsis, and all the species are polyploids with chromosome numbers ranging from 2n=4x, 6x, 8x, 12x=28, 42, 56 to 84. In the Flora of Turkey, Melderis (1985) recognized two species in the genus, *Leymus racemosus* (Lam) Tzvelev and *L. cappadocicus* (Boiss. & Bal). According to this account, the first species was confined to the coasts of Black and Marmara sea and the second one was found saline

steppes and sandy shores of salt lakes in central Anatolia. (Melderis 1985). The genomic constitution of *Leymus* was designated **NsXm**, where Xm is a genome of unknown origin (Wang et al. 1994). The ITS phylogeny also supports a closer relationship between the two genera, *Leymus* and *Psathyrostachys*, than that among species within a genus. Morphologically, the species in these two genera are very similar. Although most *Leymus* species are rhizomatous and most *Psathyrostachys* species are caespitose, there is a significant overlap in this character between the two genera (Melderis 1980; Baden 1991). *Psathyrostachys* species (**Ns** genome) served as the donor during the polyploid speciation of the *Leymus* species. Therefore, it may be suggested that different *Leymus* species and different distributions of a species derived their Ns genome from different *Psathyrostachys* species.

***Hordeum* L.**

The genus *Hordeum* covers 32 species including cultivated *H. vulgare* and *H. dicoccon* that grow in temperate and adjacent subtropical areas, at elevations from 0–4500 m. (Baden & Bothmer 1994; Bothmer et al. 1995). Of these, 15 are diploid, seven tetraploid, and four hexaploid, whereas two species include both diploid and tetraploid cytotypes, and three species include diploid, tetraploid, and hexaploid cytotypes. The monophyly of *Hordeum* is supported by several phylogenetic studies (Kellogg et al. 1996; Mason-Gamer and Kellogg 1996; Petersen and Seberg 1997, 2000, 2002; Mason-Gamer et al. 1998; Seberg and Frederiksen 2001). The most likely sister group to *Hordeum* is the Asiatic genus *Psathyrostachys* Nevski. Studies on the basis of genome analysis showed that four different haplomes are present in *Hordeum*. *Hordeum vulgare* and *H. bulbosum* constitute the **I-** genome group, the **X** (Bothmer and Jacobsen 1991; Jakob and Blattner 2009) or **Xa** (Wang et al 1996) genome group includes diploid *H. marinum*, diploids in the *H. murinum* group have the **Xu** (Wang et al 1996) or **Y** genome and the remaining diploid species constitute the **H-**genome group.

***Psathyrostachys* Nevski**

The genus *Psathyrostachys* Nevski (Poaceae; Triticeae) is a small, well-defined, perennial genus comprising only eight species (Baden 1991). This genus is characterized by having very brittle rachis and consists of the species with the same basic genome, **N,** or modified forms of this genome (Löve 1984; Dewey 1982, 1984; Barkworth and Dewey 1985; Hsiao et al. 1986; Bothmer et al. 1987; Wang 1987, 1990; Lu et al. 1989; Baden et al. 1990; and Baden 1991; Linde-Laursen & Baden 1994; Petersen et al. 2004). In Turkey, the genus

Psathyrostachys was first revised by Melderis (1985) in Flora of Turkey and the East Aegean Islands, in which he recognized only one species *P. fragilis* (Boiss.) Nevski. This species was further divided into two more subspecies, namely subsp. *secaliformis* Tzelev and subsp. *villosus* by Baden (1991). According to this account, subsp. *villosus* was confined to Erzincan province, while the subsp. *secaliformis* was found in the eastern and the northern part of Turkey (Davis et al. 1988). Bor (1968), in Flora of Iraq Vol.9, and Humphries (1980) in Flora Europaea Vol. 5, recognized only one species. In this genus Nevski (1934) recognized six species in Flora of USSR. He also made the first sectional delimitation and divided the genus into three sections: Sect. *Hordella*, Sect. *Eupsathyrostachys* and Sect. *Camptolepis* based on mainly the number of perfect florets in the spikelets. Baden (1991) did not recognize any sections in his revisional study.

***Hordelymus* (Jess.) Harz**

Wood barley [*Hordelymus europaeus* (L.) Harz (2n=4x=28)] is a caespitose perennial with a short, creeping rhizome. It is a self-compatible species and is the only member of *Hordelymus* (Jessen) Harz (Humphreys 1980). *H. europaeus* is a forest species adapted to shady conditions. It grows in rich woodlands and deciduous forests, mainly on calcareous ground, in Europe and parts of south-western Asia. (Bothmer & Jacobsen 1989).

***Taeniatherum* Nevski**

Taeniatherum (Medusahead) is the genus in the tribe Triticeae native to the Mediterranean Basin, eastern Europe and western Asia (Frederiksen 1986). It is a diploid member of the Tribe Triticeae and has a distinct genome from the rest of tribe, being most closely related to *Hordeum* (Frederiksen & von Bothmer 1989). It is mostly self pollinated (Young 1992). Medusahead can be made to hybridize with a few other Triticeae (Frederiksen and von Bothmer 1989), including *Aegilops cylindrica* (Schoder 1966), but all hybrids are sterile. This taxon was listed as the most invasive and damaging exotic species in many countries.
This species complex which has been divided by same authors into three species, the separation of which often creates some difficulty; therefore, it has been treated by other workers as one species with two or three varieties (Melderis,1985). In the Flora of Turkey, Melderis (1985) treated *T. asperum* and *T. critinum* as subspecies of *T. caput-medusae* , although their distributions overlap in Turkey.

***Henrardia* C. E. Hubbard**

The genus *Henrardia* C. E. Hubbard is monotypic which is represented with 2n = 14 *H. persica* (Boiss.) C. E. Hubbard (Bowden 1966). *H. persica* is distinctly different from other species found in the tribe with its characteristic spike morphology. In an attempt to clarify the genetic relationships between the genus *Henrardia* and other genera of the tribe, many crossing efforts were accomplished by Sakamoto (1972). For this purpose *H. persica* was crossed as either female or male parent with different species of *Aegilops*, *Agropyron*, *Eremopyron*, *Heteranthelium*, *Taeniatherum* and *Triticum*. From these crosses intergeneric hybrids were obtained so far only in crosses of *Henrardia persica* with *Eremopyrum orientale.*

1.6. Scope of study

Since the publication of the Flora of of Turkey, Although Doğan (1988, 1991a,b, 1992, and 1997) carried out extensive taxonomical studies on a number of genera in the tribes Aveneae, Agrostideae, Phalarideae and Phleae in Turkey, no comprehensive studies on this group of plants have been carried out in Turkey.

The main purposes of the study are as follows:

To revise the genera included in the tribe *Triticeaee* (Poaceae) in Turkey where the tribe includes 18 genera and 75 species many of which have great economic values.

To clarify the taxonomic limits of the genera and relationships of theirs taxa, and provide their emended and expanded descriptions, distributions and habitat requirements.

To consult the collected specimens by means of using morphological, ecological, numerical taxonomic, micromorphological and phytogeographical methods.

To put into the actual biodiversity of the tribe in Turkey. If possible to find out either new taxa to science and to Turkey.

To investigate glume and lemma epidermal features of this group of grasses with the help Scanning Electron Microscopy (SEM) for the purpose of clearing existing taxonomical problems in the related genera.

To reevaluate IUCN threat categories of the taxa and make some recommendations for their sustainable use and conservation in the country.

To construct updated keys for the infrageneric taxa and genera.

CHAPTER 2

2. MATERIAL AND METHODS

In this part of thesis, the plant materials used in the revision of the tribe as well as the methods applied during the timeline of the thesis are provided.

2.1. Methods used in field and herbarium studies

This revision is based on morphological study of fresh and conserved material belonging to the tribe Triticeae. Since 2006, as a part of revision of tribe Triticeae in Turkey, the author has carried out extensive field studies throughout Turkey and collected a large number of specimens which were pressed carefully and dried using standard techniques for further laboratory analysis (Davis & Heywood, 1973). Additionally, population size, and phenological and ecological properties were observed in the field (Davis & Heywood, 1973). Complete specimens were pressed, dried and deposited at the Plant Systematic Laboratory of Department of Biological Sciences of METU. All specimens collected in multiple sets for further distribution to various herbaria. If possible, each population sample constituted minimum ten plants. During field studies the soil samples and also seeds of the some members were gathered. Additional reference and comparable material as well as the material for detailed studies of distribution, constituted specimens from some major herbaria in Turkey (ANK, GAZI, ISTE).

The specimens were identified upon closer examination and consultation with the Flora of Turkey (Davis, 1985) and other relevant floras, such as Flora Orientalis (Boissier, 1884), Flora of Syria, Palestine and Sinai (Post, 1933), Flora Iranica (Bor, 1970), Flora of Iraq (Bor, 1968), Flora Europaea (Tutin et al., 1980), Flora of USSR (Tzvelev 1976) and the latest revisional studies such as Baden 1991, Frederiksen 1991, 1993, Baden and Bothmer 1994; van Slageren 1994; Bothmer et al. 1995. The specimens were also then compared with the type specimens, borrowed from the herbaria (E and K). The supplements to this (Davis et al. 1988; Güner et al. 2000) were also consulted. The type specimens of all recognized species

and nearly all types of their synonyms were examined. The material of *Triticeae* kept at various herbaria such as ANK, E, EGE, FUH, G, GAZI, HUB, ISTF, and K (abbreviations according to Holmgren et al., 1990) was also examined. Taxonomic authorities for Latin names of all the taxa investigated in this study are based on the Missouri Botanical Garden W3TROPICOS (2005) nomenclatural database.

The descriptions of the taxa within the genera include parallel information on the level of genus. The morphological characters given in the descriptions were measured on herbarium specimens. Mesurements were made on fresh and herbarium material with the use of Leica L2 Steromicroscope and Leica Application Suite software package. During measurements largest specimen and complete spike on each sheath is chosen and measured. Since the length of the spikelets, rachis internodes and the density of spikelets varies along the spikes, the measurements refer to the middle part of the spike. Measurements of leaf width refer to flat or unrolled leaves.

In the revision part of the thesis, each generic description is followed by a sectional key if applicable and a key to its species, and the species descriptions by keys for their infraspecific taxa, if any. Full bibliographic information is given for accepted names at the rank of genus and below; authors are given for the synonyms cited. Each species description is followed by a summary of the taxon's distribution by Davis' grid square method (1965) in Turkey and a general distribution outside the Turkey and, if applicable some notes on the taxa has been given. The species descriptions are also followed by an habitat preferences of the species such as, habitat types, altitude, phytogeographical regions inside Turkey. Base chromosome numbers are given for genera; diploid chromosome numbers are given for species. Beside the figures of the species, the distribution maps of the taxa have been given at the end of taxonomic treatment of the species.

2.2. Methods used in Ecological Studies

For the purpose of understanding the habitat requirements especially soil preferences of the species found in this tribe, soil samples were taken from the suitable habitats of the species and in a depth between 0-20 or 0-30 cm. All soil samples dried and and sieved for laboratory analysis. The analysis of the gathered soil samples were accomplished at the Soil, Fertilizers and Water Resources Central Research Institute, Ankara. During analysis, basic soil properties such as Soil texture, pH, CaCO3, N, P, K and organic matter were investigated using standart tecniques given in study of Bayraklı (1987) and Karagöz et al (2009). Results were evaluated according to Kaçar (1972).

2.3. Micromorphology and Scanning Electron Microscope (SEM) Methods

To study micromorphology of spikelets parts of the memmers of this tribe a scanning electron microscope (SEM). Samples were obtained from herbarium specimens gathered from the field as a result of revision of tribe Triticeae in Turkey. In this study, approximately 100 samples of 35 species included in 18 genera naturally found in the Triticeae were studied. A list of voucher specimens were given in Table 3. For SEM study glumes and lemmas were removed from the spikelets seated in the middle of spike and cleaned with trichloromethane for 24 h. After that they were mounted on stubs and coated with gold using a sputter coater and then examined using a JEOL JSM-6060LV (JEOL Technics Ltd.,Tokyo, Japan) Scanning Electron Microscope from middle to distal part, and taken their photographs (Doğan, 1988). Selection of micromorphological characters was based primarily on those included in previous studies of the Poaceae (Metcalfe 1960; Ellis 1979). Two specimens per species were examined whenever plant material was available. Structural features of glume and lemma epidermises were investigated, including 1) macrohairs, 2) prickle hairs, 3) shape of silica bodies, 4) long cells, and 5) stomata.

The terminology used was followed from Ellis (1979), Acedo and Llamas (2001), Ortunez and Fuente (2010).

Table 3. The list of studied taxa belonging to 18 genera recognized in Turkey

Genus	***Taxa***
Agropyron	*A. cristatum*
Elymus	*E. panormitanus, E. repens, E. divaricata*
Thinopyrum	*T. pycnanthum, T. farctum, T. erosiglumis*
Pseudoroegneria	*P. tauri*
Eremopyrum	*E. distans, E. bonaepartis, E. orientale*
Heteranthelium	*H. piliferum*
Crithopsis	*C. delileana*
Amblyopyrum	*A. muticum var. muticum* *A. muticum var. loliaceum*
Aegilops	*Ae. biuncialis, Ae. caudate, Ae. cylindrica* *Ae. geniculata, Ae. comosa, Ae. juvenalis* *Ae. tauschii, Ae. vavilovii, Ae. crassa,* *Ae. neglecta, Ae. triuncialis, Ae. umbellulata* *Ae. kotchyii,*
Triticum	*T. dicoccoides, T. dicococon, T. monococcum*
Dasypyrum	*D. villosum*
Secale	*S. sylvestre*
Leymus	*L. racemosus*
Hordeum	*H. bulbosum, H. spontaneum*
Psathyrostachys	*P. fragilis subsp. villosus* *P. fragilis subsp. artvinense* *P. narmanica*
Hordelymus	*H. europaeus*
Taeniatherum	*T. caput medusae*
Henrardia	*H. persica var. persica* *H. persica var. glaberrima*

2.4. Numerical Taxonomic Methods

Numerical taxonomic methods i.e. Cluster Analysis (CA) and Principal Coordinate (PCO) analysis have been applied for the purpose of clarifying infrageneric relationships of the taxa found in the genera *Agropyron* (Cabi and Doğan 2010, In press), *Eremopyrum* (Cabi and Doğan 2010), *Psathrostachys* (In review) and *Crithopsis* (Cabi and Doğan 2010b). For this purpose morphological characters were chosen for analysis. They included those used in existing classifications and some that, on the basis of our fieldwork, seemed worthy of further investigation. Each scored specimen was designated an OTU (Sneath & Sokal 1973; Doğan 1992, 1997). Measurements were made on herbarium material with the use of Leica L2 Steromicroscope and Leica Application Suite software package. The raw data matrix

included quantitative and ordinal variables. For the purpose of morphometric analysis Gower's (1971) General Similarity Index was chosen to generate a distance matrix. This distance matrix was used for cluster analysis using the (Unweighted Pair-Group Mathematical Average) UPGMA algorithm. Principal Coordinate (PCO) analysis as implemented in software Multi-Variate Statistical Package (MVSP) version 3.1 (Kovach 1999) was performed by using the same distance matrix. The advantage of Gower's coefficient is that it allows the presence of a mixture of all variable types and also tolerates missing values. Gower's formula has a range of [0 -1] irrespective of the number of variables, so that tree length is unaffected by the number of traits, which is considered an advantage by Mason et al. (2005).

CHAPTER 3

3. RESULTS AND DISCUSSION

3.1. Morfological characters

3.1.1. Habit

Whereas all taxa in the revised genera belonging to the tribe Triticeae are herbaceous plants, there is a great variation in terms of size and habit between the genera and species. Although the annual genera such as *Eremopyrum* and *Henrardia* never exceed more than 30-35 cm length in nature, some perennials i.e. *Thinopyrum elongatum* and *Hordeum bulbosum* may reach over 1 meter height.

As far as the revised genera are concerned, tufted species are mostly annual otherwise caespitose and rhizomatous ones are common among perennials. In general, grasses with caespitose and rhizomotous growth habit are better adapted to xeric and mesic environments respectively (Barkworth et al 2007). These species generally common in high mountains where they usually have rather thickened root-stock at the base, as in *Agropyron cristatum and A. incanum*. Most *Leymus* species are rhizomatous; however rhizomatous plants occur in the following genera: *Agropyron*, *Pseudoroegneria*, *Psathyrostachys*, *Thinopyrum*, and *Elymus* (Barkworth et al 2007). There is a direct correlation between rhizome growth habit and plants competitive ability against invasive annual species. Rhizomes provide protection from herbivory and trampling. The annual species have fibrous roots and lack rhizomes or sometimes a bulb such as *Hordeum bulbosum*.

3.1.2. Leaf properties

The shape of the leaves are usually flat to involute or convolute.To survive under harsher conditions the leaves became convolute, such as in *Agropyron incanum* and *Leymus cappadocicus* and *Thinopyrum elongatum.*

The shape of the leaf blades of the revised taxa in Turkey is usually linear or linear lanceolate, but the dimensions of the leaf blades vary significantly among the genera and within species in same genus. Generally cultivated taxa and some species as *Hordelymus europeaus* and *Elymus caninus* prefer shady and moisty places have usually broader leaf blades. Species adapt dry or salty soils usually have narrower and more or less convolute leaves. Indumentum of leaf blades vary from taxa even under the species. Generally leaves have a much more dense indumentum on the upper side than the lower side. Although the hairs usually simple one-celled hairs includes lots of variations. Leaf indumentum characters are usually used as complementary data in delimitating taxa. The indumentum types recognized in the taxa are as follows such as glabrous, scabrid, pilose, villous, spinulose ciliate. *Elymus clivorum* and *E. elongatiformis* are morphologically similar species can be differ from each other by only its leaf properties such as presence of prominent veins and spinulose-ciliate hairs.

3.1.3. Inflorescence

Generally speaking, the inflorescence consists of the flowering part of the stem. In the group revised in this thesis just only spike type of inflorescence is recognized. Spike is characterized by consisting sessile or very sortly pedicelled spikelets on the main axis. Although all the taxa in the revised group have spike as inflorescence they differed between each other on the basis of density of spike. In this group some genera, such as *Crithopsis*, *Taeniatherum*, (2 spikelets at each node), *Psathyrostachys*, *Leymus*, *Hordelymus* and *Hordeum* (3 spikelets at each node) have very dense inflorescence and more than one spikelet at each node; but in some others, such as *Dasypyrum*, *Agropyron*, *Elymus*, *Aegilops* etc. there is only one spikelet at each node and inflorescence is more or less interrupted in most cases.

Differences occurs in the number of spikelets per rachis node. *Triticum*, a typical genus in the subtribe Triticinae, has single spikelet at each rachis node, whereas *Hordeum*, in Hordeinae, has three spikelets, a triad, at the node. In other genera located taxonomically between these two typical groups, the number of spikelets varies with species or even within a spike. The density of spikelets on the spike and length of rachis internodes have a strong relationship. In some genera, the features such as the length of rachis internodes and the ratio of internodes to the spikelets are diagnostic characters for separating the taxa especially species and infraspecific taxa.

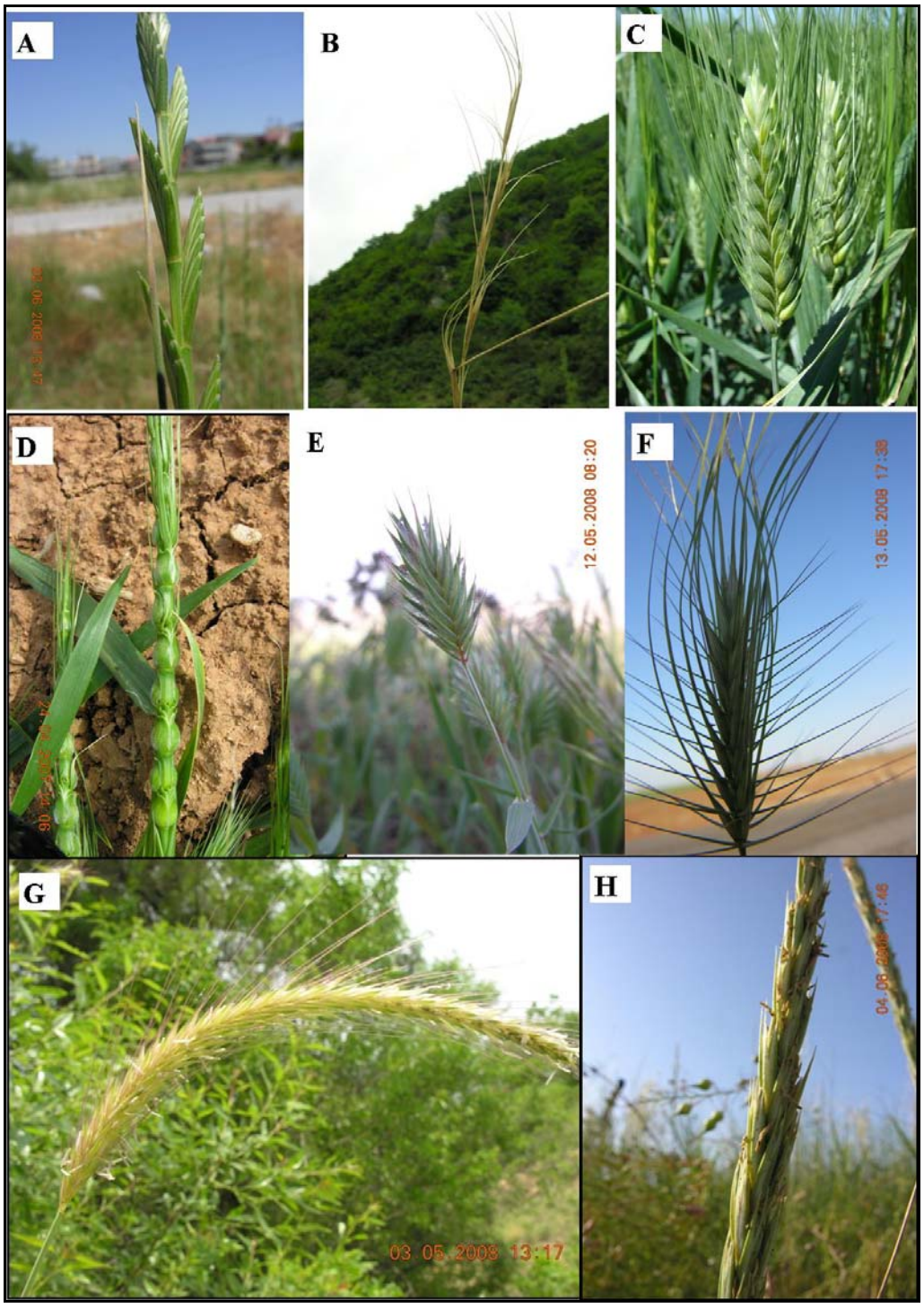

Figure 1.Examples of different types of spikes among the genera in tribe Triticeae.

A. *Thinopyrum elongatum* (1 spikelet at each node) **B**. *Elymus longearistatus*(1 spikelet at each node) **C**. *Triticum durum* (1 spikelet at each node) **D**. *Aegilops crassa* (1 spikelet at each node) **E**. *Eremopyrum orientale* (1 spikelet at each node) **F**. *Taeniatherum caput medusae* (2 spikelets at each node) **G**. *Hordeum bulbosum* (3 spikelets at each node) **H**. *Leymus racemosus* (3 spikelets at each node)

3.1.4. Rachis fragility

The **rachis** is the main axis of the **spike** to which the spikelets are attached (Fig. 2). The fragility of the rachis has been used on the taxonomy of the taxa in the tribe especially to delimitate the genera *Aegilops* and *Triticum* (e.g. Davis 1985), but on the generic level this does not hold. Not only in the rachis in the wild taxa of *Triticum* brittle, providing a useful difference with almost all cultivated groups (diploid monococoum and tetraploid dicocon to a lesser extent as their rachis is brittle upon pressure), but in *Aegilops* the rachis is in fact tough in all species with spikes that are falling entire and where the breakpoint is located at the base of rachilla of the lowest fertile spikelet (Sections *Aegilops*, *Comopyrum*, and *Cylindropyrum*).

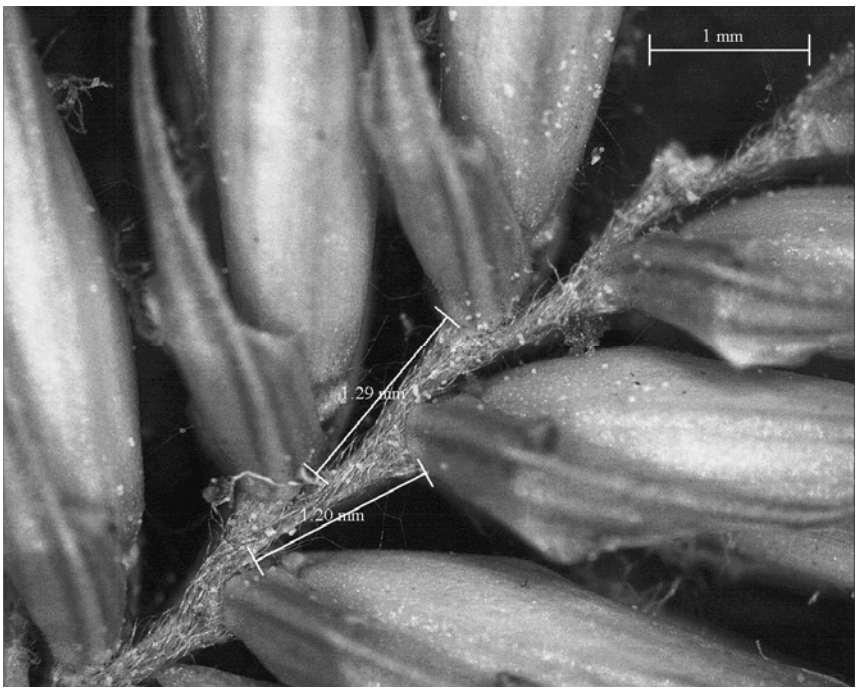

Figure 2. Brittle rachis segments of *Agropyron cristatum* subsp. pectinatum var. *pectinatum*

Three ways of disarticulation of the spike exist in *Aegilops*: (1) at the base of rachilla wedge type (2) at the top of rachilla "barrel type (i.e *Ae. crassa* and at the base of lowest fertile floret "whole spike type" (the whole spike including the rachis segment that supports the lowest fertile floret then falls as one unit. These disarticulation type almost coincides with

the sections of *Aegilops* as defined here. Of the 22 species, 13 are disarticulating whole spike type, five barrel type (only section *Vertebrata*) and only three wedge type.
A special case is seen in *Ae. speltoides*. The typical variety of this species shows whole spike disarticulation but the var. *ligustica* exhibits wedge type. This biological dimorphism is controlled by a closely linked blok of genes representing extremes of a continuum (Zohary and Imber 1963).

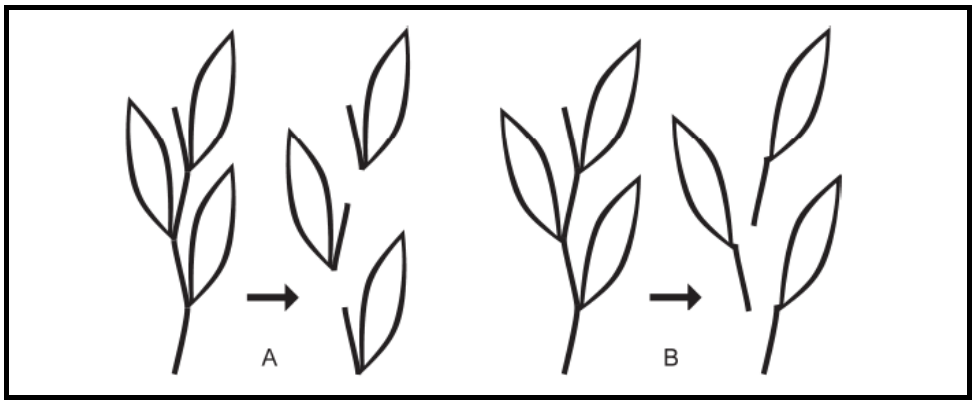

Figure 3. *Aegilops,* schematic presentation of two modes of spike disarticulation
A: spike disarticulating in dispersal units of the "barrel type"; **B**: spike disarticulating in dispersal units of the "wedge type". (Scholz 2007; Notes on *Aegilops* (Poaceae)

3.1.5. Spikelet

The majority of grasses have reproductive structures arranged into florets, which are organized within a spikelet structure (Fig.4) The arrangement of florets into spikelets that are subtended by sterile, bract-like glumes is characteristic of the Spikelet Clade, which includes all of the grasses except for the Anomochlooideae (GPWG 2001). Each floret typically possesses a lemma, palea, lodicules, androecium, and gynoecium (GPWG 2001).

There is a considerable literature dealing with spikelet morphology. The most important papers are by Arber (1934), Bews (1929), and Hubbard (1948). Glumes are always 2 in number in all genera revised. Each floret consist of a lemma ("bractlet" according to Hackel 1887) and palea (superior lemma according to Boissier, 1884). The lemma and palea protect ovary, stamens and lodicules. Whenever spikelets have more than one floret, each of these

florets is connected to others by the floret axis which is called as “rhachilla”. The attachment of the floret to the rhachilla is a scarred organ called the callus.

Shape of spikelet in size and sexuality is found to be useful at generic level. In the genera *Psathyrostachys* and *Leymus* species have spikelets similar in size and sexuality with 1 or 2 fertile florets and a sterile floret. On the contrary some genera i.e. *Hordelymus* and *Hordeum* have spikelets dissimilar in size and sexuality (except in cultivated plants), either lateral spikelets sterile or staminate, central one fertile or the central spikelet sterile the lateral ones sterile.

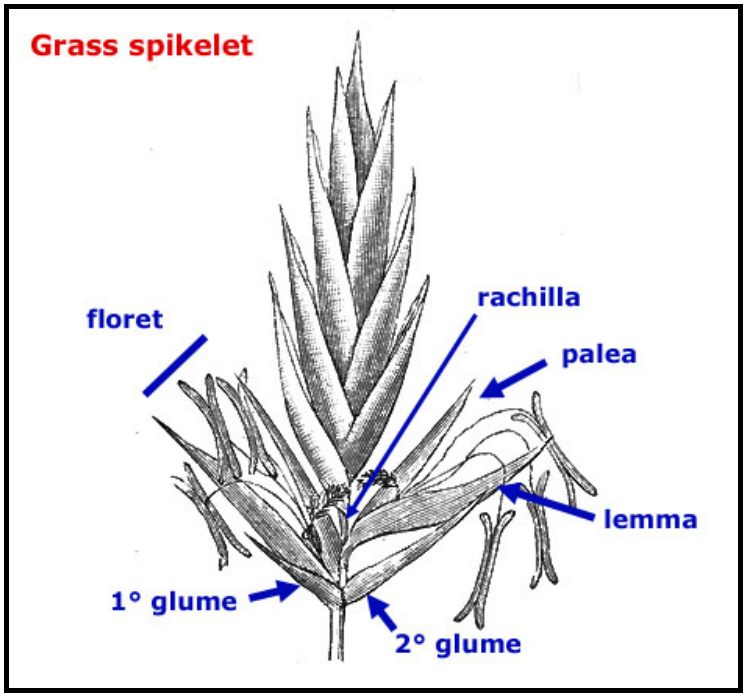

Figure 4. Typical spikelet structure for the grass family
http://www.life.illinois.edu/help/digitalflowers/Poaceae/12.htm last access on December 21th 2010

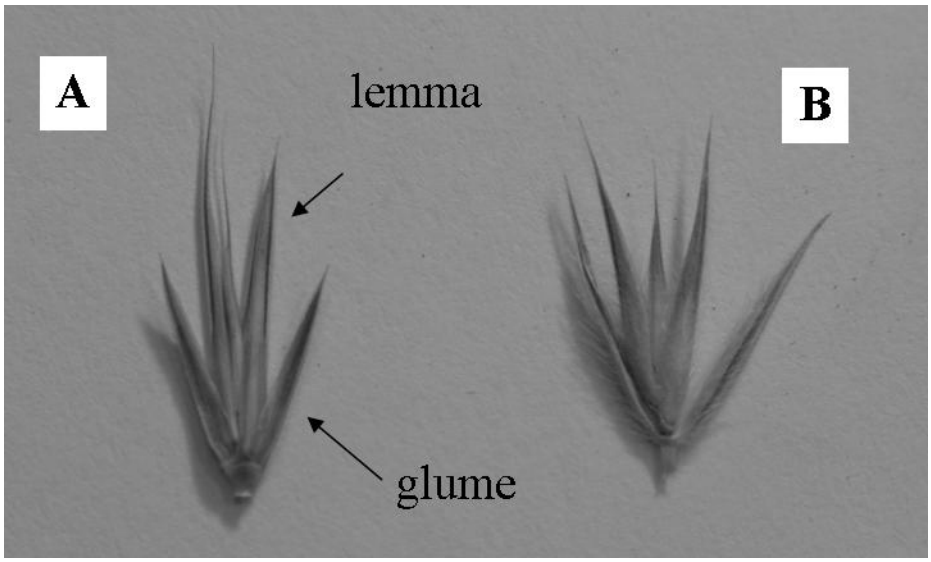

Figure 5. Spikelets of **A.** *E. boneapartis* var *sinuacum*. **B.** *E.hirsutum* var. *confusum*

3.1.6. Glumes

The relative length of glumes is of great help for distinguishing species. Glumes can be equal, as in *Crithopsis delileana*. When the lower glume is shorter than three-fourths of the upper one, the glumes are treated as unequal as in the genus *Psathyrostachys* and some species of the genus i.e. *Elymus longearistatus* subsp. *sintenisii*. The lower is sometimes longer than three-fourths of the upper one , as in i.e. *Elymus caninus*, *E. elongatiformis*, *Pseudoroegneria libanotica*. etc. Whenever the lower glumes are longer than three-fourths of the upper ones, they are termed “subequal”. The upper glumes is always the longest one when the glumes are not equal. It is often useful to compare the length of upper glume with the lowest lemma or lowest floret.

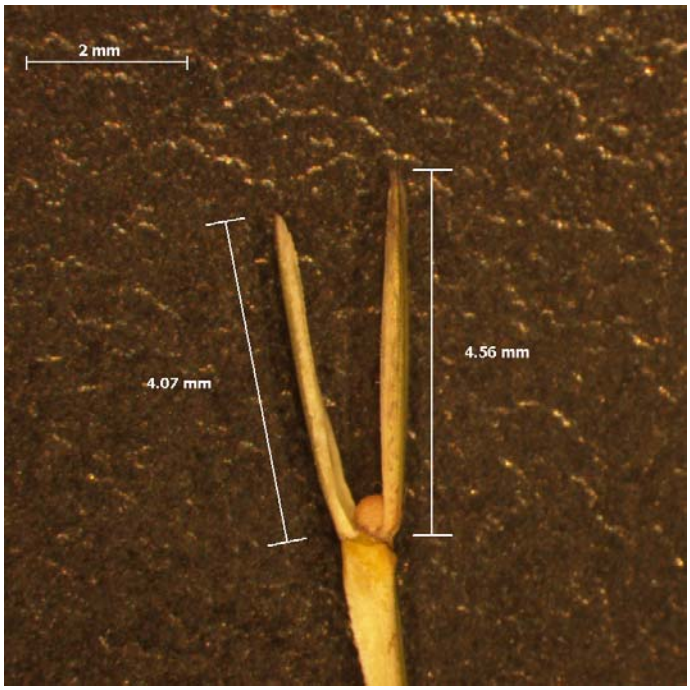

Figure 6. Dissected spikelet showing both lower and upper glume (*Pseudoroegneria sosnowskyi*).

Glumes are various in their shape. The commonest shape, as far as my revised genera are concerned, appears to be lanceolate, as in *Pseudoroegneria libanotica, Elymus transhyrcanus, E. caninus, Thinopyrum pycnanthum and Leymus racemosus* subsp. *sabulosus* or narrowly lanceolate as in *Pseudoroegneria sosnovskyi*. Other common, glume shapes are oblong (i.e.*Thinopyrum intermedium*, *T. elongatum, T. flacidifolium, Dasypyrum villosum,* etc.), cuneate oblong (i.e *Ambloyopyrum muticum*), narrowly eliptic (*Thinopyrum caespitosum*), obovate, navicular or boat shaped (*Agropyron* spp., *Eremopyrum* spp.), urceolate (*Aegilops* spp. i.e *Ae. crassa*, *Ae. juvenalis*), subulate (i.e *Heteranthelium piliferum, Psathyrostahys spp, Secale spp..*), linear subulate (*Taeniatherum caput medusae, Hordelymus europaeus*).

Among the genera revised four major glume apex types have been found: truncate (i.e. *Aegilops juvenalis* and *Ae. crassa* , etc.), obtuse (i.e. *Thinopyrum flaccidifolium*, *T. caespitosum* etc.), acute or acuminate (*Pseudoroegneria libonotica*) and subulate (i.e. *Eremopyrum triticeum*). Sometimes glumes terminate in a aristate point, as in *Elymus caninus*.and very occasionally glumes have a smaller mucro as in *A. cristatum* subsp. *pectinatum* var. *mucranatum* or an awn in different sizes as in *A. incanum*, *A. cristatum*

subsp. *pectinatum* var. *pectinatum, Dasypyrum villosum.* Rarely some taxa i.e. *Elymus divaricatus* have glumes bifid at apex with a long or short seta from the sinus.

Glumes are strongly keeled from near the base to the tip, sometimes with two keels (i.e. *Agropyron*, *Dasypyrum*, *Eremopyrum*, *Triticum*. etc.) but in the genera *Secale*, *Heteranthelium*, *Aegilops, Amblyopyrum and Henrardia* glumes are rounded on the back, not or weakly keeled at the base sometimes strongly keeled distally, but never with two keels. Whereas there have been lots of examples of usage of glume morphology for delimitation of the taxa mostly at infrageneric level in the tribe. The genus *Thinopyrum* is characterized by its thick and stiff glumes (Jarvie, 1992). It was earlier recognized under the genus *Elymus* s.l. by Melderis (1985) in Flora of Turkey.

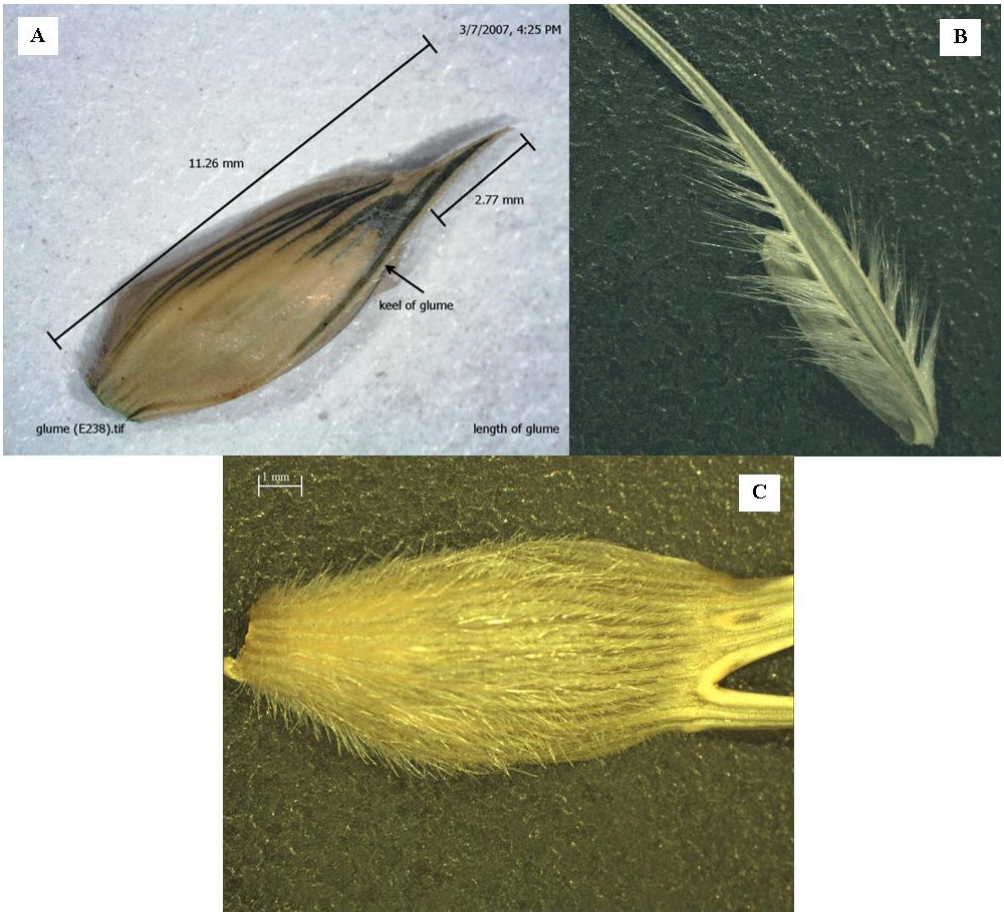

Figure 7. Keeled versus rounded glumes in the tribe **A** *Triticum durum* (1 keeled) **B** *Dasypyrum villosum* (2-keeled) **C.** *Aegilops umbellulata* (ventricose)

The number of veins in glumes vary significantly among the genera even between the taxa within the genus. It is especially helpful for discriminating the taxa at the species and subspecies level in the genera of *Elymus*, *Pseudoroegneria* and *Thinopyrum*. As an example *Elymus panormitanus* (7-9 veined) and *Elymus caninus* (3-5 veined) differ from each other by its different glume vein numbers.

3.1.7. Glume epidermal features

Epidermal features of the florets have been used before to unravel relationships in the grasses (Prat 1932; Brown 1958; Metcalfe 1960; Ellis 1979; Doğan 1988; Barkworth 1990; Acedo and Llamas 2001; Mejia-Saules & Bisby 2003; Liu et al., 2010). Although there have been lots of studies indicated that micromorphological features of the florets are so important for systematic purposes in the grasses only a few studies were accomplished on the tribe Triticeae. Prat (1932) studied glumes and lemmas in a number of genera included in tribe Triticeae and illustrated some of the cell types of epidermal system. He investigated the occurrence and appearance of papillae both epidermises leaf and inflorescence parts. Baum (1971,1980) studied surface view of glumes, lemma and caryopsis in *Avena* and some other Triticoid genera by means of SEM. As the scarce epidermal micromorphology data of the tribe, a study of glume epidermal features was started in an attempt to give detailed information about micro morphological structures of parts of spikelets in the taxa found in the tribe.

The descriptive micromorphological data about the glume epidermises of the taxa representing the genera found in the tribe was given in Tables 4-7. The results of SEM studies indicated that among the investigated taxa three types of pointed structures, hooks, prickles, and macrohairs were found on the glume epidermises of specimens.

Macrohairs.

Glumes are glabrous as in *T. dicoccon* without prickles and hooks (Fig. 3A) or scabrid in *Ae. comosa* subsp *comosa* (Fig. 3B) but sometimes covered by various types of macrohairs. Macrohairs are always unicellular differ from each other in length and direction. For example some taxa such as *Ae. juvenalis* (Fig. 3C), *Agropyron incanum* have densely pilose glume with long adpresses hairs. Contrastingly, *Amblyopyrum muticum* var. *muticum* has patent macrohairs on the glume epidermises (Fig. 3D). *Henrardia persica* var. *persica*, is the

only taxon which pubescent glumes covered with retrorsely adpressed hairs (Fig. 3E). All other taxa which have pubescent glumes have antrorsely adpressed hairs.

Hooks

Hooks are generally less than 30 µm (often 20-30 µm or less) in any dimension had rounded bases (Fig. 4A, B, C, E). They also have been called barbs, crochets or crown cells (Ortunez and De la Fuente 2010; or papillae in the literature (Tubb et al. 1993; Liu et al., 2010). Ortunez and de la Fuente (2010) defined hooks as short exodermic cells with circular bases with a small convex or conical protrusions with an apex either obtusely rounded or sharply hook shaped. Among the investigated taxa as far as go, it was realized that some taxa belonging the genera such as *Hordeum* (Fig. 4D, Fig5B), *Thinopyrum* (Fig. 4F, Fig.6F), *Psathyrostachys* (Fig. 5A), *Henrardia* (Fig. 5F, Fig. 6A) and *Leymus* (Fig. 6D) do not have hooks on the epidermises. Long cells are the dominant characters in these genera. Tubb et al. (1993) studied the inflorescence papillae and the number of pits in the base of papilla of 45 accessions from the genera *Hordeum*, *Triticum* and *Aegilops*. They found a highly significant relationship between the pit number and diameter of papillae. On the basis of their findings *Triticum aestivum* have more pits and greater diameters than *Hordeum vulgare*. In this part of the thesis study, I did not focus on counting the pit number at the base of papillae (hooks) for all the studied taxa because of the difficulties obtaining good micrographs. Also the pits are not present at the base of hooks in all examined taxa i.e *Heteranthelium piliferum* has hooks which are not pitted at the base (Fig. 6B). Our observations showed that the pitted edges are not constant for the hooks among the taxa and to be ensure range of the pit number for each taxa, further specialized observations are needed. For instance in *Aegilops umbellulata* we counted about 15-17 pits at the base of hooks observed in lemma surface. Tubb et al. counted 9-12 pits in the accessions of *Ae. umbellulata.*

Prickles

Prickles are one-celled, rigid, pointed structures that vary greatly in size and shape. They are one of the most abundant epidermal features of glume epidermises in the genera of *Aegilops, Crithopsis, Heteranthelium***.** Prickles are visible with the naked eye and always were larger than hooks. Their length is up to 200 µm. Their densities are higher towards the apex part of glume. They are especially dominant elements on the awn structures of glumes of the taxa studies. They are typically pointed antrosely (Fig. 4C, Fig 4D).

Silica bodies

Silica bodies are elliptic or circular in shape and also arranged longitudially between the long cells. Their lengths are between 15-20 µm and in generally 15-20 in 1 mm^2(Figs 5C, E, F; Fig. 6A, B, C,D).

Long cells

In surface view, long cells were the dominant epidermal cells on the surface of glumes and they provide very useful taxonomic characters. Ortunez and de la Fuante mentioned that these cells are elongated axially (parallel with the long axis of lemma). In our study long cells notably varied in length among the taxa. Basically two types of cells can be recognized. The first type consists of cells which are rather elongated and with straight cell walls (i.e. *Pseudoroegneria sosnovskyi*, *Thinopyrum pycnanthum, Psathyrostachys fragilis* subsp. *villosus* etc.). In the second type, cells are short or long but cell walls are more or less sinuous (i.e. *Eremopyrum bonaepartis, Elymus repens, Hordeum spontaneum, Taeniatherum caput medusae, H. bulbosum*, *Crithopsis delileana*, *E. distans* and *Henrardia persica* var. *persica* etc.). Doğan (1982) proposed that the degree of cell wall indulations are probably due to the amount of metabolic activities taking places in cells in the short growth period. The degree of cell wall indulations were the most prominent in the *Henrardia persica* var. *persica*.

Stomata

Following the classification of stomata types given by the Ortunez and de la Fuente (2010), on the surface of glume epidermises two types of stomata were observed. These two types are differ from each other by the shape of its subsidiary cells. They can be classified as subsidiary cells with parallel sides as in *Thinopyrum erosiglumis, Hordeum bulbosum* and curved side, looking like a dome shaped as in *Thinopyrum farctum, Leymus cappadocicus* and *Henrardia persica*. The presence of stomata seems to be specific to taxa. They usually observed as forming rows parallel to the long cells with variable distribution and frequency.

Epicuticular waxes

Among the studied taxa some of them i.e. *Thinopyrum pycnanthum* (Fig. 4F) and *Th. farctum* have glumes covered with epicuticular waxes. These waxes are not so common in the tribe. The presence of these waxes and density of them can be used for systematic purposes.

These above mentioned micromorphological features of the glume epidermises are useful for taxonomic purposes and can be used for solving problems about the relationships of the taxa in the tribe. For instance, with respect to their common morphological feature, sharing

similar spike morphology (2-3 spikelets per-node), the diploid genera *Crithopsis* Jaub. & Spach, *Taeniatherum* Nevski and *Psathyrostachys* Nevski, and *Hordeum* L. have been considered rather closely related. It was found that the principal features are of taxonomic and phylogenetic significance include the morphology of long cells, presence, frequency and distribution of macrohairs, crown cells or hooks and prickles. The results of SEM observations showed that the genera *Crithopsis* and *Taenitherum* are more closely related than the others. They both have common micro-morphological features on the glume epidermises such as none or slightly elongated long cells, presence of crown cells or hooks and absence of macrohairs. On the contrary, the genera *Psathyrostachys* and *Hordeum* have conspiciously elongated long cells and has nearly no crown cells and prickle hairs, presence of macrohairs.

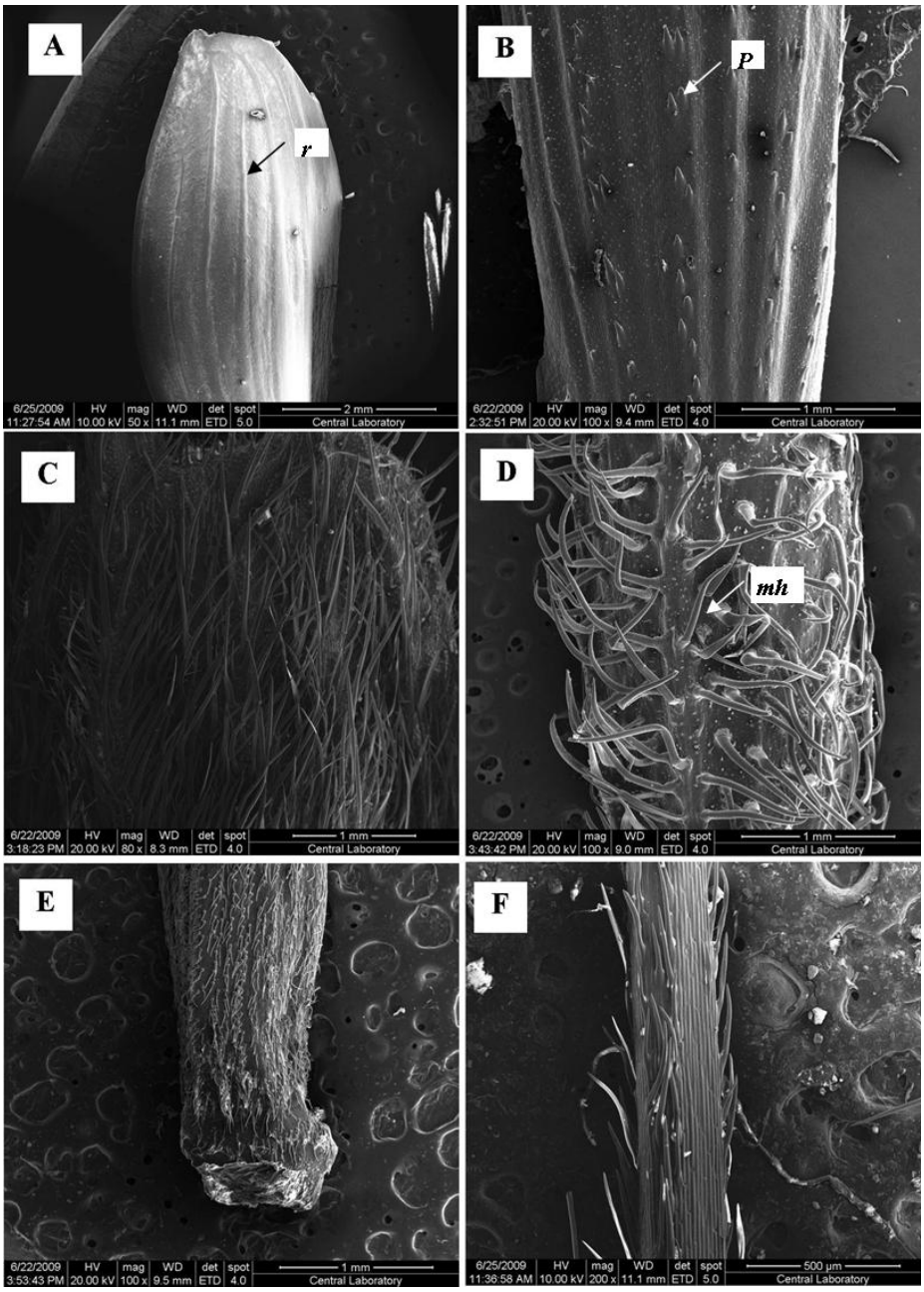

Figure 8. Abaxial epidermises of glume surfaces of some taxa belonging the genera *Triticum, Aegilops, Amblyopyrum, Henrardia* and *Psathyrostachys* in the tribe

A. Glabrous epidermis of *Triticum dicoccon* with ribs (*arrow*) **B**. *Aegilops comosa* subsp. *comosa* covered sparsely with prickles *(arrow)* especially on ribs **C.** *Ae. juvenalis* with long adpressed macrohairs **D.** *Amblyopyrum muticum* covered with patent and divergent macrohairs (*arrow*) **E.** *Henrardia persica* var. *persica* densely covered with retrorsely adpressed hairs. **F.** *Psathyrostachys fragilis* subsp. *secaliformis* with long slightly patent marohairs. Abbreviations: *r* rib, *mh* macro hair. All pictures are oriented to distal apex.

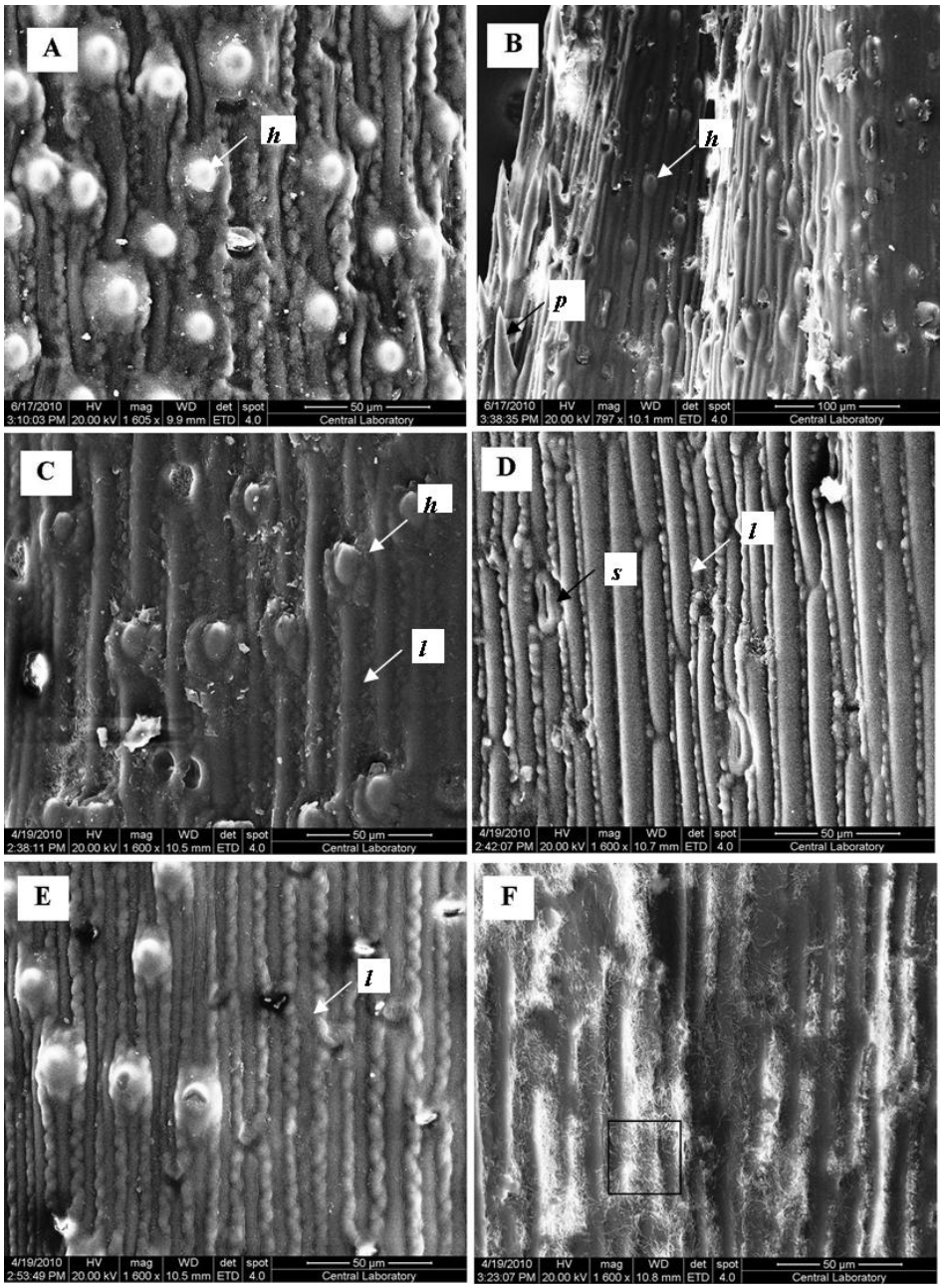

Figure 9. Abaxial epidermises of glume surfaces of some taxa belonging the genera *Eremopyrum, Pseudoroegneria, Elymus, Hordeum, Taeniatherum* and *Thinopyrum*

A. *Eremopyrum bonaepartis,* view of long cells with strongly sinuous, raised cell walls and short cells (hooks and rounded silica bodies) **B**. *Pseudoroegneria sosnovskyi* view of extremely elongated long cells with straight cell walls and short cells (hooks and rounded silica bodies) **C.** *E. repens,* long cells with strongly sinuous, unraised cell walls and short cells (hooks) **D.** *H. spontaneum,* extremely elongated long cells with highly undulate and raised walls and stomata **E.** *Taeniatherum caput medusae,* long cells with highly undulate and raised walls and short cells (hooks) **F.** *Thinopyrum pycnanthum,* long cells with straight walls and whole surface covered with thread like epicuticular waxes. Abbreviations: *l* long cell, sb silica body, p, prickle. All pictures are oriented to distal apex.

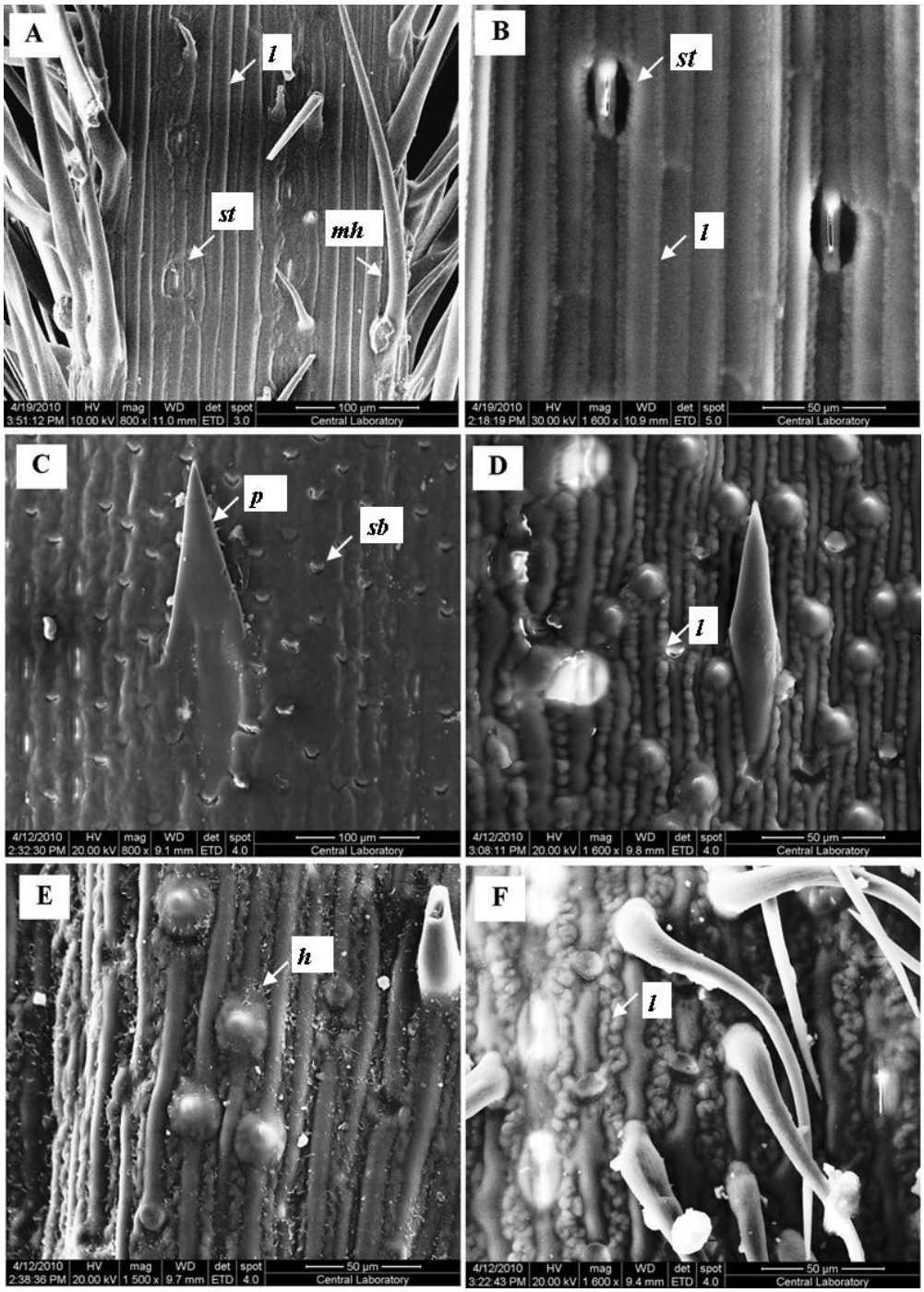

Figure 10. Abaxial epidermises of glume surfaces of some taxa belonging to genera *Psathrostachys, Hordeum, Aegilops, Crithopsis, Eremopyrum* and *Henrardia*

A. *P. fragilis* subsp. *villosus,* view of extremely elongated long cells with straight cell walls, macro hairs and stomata **B**. *H. bulbosum*, extremely elongated long cells with straight cell walls and stomata **C.** *Ae. caudata,* prickle and abundant silica bodies **D.** *C. delileana,* long cells with strongly sinous and raised cell walls and hooks **E.** *E. distans,* long cells and hooks **F.** *H. persica var. persica,* shorthened long cells with strongly raised and sinous cell walls and retrorsely pointed macrohairs *Abbreviations: l* long cell*, mh* macro hair *sb* silica body*, p,* prickle. All pictures are oriented to distal apex

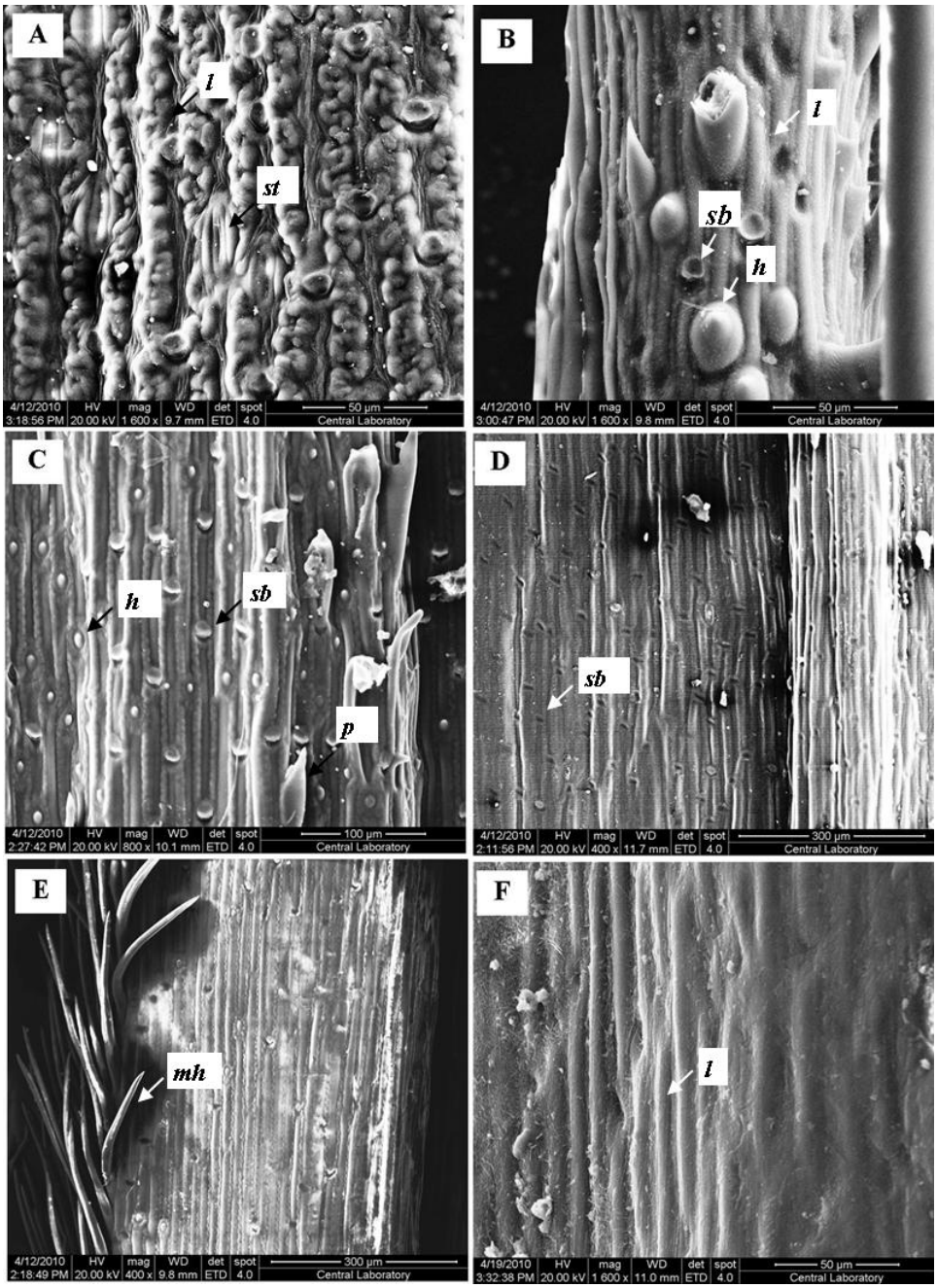

Figure 11. Abaxial epidermises of glume surfaces of some taxa belonging to genera *Henrardia, Heteranthelium, Hordelymus, Leymus, Secale* and *Thinopyrum*

A. *Henrardia persica* var. *glaberrima,* without macrohairs **B**. *Heteranthelium piliferum,* long cells, silica bodies and hooks **C.** *Hordelymus europeus,* hooks, silica bodies and prickles **D.** *Leymus racemosus,* silica bodies **E.** *Secale slyvestre,* macrohairs **F.** *Thinopyrum farctum,* extremely elongated long cells with straight cell walls**.** *Abbreviations: l* long cell*, sb* silica body, *p,* prickle. All pictures are oriented to distal apex.

Table 4. Principal micromorphological features of glume epidermises of the genera *Agropyron*, *Elymus*, *Thinopyrum*, *Pseudoroeneria* and *Eremopyrum*.

Genus	***Agropyron***	***Elymus***	***Thinopyrum***	***Pseudoroegneria***	***Eremopyrum***
Long cells	Rectangular ; flat or lightly sinuous and raised walls	Rectangular ; flat or lightly sinuous and unraised walls	Rectangular ; flat or lightly sinuous periclinal walls and unraised	Rectangular ; flat and unraised walls	Rectangular ; strongly sinuous and raised walls.
Silica bodies	Reniform or rounded, abundant	Rounded, abundant	Rounded, abundant	Rounded or reniform, abundant	Rounded, sparse
Hooks or crown cells	10-25 µm in diameter, abundant	20-25 µm, abundant	15-25 µm, abundant	15-20 µm, abundant	20-40 µm, abundant
Prickles	Present, scattered on the surface or dense on the keel especially towards apex	Taxa specific, usually absent, the only taxa *E. panormitanus* have prickles.	Absent	Absent	Prickles 100-150 µm, very sparse on the surface, mainly distributed on the edges
Macrohairs	Presence of macrohairs seem to taxa specific. *A. incanum*, *A. imbricatum* and *A. cristatum* var. *puberulum* have flexible macrohairs in different lenths between 200-800 µm	Usually absent.	Taxa specific, usually absent, some subgroups in the *T. intermedium* have macrohairs such as var. *barbulatum*	Absent.	Taxa specific, i.e. *E. distans and E. orientale* have flexible macrohairs up to 1 mm in length

Table 5. Principal micromorpholoical features of glume epidermises of the genera *Heteranthelium*, *Crithopsis*, *Amblyopyrum*, *Aegilops* and *Triticum*

Genus	***Heteranthelium***	***Crithopsis***	***Amblyopyrum***	***Aegilops***	***Triticum***
Long cells	Rectangular ; flat or lightly sinuous and raised walls	Rectangular ; strongly sinuous and raised walls	Rectangular ; sinuous and unraised walls	Rectangular ; strongly sinuous and more or less raised walls.	Rectangular ; flat or lightly sinuous and raised walls
Silica bodies	Rounded, sparse	Rounded, sparse	Rounded or elliptical, sparse	Rounded or elliptical, abundant	Rounded, abundant
Hooks or crown cells	20-30 µm in diameter, abundant	10-15 µm, abundant	10-15 µm, abundant	40-60 µm, abundant	20-25 µm, abundant, dense especially towards apex
Prickles	Sparse, up to 30 µm in length.	40-50 µm, very sparse, present only on the edges especially towards apex	Absent	Present in all taxa, 150-200 µm in length	Present especially towards apex
Macrohairs	Present, long, elongated, flexible and antrorsely pointed	Absent	var. *muticum* have long patent hairs	Taxa specific, i.e. *Ae. juvenalis, Ae. crassa, Ae. vavilovii, Ae. nelecta* have addpresed, antrorsely pointed macrohairs up to 1mm in length.	Taxa specific, i.e. *T. araraticum* has adpreseed pilose macrohairs

Table 6. Principal micromorpholoical features of glume epidermises of the genera *Dasypyrum, Secale, Leymus* and *Hordeum*

Genus	*Dasypyrum*	*Secale*	*Leymus*	*Hordeums*
Long cells	Rectangular ; strongly sinuous and raised walls	Rectangular ; slightly convex periclinal walls and unraised anticlinal walls	Rectangular ; sinuous and unraised anticlinal walls	Rectangular ; flat or lightly sinuous walls and in some of them walls are raised.
Silica bodies	Reniform or elliptic, abundant	Rounded or elliptical, abundant	Rounded, abundant	Rounded, sparse
Hooks or crown cells	30-40 µm in diameter, abundant	15-20 µm, sparse	Absent	10-15 µm, abundant
Prickles	Present, 200-250 µm long, dense on the keels	Absent	90-100 µm, Present only on the edges	30-45 µm; Usually absent but in some taxa found sparsely on the keels and edges
Macrohairs	450-600 µm long, dense on the keel	200-300 µm; dense, located on the edges of glumes, they are antrorsely pointed	Absent	Taxa specific , i.e. H. spontaneum has straight, elongated up to 1 mm macrohairs at the edge of glumes.

Table 7. Principal micromorpholoical features of glume epidermises of *Psathyrostachys, Hordelymus, Taeniatherum* and *Henrardia*

Genus	*Psathyrostachys*	*Hordelymus*	*Taeniatherum*	*Henrardia*
Long cells	Rectangular, extremely elongated ; flat and unraised walls	Rectangular ;100-140 µm long with slightly undulated and raised walls	Rectangular ; 120-140 µm long with undulated and raised walls	Rectangular ; 60-110 µm long with strongly undulated and raised walls
Silica bodies	Absent	Rounded, abundant	Elliptic or rounded, abundant	Rounded, abundant
Hooks or crown cells	Absent	15-20 µm, rare to common	10-20 µm, rare to abundant. Density of crown cells in 100 μm^2 is (2-5)	10-12 µm, abundant
Prickles	Absent	60-70 µm, very sparse, present only on the veins	Absent	Absent
Macrohairs	Macrohairs are very dense on the edes of glumes in length between 70 µm to 1 mm.	Absent	Absent	Seem to taxa specific, var. *persica* has very dense retrorsely pointed macrohairs in length 150-200 µm.

3.1.7. Callus

Clayton (1975) has stated that the callus is formed by the fusion of the lower rachilla internode and vestige of the lower glume. Gould (1968) described the callus as the reduced first glume fused with the rachis node. Hitchcock (1951) referred to the callus as a thickening of the lower rachilla joint with the reduced first glume adnate to and sheathing about the joint. While these authors all agree that the callus is in part a reduced first glume, no morphological evidence has been reported. Wang and Henwood (1999) carried out a SEM survey of rachillas, calluses and paleae of Australian and New Zealand species of *Elymus*. As a result of this study they proposed that micromomorphological features of calluses such as shape, distribution of indumentum and thickness of tips may provide valuable information taxonomically important. In the genus *Pseudoroegneria* a distinct callus is present below the lemmas and with this characteristic feature the members of this genus delineate from the *Elymus* s.l.

3.1.8. Lemma

There is a considerable variation in lemma shape. Lemmas are lanceolate, as in the genera *Aropyron, Elymus and Pseudoroegneria* with apices obtuse, acute, muticous, mucronate or awned; oblong lanceolate as in *Crithopsis*; elliptical, as in *Eremopyrum* with an acuminate apices; oblong in *Thinopyrum* , with apices truncate, obtuse, or acute, sometimes mucronate or awned. The only genus which have tuberculate lemmas is *Heteranthelium*. The lemma apex presents a great range of variation from truncate to acuminate or aristate. It is found to be one of the most valuable taxonomic characters. Lemmas sometimes strongly keeled from near the base to the tip as in *Secale*, but usually lemmas do not have prominent keel, sometimes they are keeled usually on the upper half and rounded at the back as in the genera *Agropyron* and *Elymus.*

3.1.9. Lemma epidermal features

In this part of thesis a scanning electron survey of the lemma epidermal features in the selected species of genera included in the tribe Triticeae is presented. Characters observed included the pattern of long and short cells of the epidermis, distribution of prickles, pattern and prominence of cell walls, distribution of macrohairs, and the awn base. Three types of pointed structures, hooks, prickles, and macrohairs were found on the glume lemma and palae epidermes of various taxa.

Macrohairs

Macrohairs were unicellular structures, soft or rigid and elongate structures which can be observed with the naked eye; usually greater than 500 µm in length and linear lanceolate as in shape i.e *Agropyron incanum* (Fig 7A), *Eremopyrum distans* (Fig. 11A), Aegilops juvenalis (Fig 15A), *T. timophevii* var. *araraticum* (Fig 17D) or rarely lanceolate as in *Amblyopyrum muticum* (Fig. They usually vary in density, length and flexibility. They occur between other epidermal cells, and, in some cases, they have an associated small cork cell. The results of SEM observations showed that presence of macrohairs seems to taxa specific. For example whereas *Thinopyrum intermedium* subsp *intermedium* var. *intermedium* do not have any macrohairs, var. *barbulatum* have lemmas densely covered with macro hairs. Among the investigated taxa, the only *Henrardia persica* var. *persica* has retrorsely pointed macrohairs on the lemma surfaces the remaining taxa have antrorsely oriented macrohairs. Macrohairs observed on the lemma surface are usually linear lanceolate and longer than 500 µm. The only taxon *Heteranthelium piliferum* (Fig. 12 A,B,C) has twisted macrohairs on the lemma surface in the tribe that makes it special in the tribe.

Silica bodies

Our results showed that silica bodies are of little value for diagnostic and taxonomic puposes. They observed in all surfaces of studied taxa and had mainly rounded or elliptical rounded shapes. Some taxa have reniform (Fig 7H) shaped of silica bodies such as *A. cristatum* subsp *pectinatum* var. *mucronatum.* The density of the silica bodies show considerable variation even on the same taxon.

Prickles

Prickles, exodermic cells, were always larger than hooks (length to 350 µm) and usually had inflated, swollen bases. They vary in shape such as elongate, oval or elliptical and with a sharply pointed apex. They were hook shaped with a more or less curved point and thick walls. Prickles were commonly observed in lemmas of the members of the tribe Triticeae, with a sharply acute apex that typically pointed antrorsely.

Long cells

Long cells were the dominant element of the epidermal surfaces, but varied notably in length. These cells were elongated axially (parallel with the long axis of the lemma). The relative lengths and shapes of the axial and transverse anticlinal walls determined the cells'

shape. The studied taxa showed the following types: elongated, more than five times longer than wide and with constant width and thickened or raised anticlinal walls (*T. monococcum*, *Agropyron cristatum* subsp. *pectinatum*, *Leymus cappadocicus*, *Elymus longearistatus* subsp *sintenisii*); elongated, more than five times longer than wide and without thickened or raised anticlinal walls (*Ae speltoides, Ae tauschii*).

Presence, shape and distribution of stomata in the epidermal glume and lemma surfaces were studied. Two types of paracytic stomata were observed according to shapes of subsidiary cells in the surface view; subsidiary cells with parallel sides and curved side which were sometimes dome shaped.

Table 8. Principal micromorphological features of lemma epidermises of the genera *Agropyron*, *Elymus*, *Thinopyrum*, *Pseudoroeneria* and *Eremopyrum*

Genus	*Agropyron*	*Elymus*	*Thinopyrum*	*Pseudoroegneria*	*Eremopyrum*
Long cells	Rectangular ; flat or lightly sinuous and raised walls	Rectangular ; 50-100 µm flat or slightly sinuous and unraised walls	Rectangular ; flat or lightly sinuous periclinal walls and unraised	Rectangular; slightly to moderately sinuous and unraised or raised walls	Rectangular to square; very short 40-60 µm strongly sinuous and raised walls.
Silica bodies	Reniform or rounded, abundant	Rounded or elliptic, abundant	Rounded, abundant	Rounded, abundant	Rounded, abundant
Hooks or crown cells	10-25 µm in diameter, abundant	20-25 µm, abundant	15-25 µm, abundant	15-25 µm, abundant	30-40 µm, abundant
Prickles	Present, scattered on the surface or dense on the keel especially towards apex	Taxa specific, usually present, the only taxa *E. repens* lack prickles.	Absent	Taxa specific, *Ps. tauri* has small triangular 20-25 µm long prickles. These prickles do not accurately fit the commonly observed prickles in length and shape.	Absent
Macrohairs	Presence of macrohairs seem to taxa specific. *A. incanum*, *A. imbricatum* and *A. cristatum* var. *puberulum* have flexible macrohairs in different lengths between 200-800 µm	Absent.	Taxa specific, usually absent, some subgroups in the *T. intermedium* have macrohairs such as var. *barbulatum*	Absent.	Taxa specific, i.e. *E. distans and E. orientale* have flexible macrohairs up to 1 mm in length

Table 9. Principal micromorpholoical features of lemma epidermises of the genera *Heteranthelium*, *Crithopsis*, *Amblyopyrum*, *Aegilops* and *Triticum*

Genus	***Heteranthelium***	***Crithopsis***	***Amblyopyrum***	***Aegilops***	***Triticum***
Long cells	Rectangular; very short smaller than 50 µm, with flat or slightly sinuous and raised walls	Rectangular ; strongly sinuous and raised walls	Rectangular ; sinuous and unraised walls	Rectangular ; strongly sinuous and more or less raised walls.	Rectangular ; flat or lightly sinuous and raised walls
Silica bodies	Rounded, abundant	Rounded, sparse	Rounded or elliptical, sparse	Rounded or elliptical, abundant	Rounded, abundant
Hooks or crown cells	20-25 µm in diameter, abundant	10-15 µm, abundant	40-50 µm, abundant	40-60 µm, abundant	20-25 µm, abundant, dense especially towards apex
Prickles	Absent.	40-50 µm, very sparse, present only on the edges especially towards apex	Absent	Present in all taxa, 150-200 µm in length	Present especially towards apex
Macrohairs	Present, long, elongated, flexible and antrorsely pointed. The unique feature of them is that they all twisted.	Absent	Var. *muticum* have long, patent and rigid hairs in length 200-500 µm. The density of hairs are very sparse and restricted to the upper side of lemmas.	Taxa specific, i.e. *Ae. juvenalis, Ae. crassa, Ae. vavilovii, Ae. nelecta* have addpresed, antrorsely pointed macrohairs up to 1mm in length.	Taxa specific, i.e. T. araraticum has adpreseed pilose macrohairs

Table 10. Principal micromorpholoical features of lemma epidermises of the genera *Dasypyrum, Secale, Leymus* and *Hordeum*

Genus	***Dasypyrum***	***Secale***	***Leymus***	***Hordeum***
Long cells	Rectangular ; strongly sinuous and raised walls	Rectangular ; slightly convex periclinal walls and unraised anticlinal walls	Rectangular ; moderately long 100-140 µm with flat and unraised walls	Rectangular ; flat or lightly sinuous walls and in some of them walls are raised.
Silica bodies	Reniform or elliptic, abundant	Rounded or elliptical, abundant	Rounded, abundant, sometimes they have small cavities.	Rounded, sparse
Hooks or crown cells	30-40 µm in diameter, abundant	15-20 µm, sparse	Absent	10-15 µm, abundant
Prickles	Present, 200-250 µm long, dense on the keels	Absent	90-100 µm, Present only on the awns not the surface of the lemmas	30-45 µm; Usually absent but in some taxa found sparsely on the keels and edges
Macrohairs	450-600 µm long, dense on the keel	200-300 µm; dense, located on the edges of glumes, they are antrorsely pointed	Seems to taxa specific, *L. racemosus* have linear lanceolate flexible macrohairs in length bet. 160-320 µm	Taxa specific , i.e. H. spontaneum has straight, elongated up to 1 mm macrohairs at the edge of glumes.

Table 11. Principal micromorpholoical features of lemma epidermises of the genera *Psathyrostachys, Hordelymus, Taeniatherum* and *Henrardia*

Genus	***Psathyrostachys***	***Hordelymus***	***Taeniatherum***	***Henrardia***
Long cells	Rectangular, 60-140 µm long, distinctly shorter than ones on the glumes, with flat and unraised walls	Rectangular ;100-140 µm long with slightly undulated and unraised walls	Rectangular ; 60-100 µm long with flat and unraised walls	Rectangular ; 60-110 µm long with strongly undulated and raised walls
Silica bodies	Reniform, scarce	Rounded, abundant	Elliptic or rounded, abundant	Rounded, abundant, sometimes they have small cavities
Hooks or crown cells	20-25 µm , abundant	15-20 µm, abundant	20-40 µm,abundant.	Absent
Prickles	Absent	60-100 µm, very sparse, distributed to the whole surface	100-160 µm, very sparse, distributed to the whole surface	Absent
Macrohairs	Flexible and usually longer than 500 µm in length. Density specific to the taxa in the genus.	Absent	Absent	Seem to taxa specific, var. *persica* has very dense retrorsely pointed macrohairs in length 150-200 µm.

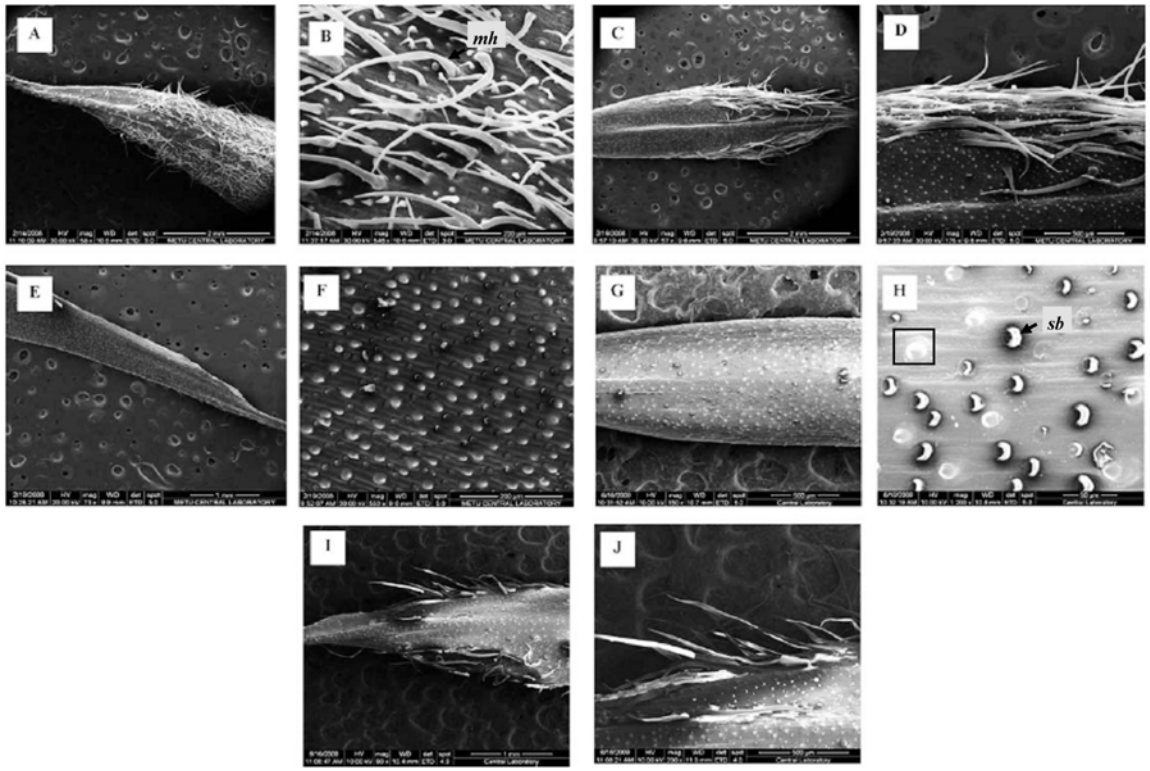

Figure 12. Abaxial epidermises of lemma surfaces of the taxa in the genus *Agropyron*

A-B *A. incanum,* villous maro hairs (*arrow*) covered the whole surface **C-D** *A.cristatum* subsp. *pectinatum* var *puberulum* **E-F** *A. cristatum* subsp. *pectinatum* var *pectinatum* **G-H** *A. cristatum* subsp. *pectinatum* var *mucranatum* **I-J.** *A. imbricatum* **.** Abbreviations: mh macrohairs, sb silica body, h hook. All pictures are oriented to distal apex

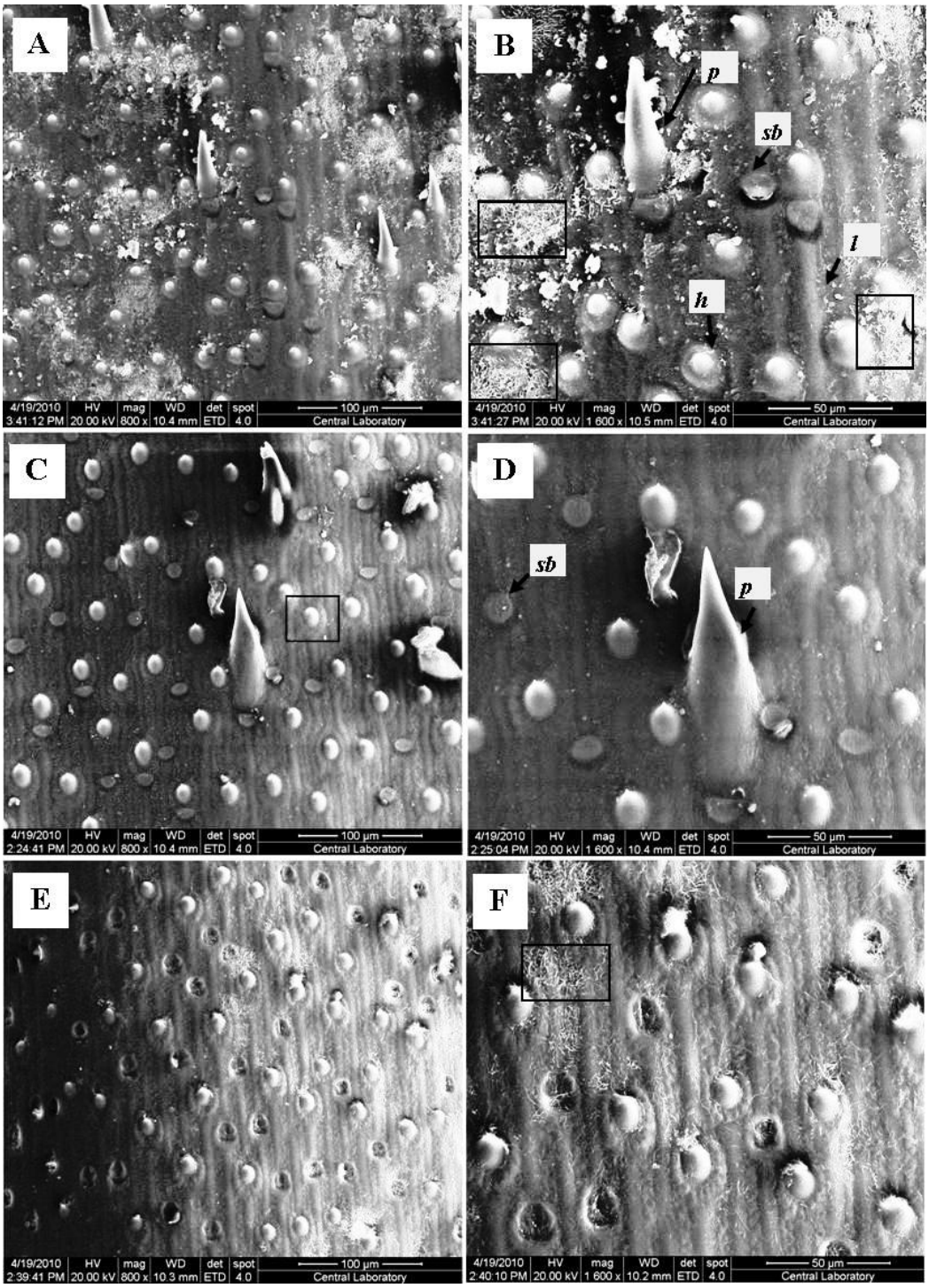

Figure 13. Abaxial epidermises of lemma surfaces of some taxa in the genus *Elymus*

A-B *Eymus divaricata,* prickles, hooks, silica bodies and rectangular long cells with straight walls (*arrows*), lemma surface covered partly with thread like epicuticular waxes *(square)*. **C-D** *E. panormitanus,* hooks *(square)* silica bodies and prickles with acuminate tip, and **E-F** *E.repens,* thread like epicuticular waxes were also observed *(square)*. Abbreviations: *l* long cell, s short cell, sb silica body, p, prickle. All pictures are oriented to distal apex.

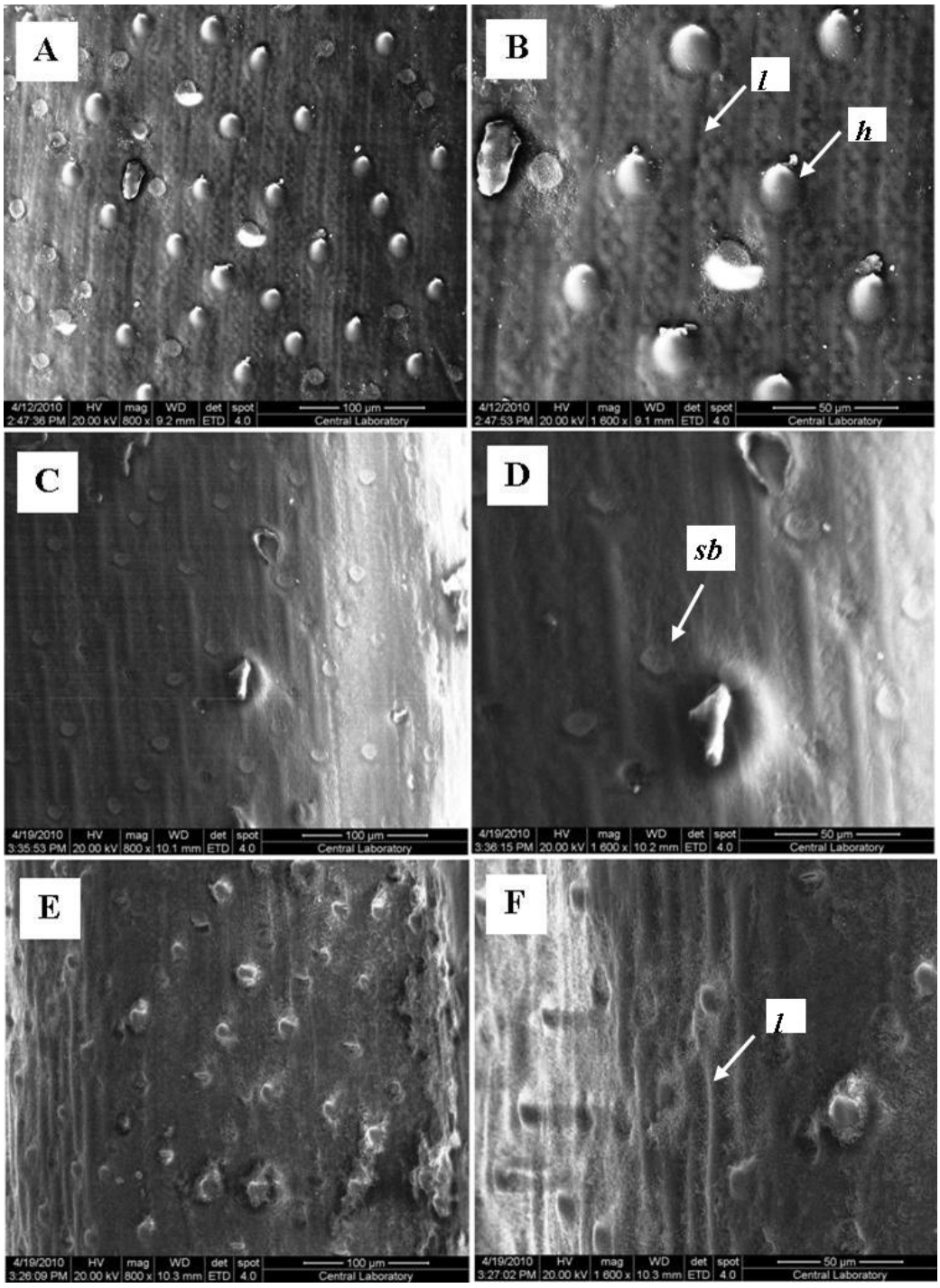

Figure 14. Abaxial epidermises of lemma surfaces of some taxa in the genus *Thinopyrum* **A-B** *Thinopyrum erosiglumis*, hooks and long cells *(arrows)* **C-D** *Th. farctum*, silica bodies *(arrows)* and **E-F** *Th. pycnanthum,* rectangular long cells with straight walls *(arrows)***.** Abbreviations: h hook, *l* long cell, sb silica body. All pictures are oriented to distal apex

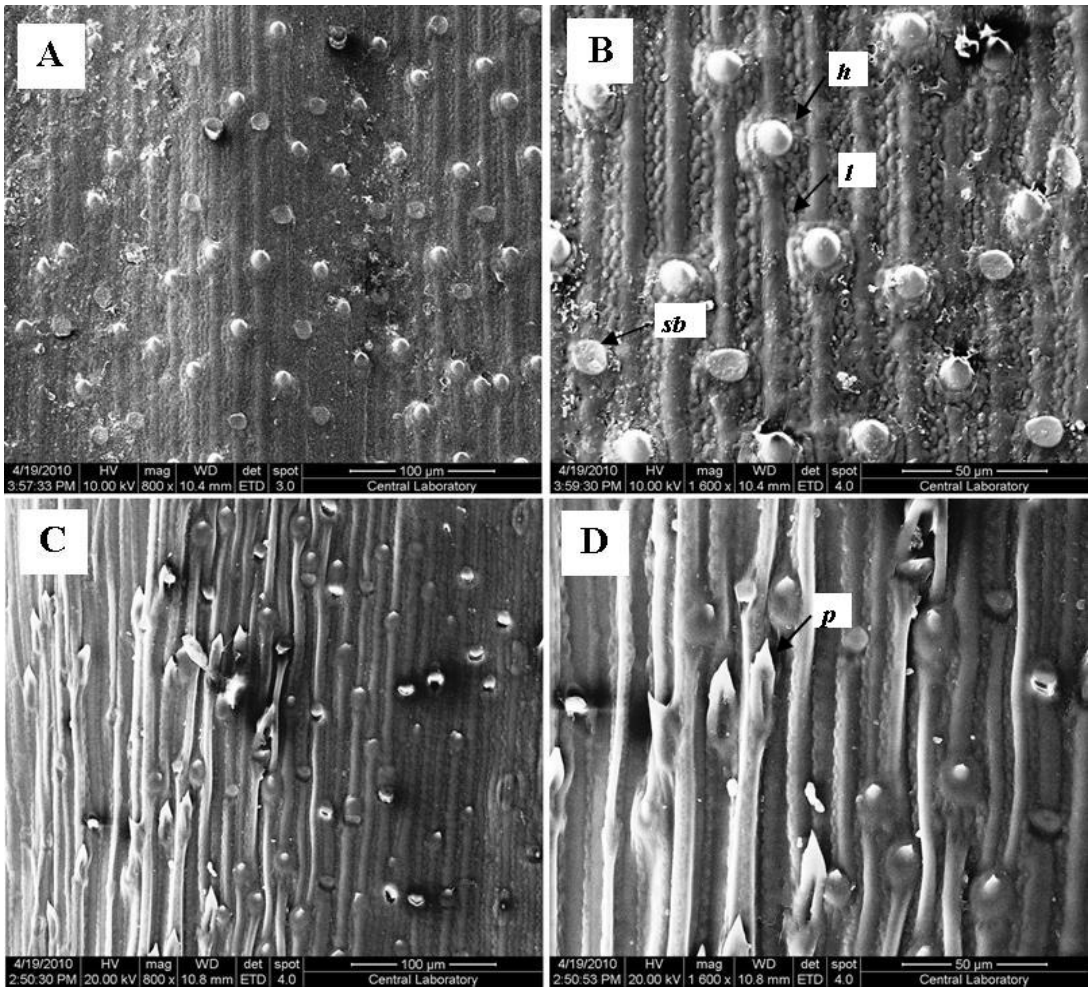

Figure 15. Abaxial epidermises of lemma surfaces of some taxa in the genus *Pseudoroegneria*

A-B *Pseudoroegneria libanotica,* hooks, long cells and silica bodies *(arrows)*, **C-D** *P.tauri,* prickles with acuminate tips *(arrows)* Abbreviations: *l* long cell, *h* hooks, sb silica body, p, prickle. All pictures are oriented to distal apex.

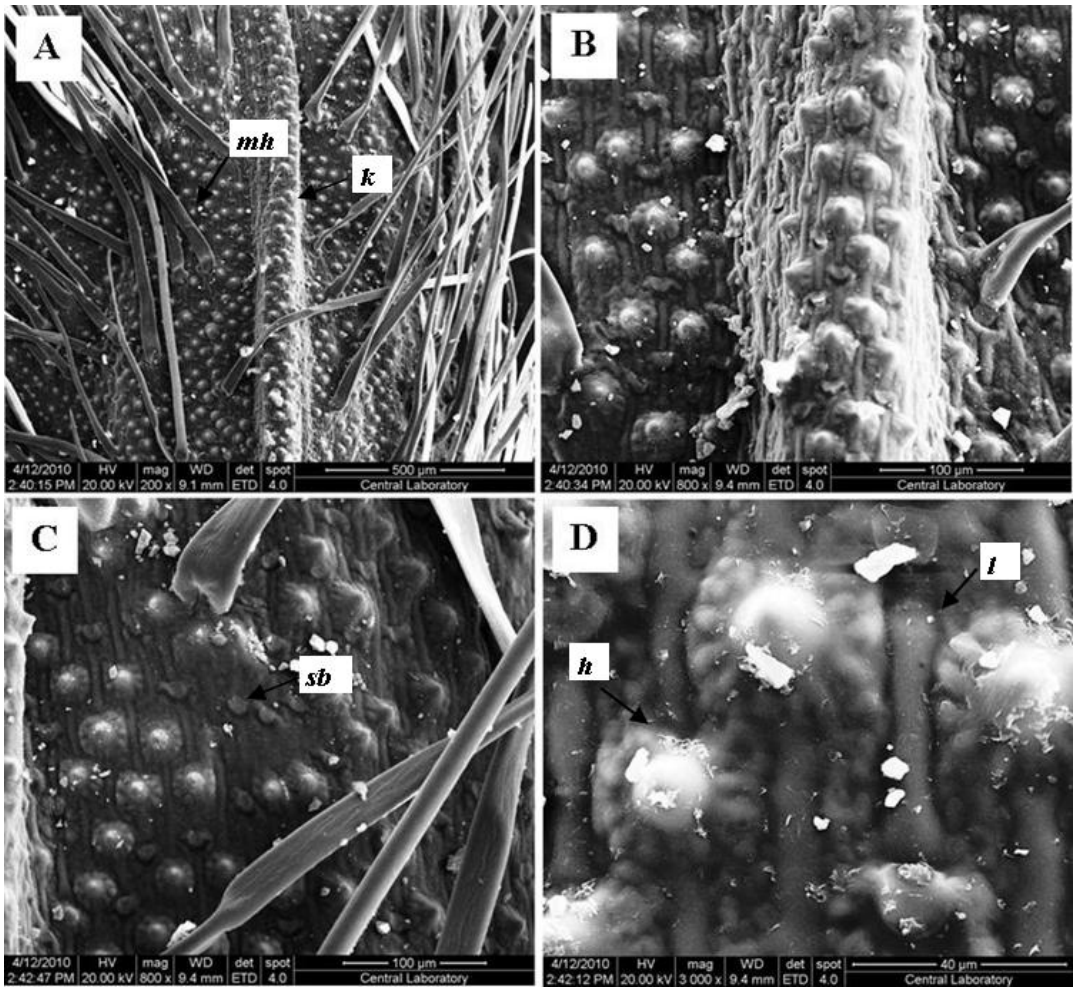

Figure 16. Abaxial epidermis of lemma surface of *Eremopyrum distans*.

A-D *Eremopyrum distans* in different magnifications**,** prominent keel throughout the lemma, linear lanceolate macro hairs**,** rounded silica bodies, hooks with 12-14 pits at the base and moderate long cells with raised and sinuated walls. Abbreviations: *l* long cell, s short cell, sb silica body, p, prickle. All pictures are oriented to distal apex

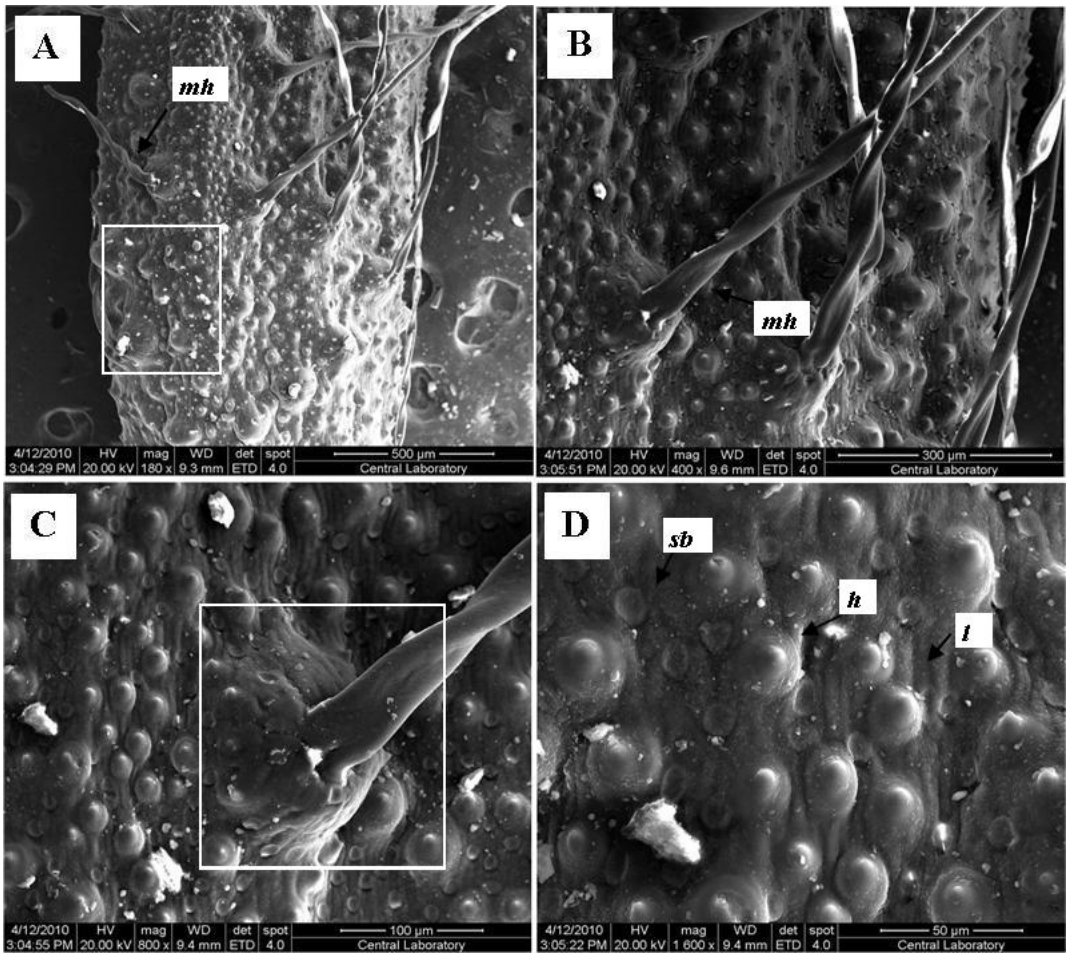

Figure 17. Abaxial epidermis of lemma surface of *Heteranthelium piliferum* in different magnifications.

A-D Lemma surface of *Heteranthelium piliferum* in different magnifications, tuberculate lemma surface (*Square*) is characteristic for the genus, twisted macrohairs with swollen bases (*Square*), silicabodies, hooks, and moderate long cell (arrows). Abbreviations: *h* hook, *l* long cell, *mh* macrohairs, sb silica body. All pictures are oriented to distal apex.

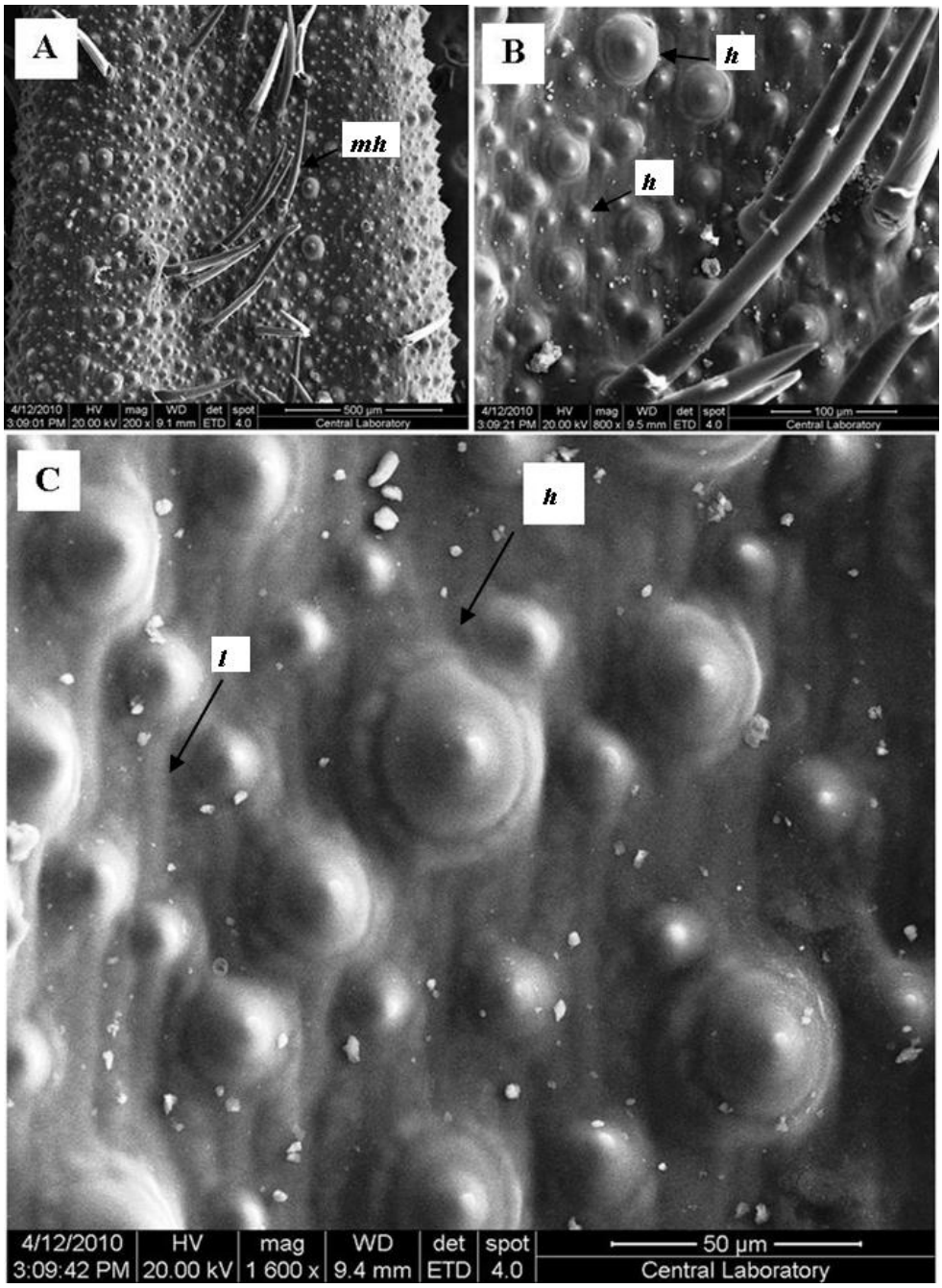

Figure 18. Abaxial epidermis of lemma surface of *Crithopsis delileana* in different magnifications

A-C. *C. delileana* , linear lanceolate macrohairs without swollen bases, abundant hooks in different diameters and long cells (*arrows*). Abbreviations: *l* long cell, s short cell, sb silica body, p, prickle. All pictures are oriented to distal apex

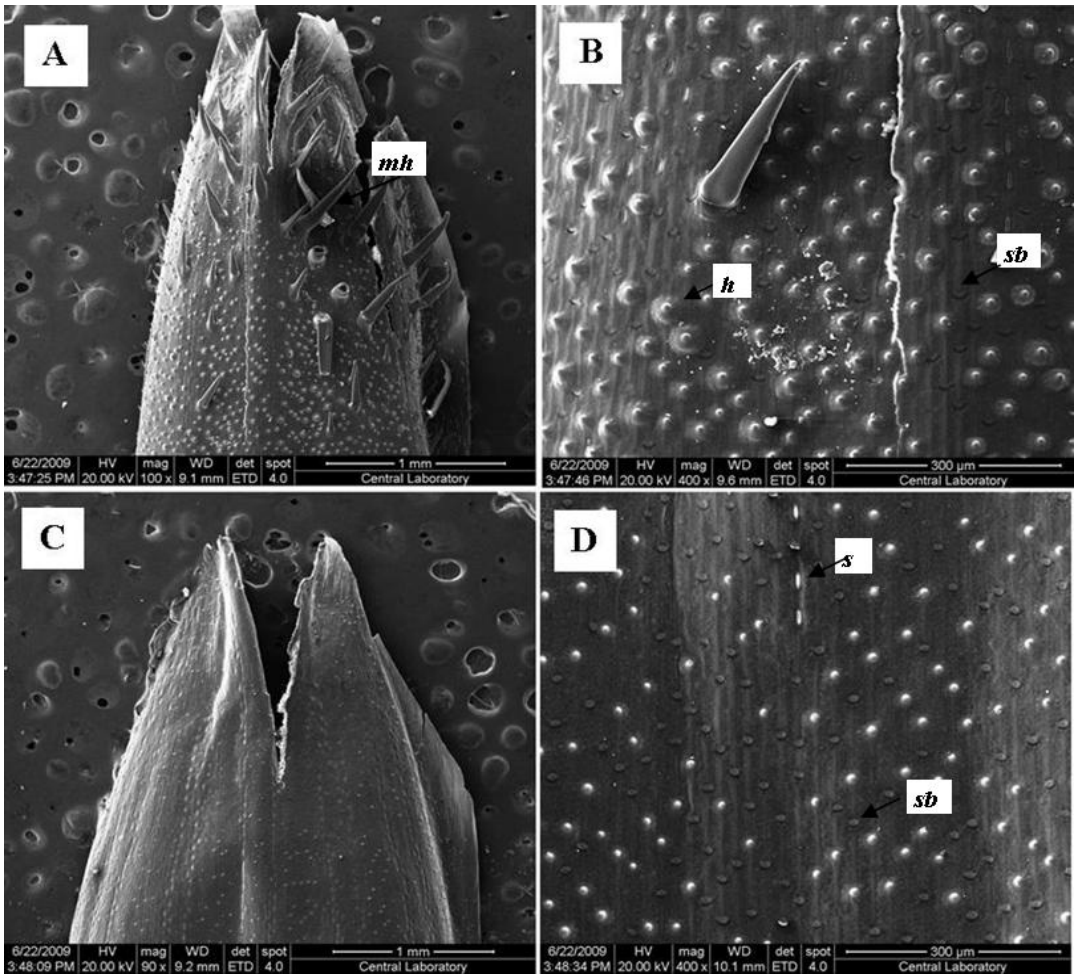

Figure 19. Abaxial epidermis of lemma surface of *Amblyopyrum muticum*

A-B *A. muticum* var. *muticum*, patent macrohairs, hooks, silica bodies (*arrows*), **C-D** *Amblyopyrum muticum* var. *loliaceum,* without macrohairs, hooks and stomata. Abbreviations: *h* hooks, *mh* macro hairs, s stomata, sb silica body. All pictures are oriented to distal apex.

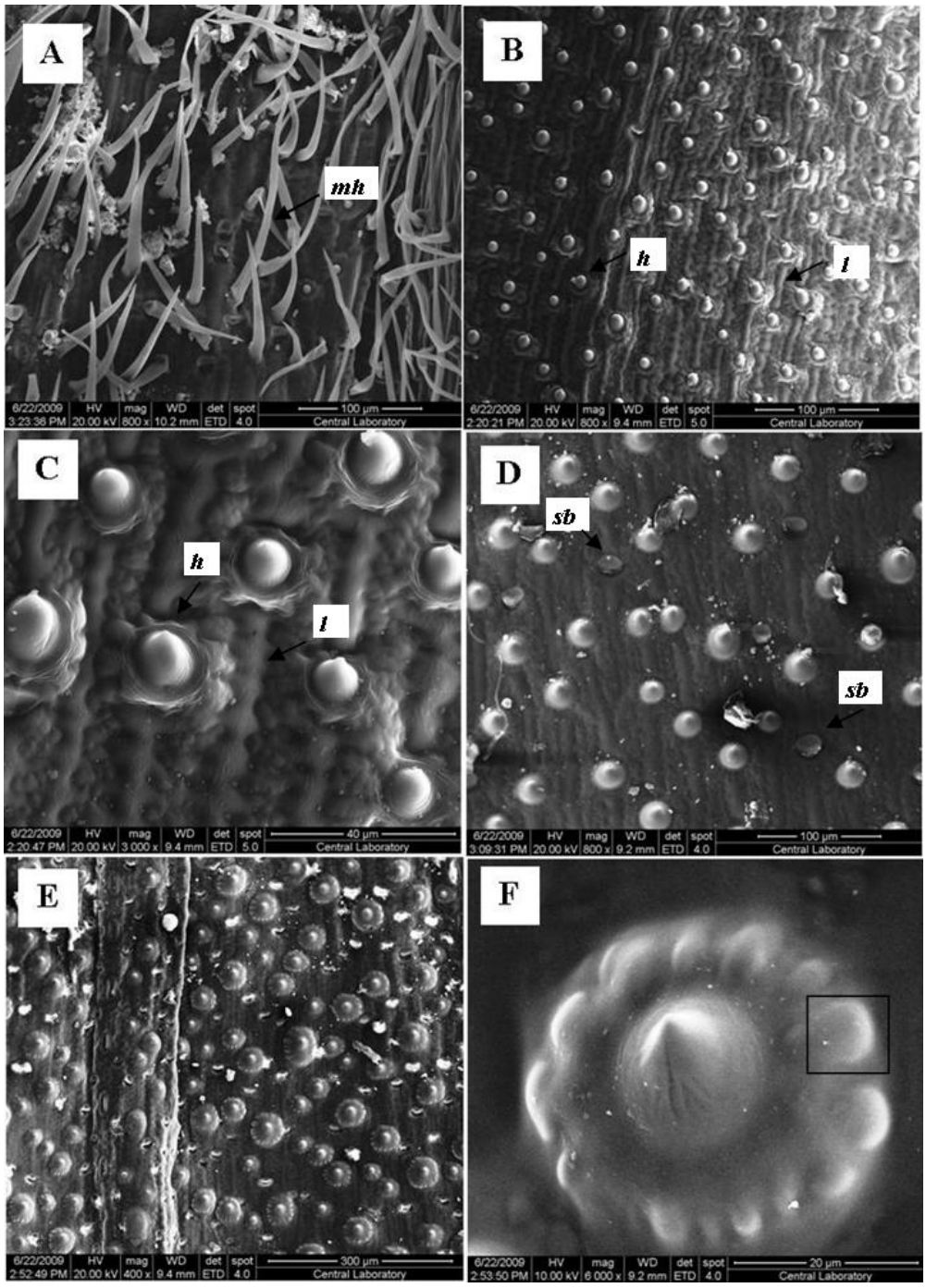

Figure 20. Abaxial epidermises of lemma surfaces of some taxa in the genus *Aegilops*.
A. *Ae. juvenalis*, macrohairs (*arrow*) **B-C** *Ae. tauschii,* hooks and long cells (*arrows*), **D.** *Ae. vavilovii,* silica bodies **E-F** *Ae. columnaris,* pit (*square*) number at the base of hooks can recognizable. Abbreviations: *h* hook, *l* long cell, *mh* macrohair, sb silica body. All pictures are oriented to distal apex

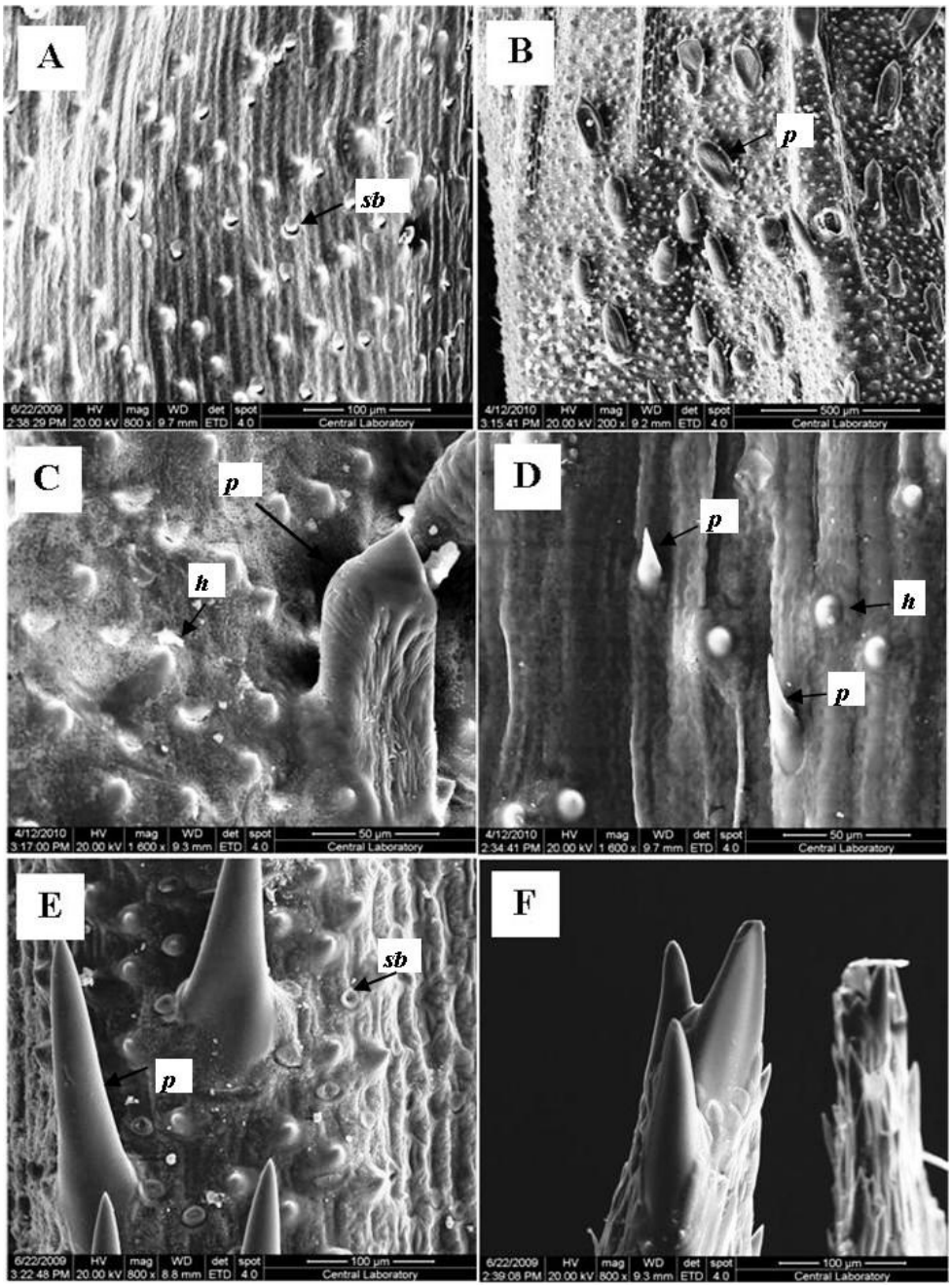

Figure 21. Abaxial epidermises of lemma surfaces of some taxa in the genus *Aegilops*

A. *Ae.comosa* subsp. *comosa*, silica bodies (*arrow*) **B-C** *Ae. geniculata,* oblong prickles with apiculate beak (*arrow*) **D.** *Ae. caudate,* hooks, prickles (*arrows*) **E** *Ae. juvenalis*, prickles, silica bodies (*arrows*) **F** Apex of teeths of *Ae. comosa subsp. comosa* . Abbreviations: *h* hook, *sb* silica body, *p*, prickle. All pictures are oriented to distal apex

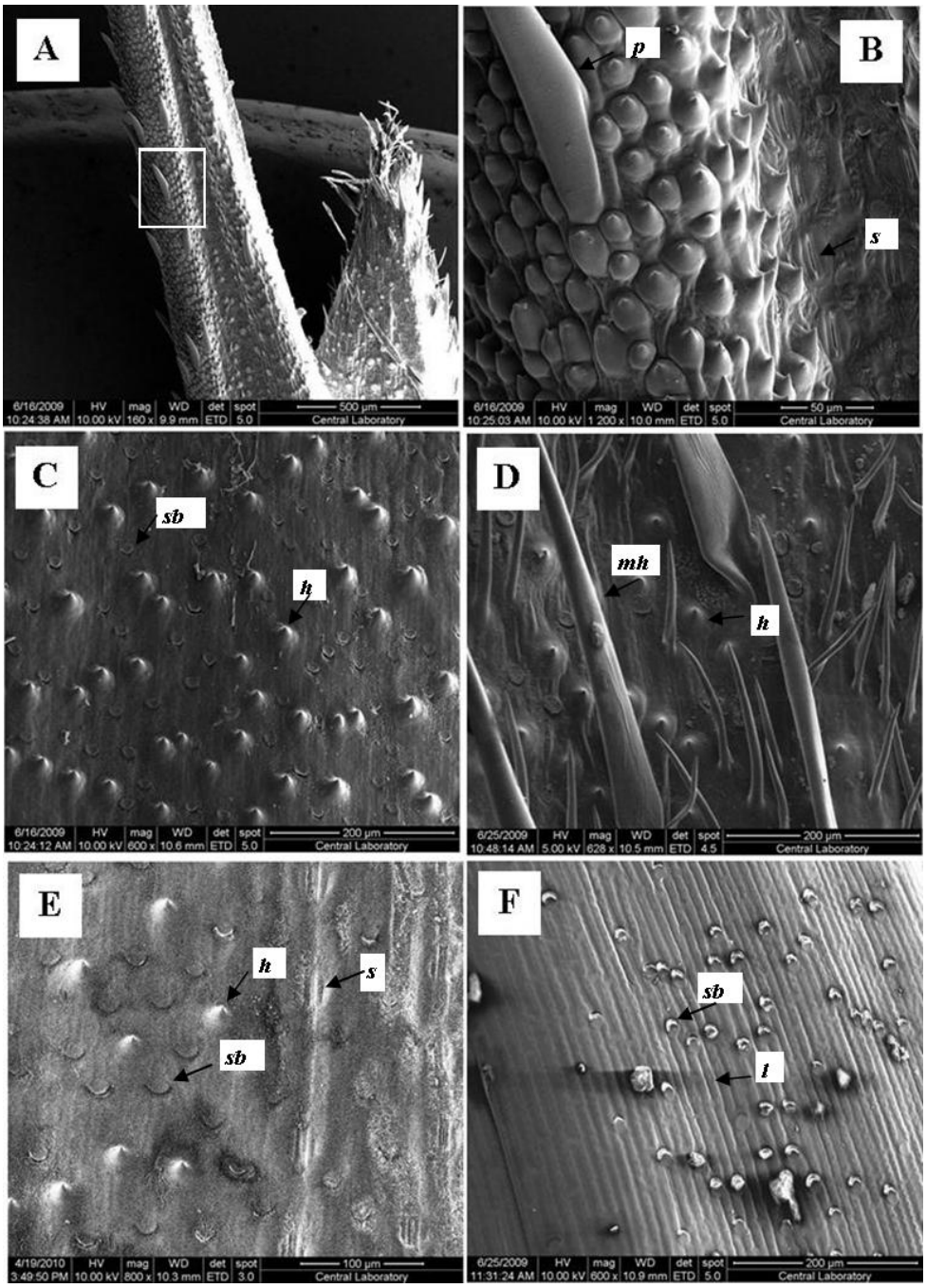

Figure 22. Abaxial epidermises of lemma surfaces of some *Triticum* taxa

A-B. *Triticum boeoticum* awn of lemma **C**. *T. boeticum* lemma surface **D.** *T. timophevii* var. *araraticum* **E.** *T. dicocoides* **F**. *T. monococum.* Abbreviations: *l* long cell, s short cell, sb silica body, p, prickle. All pictures are oriented to distal apex

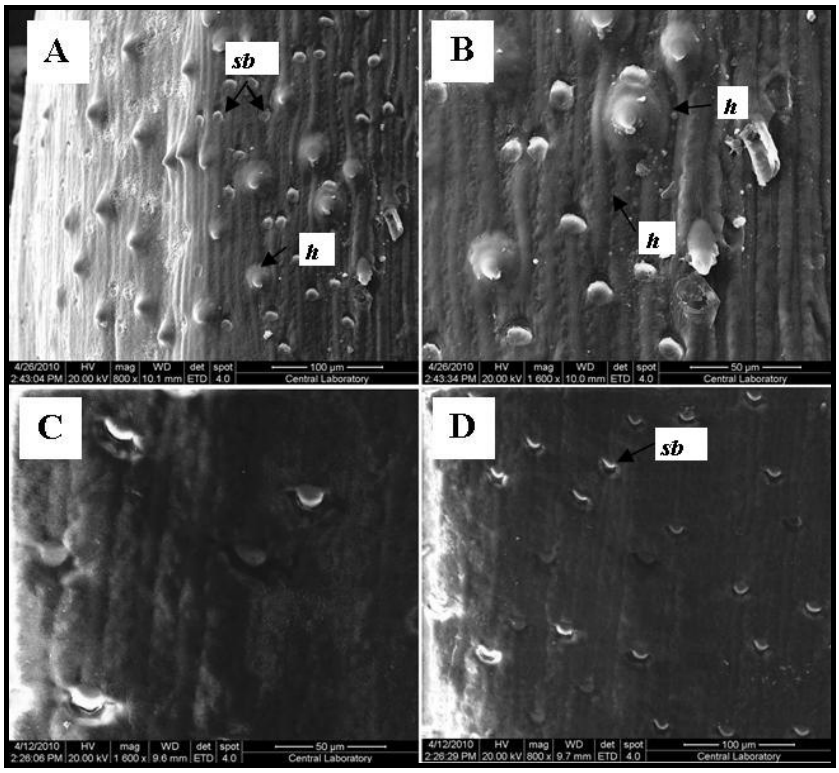

Figure 23. Abaxial epidermises of lemma surface of *Dasypyrum villosum.*
Abbreviations:*h* hook, *l* long cell, sb silica body. All pictures are oriented to distal apex

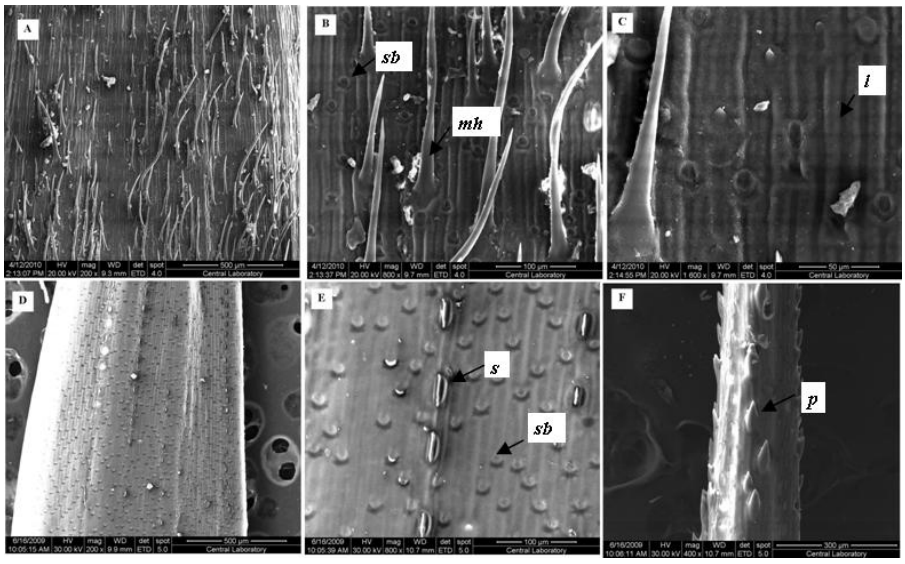

Figure 24. Abaxial epidermises of lemma surfaces of the taxa found in the genus *Leymus*
A-C *Leymus racemosus,* linear lanceolate macrohairs, rounded silica bodies and long cells (*arrows*)
D-F *Leymus cappadocicus,* stomata, slica bodies and prickles on the surface of lemma awns (*arrows*).
Abbreviations: *l* long cell, s short cell, sb silica body, p, prickle. All pictures are oriented to distal apex

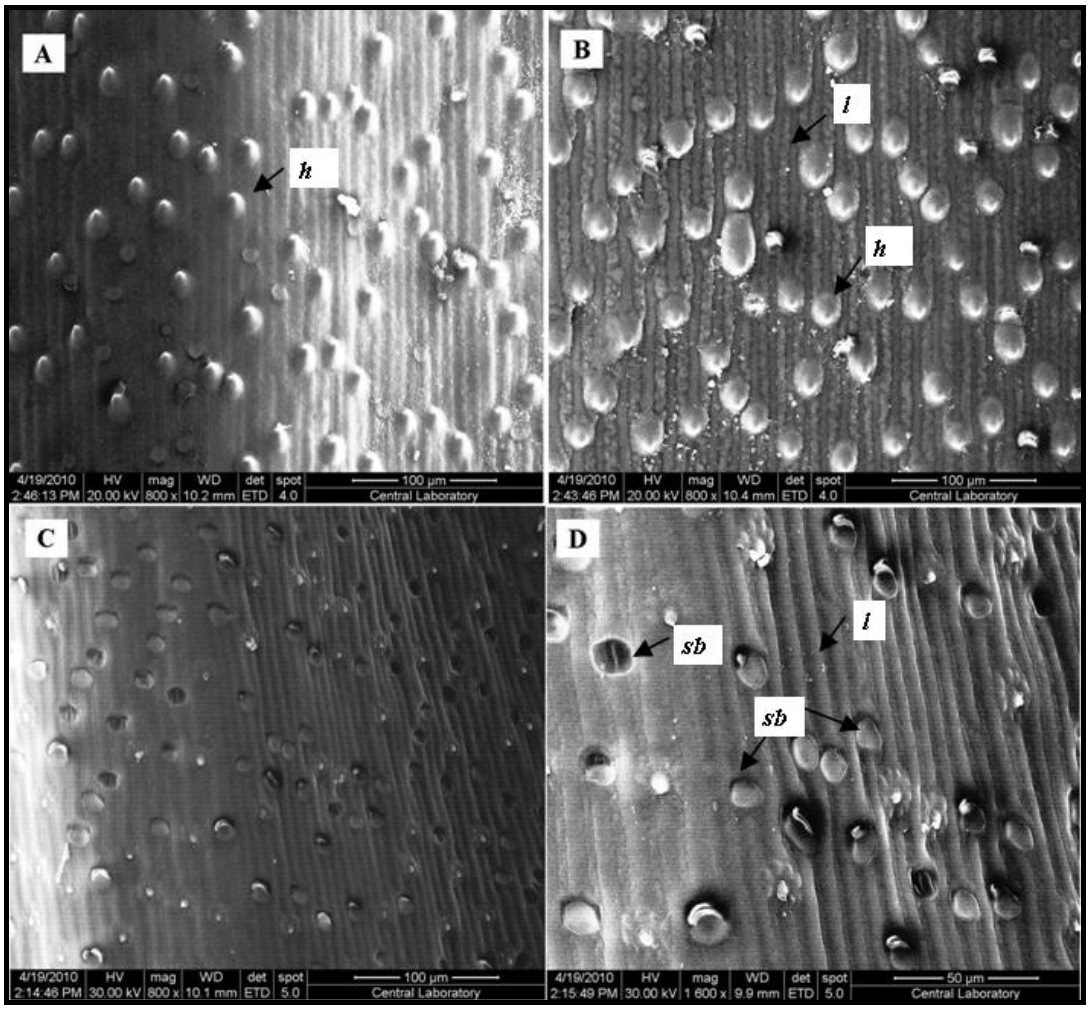

Figure 25. Abaxial epidermises of lemma surface of some taxa in the genus *Hordeum*
A-B *H. spontaneum* **(A)** lemma surface of central spikelet, hooks (*arrow*) (B) lemma surface of lateral spikelet, hook and long cells **C-D** *H. bulbosum,* lemma surface of central spikelet, silica bodies, long cells (*arrows*). Abbreviations:*h* hook, *l* long cell, sb silica body, p, prickle. All pictures are oriented to distal apex

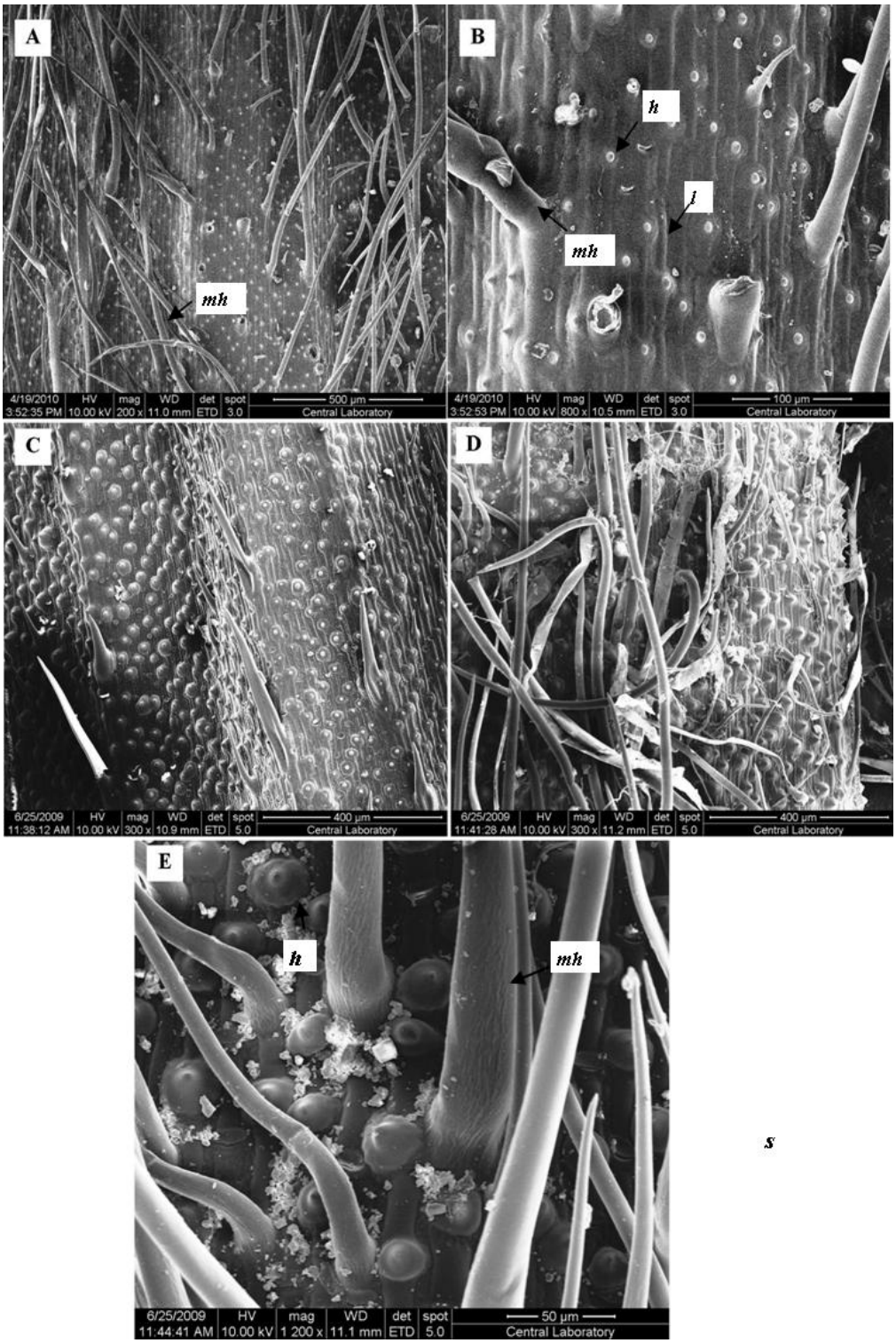

Figure 26. Abaxial epidermises of lemma surfaces of some taxa found in the genus *Psathyrostachys*

A-B P. fragilis subsp. *villosus* villous macrohairs, hooks and lon cells (*arrows*) **C.** P. fragilis subsp. *secaliformis* **D.** P. fragilis subsp. artvinense subsp. nova **E.** P. narmanica sp. nova, macrohairs and hooks (*arrows*).

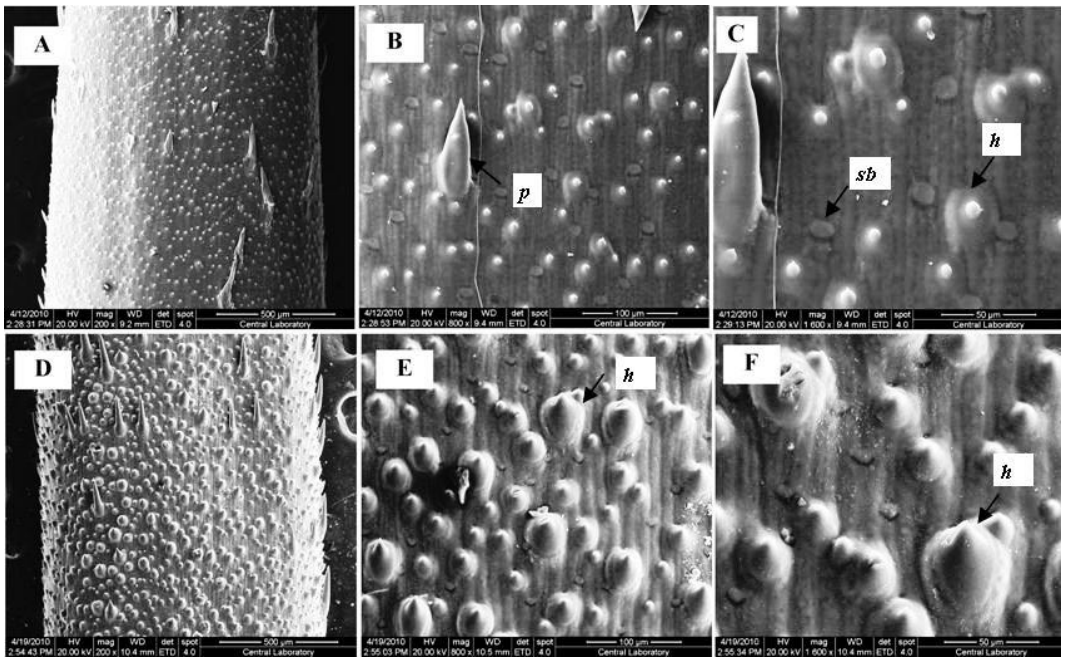

Figure 27. Abaxial epidermises of lemma surfaces of the taxa in the genera *Hordelymus* and *Taeniatherum.*

A-C *Hordelymus europeus,* prickles, silica bodies and hooks (*arrows*) **D-F** *Taeniatherum caput medusae,* hooks (*arrows*). Abbreviations: *h* hook, sb silica body, p, prickle. All pictures are oriented to distal apex

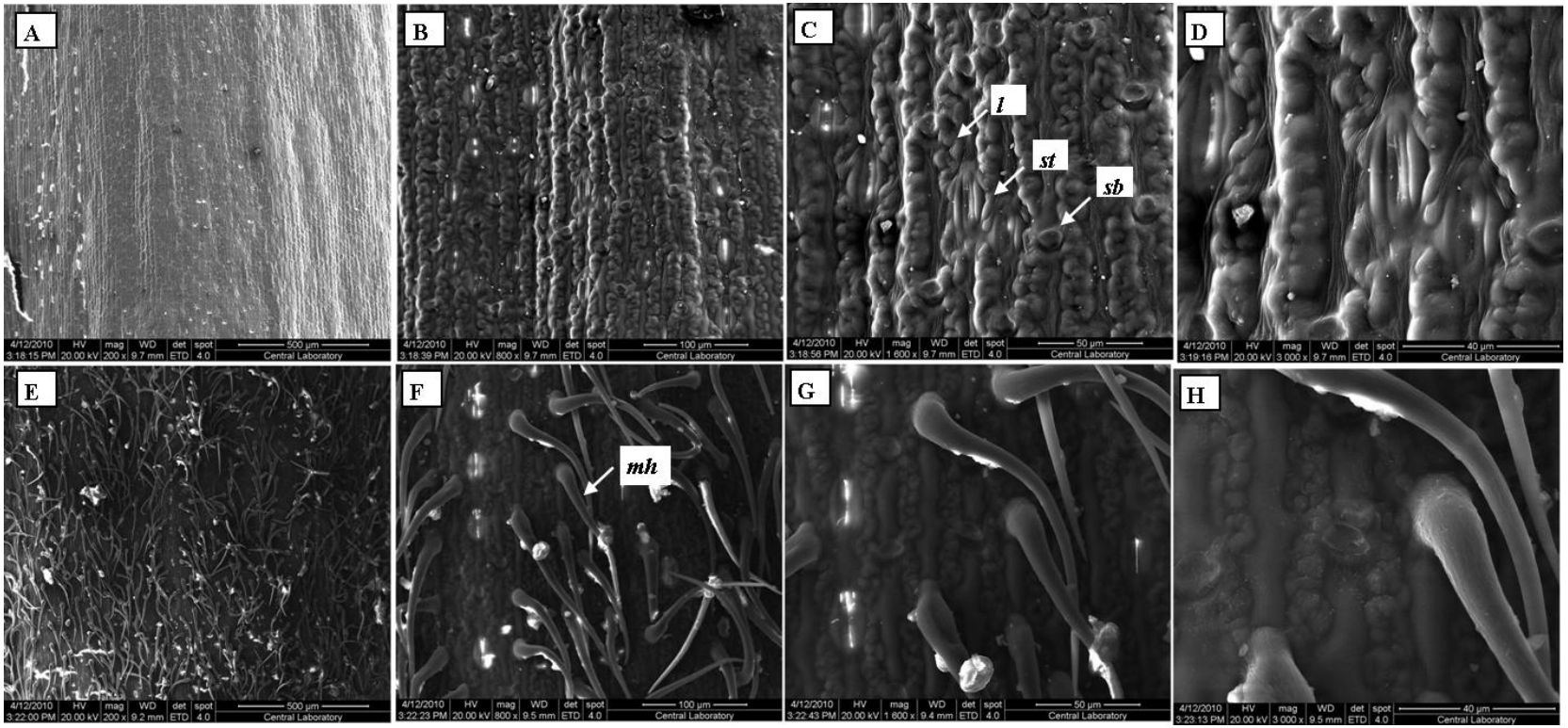

Figure 28. Abaxial epidermises of lemma surfaces of monotypic genus *Henrardia*

H persica with two varieties var. glaberrima and var persica **A-D** *var. glaberrima* in different magnification **E-F.** *var. persica*. Abbreviations: mh macro hair. All pictures are oriented to distal apex

3.1.9. Palea

In all the revised genera the palea protects the ovary and stamens and often invests the caryopsis more or less tightly within the lemma. The length of palea varies greatly among the members of the genera, some species have palaes as long as their lemmas, but in some other genera palaes are slightly or distinctly shorter than lemmas. Paleas always two keeled among the members of the tribe. The palea apex is bifid or entire among the revised genera as far as go. In certain species the bifid apex of the palea provides useful diagnostic features between species. For example, *Eremopyrum distans* can be distinguished from other *Eremopyrum* species by its two exserted aristae at the apex of the palea. With using the same character I proposed a new variety under the species of *H. spontaneum* var. *anatolicum* Cabi & Doğan var. nov. The hairiness of palea is not very useful separating the taxa above the species in most of the genera, but in species infraclassification

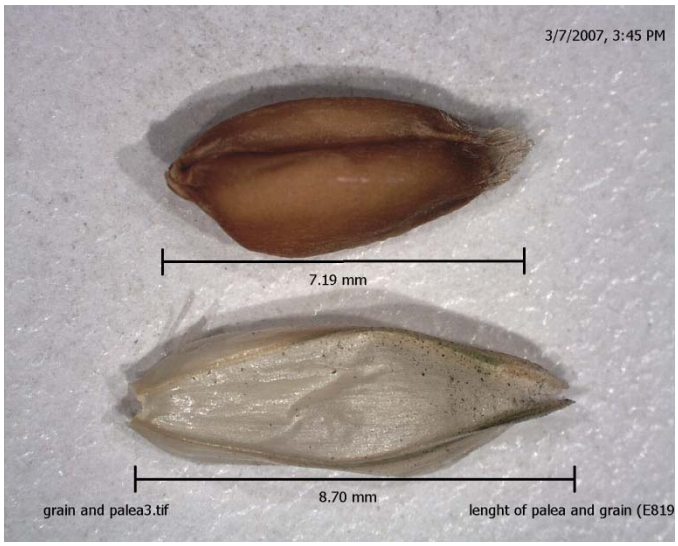

Figure 29. Palea and caryopsis of *Triticum durum*

3.1.10. Awns

In taxonomic treatments awn characters such as presence or absence, position when present, geniculation, etc. are used very often (Doğan 1982). Some genera can be recognized as having lemmas with straight awns , such as *Crithopsis* with a short awn up to 15 mm long, contrastingly the genus *Taeniatherum* has more or less recurved awn elongated up to 12-13 cm long.

3.1.11. Caryopsis Characteristics

The caryopsis is a unique fruit type and it is one of the distinguishing features of the Poaceae (GPWG 2001). In grasses normally the thin pericarp firmly adharent to the seed coat in the caryopsis . The structure of the embryos and caryopses of several of these important species have been published (e.g., *Avena* and *Triticum*, Avery, 1930; *Hordeum*, MacLeod and Palmer, 1966). Körber-Grohne (1981) emphasized that the structure of the transverse cells of the pericarp was useful in identifying fossilized grains of *Triticum* L. and *Secale* L., and caryopsis morphology may represent an important link to the fossil record and assist in reconstructing phylogenetic relationships. As characters of caryopsis are relatively specific to species, the usefulness of these characters are so common and functional for systematic purposes. (Tomb 1974; Brisson & Peterson, 1976). Caryopsis characters such as length, shape, compression type, presence or absence of lateral ridges and the extent of their development, sulcus depth and density and length of apical hairs are useful to differentiate among members of Triticeae (Terrel and Petersen 1993).

Terrel and Peterson (1993) studied the 35 species included in 18 genera recognized in tribe Triticeae and proposed that this tribe can be divided into three major subtribes one of which is monogenomic substribe. First one of these subtribes containing the genera *Elymus, Thinopyrum, Leymus, Psathyrostachys, Agropyron, Eremopyrum, Hordeum, Crithopsis, Hordelymus, Taeniatherum* is Elymoid group. Second one called as Triticinoid group contains the genera *Aegilops, Amblopyrum, Triticum, Secale, Dasypyrum* and *Heteranthelium*, the last third one, Henrardioid group consist of just only the genus *Henrardia.*

The goals of this study were 1) to present an overview of the micromorphological characters of caryopses in triticoid grasses, 2) to assess the potential systematic value of caryopsis characters in this subfamily.

Material used in this study gathered from the natural habitats during the revision of tribe. Voucher specimens were deposited at Plant systematics Laboratory in Middle East Technical University, Department of Biological Sciences. Mature, dry caryopses were examined with a low-power stereo microscope and the most important characters were described for each species. When available, more than one accession was examined to study the variation, and additional accessions were drawn for certain species to show the variation. For SEM studies, mature caryopses were dissected and selected, then mounted directly on stubs and attached

with sticky tape. The specimens were coated in a sputter coater with Gold-Paladium using Polaron SC 502 trade gold coater. The specimens were then studied and photographed by a Jeol JSM-840. The terminology used for describing the seed coat features follows Terrel & Petersen (1993).

Morphological characteristics of caryopses examined in this study are summarized in Table 1. As far as investigated genera go, the length of caryopsis varies from 2.5 to 11 mm long. The size of caryopsis is certainly a useful taxonomic character, often used for comparative reasons, but there is almost no genus in which the caryopsis has uniform length and is alone sufficient to identify this genus. In spite of this difficulty, it is easy to distinguish a few groups of genera on their caryopsis length, such as the genera *Hordeum*, *Taeniatherum* and *Triticum*. In these genera the caryopsis is relatively large, being at least 7-10 mm long.

Terrel and Peterson (1993) investigated seeds of a number of genera of Triticeae on their longitudional and cross-section and finally illustrated the caryopsis of many species of Triticeae. Doğan (1982) made a number of cross-sections among the seeds belonging to different genera included in the tribe Aveneae, Phleaee, Phalarideae and Milideae within the area covered by the Flora of Turkey. He recognized two major types in the genera revised. The first type includes genera in which the caryopsis is laterally compressed obovate in outline. The second type includes the remaining genera in which caryopsis sections more or less circular in outline and there is always a minute groove on the lateral side. He also stated that, shape of caryopsis in cross section is correlated with the palea and lemma characters, because in the first type the number of palea veins is always one and the lemmas strongly keeled. In the second type the palea has two veins and the lemmas either not keeled or only slightly so. In most of the revised genera in the tribe Triticeae, the compression of caryopsis is dorso-ventral, but in a few genera the caryopsis is compressed laterally (i.e. *D. villosum* and *H. piliferum*) or compression is none (i.e. *Secale*). Degree of compression is different among the genera also within the genera (Table 12).

The caryopsis shape is oblong in *Ae. crassa* (Fig. 30.A), *E. repens*, *P. fragilis*, *Th. elongatum*. In some other taxa, such as *D. villosum*, *H. spontaneum*, *S. cereale*, caryopsis shape is oblong elliptical. Caryopsis shape is occasionally ovate as in *Heteranthelium piliferum*, and ovate-elliptical as in *E. triticeum*, *T. aestivum*, *T. dicoccon*, *T. monococcum*. In *Taeniatherum*, and *Hordelymus*, caryopsis shape is lanceolate.

Figure 30**.** Light micrographs of the caryopses of some taxa belonging the genera *Aegilops* and *Hordeum*.

A. *Ae. crassa* **B.** *Ae. triuncialis* **C.** *H.distichon* **D.** *H. spontaneum* (dorsal face) (taken with Leica L2 stero microscope).

Figure 31. Light micrographs of the caryopses of some taxa belonging the genera *Crithopsis, Heteranthelium, Triticum and Eremopyrum* in the tribe.

A. *Crithopsis delileana,* eliptic lanceolate, compressed strongly dorsiventrally, sulcus is prominent, apical hairs are absent **B.** *Heteranthelium piliferum* (ventral) **C.** *Triticum durum* **D.** *Triticum aestivum* **E**. *Eremopyrum triticeum* (ventral) (taken with Leica L2 steromicroscope).

Sulcus: Sulcus can be defined as the scar in different depths located on ventral side of the caryopsis coat. The presence of the sulcus is characteristic for all taxa belong to revised genera. The depth of sulcus is one of the important discriminating features shows variety among the genera (Table 12).

Corona: The small membranous corona is attached to the apex of caryopsis and varies from whitish to yellowish. The corona may be partly concealed by the apical hairs. caryopsis and varies from whitish to yellowish. The corona may be partly concealed by the apical hairs. In *Triticum* relatives, especially *Dasypyrum* (formerly *Haynaldia)* and *Heteranthelium,* the corona is a smooth or angulate cap (Figure *12a-d).* Apical hairs range from long to short and may densely or sparsely cover the surface. The apex may be glabrous or glabrate in some

individuals of *Dasypyrum, Heteranthelium, Hordeum distichon, H. vulgare,* and *Secale cereale.*

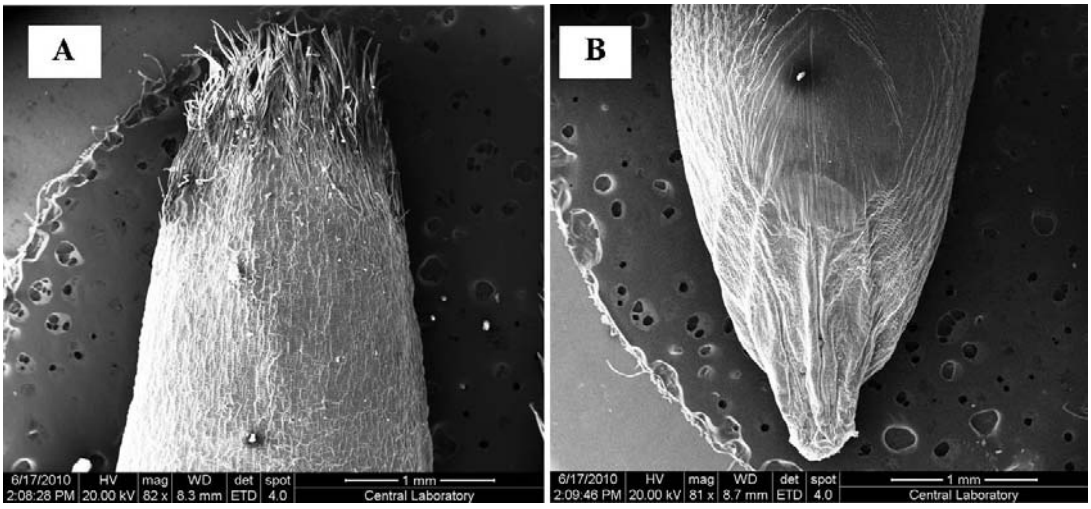

Figure 32. SEM micrographs of the caryopsis of *Aegilops biuncialis* showing details of apical hairs (A) and the embryo (B).

Table 12. List of studied taxa and some important charateristics of their caryopsis

Taxa	**Caryopsis Length (mm)**	**Shape of Caryopsis**	**Compression of Caryopsis**	**Depth of sulcus**	**Indumentum of apex of caryopsis**
Agropyron cristatum	3-5	Onlong or lanceolate	Dorsiventral-slightly	Shallow-medium	Sparse-dense
Aegilops crassa	7-7.5	Oblong	Dorsiventral-moderate-strong	Medium	Sparse-dense
Ae. cylindrica	6-7.5	Lanceolate – narrowly elliptic	Dorsiventral-moderate-strong	Medium	Dense
Ae. triuncialis	5-6	Oblong-widely elliptic	Dorsiventral - moderate-Strong	Medium	Dense
Amblyopyrum muticum	3-4	Elliptic-oblong	moderate-strong	Shallow	Sparse-dense
Crithopsis delileana	4-5	Elliptic-lanceolate	Dorsiventral-Strong	Medium-deep	Absent
D. villosum	5-7	Oblong-elliptic	Lateral-Slightly	Shallow-medium	Sparse
Elymus repens	4.5-5	Oblong	Dorsiventral-Slightly	Shallow-medium	Sparse
Eremopyrum triticeum	2.5-3	Ovate- elliptic	Dorsiventral-Slightly	Medium	Sparse
Henradia persica	4.5-6	Lanceolate-oblong	Dorsiventral-Strong	Shallow	Dense
Heteranthelium. Piliferum	5-7.5	Ovate	Lateral-Slightly	Medium	Very sparse-absent
Hordeum distichon	8-9	Elliptic-ovate	Dorsiventral-Slightly	Shallow	Absent
H. spontaneum	9-10	Oblong-elliptic	Dorsiventral-Moderate	Shallow	Sparse
Hordelymus europeous	7-8	Lanceolate	Dorsiventral-Strong	Medium-deep	Sparse-dense
Psathyrostachys fragilis	6.5-7	Oblong	Dorsiventral-moderate	Medium	Dense
Secale cereale	5-9	Oblong –elliptic	Absent	Medium	Very sparse-absent
Taeniatherum caput medusae	7.5-9	Lanceolate	Dorsiventral-strong	Medium-deep	Sparse-dense
Thinopyrum elongatum	5-6	Oblong	Dorsiventral-moderate	Shallow	Dense
Triticum aestivum	7-9	Ovate-wide elliptic	Absent	Medium-deep	Sparse-absent
T. dicoccon	8-10	Ovate-elliptic	Absent	Medium-deep	Dense
T. monococcom	7-8	Ovate-elliptic	Absent	Medium-deep	Sparse-dense

3.2. Ecology, Endemism, Phytogeography and Conservation Status of the Species

3.2.1. Habitat, Phenology and Altidutional Range of the Species

Habitat

Bothmer (1996) emphasized that Near East geographical region encompassing Anotolia is one of the major centers of diversity for the tribe Triticeae. It is known that several cultivated crops (wheat, barley and lentil) and their relatives evolved in the area. The evolutional processes caused domestication in the area originated from the rich diversty of annual grass species and wide range of environmental conditions. The tribe Triticeae has been subject of numerious studies incorporated different data sets and information gathered from diverse disciplines. Although the huge information obtained from diverse disciplines there are still disputations on the taxonomy and evolution of this tribe members. Bothmer (1996) indicated that the information about the habitat preferences of the taxa found in this tribe is so important to understand the adaptive radiation and evolution in the tribe. He also emphasized that to determine the habitat preferences and distribution patterns of tha taxa is the first step for optimum utilizing from the wild species as gene sources in plant breeding.

Grasses have adapted to a wide range of environmental conditions from obligate aquatics to desert species, which has also led to morphological variability. Field observations that occured from the year 2006 to now showed that the members of the tribe Triticeae have also a wide range distribution showing highest adaptation to a variety of different environments in Turkey such as dry habitats, salty marshes (i.e. *Leymus cappadocicus, Eremoprum spp.*), rocky slopes (*E. longearistatus subsp. sintenisii* , pastures, sandy coasts (*Leymus racemosus* subsp. *sabulosus*) roadsides (*Aegilops* spp), and edges of cultivational areas (*Aegilops* spp). Unlike most species in the tribe Triticeae, which are open grassland-like steppe and meadow plants, *H. europaeus* is a forest species adapted to shady conditions. It grows in rich woodlands and deciduous forests, mainly on calcareous ground, in Europe and parts of south-western Asia. The members of the annual genera such as especially, *Heteranthelium* Hochst*, Eremopyrum* (Ledeb.) Jaub & Spach*,* and *Taeniatherum* Nevski, usually prefers the semi arid desert vegetations close to Central Asia and Near East.

The genera *Aegilops* and *Amblyopyrum* have species prefer to some extent disturbed habitats and some taxa in the genus *Aegilops* such as *Ae. biuncialis*, *Ae geniculata* and *Ae. triuncialis*

are accepted as invaders or colonizers. These species frequently found along roadsides, edges of cultivated areas, sometimes as weeds among crops.

Amblyopyrum is one of the monospecific genera found in tribe and includes only one species and one non typical variety. This genus occurs only in the Central Anatolian of Turkey and Armenia. In Flora of Turkey this genus is evaluated as endemic species. The status of this species has changed to from endemic to nonendemic. The ecology is smilar to that of *Aegilops* being also typical representative of Sakomoto's Mediterrenean group.

The members of the genus *Leymus* are distributed in the temperate regions of Eurasia, North America, and South America, extending to the subtropics and the tropic alpine regions. (Tzvelev 1976; Dewey 1984). The members of this genus can adapt to a variety of habitats such as saline and alkaline lands and also dry and semidry environments so they usually provide important genetic source for the improvement of forage and cereal crops in Triticeae (Dewey 1984; Dong et al. 1992).

The species of *Hordeum* are confined to rather moist habitats, even on saline soils. The annual species occupy seasonally moist habitats that cannot sustain a continuous grass cover. The genus is native to Eurasia, the Americas, and Africa, and has been introduced to Australia. Some species of *Hordeum*, such as *H. marinum* and *H. murinum*, are cosmopolitan weeds.

Phenology

The results of field observations showed that the flowering time of the members of this tribe in Turkey is from April–May until August–September, depending on the species and their ecogeographical location. They show considerable variations about the flowering times.

Altitudional range

The altitudional distribution of the taxa in the tribe varies from seal level to 3500 m. This variation is also present among both the genera, species and infraspecific taxa. For example some species such as (*Thinopyrum farctum*, *Leymus racemosus* subsp. *sabulosus* and *Secale sylvestre* can grow only at seal level. Some species such as *A. incanum* (2600-3350m), *A. imbricatum* (1600-2900m) are typically highland species grows over 1500 m. It is obvious that some species such as *E. caninus* have a wide range of altitute from sea level to 2000m.

3.2.2. Soil Features of the Species

As Karagöz et al. (2009) indicated that the term "genetic diversity" includes not only the living entites but also their ecosystems and habitats especially soil, as integral part of it. So knowledge about the soil preferences of wild relatives of wheat, rye and barley for conservation activieties especially carried out in-situ approach can provide important findings. For the purpose of determining the basic soil requirements of the taxa in the tribe, soil samples were taken from the depth of 0-20 or 0-30 cm depending on the soil depth, dried, and sieved for laboratory analysis. The following analyses were performed at the Soil, Water and and Fertilizer Resources Central Research Institute, Ankara: Soil texture, pH, $CaCO_3$, N, P, K and organic matter by using standart techniques the study of Bayraklı (1987) and Karagöz et al (2009).

The results of soil analysis of the samples gathered from suitable habitats of the species showed that the members of this tribe shows high ecological tolerance and grow in a variety of soil textures such as clayish (C), clay loam (CL), loam (L), sandy (S), sandy-clay-loam (SCL), sandy loam (SL), silt clay (SiC) and silt clay loam (SiCL). Some species i.e. *Thinopyrum farctum* (Viv) Cabi&Dogan comb. nov., *Leymus racemosus* (Lam.) Tzvelev subsp. *sabulosus* (Bieb.)Tzvelev grow only sandy soils with pH between (7.74) 8.29-8.72.

Organic content of the analysed soils ranges from 0.03% (*Th. farctum*-sandy soils)to 6.53 % (*Taeniatherum caput medusae*-clay soil). It seems that there is a huge variation even between the populations of the same species. For example the invasive species, *Taeniatherum caput medusae,* grow in a variety of soil types with different organic contents range from 0.19% to 6. 53 %.

pH values of the analysed samples are also so variable and range from 6.78 to 8.72. Most of the members of the tribe prefer the nötr or slihtly alkaline soils. Sankary (1990) reported that all of the sites of *Aegilops* species in Syria had calcareous soils with pH between 7.0 and 7.8. Our results showed that most of the *Aegilops* species grow in slightly alkaline conditions between in a range from 7.5 to 8 in the analysed soils.

The percentage of $CaCO_3$ in the analysed soils changed between 0.42% to 36.83%. One sample of location that *Ae. triuncialis* subsp *persica* and *Ae. columnaris* grow sympatricly included extreme $CaCO_3$ concentration

Table 13. Soil properties of taxa in the tribe Triticeae.

C: Clay, **L**: Loam, **Si**: Silt, **S**: Sand, **CL**: Clay-Loam, **SiCL**: Silt-Clay-Loam, **SiC**: Silt-Clay, **SiL**: Silt Loam, **LS**: Loam-Sand, **SCL:** Sand-Clay-Loam

Taxa	**pH**	**CaCO3**	**P(ppm)**	**K(ppm)**	**Organic content %**	**Texture**
Agropyron cristatum subsp. pectinatum var. pectinatum	7.89	15.39	9.76	306.83	0.25	C
	7.61	0.94	2.57	74.68	1.76	CL
	7.88	1.12	1.39	52.61	1.23	L
	7.46	2.03	10.71	116.00	1.49	C
A. incanum	7.74	1.88	5.29	87.00	2.80	SL
Elymus repens	7.70	9.57	1.76	93.37	0.66	SL
	8.01	10.47	1.94	65.72	0.58	L
E. elongatiformis	7.01	0.75	8.68	43.01	1.16	CL
E. panormitanus	7.90	13.13	1.48	46.83	0.22	SL
E. divaricatus	7.82	28.88	2.85	99.94	2.61	L
	8.12	36.83	2.48	22.50	1.03	L
	8.38	9.65	2.79	24.33	0.65	L
E. lazicus	8.08	2.24	1.01	32.14	1.11	CL
E. longearistatus	7.43	0.75	7.59	38.51	2.95	CL
Thinopyrum erosiglumis	7.78	36.80	1.36	93.37	1.07	CL
	8.12	36.83	2.48	22.50	1.03	L
Th. farctum subsp. bessarabicum	8.52	24.16	0.68	32.06	0.22	S
Th. pycnanthum	8.10	4.41	1.79	9.66	0.28	L
Th. intermedium subsp. pulcherrimum	7.89	15.39	9.76	306.83	0.25	C
	7.61	0.94	2.57	74.68	1.76	CL
Th. intermedium subsp. *intermedium var. barbulatum*	7.74	1.88	5.29	87.00	2.80	SL
	7.99	1.32	2.03	18.82	0.63	SCL
	8.12	9.72	0.23	45.34	0.31	L
	6.78	-	0.23	86.15	4.16	CL
Th. intermedium subsp. *intermedium* var. *intermedium*	7.74	1.88	5.29	87.00	2.80	SL
	7.54	2.99	20.23	234.55	1.31	CL
	7.84	25.42	2.87	98.92	1.22	CL
	6.78	-	0.23	86.15	4.16	CL
Th. elongatum subsp. turcicus	7.85	22.53	2.03	74.68	0.88	SCL
Th. elongatum subsp. elongatum	7.33	5.98	12.88	126.84	4.35	C
	8.29	7.34	2.56	5.67	0.16	L
Th. caespitosum subsp. *sinuatum*	7.86	16.34	1.76	46.83	1.13	CL
Th. caespitosum subsp gypsicoulus	7.95	23.74	0.85	80.07	0.74	CL
Th. farctum subsp. *bessarabicum*	8.38	2.03	1.79	6.95	-	L
	8.72	1.40	1.32	95.65	0.03	L
	8.46	19.16	2.10	11.09	0.06	L
Th. farctum subsp. *rechingeri*	7.74	31.75	13.89	149.86	3.11	CL
subsp *farctum var. farctum*	8.29	7.34	2.56	5.67	0.16	L
Pseudoroegneria tauri	7.84	25.42	2.87	98.92	1.22	CL
Eremopyrum bonaepartis	7.45	24.21	22.50	396.85	1.76	SiCL
	7.81	17.27	2.99	99.94	2.26	SL

Table 13 Continue. Soil properties of taxa in the tribe Triticeae.

	Taxa	pH	CaCO3	P(ppm)	K(ppm)	Organic content %	Texture
	Eremopyrum orientale	7.13	14.06	2.02	123.18	1.15	CL
		7.88	33.61	7.46	458.48	3.45	L
		7.88	27.28	34.23	485.30	1.40	CL
	E.distans	7.78	10.95	15.60	174.62	0.88	SL
		7.88	33.61	7.46	458.48	3.45	L
	E. confusum var. sublanigunosom	7.78	36.80	1.36	93.37	1.07	CL
		7.88	33.61	7.46	458.48	3.45	L
		8.10	21.50	1.32	80.07	0.46	CL
		7.13	14.06	2.02	123.18	1.15	CL
	var. confusum	7.96	7.13	18.31	339.36	1.26	C
	E. triticeum	7.88	27.28	34.23	485.30	1.40	CL
	Heteranthelium piliferum	7.21	10.76	5.97	385.03	1.10	C
		7.81	17.27	2.99	99.94	2.26	SL
		7.13	1.05	1.63	92.44	2.70	CL
		7.75	27.98	10.25	134.32	0.65	CL
	Crithopsis delileana	7.83	36.05	10.45	166.39	0.60	SCL
		7.76	16.34	18.99	565.63	1.76	SiC
	Amblopyrum muticum (both vareties)	7.90	4.13	0.28	41.76	0.66	SCL
		7.81	1.31	3.79	209.11	0.19	SL
		8.04	7.74	3.39	36.81	0.47	SL
	Aegilops markgraffi	7.81	17.27	2.99	99.94	2.26	SL
		7.80	29.37	3.10	123.18	1.06	CL
		7.65	6.57	18.01	77.10	1.68	CL
	Ae. crassa	7.76	16.34	18.99	565.63	1.76	SiC
		7.81	17.27	2.99	99.94	2.26	SL
	Ae. cylindrica	7.76	16.34	18.99	565.63	1.76	SiC
		7.46	2.03	10.71	116.00	1.49	C
		7.88	27.28	34.23	485.30	1.40	CL
	Ae. tauschii	7.76	16.34	18.99	565.63	1.76	SiC
		7.81	17.27	2.99	99.94	2.26	SL
	Ae. geniculata	7.83	36.05	10.45	166.39	0.60	SCL
		7.76	21.96	4.35	112.48	0.56	CL
		7.70	8.74	7.92	174.67	0.62	C
	Ae. truncialis	7.83	36.05	10.45	166.39	0.60	SCL
		7.87	27.04	0.68	57.49	0.41	C
		7.70	9.57	1.76	93.37	0.66	SL
		6.78	-	0.23	86.15	4.16	CL
		8.38	2.03	1.79	6.95	-	L

Table 13 Continue. Soil properties of taxa in the tribe Triticeae.

	Taxa	pH	CaCO3	P(ppm)	K(ppm)	Organic content %	Texture
	Aegilops triuncialis subsp. *persica*	7.72	64.34	12.73	138.13	2.36	CL
		7.75	27.98	10.25	134.32	0.65	CL
	Ae. speltoides var. speltoides	7.51	1.13	2.45	275.76	0.38	C
		7.81	17.27	2.99	99.94	2.26	SL
	Ae. speltoides var. ligustica	7.21	10.76	5.97	385.03	1.10	C
		7.76	16.34	18.99	565.63	1.76	SiC
		7.75	9.27	5.28	174.67	0.75	CL
	Ae. neglecta	7.51	1.13	2.45	275.76	0.38	C
		7.81	1.31	3.79	209.11	0.19	SL
		7.75	27.98	10.25	134.32	0.65	CL
	Ae. vavilovii	7.70	36.24	3.67	182.99	1.54	CL
	Ae. peregrina	8.38	2.03	1.79	6.95	-	L
		8.17	26.30	1.16	20.72	0.16	L
	Ae. columnaris	7.72	64.34	12.73	138.13	2.36	CL
	Ae. kotchyii	7.64	15.60	7.92	50.13	3.17	CL
		8.17	26.30	1.16	20.72	0.16	L
	Ae. biuncialis	7.80	29.37	3.10	123.18	1.06	CL
	Ae. comosa subsp. comosa	7.76	21.96	4.35	112.48	0.56	CL
	Ae. juvenalis	7.76	21.96	4.35	112.48	0.56	CL
	Ae. umbellulata	7.75	27.98	10.25	134.32	0.65	CL
	Triticum boeticum	7.87	17.27	8.26	317.48	0.94	C
		7.80	29.37	3.10	123.18	1.06	CL
		7.65	6.57	18.01	77.10	1.68	CL
	T. urartu	7.71	34.57	15.32	46.83	2.92	SL
		7.13	1.05	1.63	92.44	2.70	CL
		7.42	0.42	2.48	98.92	1.03	CL
	T. dicocoides	7.63	9.44	4.58	254.66	2.55	CL
		7.42	0.42	2.48	98.92	1.03	CL
	T. diccocon	7.66	36.04	2.45	127.82	2.64	CL
	T. monococcum	7.66	36.04	2.45	127.82	2.64	CL
	Dasypyrum villosum	7.09	2.03	3.26	32.14	0.90	L
	Secale cereale var. ancestrale	7.78	10.95	15.60	174.62	0.88	SL
	Secale slyvestre	7.74	31.75	13.89	149.86	3.11	CL
		8.19	5.18	1.55	9.66	0.12	L
	Secale strictum	8.12	9.72	0.23	45.34	0.31	L
		7.84	25.42	2.87	98.92	1.22	CL
	Leymus racemosus	8.52	24.16	0.68	32.06	0.22	S
		8.29	7.34	2.56	5.67	0.16	L
	Leymus cappadocicus	7.88	9.35	6.59	373.27	1.63	CL
	H. bulbosum	7.87	17.27	8.26	317.48	0.94	C
		7.70	8.74	7.92	174.67	0.62	C
		6.78	-	0.23	86.15	4.16	CL
		7.42	0.42	2.48	98.92	1.03	CL
		7.54	2.99	20.23	234.55	1.31	CL
		7.93	16.37	1.79	57.70	1.24	CL
		7.88	27.28	34.23	485.30	1.40	CL

Table 13 Continue. Soil properties of taxa in the tribe Triticeae

	Taxa	pH	CaCO3	P(ppm)	K(ppm)	Organic content %	Texture
	Hordeum murinum	7.21	10.76	5.97	385.03	1.10	C
		7.70	8.74	7.92	174.67	0.62	C
		7.46	2.03	10.71	116.00	1.49	C
		7.88	27.28	34.23	485.30	1.40	CL
	H. violaceum	7.57	23.78	1.76	158.36	0.91	C
		7.73	16.82	3.39	166.39	2.83	C
		7.74	1.88	5.29	87.00	2.80	SL
		6.74	1.11	2.17	182.99	0.25	SiCL
	H. geniculatum	7.21	10.76	5.97	385.03	1.10	C
		7.42	0.42	2.48	98.92	1.03	CL
	H. marinum	7.09	2.03	3.26	32.14	0.90	L
	H. spontaneum	7.13	1.05	1.63	92.44	2.70	CL
		7.75	9.27	5.28	174.67	0.75	CL
		7.70	8.74	7.92	174.67	0.62	C
	Psathrostachys fragilis subsp. villlosus	8.02	26.42	0.94	255.91	0.41	C
		7.99	1.32	2.03	18.82	0.63	SCL
	subsp. secaliformis	7.74	1.88	5.29	87.00	2.80	SL
	Taeniatherum caput medusae	7.68	1.69	14.10	484.28	6.53	C
		7.21	10.76	5.97	385.03	1.10	C
		7.51	1.13	2.45	275.76	0.38	C
		7.81	1.31	3.79	209.11	0.19	SL
		7.90	13.13	1.48	46.83	0.22	SL
		7.13	1.05	1.63	92.44	2.70	CL
		6.78	-	0.23	86.15	4.16	CL
	Henrardia persica	8.10	21.50	1.32	80.07	0.46	CL

3.2.3. Endemism, Phytogeography and IUCN Threat Categories of the Species

Endemism

As endemism in my group is not particulary high in Turkish grasses (being c. 9%), their widespread occurrence may often be the result of having rather specialized dispersal mechanisms. Among the genera revised there is not any endemic genus but there are a number endemic taxa at the species and subspecies level, such as *Elymus longearistatus subsp. sintenisii, E. divaricatus* subsp. *divaricatus, E. divaricatus* subsp. *lomotolepis.*

Phytogeography

According to Davis (1965) Turkey is the meeting place of three phytogeographical regions: Euro Siberian (represented by the Euxine province), Mediterranean (represented by the East

Mediterranean provinces of West Anatolia, Taurus and Amonos [West and South Anatolia respectively] and Irano-Turanian (represented by Inner Anatolia. The phyto geographical regions of Turkey shown in Figure 33.

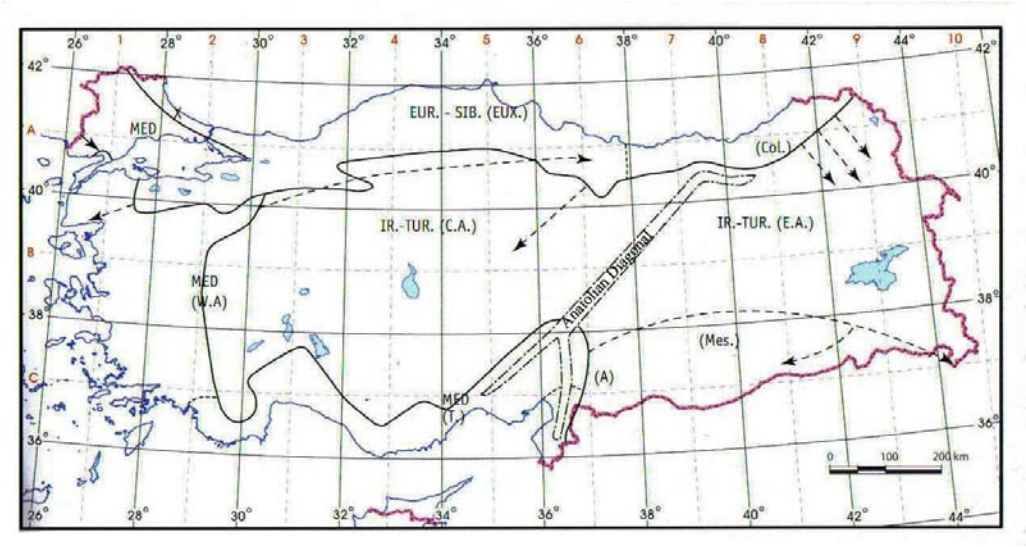

Figure 33. Phytogeographical regions of Turkey

Sakamoto (1974) classified the Tribe Triticeae into two major groups on the basis of geographical distribution. The first one is the Mediterranean-Central Asiatic group. This group includes ten genera consisting mostly annual species of the genera The second group includes five genera distributed in the arctic temperate regions of the world (Table 14). The ecogeographical patterns of the tribe members were given in Tables 15-20.

Table 14. Sakamoto's classification of the tribe Triticeae on the basis of geographical distribution (Sakamoto 1974)

Distribution	**Perennial**	**Perennial+Annual**	**Annual**	**Rachis node with**
Meditteranean-Central Asiatic region		*Secale* *Haynaldia*	*Aegilops* *Eremopyrum* *Henrardia* *Heteranthelium* *Triticum*	Solitary spikelets
	*Psathyrostachy*s			Spikelets in group
Arctic temperate regions of the world	*Agropyron*			Solitary spikelets
	Asperalla *Elymus* *Sitanion*	*Hordeum*		Spikelets in group

Table 15. Summary of distribution of the taxa in the genera *Agropyron* and *Elymus* recognized in Turkey.

	Species	**Phytogeographical region**	**Comments**
1	*A. cristatum subsp. pectinatum*	Mult. Reg.	Widespread, Locally common throughout the Turkey
2	*A. incanum*.	Ir.-Tur.	Locally abundant, only N.E. and East Anatolia
3	*A. imbricatum*	Ir.-Tur.	Locally abundant, only East Anatolia
4	*Elymus transhyrcanus*	Ir.-Tur.	Locally abundant, only N.E. and East Anatolia
5	*E. caninus* .	Mult. Reg. (Mainly Euro-Siberian)	Locally common in lowland woods from sea level to 2000 m.
6	*E. panormitanus*	Mult. Reg. (Mainly Medit. element)	Locally common in mountain woodlands
7	***E. longearistatus subsp. sintenisii***	Ir.-Tur.element	**Endemic**, Rare, known only two localites in N.E. of Turkey
8	***E. lazicus***	Ir.-Tur.element	**Endemic**, Rare, known only two localites in N.E. of Turkey
9	***E. divaricatus subsp. divaricatus***	Ir.-Tur.element	**Endemic**, Widespread especially in Inner Anatolia
	E. divaricatus subsp. lomotolepis	Ir.-Tur.element	**Endemic**, known only type gathering
10	***E. clivorum***.	Ir.-Tur.element	**Endemic**, known only type gathering
11	*E. elongatiformis*	Mult. Reg.	Widespread and common in Inner Anatolia
12	*E. repens*	Mult. Reg.	Widespread and common throughout the Turkey

Table 16. Summary of distribution of the taxa in the genus *Thinopyrum* in Turkey.

	Species	**Phytogeographical region**	**Comments**
1	*Thinopyrum flaccidifolium*	Medit. element	Locally common in salty marshes, known only four localities from Turkey
2	*T. elongatum subsp. elongatum*	Medit element	Locally common on the coast of South Anatolia and N.W. Turkey
	T. elongatum subsp. ponticum	Ir.-Tur.element	Widespread, distributed mainly in Central Anatolia
	T. elongatum subsp. turcicum	Ir.-Tur.element	Widespread and common, throughout the Turkey
	T. elongatum subsp. salsum	Ir.-Tur.element	**Endemic**, known only type gathering
3	*T. caespitosum subsp. caespitosum*	Ir.-Tur.element	Distributed in North Anatolia
	T. caespitosum subsp. sinuatum	Ir.-Tur.element	Rare in Turkey, restricted only to N.E. Anatolia
	T. caespitosum subsp. gypsicolus	Ir.-Tur.element	**Endemic**, known only type gathering
	T. caespitosum subsp. platphyllus	Ir.-Tur.element	**Endemic**, known only type gathering
4	*T. gentryi*	Ir.-Tur.element	Very rare in Turkey, known only one locality from Hakkari
5	***T. erosiglumis***	Ir.-Tur.element	**Endemic,** rare in Turkey
6	*T. pycnanthum*	Medit. element	Locally common on the coasts of N. Anatolia
7	*T. intermedium subsp. intermedium*	Mult. Reg. (Mainly Ir.-Tur.)	Widespread throughout the Turkey.
	subsp. pulcherrimum	Ir-Tur	Confined to East Anatolia
8	*T. farctum* subsp. *farctum*	Medit. element	Locally common on the coasts of Turkey
	subsp. *rechingeri*	Medit. element	Locally common on the coasts of Turkey
	subsp. *bessarabicus*	Medit. element	Locally common on the coasts of Turkey

Table 17. Summary of distribution of the taxa in the genera *Pseudoroegneria, Eremopyrum, Heteranthelium, Crithopsis* and *Amblyopyrum* in Turkey.

	Species	**Phytogeographical region**	**Comments**
1	*Pseudoroegneria libanotica*	Ir.-Tur.element	Typical higland species, distributed in S. and S.E. Anatolia
2	***P. sosnovskyi***	Ir.-Tur.element	**Endemic**, Rare to uncommon, known only a few locations from E. Anatolia
3	*P. tauri*	Ir.-Tur.element	Sympatric with *P. libanotica,* grow mainly in S: Anatolia
4	*P. koshaninii*	Ir.-Tur.element	Rare in Turkey, known only three gatherings from Turkey
5	*Eremopyrum triticeum*	Ir.-Tur.element	Locally common in Inner Anatolia
6	*E. bonaepartis*	Ir.-Tur.element	Locally common in Inner Anatolia
7	*E. orientale*	Ir.-Tur.element	Locally common in Inner Anatolia
8	*E. distans*	Ir.-Tur.element	Locally common in Inner Anatolia
9	*E. confusum*	Ir.-Tur.element	Locally common in Inner Anatolia
10	*Heteranthelium piliferum*	Ir.-Tur.element	Common in S. E. Anatolia, typical lowland species except gathering from Mardin
11	*Crithopsis delileana*	Ir.-Tur.element	The distribution is confined to C4 to C8 squares, typical lowland species, two new records for C4 and C8 grid squares were gathered .
12	*Amblyopyrum muticum*	Ir.-Tur.element	Widespread and locally common in Turkey. This genus occurs only Central Anatolian of Turkey and Armenia

Table 18. Summary of distribution of the taxa in the genus *Aegilops* in Turkey.

	Species	**Phytogeographical region**	**Comments**
1	*Aegilops speltoides*	Ir.-Tur.element	Widespread and locally common in Turkey
2	*Ae. markgraffi*	Medit. element	This taxon is distributed throughout Turkey except N.E. and E. Anatolia
3	*Ae. cylindrica*	Multiregional element	Widespread and common throughout the Turkey
4	*Ae. tauschii*	Ir.-Tur.element	Uncommon to rare in Turkey. Its distribution confined to E. and S.E. Anatolia
5	*Ae. vavilovii*	Ir.-Tur.element	Rare in Turkey, grows in the step of S.E. Anatolia
6	*Ae.crassa*	Ir.-Tur.element	Uncommon to rare in Turkey, may grow sympatric with the *Ae. vavilovii*
7	*Ae. juvenalis*	Ir.-Tur.element	Very rare, known only from one location
8	*Ae. comosa var. comosa*	Medit. Element	Rare, known only three locations throughout the Turkey.
9	*Ae. uniaristata*	Medit. Element	Very rare probably extinct in Turkey. The last specimen was collected by A. Baytop in 1975. The given localities in Flora of Turkey are historical.
10	*Ae.umbellulata*	Medit. Element/ Ir.-Tur.element	Widespread and common in Turkey
11	*Ae. peregrina*	Medit. Element	Uncommon to rare in Turkey. It is confined to the coast of South Anatolia
12	*Ae. kotchyi*	Medit. Element	Uncommon to rare in Turkey. It is confined to the coast of South Anatolia
13	*Ae. triuncialis*	Multiregional element	Widespread and common in Turkey..
	Subsp. *persica*	Ir.-Tur. element	Subsp. *persica* is confined only in South Eastern part of Turkey
	Subsp. *bozdagensis*		Known only from one locality, Denizli (Bozdağ)
14	*Ae. biuncialis*	Medit. Element/ Ir.-Tur.element	Locally abundant and widesperead in Turkey
15	*Ae. columnaris*	Medit. Element/ Ir.-Tur.element	Locally abundant and widespread in Turkey
16	*Ae. neglecta*	Multiregional element	Locally abundant and widespread in Turkey
17	*Ae. geniculata*	Multiregional element	Widespread and common in Turkey

Table 19. Summary of distribution of the taxa in the genera *Triticum*, *Dasypyrum*, *Secale* and *Leymus* in Turkey.

	Species	**Phytogeographical region**	**Comments**
1	*Triticum boeoticum*	Ir.-Tur.element	Widespread and locally common in Turkey
2	*T. urartu*	Ir.-Tur.element	This taxon is confined to the S.E. Anatolia. More limited distribution than *T. boeticum*. Known only a few locations from Turkey.
3	*T. monococum*	Multiregional element	Cultivated only North Anatolia, landraces
4	*T. araraticum*	Ir.-Tur.element	Uncommon to rare in Turkey. Its distribution confined to E. and S.E. Anatolia
5	*T. diccocoides*	Ir.-Tur.element	Rare in Turkey, grows in the step of S.E. Anatolia
6	*T. dicoccon*	Ir.-Tur.element	Cultivated only North Anatolia, landraces
7	*Dasypyrum villosum*	Medit. Element	confined to A1 (A1 sensu Davis 1965) to C2 squares in Turkey
8	*Secale strictum s. lat.*	Ir.-Tur.element	Widespread and locally common in Turkey.
9	*Secale cereale s. lat.*	Ir.-Tur.element	.
10	*Secale sylvestre*	Euro-Siberian	Known only from two localities in Turkey
11	*Leymus racemosus* subsp. *sabulosus*	Medit. Element	
12	*Leymus cappadocicus*	Ir.-Tur.element	Locally common in salty marshes found inner Anatolia.

Table 20. Summary of distribution of the taxa in the genara Hordeum, *Psathyrostachys*, *Hordelymus*, *Taeniatherum* and *Henrardia* in Turkey.

	Species	**Phytogeographical region**	**Comments**
1	*Hordeum brevisubulatum* subsp. *violaceum*	Ir.-Tur.element	This subspecies is occurred in the montane to low alpine zone Widespread and locally common in Inner and East Anatolia.
2	*H. geniculatum*	Medit. element	This taxon is distributed throughout Turkey except N.E. and E. Anatolia
3	*H. marinum*	Multiregional element	Widespread and common throughout the Turkey
4	*H. murinum*	Ir.-Tur.element	Widespread and common throughout the Turkey
5	*H. bulbosum*	Ir.-Tur.element	Widespread and common throughout the Turkey
6	*H. spontaneum*	Ir.-Tur.element	
7	***Psathyrostachys fragilis* subsp. *villosus***	Ir.-Tur.element	Restiricted to the Erzincan and Sivas provinces
	Subsp. secaliformis	Ir.-Tur.element	
	Subsp artvinense	Ir.-Tur.element	
8	***P. narmanica sp. nova***	Ir.-Tur.element	Rare, known only three locations throughout the Turkey.
9	***P. daghestenica* subsp. *erzurimica* subsp. nov.**	Ir.-Tur.element	Very rare known only two localities including its type locality.
10	*Hordelymus europeus*	Euro-Siberian	It grows in rich woodlands and deciduous forests. Widespread and locally common in Northern part of Turkey. Habitat loss is the main threat for the taxon
11	*Taeniatherum caput medusae*	Euro-Siberian and Ir.-Tur. element	Widespread and common in Turkey.
12	*Henrardia persica*	Ir.-Tur.element	Widespread but locally common

IUCN Threat categories of the taxa found in the tribe

The updated and precise evaluation at the national level of the conservation status of members of Tribe Triticeae were carried out as a result of our current taxonomic revision. Re-evaluation process of the taxa was based on the field and population observations carried out between 2006-2009, as well as gathered distribution data from published materials and herbarium studies. During the timeline of the thesis, type and the other known localities of the taxa, as well as a number of other sites where they might occur were visited. All field studies were planned to cover whole possible representative geographical coverage of the taxa. In the field, the specimens´GPS coordinates, habitat, and relevant field observations were also recorded. For each taxa following characteristics were observed: the area of occupancy and distribution, populations and their size, and the number of mature individuals. Moreover, current distribution areas of the taxa were determined using GPS data.

Threat categories are proposed at the national level for all the taxa according to IUCN Red List Categories Version 3.1 (2001) and the Application of IUCN Red List Criteria at National Levels. The following categories established and defined by IUCN (2001) were used in this study: Data deficient (DD): inadequate information available to make an direct assessment; Critically endangered (CR): the taxon has an extremely high risk of extinction in the wild; Endangered (EN): the taxon has a very high risk of extinction in the wild; Vulnerable (VU): the taxon has a high risk of extinction in the wild in the medium term future; Near threatened (NT): the taxon is none of the above, but it close to qualifying for or is likely to qualify for a threatened category in the near future; Least concern (LC): the taxon is none of the above. Widespread and abundant taxa are included in this category (Gardenfors et al., 2001). Details of the threats are determined for each species and comments are made according to Broughton and McAdam (2002).

Previously 27 taxa were evaluated under different threat categories in Turkish red data Book (Ekim et al., 2000). However, our studies and field observations showed that previous evaluations of the species were not properly made due to lack of field/herbarium studies and data. The peresent study aims to provide a comprehensive assesment of the conservation status of Triticeae taxa throughout the Turkey.

According to results, threat categories of taxa at national level are as follows: 5 taxa Data Deficient (DD), 1 taxon Extinct (E), 1 taxon Critically Endangered (CR), 12 taxa Endangered (EN), 9 taxa Vulnerable (VU), and remaining taxa Least Concern (LC) (Table 21).

Table 21. The IUCN threat categories of the taxa (Ekim et al. 2000)

Threat categories	**Taxa found in Red data book of Turkish Plants (Ekim et al. 2000)**	**Recommended threat categories for national level**
Ex-Extinct	*Triticum parvicoccum*	*T.parvicoccum*
Critically Endangered B1ab(iii,v)+2ab(iii,v)	**Agropyron deweyi*	*Elymus lazicus* subsp *lomotolepis*
EN-Endangered-B1ab(iii)+2ab(iii)	*Elymus clivorum* *Elymus longearistatus* subsp. *sintenisii* **Elymus nodosus* subsp *gypsicolus* **Elymus nodosus* subsp *plathyphyllus* **Elymus sosnowskyi*	*Elymus clivorum* *E. longearistatus* subsp. *sintenisii* *Elymus nodosus* subsp *gypsicolus* *Elymus nodosus* subsp *plathyphyllus* *Elymus sosnowskyi* *Elymus lazicus* *Aegilops juvenalis* *Aegilops vavilovii* *Secale sylvestre* *Triticum araraticum* *Elymus gentryi* *P.fragilis subsp. artvinense*
VU- Vulnarable B2ab(i,ii,iv)	**Elymus lazicus* subsp. *lazicus* **Secale cereale* var. *ancestrale* *Elymus farctus* subsp. *bessarabicus* var. *strialus* subsp. *rechingeri* *Elymus gentryi* *Crithopsis delileana* *Leymus cappadocicus* *Secale ciliatoglume* *Secale sylvestre* *Triticum dicoccoides* *Triticum monococcum*	*Aegilops comosa* subsp. *comosa* *Elymus farctus* subsp. *bessarabicus* var. *strialus* subsp. *rechingeri* *Crithopsis delileana* *Leymus cappadocicus* *Secale ciliatoglume* *Triticum dicoccoides* *Triticum monococum* *H. europaeus*
DD-Data Deficient	*Elymus elongatus* subsp *salsus* **Elymus lazicus* subsp *lomotolepis* *Aegilops comosa* subsp. *comosa* *Ae comosa* subsp *heldreichii* *Aegilops peregrina* *Aegilops uniaristata* *Elymus koshaninii* *Hordeum murinum* subsp. *leporinum* var. *simulans* *Triticum timopheevi* var. *araraticum*	*Elymus elongatus* subsp *salsus* *Aeilops comosa* subsp *heldreichii* *Aegilops uniaristata* *Elymus koshaninii* *Hordeum murinum* subsp. *leporinum* var. *simulans*

According to IUCN (2001) criteria at national level, *Elymus elongatus* subsp *salsus, Aegilops comosa* var. *subventricosa, Aegilops uniaristata, Elymus koshaninii, Hordeum murinum* subsp. *leporinum* var. *simulans* are evaluated as Data Deficient (DD). This taxa were not found in detailed floristic researchs conducted in the type localities and other potential locations during the timeline of the thesis. Therefore, we have not got inadequate information to make a direct or indirect assessment of its vulnerability. This might be due to extinction of the species in the area, or habitat destruction in their type localities. *Elymus*

lazicus subsp *lomotolepis* is Critically Endangered [CR B1ab(i,ii,iv); C2a(ii): extent of occurrence less than 100 km2; area of occupancy less than 10 km2; known to exist at only a single location; all mature individuals placed in one population and estimated mature individuals fewer than 100]. *E. clivorum, E. longearistatus* subsp. *sintenisii, Elymus nodosus* subsp *gypsicolus*, *Elymus nodosus* subsp *plathyphyllus*, *Elymus sosnowskyi, Elymuslazicus, Ae. juvenalis, Ae. vavilovii, Secale sylvestre*, *Triticum araraticum, Elymus gentryi* are Endangered [EN B2ab(i,ii,iv): area of occupancy less than 500 km2, known at no more than 5 locations]. Nine taxa are evaluated as Vulnerable [VU B2ab(i,ii,iv): area of occupancy less than 2000 km2, known at no more than 10 locations; inferred decline in the area]. The remaining taxa are evaluated as Least Concern (LC) since they are widespread or abundant (Table 1, Figure 2).

Triticum parvicoccum Kislev is extinct archaeobotanical tetraploid species found only in archelogical excavations. As it was found in southern parts of the Near East where *T. durum* prevails today, it was suggested that it is tetraploid (Kislev, 1984). On the basis of recent remmants of this wheat found at Israel, Kislev (1984) stated that 13 morphological characters related to ear and grain remmants are common with the tetraploid wheats. The characteristics of this species are as follows: small grains less than 5 mm in length (3.6-4.9mm on the avarage) and short internodes about 1-2 mm. *T. parvicoccum* is presumably the most ancient naked wheat modern bread wheat and also macoroni wheat descended. Although it was excavated from several archaelogical sites in Diyarbakır, Aydın, Burdur, and Konya provinces from Turkey (Tan, 1985), no living material has been reported until now. ***Agropyron deweyi*** was evaluated as a synonym of *A. cristatum* subsp *pectinatum var. pectinatum* because of the fallowing facts: The address of *A. deweyi* may possibly be wrong. The seeds were collected from 32 miles east of B9 (sensu Davis 1965) Van at altitute of 630 m by J. R. Harlan. We also made intensive expeditions around Van and the area covered the type locality of *A. deweyi* is not under 1600 m. The photograph of the neotype of *A. deweyi* shows characteristics of *A. cristatum* subsp. *pectinatum*. The spike of the neotype *A. deweyi* has distinct gaps and tapering above and also spikelets are clearly pectinate. ***Crithopsis delileana,*** the threat category of *C. delileana* was assessed as vulnerable (VU) in Turkish Red Data Book (Ekim *et al.* 2000). According to the recent field surveys conducted by us, although the species is distributed more than 10 locations, the populations of *C. delileana* are still vulnerable to grazing activity of the sheeps and cattle. Distribution area is affected by anthropogenic factors such as habitat degradation and overgrazing. The effects of overgrazing are so high especially dry and hot summers (Cabi et al 2010).

3.3. Taxonomic Treatment

Since the Pre_Linnean period taxonomists have been trying to establish the real nature of taxonomic categories. Certainly concepts of the categories have changed over the years, but as far as the revised group is concerned, it seems desirable to give an explanation of my treatment of five taxonomic categories: Genus, section, Species, Subspecies and Variety.

Genus

As I mentioned in the Introduction part there are considerably different generic approaches to the taxonomy of tribe Triticeae. I have recognized 18 genera in the tribe Triticeae mainly on the basis of their overall similarities and dissimilarities as well as the known genomic constitutions of the taxa. My treatment of the genus is very much morphological one which may appear more or less a tradition in the Poaceae family. However I took into considerations the genetic homegeinity in the group of species while deciding or separating the genera. Certainly the degree of difference between the species of one genus is not as great as two species belonging the two genera.

The generic delimitation in the genus *Elymus* has been reevaluated and It is decided that the genera *Thinopyrum* and *Pseudoroegneria* should be separated from the genus *Elymus*. It became evident that the nomenclature of several specific and infraspecific taxa in *Elymus* needed adjustment. We proposed some novelties in order to make these names available for this and other Turkish floristic works now in progress.

Section

Sections recognized just only in the genus *Aegilops*.

Species

Taxa with different genomic constitutions are treated as distinct species in the present revision. In some cases, however, delimitation of species even with different genomic constitutions is difficult.

Subspecies

My treatment of subspecies is basically the same as that proposed by Du Rietz (1930) and Doğan (1985). Major geographical races of the species are treated as subspecies. In spite of being always differantiated by morphological features, subspecies are morphologically not so well seperated as the species because the degree of difference between them is less pronounced. For reachin a more consistent subspecies concept, a species should be investigated throughout its entire geographical range. Subspeices have rather distinct geographical distributions, but may be interconnected clinically in the contact zone by populations or individuals exhibiting transitional characters. In many cases however, subspecies are completely allopatric, and in such situations morphological intermediates may not be found.

Variety

Varietal rank is often assigned to local populations of a species or subspecies. Varieties differ from other such populations in one or more hereditary characters. The variety may or may not be confined to adefinite geographical range in relation to other varieties of the same taxon.

TRITICEAE Dumort. Observations sur les Graminées de la Flore Belgique 82, 84, 91. 1824.

Type species : *Triticum* L. - *Species Plantarum* 1: 85-87. 1753.

Syn. *Hordeeae* Kunth ex Spenn. Flora Friburgensis 1: 155. 1825. *Secaleinae* Rchb. Conspectus Regni Vegetabilis 48. 1828.

Annuals or perennial herbs, rhizomatous or non-rhizomatous. Culms caespitose or solitary. Leaves festucoid type anatomy without two cells microhairs; leaf sheaths usually open at base. Ligule usually membranous. Leaf blades linear or lanceolate, silica bodies oblong to elliptic; 2-celled micro-hairs absent. Inflorescence a spike. Spikelets with 1 to many florets, solitary or in groups of 2-3, usually hermaphrodite ,sessile and alike, or with the lateral spikelets of a triad pedicellate, male or barren and much reduced. Rachilla disarticulating above glumes. Glumes coriaceous, strongly veined, half as long to almost as long as spikelet. Lemma chartaceous to coriaceous, awnless or awned from apex, keeled or rounded on back, 5-to many-veined. Palea 2-keeled. Lodicules 2, entire or ± toothed, ciliate. Stamens 3. Ovary hairy at apex but not appendaged. Styles 2. Hilum linear, as long as caryopsis. Starch grains simple. Chromosomes large; basic number x = 7.

3.4. Key to genera

1 Inflorescence a dense spike, with 2 or more spikelets at each node (internodes hidden by spikelets.

2. Spikelets 2 at each node

3 Axis of inflorescence densely pilose; glumes strap shaped, 1 or 3 veined, lemma with a short awn up to 15 mm long, awns straight .....**7. *Crithopsis***

3 Axis of inflorescence glabrous; glumes awn like, lemma with an 6-12 cm, awns more or less recurved…….....**17. *Taeniatherum***

2 Spikelets 3 at each node.

4. All spikelets similar in size and sexuality with 1 or 2 fertile florets and a sterile floret

5. Rachis fully fragile, easily disarticulating at maturity; glumes awn like …….....**15. *Psathyrostachys***

5. Rachis tough, not disarticulating at maturity; glumes narrowly lanceolate or linear in basal part, subulate towards apex…….……**13. *Leymus***

4. Spikelets dissimilar in size and sexuality (except in cultivated plants), either lateral spikelets sterile or staminate, central one fertile or the central spikelet sterile the lateral ones sterile

6. Spikelets pedicellate, with 1 or 2 florets, lowest floret of all spikelets sessile, floret of lateral spikelets fertile, floret of central spikelet sterile; rachis tough…….....**16. *Hordelymus***

6. Spikelets pedicellate or not, with one floret, lateral spikelets usually shortly pedicellate and sterile (except in cultivated plants), central spikelet sessile and fertile, rachis fragile if all three spikelets sessile and fertile, rachis not fragile……...**14. *Hordeum***

1. Inflorescence more or less dense spike, with 1 spikelets at each node (internodes usually visible)

7. Glumes lanceolate to ovate and strongly keeled from near the base to the tip, sometimes with two keels

8. Glumes distinctly awned, awns longer than 15 mm long.....**11. *Dasypyrum***

8. Glume apices truncate to acute, unawned, mucronate, toothed or with an awn less than 15 mm long

9. Plants perrennial.....**1. *Agropyron***

9. Plants annual

10. Spikelets strongly divergent, more than three times the length of adjacent internode, plants 3-40 cm uzunluğunda, inflorescence never breaking up at maturity.....**5. *Eremopyrum***.

10. Spikelets ascending to adpressed, 1-3 times as long as the adjacent internode, plants 14-180 cm, inflorescence breaking at maturity except cultivated taxa.....**10.*Triticum***

7. Glumes subulate to linear, if lanceolate not or weakly keeled at the base sometimes strongly keeled distally, never with two keels.

11. Lemmas strongly keeled, keels conspiciously ciliate distally, glumes subulate…….....**12. *Secale***

11. Lemmas not both strongly keeled and conspiciously ciliate distally, glumes subulate, linear, lanceolate, rectangular or ovate

12. Plants annual

13. Inflorescences with a sterile and fertile florets intermixed, glumes with ciliate edges, lemmas tuberculate…….....**6. *Heteranthelium***

13. Inflorescences either with no few sterile spikelets or sterile and fertile spikelets in different regions, glumes edges not ciliate, lemmas smooth or scabrous not tuberculate

14. At least some glumes and lemmas awned .....**9. *Aegilops***

14. All glumes and lemmas unawned

15. Glumes facing each other not concealing the florets, widest distally with 5-7 slightly divergent veins.....**8. *Amblyopyrum***

15. Glumes lying side by side, concealing the florets, widest near midlength, with 5-9 parallel or convergent veins.....**18. *Henrardia***

12. Plants perennial

16. Glumes and lemmas rectangular, stiff, coriaceous to indurate at maturity, hyanline margins widest distally, midveins prominent distally, smooth and glabrous their whole length or with a few low teeth distally, apices truncate to obtuse or acute, muticous or mucronate, the mucros to 2.5 mm, rarely awned.....**3. *Thinopyrum***

16. Glumes subulate, linear, lanceolate to ovate lanceolate, often flexible, sometimes stiffly membranous to coriaceous at maturity, their midveins usually not more conspicuously prominent distally, nor with teeth confined to their distal portion, hyaline margins widest below midlength, apices obtuse to acute, acuminate or awned; lemmas lanceolate, often awned, sometimes unawned.

17. Plants caespitose or solitary with long creping rhizomes or not; lemma usually with disctinct callus at base .....**2. *Elymus***

17. Plants always caespitose with short rhizomes or not; lemma usually with obscure callus at base ……..... **4. *Pseudoroegneria***

3.4.1. *Agropyron* Gaertner

The morphological variation in *Agropyron* Gaertner within Turkey was examined by using numerical analyses. For this purpose, some of these herbarium specimens and collected specimens were selected for the multivariate analysis. A list of studied material for numerical analysis is given in Table 22. A set of 21 diagnostic characters and some of them with their character states. (Table 23) was chosen and scored for the OTU's (Sneath & Sokal 1973). The results indicate that there are five morphologically distinct entities in Turkey, representing three species, *A. imbricatum* Roem. & Schult., *A. cristatum* (L.) Gaertn., and *A. incanum* (Nábělek) Tzvelev. *Agropyron cristatum* is represented by three entities that we recognize as varieties of *A. cristatum* subsp. *pectinatum* (M. Bieb.) Tzvelev: var. *pectinatum,* var. *mucronatum* E. Cabi & Doğan var. nov., and var. *puberulum* Boiss. Morphological differences between these three species are given in Table 24.

In cluster analysis of *Agropyron* species based on the qualitative and the quantitative characters, two major clusters or subgroups are formed. The phenogram (Fig. 31) proves that a cut off line can be drawn at 0.68 similarity level which supports the existence of two major distinct subgroups. The first subgroup includes *A. cristatum* subsp. *pectinatum* and *A. imbricatum* The second subgroup includes the remaining accessions of *A. incanum*. However, species cut off line seems to lie at 0.7 similarity point. We have also found that the separation among clusters is mainly determined by general presence or absence of sterile shoots, basal internodes, gaps between spikelets and also spike shape characteristics. Three dimensional display (Fig 2) of the first three principal components accounted for 68,3 of the total variance revealed three groups among all OTU's of *Agropyron* used in the cluster analysis.

Table 22. List of specimens used in constructing the cluster analysis**.**

OTU's	Nomenclature	Acs. Nmr	Localities
1	*A. incanum*	E. Cabi 2545	Bayburt
2	*A. incanum*	E00257882	Van
3	*A. incanum*	E00257883	Bitlis/Vani
4	*A. incanum*	E00257884	Hakkari
5	*A. incanum*	G. Akaydın 7917	Van
6	*A. incanum*	E00257885	Van
7	*A.imbricatum*	E00257886	Van.
8	*A. incanum*	E00257887	Van
9	*A. cristatum* subsp. *pectinatum* var. *puberulum*	E.Cabi 2258	Kars
10	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	E. Cabi 2526	Kars
11	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	E.Cabi 1597	Ankara
12	*A. cristatum* subsp. *pectinatum*	E.Cabi 2474	Erzincan
13	*A. cristatum* subsp. *pectinatum* var. *mucronatum*	E. Cabi 2444	Sivas
14	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	G. Akaydın 10319	Ankara
15	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	E. Cabi 2257	Ağrı
16	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	E. Cabi 2498	Ağrı
17	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	E. Cabi 2496	Erzurum.
18	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	E. Cabi 2422	Sivas
19	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	E. Cabi 899	Kırıkkale
20	*A. cristatum* subsp. *pectinatum* var. *pectinatum*	G.Akaydın 7753	Van
21	*A. cristatum* subsp. *pectinatum* var. *mucronatum*	G. Akaydın 10320	Ankara

Table 23. The emended list of characters studied in *Agropyron* genus

1.	Culm Length
2.	Culm Indumentum; hairy 0, glabrous 1, scabrous 2
3.	Number of nodes on the stem
4.	Spike Length
5.	Spike Width
6.	Glume Length (including awn)
7.	Awn of Glume Length
8.	Glume Indumentum; villous 0, densely villous 1, scabrous 2, glabrous 3
9.	Lemma Length (including awn)
10.	Awn of Lemma Length
11.	Lemma Indumentum; villous 0, densely villous 1, scabrous 2, glabrous 3
12.	Palea Lenth
13.	Apex of lemma awned 0, unawned 1
14.	Rachis fragility: Fragile 0, nonfragile 1
15.	Distance bet. spikelets very close 0 or presence of distinct gaps between spikelets 1
16.	Leaves flat 0, convolute 1, conduplicate 2
17.	Leaf indumentum glabrous 0 or pilose 1
18.	The presence of cauline leaves of non flowering shoots; present 0, absent 1
19.	Florets number per spikelet
20.	Rachis indumentum; glabrous 0, pilose 1
21.	Culms abundant 0 or rare 1

Table 24. Distinguishing characteristics of three *Agropyron* species recognized in Turkey

A. imbricatum	***A. cristatum* subsp. *pectinatum***	***A. incanum***
Rachis tough at maturity	Rachis tough at maturity	Rachis fragile at maturity
Densely caespitose perennial, a sod like structure formed at base	Caespitose perennial, a sod like structure is absent at base	Densely caespitose perennial, a sod like structure formed at base
Culms sparse, covered adpressed hairs throughout and glaucos green	Culms abundant, pilose below the spike and the remaining parts are glabrous or scabrid	Culms sparse, densely pilose throughout.
Sterile shoots are rare	Sterile shoots are rare	Sterile shoots are abundant
Leaves of flowering shoots flat	Leaves are flat and also becoming folded when dried	Basal leaves of sterile shoots are are strictly convolute and glabrous
Very short compact dense spikes with distict gaps between the spikelets	Spikelets have distinct gaps	Compact ovoid spikes without gaps between the spikelets.
Spike eliptic, linear eliptic 2.5-5 cm	Spike broad, tapered pectinate spikes 2.7-6 cm	Spike ovate, rectangular eliptic 2.5-3cm

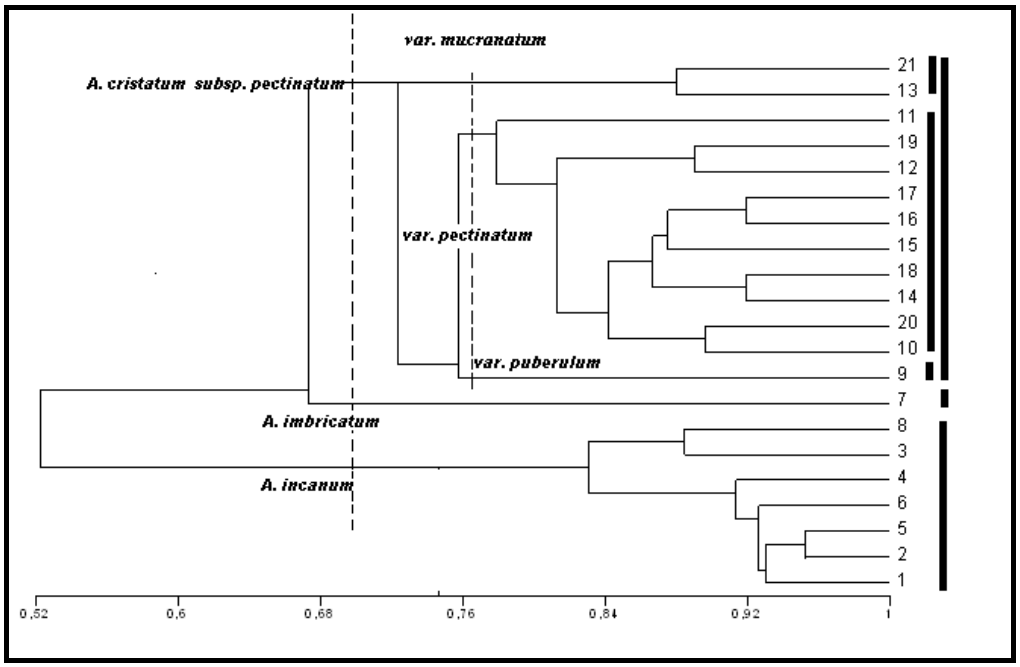

Figure 34. Phenogram constructed by means of UPGMA algorithm and Gower General Similarity.

OTUs.: OTU 1-6, 8 *A. incanum;* OTU 7 *A. imbricatum* OTU *9-21 A. cristatum* subsp*. pectinatum.* (see Table 22).

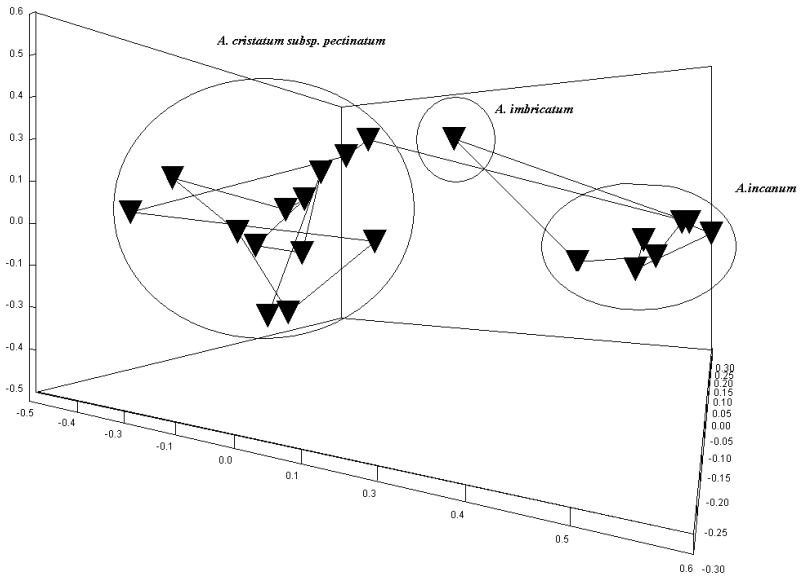

Figure 35. Three dimensional display of the first three principal axes from principal coordinate analysis of all OTU's of *Agropyron* used in the cluster analysis

The above given results were used to develop a key, descriptions, and distribution maps for *Agropyron* in Turkey.

***Agropyron* Gaertner** In Novi Comment. Acad. Sci. Imp. Petrop. 14(1): 539. 1770.

Type species: *Agropyron cristatum* (L.) Gaertn. - *Novi Commentarii Academiae Scientiarum Imperalis Petropolitanae* 14: 540. 1770. LT designated by Nash in N.L. Britton et A. Brown, Ill. Fl. N.U.S. ed. 2. 1: 283 (1913)
Syn. *Agropyrum* Roem. & Schult. Systema Vegetabilium 2: 750. 1817. ***Australopyrum*** (Tzvelev) Á. Löve Feddes Repertorium 95(7-8): 442. 1984.

Perennials. Leaf blades flat to involute. Inflorescense a distichous spike, rachis tough or fragile, with short internodes. Spikelets solitary, strongly compressed laterally, alternaly arranged, pectinate or imbricate, with 3-10 florets; rachilla disarticulation below florets. Glumes boat shaped, coriaceous, with prominent keel and 1-2 inconspcuous marginal veins ± abrubtly tapering into a short awn or a mucro. Lemma 5 veined, keeled in upper half and, rounded in the lower half, usually awned or occasionally a mucro, Palea equally to lemma with two vein, bifid at apex. Anthers 3. Haploid genome **P** (haplome designations from http://www.herbarium.usu.edu/triticeae/genmsymb.htm).

Key to species

1. Rachis fragile at maturity; stem with sterile shoots ……**2. *A. incanum***
1. Rachis tough at maturity; stem without sterile shoots.
- **2.** Spikes dense with distict gaps between spikelets; leaf blades green.....**1**. ***A. cristatum***
- **2.** Spikes without distict gaps between spikelet; leaf blades glaucous ……..**3**..***A. imbricatum***

3.4.1.1. Agropyron cristatum (L.) subsp. pectinatum (Bieb.) Tzvelev in Sched. Herb. Fl. URSS 18:25. 1970.

Caespitose perennial. Stem 21-70 cm erect or slightly geniculate at base, smooth and glabrous or pubescence below the infloresence with two or three nodes, with sterile shoots. Leaf blades narrowly linear, acute or acuminate, up to 16 cm × 3mm, sparsely to densely

hairy on both surfaces or glabrous. Spike 3-6 cm × 0.6-1.7 cm, eliptic, narrowly rectangular to wide rectangular or linear. Spikelets loosely pressesed together, disarticulating below glumes, with 4 to 7 florets. Glumes ± equalling, keeled; lower glume 5-8 mm (incl. awn ca. 1-4 mm); upper glume 5-9 mm (incl. awn ca. 1.2-4 mm). Lemma 6-11 mm, lanceolate, usually with an awn(ca. 0.7-4.5 mm) or a mucro(up to 0.7 mm), glabrous or sparsely pilose. Palea 4-6 mm, bifid, scabridilous on keels. Genome **PP, 2n=4x=28** (Assadi 1995)

Spikelets pilose …….....var. ***puberulum***
Spikelets glabrous.
Lemma with a short mucro (0.5-0.7 mm)…….....var. ***mucronatum***
Lemma with a short awn (1-3 mm)……..var. ***pectinatum***

var. ***pectinatum***
Syn *Triticum pectinatum* M. Bieb., Fl. Taur.- Cauc. 1:87. 1808. *Agropyron pectinatum* (M. Bieb.) P. Beauv., Ess. Agrost. 146. 1812. *Agropyron pectinoforme* Roem. & Schult., Syst. Veg. 2:758. 1817. *Agropyron deweyi* A. Löve Feddes Repertorium 95(7-8): 432. 1984.

Flowering and Habitat May-June. Dry pastures, calcerous rocks, roadsides and dry meadows **Altitude:** 650-2100 m.
Type: "[Crimea] cum praecedente [*Triticum cristatum*] in Tauriae rupestarius" (Holotype: LE!; Isotype: W)

Turkey-in-Europe, Inner and East Anatolia A1(E) Edirne: İpsala to Enez, A. Baytop (ISTE 15760!). **A3 Bolu**: Bolu to Ankara, 13.06.2008, E. Cabi 3290. **A4 Kırıkkale**: 4 km E. of Kızılırmak, 800 m., 23.06.1990, A.A. Dönmez 2498!. **A8 Erzurum:** Oltu to Tamru, 2 km to Oltu, 1450 m 25.06.1988, Feldern 43466! **A9 Kars:** Kuyucak village, around Kuyucak lake, dry pastures, 40°43'40.9" N, 43°25'29.9" E, 1642 m, 08.07.2007, E. Cabi 2526 (with var. *puberulum*). **Kars:** Digor to Iğdır, 40 km to Tuzluca , 40°18.666' N, 43°29.860' E, 1638 m, dry pastures, calcerous rocks, 26.06.2008, E. Cabi 3571; **B3: Eskişehir**: Polatlı to Sivrihisar, 32 km to Sivrihisar, 38°33.843' N, 31°48.627' E, 870 m, 16.06.2008, E. Cabi 3316. **B4 Ankara:** Gölbaşı to Haymana, 33 km to Haymana, 39°37'41.0" N, 32°42'05.2" E, 1073 m, dry calcerous hills, 16.06.2008, E. Cabi 3294. **B5 Nevşehir:** Nevşehir to Ürgüp, 10 km to Ürgüp, 38°36.555' N 34°44.513' E, 1318 m, 29.05.2008, E. Cabi 3071. **Kayseri:** Sultan Sazlığı, Yahyalı, Ova Çiftliği Village, around Bird Museum 1071 m, 10.07.1993, Yıldırımlı 16167. **B6 Sivas:** Campus area of Cumhuriyet University, 1269 m, 18.06.2008, E. Cabi 3365. **Sivas:** the crossroad of Ulaş-Gürün, Deliilyas and Altınyayla Villages , 39°23'47.2" N, 37°04'59.3" E, 1434 m, limestone slopes, 19.06.2008, E. Cabi 3378 (with var.

puberulum). **B7 Erzincan:** Spikör Mountain, 1 km before Kolçekmezdağı Pass, 39°49'08.0" N, 39°31'05.7" E, 2099 m, 07.07.2007, E. Cabi 2474. **B8 Elazığ:** Elazığ-Bingöl, 37 km to Bingöl, 38°57.067' N 40°10.994' E, 1605 m, 26.07.2008, E. Cabi 3722. **B9 Van**: Özalp, Yorumkara Şemsettin Villages, 2000m, 19.05.1997, F. Özgökçe 8529. **Erzurum:** Horasan to Ağrı 17 km to Ağrı, calcerous slopes, 39°42'03.7" N, 42°17'21.8" E, 1715 m, 08.07.2007, E. Cabi 2496. **B10 Ağrı:** Doğubeyazıt to Iğdır 9.5 km to Iğdır , dry volcanic rocks and slopes, 39°39'26.8" N, 44°02'34.6" E, 1545 m, 08.07.2007, E. Cabi 2257.

External Distribution. C. Europe, Mediterranean area, C. & S. Russia, Crimea, Caucasia, Iran, Afghanistan, C. Asia, Siberia; introduced in many temperate countries. **Multiregional.** Threat category: **LC**

Figure 36. Habit of *Agropyron cristatum* subsp. *pectinatum* var. *pectinatum* and its spike in close view

var. *mucronatum* E. Cabi & Doğan, var. nov.

Type: [TURKEY**] B6 Sivas**, Entrance of Cumhuriyet Üniversitesi campus, 1275 m 19.06.2007, E. Cabi 2444 and E. Karabacak (Holotype: GAZI). Syntype : [TURKEY]**: B4 Ankara**: Polatlı, around Ayaş Bridge ,12.07.1971 Turan Uslu 138 and Mahmut Kılınç. (ANK!)

Flowering and Habitat: June**,** near roads and open woodlands, ca. 900-1300 m.

Affinis var. *pectinatum lemmatis mucronatis 0.5–0.7 mm longis differt*

Endemic. **Ir-Tur element**. Threat category: **LC.**

var. *puberulum* Boiss.

Syn. *Triticum puberulum* Boiss. ex Steud.. *Agropyron puberulum* (Boiss. ex Steud.) Grossh., Trud. Bot. Inst. Akat. Nauk SSSR. Azerb. Fil. Baku 8:48 (Fl. Kavkaza, 1:340. 1939. *Agropyron cristatum* subsp. *puberulum* Boiss. ex Steud. Tzvelev; *Agropyron cristatum* var. *puberulum* Boiss., Diagn. Pl. Orient., ser. 1, 13: 67. 1853.

Central and North East Anatolia: A5 Çorum: Çorum to Amasya, 3 km to Boğazkaya Village, 40°33'57.0" N, 35°25'09.2" E, 658 m, slopes near fields, 17.06.2008, E. Cabi 3330. **B6 Sivas:** Ulaş to Gürün, the crossroad of Deliilyas and Altınyayla villages, slopes, 39°23'47.2" N, 37°04'59.3" E, 1434 m, 19.06.2008, E. Cabi 3378b. **A9 Kars:** Kuyucak Village, around Kuyucuk Lake, pastures, 40°43'40.9" N, 43°25'29.9" E, 1642 m, 08.07.2007, E. Cabi 2258.

Flowering and Habitat: June. Limestone slopes and hills. 650-1650 m.

External Distribution. Caucasia, Iran, Russia

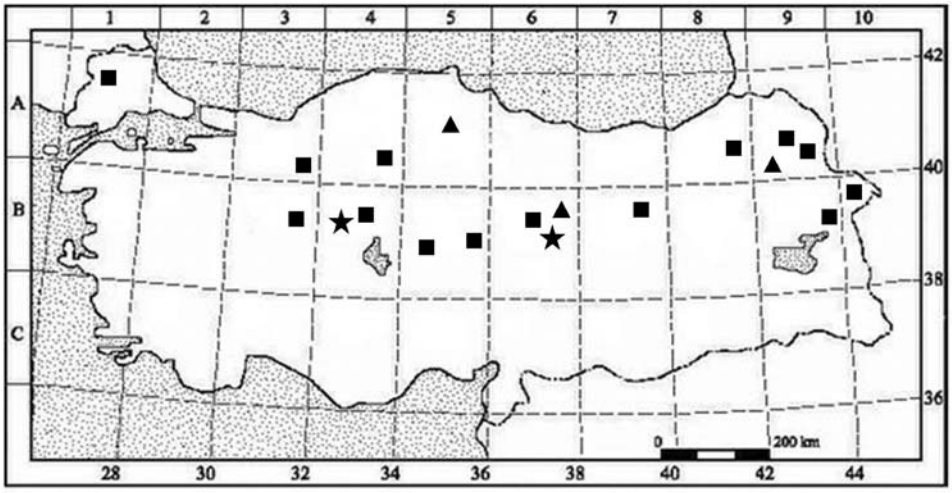

Figure 37. Distribution of *Agropyron cristatum* subsp. *pectinatum* in Turkey

Legend. *Agropyron cristatum* subsp. *pectinatum* (■) var. *pectinatum*, (★) var. *mucranatum* and (▲) var. *puberulum*

In this study, *A. deweyi* was evaluated as a synonym of *A. cristatum* subsp *pectinatum var. pectinatum* because of the fallowing facts: The address of *A. deweyi* may posssibly be wrong. The seeds were collected from 32 miles east of B9 (sensu Davis 1965) Van at altitute of 630 m by J. R. Harlan. We also made intensive expeditions around Van and the area covered the type locality of *A. deweyi* is not under 1600 m. The photograph of the neotype of *A. deweyi* shows characteristics of *A. cristatum* subsp pectinatum. The spike of the neotype *A. deweyi* has distinct gaps and tapering above and also spikelets are clearly pectinate.

3.4.1.2. *Agropyron incanum* (Nábělek) Tzvelev, Bot. Zhurn. (Moscow & Leningrad) 78:88. 1993.

Basionym: *Agropyron cristatum* var. *incanum* Nábělek Spisy Vydávané PYírodovědeckou Fakultou Masarykovy University 111: 26. 1929.

Syn. *Agropyron cristatum* (L.) Gaertn. subsp. *incanum* (Nábělek) Melderis, Notes Roy. Bot. Gard. Edinburgh 42:77. 1984.

Syntype: [Turkey] C9 Hakkari Cilo Mountain Nábělek 3413,3373 (BRA). Ic.: Nábělek, Spisy Přír. Fak. Masarykovy Univ. 105: t. 4 f.2. 1929.

Plants densely caespitose. Culms 27–45 cm, with 2-nodes, erect, densely pubescent , producing numerous sterile shoots 4.5–11 cm long. Leaf blades 2.5–6 cm × 0.5–1.2 mm, linear-lanceolate, becoming convolute, densely puberulent, glaucous or green; Spikes 2.5–3 cm × 0.9–1.3 cm, ovate, rectangular elliptic to elliptic; Spikelets closely pressed together, disarticulating below glumes with 4 to 7 florets. Glumes ± equal, keeled; lower glume 5.5–7 mm (including awn of 1.5–3.5 mm; upper glume 6–8 mm (including awn of 1.5–3.5 mm. Lemmas 9–12 mm, lanceolate, densely pilose, with 1.5–4.5 mm awn, densely pilose, palea 5–7.5 mm, bifid, scabridilous on keels. Genome **PPP, 2n=6x=42** (Assadi 1995)

Icones.—Nábělek, Spisy Přír. Fak. Masarykovy Univ. 105: t. 4 f.2. 1929.

Flowering and Habitat: July-August. Mountain slopes, steppes and scree; 2600–3350 m.

East Anatolia. A8 Erzurum: Aşkale-Bayburt, Kop Mount. 40°01'38,0" N 40°31'20,4" N, 2401 m, 09.07.2007, E. Cabi 2545. **B9 Bitlis:** Pelli Mount., above Pelli , 3050 m, 08.07.1954, Davis 22589 (E!). Van**:** Gevaş, Artos Mountain., 3350 m,15.07.1954 Davis. 22864 (ANK!). Van: Başkale, Ispiriz Mount., 3200 m., 31.07.1954 Davis 23700 (E!) Van: Özalp 2080 m 05.10.1997, F. Özgökçe 1509 (VANF!) Van: near Muradiye and Beşparmak

Villages and Köseveli Mount., 2400 m, M. Ünal 1872 (VANF!) **C10 Hakkari:** Cilo Mount., 10 km west of Cilo Hill , 3200 m, 09.08.1954, Davis. 24128 (ANK!., E!.)

External Distribution. Caucasia, Iran, Ir-Tur. element, Threat category **LC**

Figure 38. *Agropyron incanum* general view and its spike in close view

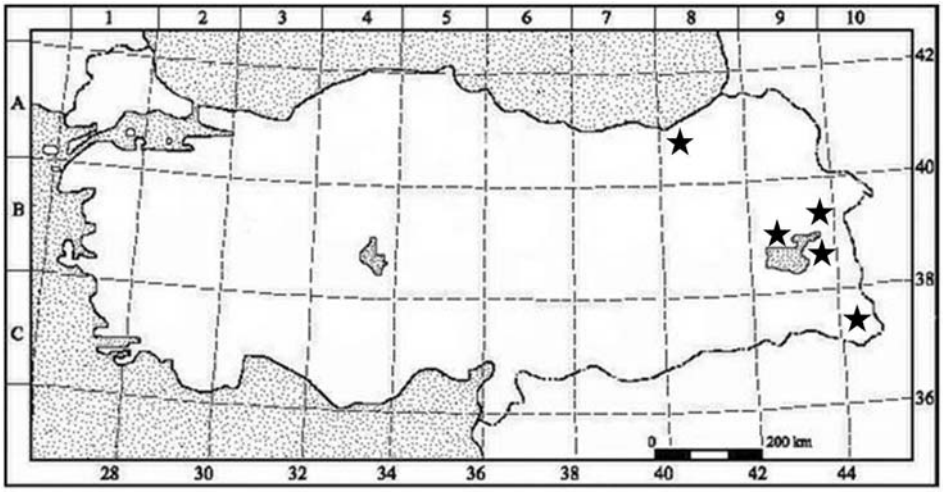

Figure 39. Distribution of *Agropyron incanum* in Turkey

Notes on the taxon

Dewey & Asay (1975) reported a hexaploid *A. cristatum* from almost the same locality in Azerbaijan, noting that the tall, coarse, caespitose hexaploids in Azerbaijan (and Turkey) are distinct from typical *A. cristatum*, but refrained from any subspecific recognition since the whole genus is in need of a biosystematic study before a reliable taxonomy can be achieved (Assadi 1995). Baum et al (2008) cited *Agropyron cristatum* (L.) Gaertner subsp. *incanum* as one of the synonyms of *A. deweyi. A. incanum* is characterized having spikes with spikelets closely pressed together and densely pilose lemmas contary to *A. deweyi.* Löve (1984) also noted that this species may be a variant of *A. cristatum* which has arisen under cultivated conditions far from its native habitat.

3.4.1.3. *Agropyron imbricatum* Roem. & Schult., Syst. Veg. 2:757.1817.
Basionym: *Triticum imbricatum* Stev. ex M. Bieb. Flora Taurico-Caucasica 1: 88. 1808.

Syn. *Agropyron cristatum* subsp. *pectinatum* var. *imbricatum* Melderis, Notes Roy. Bot. Gard. Edinburgh 42:77. 1984. *Agropyron puberulum* (Boiss. ex. Steud.) Grossh., Fl. Kavk. ed. 2, 1:340. 1939. Type: [Caucasia] Iberia, *Steven* (holotype: LE; isotype: W!).

Densely caespitose perennial. Stem 23–36 cm, slightly geniculate at base, densely pubescent with two nodes, flowering shoots are sparse. Leaf blades 5.5–14 cm × 2.0–4.5 mm, acuminate, flat, densely puberulent, glaucous; Spike 5 cm × 0.9 cm, elliptic to linear; Spikelets loosely pressesed together, rachis segmets are visible, with 4 florets. Glumes ± equalling, keeled; lower glume 7.5 mm (incl. awn) with 4 mm awn; upper glume 7.5 mm (incl. awn) with 3.5 mm awn. Lemma 10.5 mm, sparsely pilose, lanceolate, with 4.5 mm awn. Palea 5 mm, bifid, scabridilous on keels.

Flowering and Habitat: June-August. Stony slopes and fields, 1600-2900 m.
East Anatolia (Figure 4.6). B7 Tunceli: Sultan Baba Mount. (Tunceli'nin ~40 km kuzeyi), 1700-2900 m, 20 Aug 1982 Sorger & Buchner 82-130-36 (W). **B9 Van:** Gümüşpınar'dan Hoşap'a 24 km kala, 2000 m, 09.06.1966, Davis. 44698 (E.) **Van**: Gürpınar, Yedisalkım Köyü'nün arkası, 2400 m 23.07. 2003, M. Ünal 5512 (VANF) **Van**: Özalp, Damlacı Köyü, Boncuk Vadisi, 09.07.1997, F. Özgökçe 5735 (VANF)

External Distribution. Caucasia, Iran, Central Asia. **Ir-Tur element** Threat category: **LC**

Figure 40. Herbarium photo of *Agropyron imbricatum*

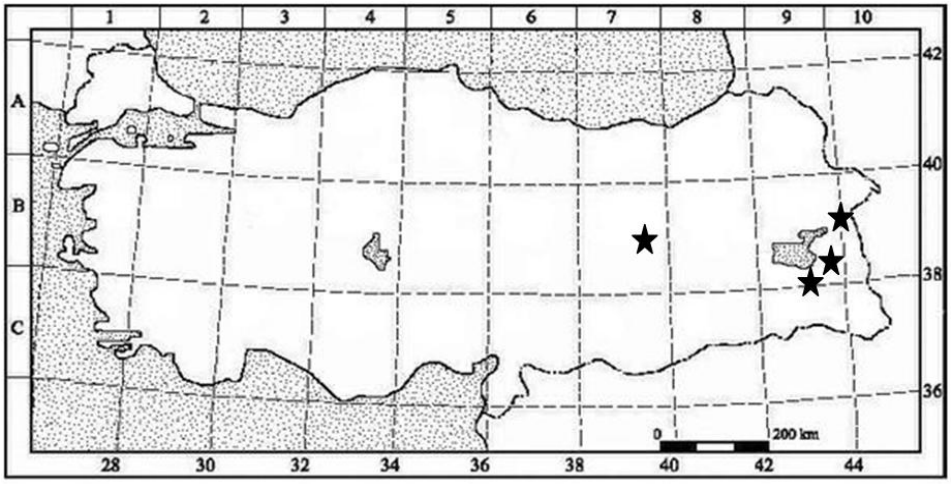

Figure 41. Distribution of *Agropyron imbricatum* in Turkey.

3.4.2. *Elymus* L.

The generic delimitation in the genus *Elymus* has been reevaluated and **i**t is decided that the genera *Thinopyrum* A. Löve and *Pseudoroegneria* (Nevski) A. Löve should be separated from the genus *Elymus* s. lato. For the transferring of the taxa genomic constitutions and morphological differences given in the generic key were taken into account. Cytologically All **StH, StY** (*Roegneria*) species and theirs' morphologically similar species retained in *Elymus* s.str. On the basis of this treatment, the genus *Elymus s. str.* is represented with 9 species in Turkey. The list of species recognized for the Flora of Turkey has been given in Table 25.

Table 25. *Elymus* species occurring in Turkey, their chromosome numbers and genomic constitutions

Species	**Genome symbols**	**Cytology**	**References**
Elymus elongatiformis	StStStHH	2n = 6x = 42	Assadi & Runemark 1995
E. repens	StStStHH	2n = 6x = 42	Assadi & Runemark 1995
E. clivorum	Not designated	Unknown	
E. divaricatus	Not designated	Unknown	
E. lazicus	Not designated	Unknown	
E. caninus	StStHH	2n = 4x = 28	Readinbaugh et al 2000 and Zhang et al. 2009
E. panormitanus	SSYY or SSSSYY	2n= 4x=28 or 2n=6x=42	Salomon1992; Redinbaugh et al. 2000
E. longearistatus subsp. *sintenisii*	StY		
E. transhyrcanus	StStStHH	2n = 6x = 42	Assadi 1995

***ELYMUS* L.** Species Plantarum 1: 83-84. 1753.

Type Species: *Elymus sibiricus* L. - *Species Plantarum* 1: 83. 1753. LT designated by Hitchcock, Prop. Brit. Bot. 121 (1929); also by Bowden, Canad. J. Bot. 42: 554 (1964); see Jarvis, Taxon 41: 562-563 (1992)

Syn. *Elytrigia* Desv. Nouveau Bulletin des Sciences, publié par la Société Philomatique de Paris 2: 190. 1810: *Roegneria* K. Koch Linnaea 21(4): 413. 1848.

Rhizomatous or non-rhizomatous caespitose perennials. Leaf sheath of cauline leaves split almost at base. Leaf blades flat or ± convolute. Inflorescence a lax or dense spike Spike erect, lanceolate; rachis tough. One spikelet at each node, without pedicel, compressed laterally, with 3-10 florets; rachilla disarticulating below the glumes. Glumes oblong, ovate or lanceolate, usually asymmetric, with (3) 5-7 prominent veins. Lemma lanceolate, 5-7 veined, rounded at back, keeled at abaxial side or apex, callus usually glabrous. Palea 2 keeled, slightly shorter than lemma, ciliate along the keels. Caryopsis usually adherent to lemma and palea, oblong. x=7.

Key to species

1. Plants usually with creeping rhizomes not forming dense tufts, spikelets falling entire at maturity, glumes are not persistent.

2. Spike dense, spikelets imbricate, longer than the internodes 2-3 times; lemma acuminate or awned; leaf sheaths not ciliate on margins. .....**9. *E. repens***

2. Spike loose, spikelets not imbricate, as long as internods; lemma unawned; leaf sheaths ciliate on margins.

3. Lower leaves with prominent marginal veins, bearing sparse spinulose cillia; glumes 5-6 mm, narrow (c. 1 mm broad), 3-4 veined; lemma 6-7 mm ……..……..**7. *E. clivorum***

3. Lower leaves without prominent marginal veins bearing spinulose cilia; glumes 5-10 mm, broader, 3-7-veined; lemma 6-11 mm……..8**. *E. elongatiformis***

1. Plants forming dense tufts, without or with very short rhizomes; whole spikelet breaking up at maturity; glumes persistent on rachis

4. Lemma with an awn longer than 8 mm

5. Awn of lemma erect or slightly flexuous at maturity.

6. Glumes 7-9 veined, broadest below, lower glume exceeding lowest floret.…..……..…….**3. *E. panormitanus***

6. Glumes 3-5 veined, broadest in middle, lower glume distinctly shorter than lowest floret.....**2. *E. caninus***

5. Awn of lemma recurved or ± divaricate at maturity

6. Awn of lemma recurved, conspicuously dilated and ± canaliculate at base; callus longer than broad, c. 0.5 -0.8 mm, slightly strigose on sides; glumes 3-5 veined …….....**4. *E. longearistatus* subsp. *sintenisii***

6. Awn of lemma ± divaricate, not conspicuously dilated and canaliculate at base; callus rounded, less than 0.5 mm, smooth on sides; glumes 5-7 veined

7. Spike loose**,** 2-6 spikelets, spikelets 19-24 mm……..**5. *E. lazicus***

7. Spike dense, 4-10 spikelets, 11-21 mm ……..**6. *E. divaricatus***

4. Lemma unawned or with a short awn to 3 mm……**1. *E. transhyrcanus***

3.4.2.1. *Elymus transhyrcanus* (Nevski) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 9:61 (1972).

Basionym: *Roegneria transhyrcana* Nevski Trudy Sredne-Aziatskogo Gosudarstvennogo Universiteta. Seriya 8b, Botanika 17: 70. 1934.

Caespitose perennial. Stems 40-100 cm. Leaves 3-5 mm broad, flat or ± convolute, scabrid, sometimes also sparsely pilose on upper surface. Spike 7-15 cm, lax, erect; rachis usually slightly scabrid dorsally. Glumes 7-11 mm, 3-7 veined, scabrid on veins, acuminate or with short awn to 1 mm. Lemma 8.5-11 mm, glabrous on back, scabridulous towards apex, unawned or with short awn to 5mm.

Flowering and Habitat: June-August. Rocky slopes, scree*,* 2200-3660 *m*.

Type: [USSR] Kopet-dagh [Mons Czapandagh (prope Kara-kala) Turcomaniae occidentalis, 26 viii 1931, W.Borissova 725 (holo. LE!-also type of *R. leptoura* Nevski)].

N.E & S.E Anatolia. **A8 Erzurum**: 70 km N.W. of Erzurum, 2200 m, Sorger & Buchner 82-122-36! **Erzurum:** Erzurum to Pazaryolu-İspir, 60 km before Pazaryolu, near Rizekent, 40°09.422' N, 41°01.606' E, 2024 m, scree, 21.06.2008, E. Cabi 3445. **Erzurum**: Uzundere to Oltu, around Başbağlar village, 2089 m, 40°26.173' N 41°36.171' E 22.06.2008, E. Cabi 3482. **B7 Erzincan** Spikör Mount., 3 km before Spikör Pass, calcerous slopes, 2277 m, 39°52'25.9" N 39°33'21.0" E 07.07.2007, E. Cabi 2485. **C10 Hakkari**: Cilo Mountain, 10 km W. of Cilo Hill, 3200 m, D.24165! ibid., 3660 m, D.24174!

External Distribution. Transcaucasia, Iran, Central Asia. **Ir.-Tur. element**. Threat category **LC**

Figure 42. Habit of *Elymus transhyrcanus* and spike in close view

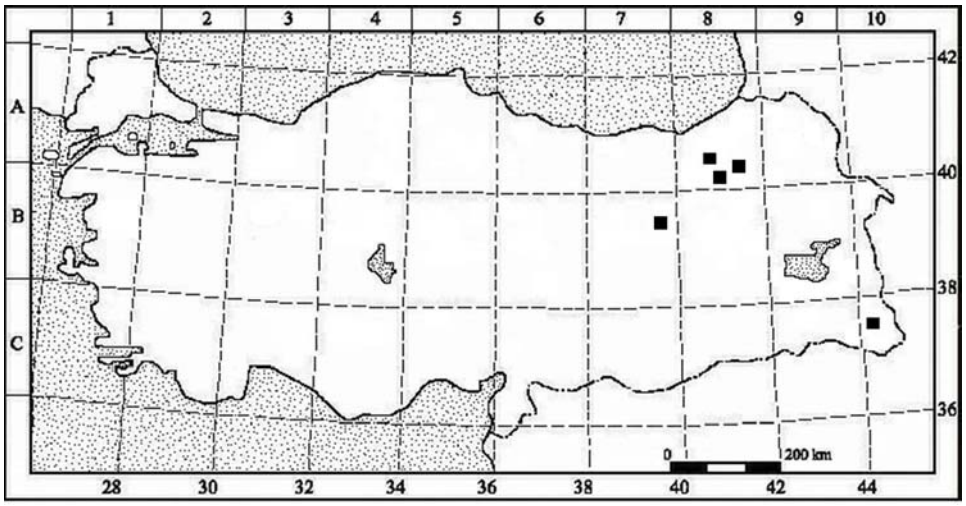

Figure 43. Distribution of *Elymus transhyrcanus* in Turkey

3.4.2.2. *Elymus caninus* (L.) L., Fl. Suec. ed 2:39 (1755).

Basionym: *Triticum caninum* L. Species Plantarum 1: 86-87. 1753!.

Syn. *Agriopyrum caninum* (L.) Pall. ex Hegi Illustrierte Flora von Mittel-Europa 1: 488. 1908. *Agropyron caninum* (L.) Nevski Flora URSS 2: 617. 1934. *Agropyron caninum* (L.) P. Beauv. Essai d'une Nouvelle Agrostographie 1: 102, 146. 1812. *Brachypodium caninum* (L.) F. Herm. ex Lindm. Svensk Fanerogamflora 104. 1918. *Braconotia canina* (L.) Fourr. Annales de la Société Linnéenne de Lyon, sér. 2, 17: 189. 1869. *Elytrigia canina* (L.) Drobow Flora Uzbekistanica 1: 285, 539. 1941. *Goulardia canina* (L.) Husn. Graminées. Descriptions. France, Belgique, Isles Britanniques, Suisse 83. 1899. *Roegneria canina* (L.) Nevski Flora URSS 2: 617. 1934. *Zeia canina* (L.) Lunell American Midland Naturalist 226. 1915.

Ic. Hubbard, Grasses ed. 2:96 (1968), as *A. caninum*. Map 36. **-** Lectotype (designated by Cope & van Slageren): Herb. Linn. No. 100.10 (LINN).

Caespitose perennials with short rhizomes. Stems 50-120 cm, erect or slightly geniculate at base, usually on and below nodes densely or minutely pilose. Leaves properly arranged on stems, auricles up to 1.5 mm, ligule 0.2-1.5 mm; 15-25 cm long and 5-15 mm wide, flat, üst yüzde seyrek piloz. Spike usually 7-15 cm with 16-20 spiklets, dense, erect or nodding; rachis spinulose-ciliate on main angles. Spikelets 10–15(20) mm, 2–5(7) mm wide, erect or silightly divergent, with 2–6 florets; rachilla scabridulose or pubescent, disaarticulates above the glumes and below the florets. Glumes subequal, lanceolate or ovate, 5-8 mm x 0.6-1 mm, 3-5 veined, scabrid on veins, with prominent c 1 mm hyaline margin, ± abruptly tapering in to a short awn c. 0.3 mm. Lemma 8-10 mm, glabrous at back, ± scabridulous towards apex,

awn erect or flexuous, 1.5-1.8 cm long. Palea nearly equal to lemmas, keels prominently ciliate throughout. Anthers 2–3 mm. **2n = 28**. Haploid Genome symbol **StH (SSHH).**

Flowering and Habitat: June-Agust. Usually in woods, nr s.l.-2000m
Described from Europe. (Hb. Linn.100/9).

Turkey-in-Europe, N., C. & S. Anatolia (Figure 4.11.) A2(E) Istanbul: Tschilingos (Çilingoz), Hermann. **A4 Ankara**, Kızılcahamam, Soğuksu National Park, to Karacaören 1265 m, 40 26 769 N 32 36 499 E, Quercus-Pinus forest, near roads, 27.06.2006, E. Cabi 1192; **Kastamonu**: Ilgaz to Kastamonu road, Ilgaz Pass, Abies forest, 1729 m, 41°03'32.3" N 33°44'23.7" E, 13. 06. 2007, E. Cabi 2363. **Ankara**: d. Kızılcahamam, Aliş Mount., 1250 m, Khan et al. 502! **A7 Trabzon**: nr Sumela monastery, 800-1300 m, Sorger & Buchner 82-91-17! **A8 Rize**: Dijimil (Cimil), 2000 m, vii 1866, Bal.! **B7 Erzincan**: Sipikör Mount., Pirinbaghre (Firinbahçe), Sint. 1890:3561!

External Distribution: Europe, Caucasia, Siberia, Iran, Iraq, Afghanistan, W. Pakistan, N. W. India, C. Asia. **Euro-Sib. element**.Threat category. **LC.**

Notes on the taxon. *Elymus caninus* is most likely to be confused with awned plants of *E. trachycaulus.* The two species also differ in their molecular characteristics, and in at least one chromosome interchange (Sun et al. 1998). C.L. Hitchcock et al. (1969) treated *Elymus trachycaulus* as a subspecies of *E. caninus*; it differs consistently from the latter species in glumes that are glabrous on the adaxial (inner) surface, in a chromosome interchange, and in its molecular characteristics (Sun et al. 1998). It also tends to have a more erect spike.

Figure 44. Spike of *Elymus caninus* in close wiew

3.4.2.3. *Elymus panormitanus* (Parl.) Tzelev in Shed. Herb. Fl. URSS 18:27 (1970).
Syn: *Agropyron panarmitanum* Parl., Rar. Fl. Sic. 2:20 (1840); *Triticum panormitanum* (Parl.) Bertol., Fl. Ital. 4:780 (1841); *Roegnaria panormitana* (Parl.) Nevski in Fl. URSS 2:612 (1934). Ic: Fl. Iraq 9: t. 72 (1968); Pignatti, Fl. Ital. 3:536 (1982), both as *A. panormitanum*.

Caespitose perennials. Stems with 2-3 glabrous or shortly pubescent nodes, 65-90 cm. Leaves 15-25 cm X 2.5-6.5 mm, usually flat, becoming convolute, usually scabrid or sparsely pilose on upper surface. Spike 10-20 cm, with 7-15 spikelets, erect or slightly nodding; rachis internodes 10-15 mm. Glumes 15-18 mm, 7-9 veined, scabrid on veins, with

very narrow hyaline margin, gradually tapering into a short awn 1-3 mm, lower gluma as long as or slightly exceeding lowest floret. Lemma 9-12 mm, scabrid towards apex, with erect awn 20-35 mm Palea 9-10 mm, obtuse, scabrid on veins. Anthers c. 5 mm.

Flowering and Habitat: June-August. Mountain woods, shaley abandoned fields on hills, 550-1625 m.

Type: [Sicilya] Palermo alla Pizzuta, alla Moarta, e a Monte Cuccio, Parlatore.

W., S. & E. Anatolia A5 Kastamonu: Tosya, Gavur Mountain, 1443 m 41°03'12,4" N 34° 00' 25,9" E 14 06 2007 E. Cabi 2382 (new record for **A5** grid square) **B1 Izmir**: Kemalpaşa, ca. 490 m, 38° 25.061 N 27° 24' 15" E, 02.06.2008, E. Cabi 3142. **Manisa**: mt. Sipylos (Spil Mount.), 600 m, 09. 06 Bal. 1854:11 ! **B7 Tunceli**: Ovacık, above Tornava 1100-1450 m 26.07.1979, Ş. Yıldırımlı 2187b (HUB!) **B8 Bingöl**: 2 km W. of Bingöl towards Elazığ, 1480 m, 02.06.1970, Kyoto Univ. Exped. 7-2-7 A! **Bingöl:** Tunceli to Bingöl 2km before Bingöl, Topalan Village 1352 m, 38° 54.519 N 40° 26.485 E, 03.07.2006, E. Cabi 1404. **B9 Bitlis**, Hizan, Soğanlı district around dormitory, 2500m, 03.06.1990, L. Behçet 2144 (VANF!) **C3 Antalya**: Akseki, Tuzaklı Mount., Serebil Mevkii, S.E. of Mahmutlar village 2000 m 01.06.96 A. Duran 3808 (GAZI!) Kemer, between Yaylakuzdere and Çukuryayla 1200-1500 m, 28.07.1979, H. Peşmen 4445 (HUB!) Kemer, TV anten tower, 1200-1700 m 21.07.1978, H. Peşmen 3912 (HUB!) **C4 Konya**: Kara Mount., 8 km N.E. of Mersin, 05.06.1855, Bal.! **Adana**: Bulgar (Bolkar) Mount., 1853, Kotschy. **C5 İçel** Bouloukli to Alla Dagh (Ala mount.), 8 km N.E. of Mersin, 05.06.1855 Bal!. **C6 Kahramanmaraş**:Engizek Mount., Eğrice hill, 1500 m, 13.06.1987, H. Duman 3245 (GAZI!).

External Distribution: S. Spain, Italy, Siciliy, Balkans, Romania, Crimea, Lebanon, Cyprus, N. Iran, N. Iraq. **Medit. element**. Threat category **LC.**

Figure 45. Spike of *Elymus panormitanus*

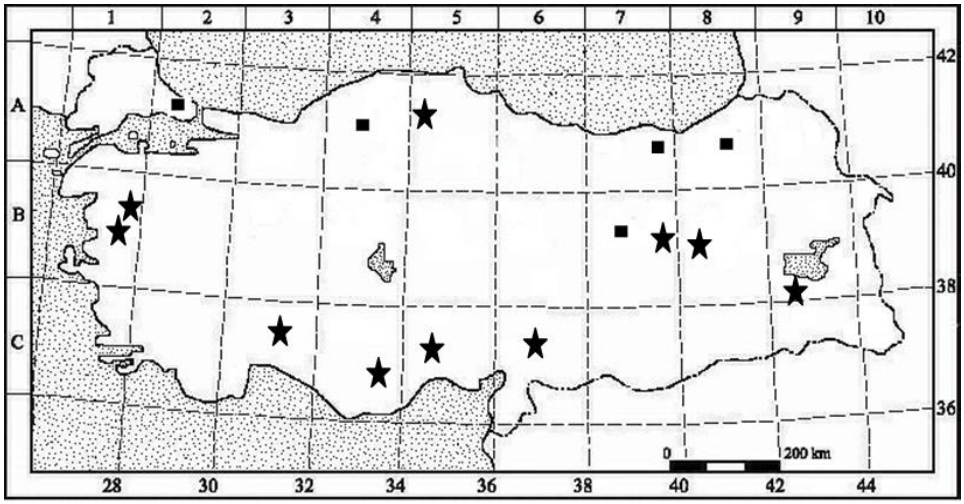

Figure 46. Distribution of *Elymus caninus* and *E. panormitanus* in Turkey.

Legend. (■)*Elymus caninus* and (★) *Elymus panormitanus***.**

3.4.2.4. *Elymus longearistatus* (Boiss.) Tzelev in Novit. Syst. Pl. Vasc. (Leningrad) 9:62 (1972).

Syn. *Brachypodium longearistatum* Boiss., Diagn. ser. 1 (7):127 (1846)! Agropyron longearistatum (Boiss).,Fl.Or.5:660 (1884)! *Agropyron longearistatum* (Boiss.) Boiss. *var.haussknechtii* Boiss., loc. cit (1884)! *Anthosachne longiaristatus* (Boiss.) Nevski in Acta univ. Asia Med. ser. 8b (Bot.) 17:64 (1934)!

subsp. ***sintenisii*** Melderis in Notes R.B.G. Edinb. 42:79 (1984).

Caespitose perennial. Stems 20-60 cm, with 2-3 nodes, sparsely and minutely strigilose below the nodes. Uppermost internode 16 cm long. Leaves c.15 cm X c. 1.5 mm in width, involute, more or less strigose on upper surface, also beneath; sheaths sparsely strigilose. Spike erect, 4-8 cm, usually 4-7 spikelets; rachis minutely spinulose ciliate or glabrous on main angles. Spikelets 15-17 mm (excl. awns), with 4-5 florets, tinged with purple; rachilla 2-3 mm, strigiloz, areadily breaking up at maturity. Glumes 5-12 mm, unequal, conspicuously 3-5 veined, acuminate, with a short awn 1-4 mm, often bidendate. Lemma 9-10 mm, minutely strigilose towards base and scabridilous towards apex; callus 0.5-0.8 mm, dorsally compressed; awned at apex, awn 2.5-5 cm, recurved, dilated and ± canaliculated at base.

Flowering and Habitat: June-July. Rocky slopes, 350-500 m.

Type: [TURKEY] A7 Gümüşhane: Kırkpauli, in declivibus, 16 vii 1894, P. Sintenis 6261 (holo. LD iso. HAL, Hb. Hausskn.).

N.E. Anatolia. A7 Trabzon: 2-3 km W. of Maçka, 500 m, Sorger & Buchner 82-90-20! 2-3 km west of Maçka entrance of Kayadibi Saklıbahçe , 346 m, 40°49.047' N 39°36.670' E, 01.08.2008, E.Cabi 3795.

Endemic, Ir. Tur. Element, Threat category **EN**

Figure 47.Spike of *Elymus longearistatus.*

Notes on the taxon: Specimens collected from B7 Malatya [Kübe Mount. 1700 m., 20.07.1993, B. Yıldız 11681 and Bey Mount. 1600-1800 m 01.07.1994] identified as *E. longearistatus.* subsp. *sintenisii.* These specimens should be checked again and they are probably belong to *E. divaricatus.* These two taxa can easily misidentified.

3.4.2.5. *Elymus lazicus* (Boiss.) Melderis

Syn: *Agropyron lazicum* Boiss., Fl. Or. 5:661 (1984)! Map 37. *Elytrigia lazica* (Boiss.) Valdés & H. Scholz., Wildenowia 36(2): 661.2006.

Flowering and Habitat: July-September. Mountain woods, rocks, 1600-1950 m.

Caespitose perennial with short rhizomes. Stems 40-60 cm, erect, usually with 2 nodes, internode length 9-12 cm, stem minutely strigillose throughout densely scabridulous close nodes. Leaves up to 20 cm long involute, glabrous on upper surface, puberulent on abaxial (lower) side. Spike loose, 4-13 cm (excl. awns), with 2-6 spikelets; internode length 12-21 mm; rachis shortly spinulose-ciliate on angles. Spikelets 18-22 mm more or less remote to rachis Glumes 9-10,5 mm, distinctly shorter than lowest floret, ± unequal, slighltly scabrid on veins,5-7 veined, usually gradually tapering into an awn up to 5 mm or bifid into two short awns or mucro. Lemma 13-16,5 mm. (exc. awn) scabridulous towards apex with long, ± recurved awn up to 6 cm, Palea 9-11 mm, scabrid on keels, apex of palea obtuse; Anther length 4,5-6 mm, caryopsis 6,5-7 mm long.

Type: [Turkey] A8 Rize in sylva Abetis Orientalis supra Khabackar (Kabakçor) Ponti Lazici, 1645, [01. Sep 1866], Balansa (holo. G!, iso BM)

N.E. Anatolia A7 Trabzon: Zigana silk road, around Zigana pass, 1766 m, 40°37.818' N 39°23.699' D, 01.08.2008, E. Cabi 3791. **Trabzon**: Zigana Chanlari, vii 1917, Schischkin **A8 Çoruh**: 10 km above Sarıgöl, 1600-1950 m, Sorger & Buchner 82-86-34

Endemic. Euxine element. Threat category **EN**

Figure 48. Spike of *Elymus lazicus*

3.4.2.6. *Elymus divaricatus* Drobow. In Repertorium Specierum Novarum Regni Vegetabilis 21: 45. 1925.

Syn. *E. lazicus* (Boiss.) subsp. *divaricatus* Melderis in Notes R.B.G. Edinb. 42:79 (1984).:*Agropyrum divaricatum* Boiss. & Bal. in Bull. Soc. Bot. Fr. 4:307(1857); *Elytrigia divaricata* (Boiss. & Bal.) Nevski in Acta Inst. Bot. Acad. Sci. URSS ser. 1, 2:78 (1936) *Agropyron strigosum* auct. tuec. non (Bieb.) Boiss. (1884). Map37.

Flowering and Habitat. June-August Rocky-calcerous slopes, 1000-2700 m.

Type: [Turkey] B5 Kayseri région sous-alpine du Karamas-Dagh et du Dede-Dagh (Cappadoce), 1600m, Balansa 840 (holo, G!. iso. BM! W).

Densely caespitose perennial with short rhizomes. Stems 35-85 cm, slightly geniculate below, usually with 1 or 2 nodes, nodes glabrous to densely pilose, internode length up to 12 cm, stem glaucous, often minutely strigillose below nodes or rarely glabrous to pilose throughout. Leaves 1.5-3 X 6-15,5 mm broad, flat or involute, densely puberulent on both adaxial and abaxial surface or minutely puberulent on adaxial surface. Spike dense or fairly dense, 5-14 cm (excl. awns), with 5-12 spikelets; internode length 6,5-19 mm; rachis shortly spinulose-ciliate on angles. Spikelets 13-21 mm. Glumes 8-10,5 mm, ± unequal, glabrous or slightly scabrid on midvein, 5-7 veined, abrubtly tapering into awn 1-5 mm or a mucro. Lemma 9,5-13 mm. (exc. awn) glabrous with long, ± recurved awn up to 3,5 cm, bidentate at the base awn. Palea 9-9,5 mm, slightly scabrid on keels, apex of palea obtuse; Anther length 4,5-6 mm, caryopsis 4,5-5,5 mm.

1. Lemma glabrous, with an awn 1.5-2.5 cm in length; Stem minutely strigilose below nodes ……subsp. ***divaricatus***

1. Lemma ± densely and shortly pilose along margins, with 2.5-3.5 cm awn; Stem glabrous throughout……...…….subsp. ***lomatolepis***

subsp. *divaricatus*.

Syn: *Agropyrum divaricatum* Boiss. & Bal. in Bull. Soc. Bot. Fr. 4:307(1857); *Elytrigia divaricata* (Boiss. & Bal.) Nevskiin Acta Inst. Bot. Acad. Sci. URSS ser. 1, 2:78 (1936)! *Agropyron strigosum* auct. tuec. non (Bieb.) Boiss. (1884). Map37. *Pseudoroegneria divaricata* (Boiss. & Balansa) Á. Löve Feddes Repertorium 95(7-8): 444. 1984. *Elytrigia lazica* subsp. *divaricata* (Boiss. & Balansa) Valdés & H. Scholz Willdenowia 36(2): 661. 2006.

Flowering and Habitat: May-July, Rocky limestone slopes, 800-2300 m.

Inner, South and East Anatolia. A8 Erzurum: 26 km from Tortum to Oltu, W. side of pass, rocky limestone slopes, 2200 m, 29.07.1966, Davis 47550 (BM!). **B2 Kütahya**: Gediz to Kütahya, 13 km S. of Kütahya, 1000 m, 07.07.1962, Davis 36941 (BM!). **B3 Konya**: Sultan Mount., Akşehir, 1000-1100 m. 13.06.1899, Bornmüller5692(BM!). **Eskişehir:** Sivrihisar to Polatlı, 1km before Oğlakçı, 824 m, 39°32.526' N 31°42.152' E, E. Cabi 2054; **B4 Ankara** Haymana to Polatlı, 35 km to Polatlı, 1004 m, 39°28.205' N, 32°27.888' N, E. Cabi 2111. **Ankara**: 22 km from Şereflikoçhisar to Aksaray, 38°47.468' N 33°38.554' E, 953 m, rocky slopes, E. Cabi 1536. **B5 Kayseri**: Tomarza to Pınarbaşı, 1394 m, 38°24.594' N,

35°56.992' E, E. Cabi 3254; **Kayseri**, Sultanhanı, rocky slopes and scree, 1320 m, 38°56'21" N, 35°49'29" E, E. Cabi 2077; **B6 Kayseri**, Sarız-Yeşilkent (Yalak) Binboğa Mount. Döy oluk village, 38°21.082' N 36°30.905' E, 2180 m, rocky mountain steps, E. Cabi 936; **Kayseri:** Pınarbaşı to Sarız, 6 km before to Sarız N 38° 29.940' E 36° 26.782' 1696 m E.Cabi 3655; **Kayseri** Pınarbaşı to Sarız c.15 km 1636 m Serpantine rocks E Cabi 1565; **Sivas:** between Etyemez and Dürmepınar , 1377 m N 38° 58.646' E 37° 25.981' E. Cabi 1347; **Sivas**: Gürün, East of Gökpınar N 38° 39.881' E 37° 18.864' 1455 m.(with *E. clivorum*) E. Cabi 3646 **Sivas:** Kangal to Gürün, around Etyemez Village , 39° 00' 11.1" N 37° 25' 19.7" E 1468 m E. Cabi 3406 Fl. 6-7. Stony slopes, red soil slopes, rocky limestone slopes, 1350-1500 m. **Sivas**: Ulaş, Kutlukaya to Boğazdere, around Boğazdere village N. 39° 22.633' E 36° 55.286' 1491-1501 m E. Cabi 1303; **Sivas** Boğazdere to Kutlukaya, 4km after Kutluköy N 39° 22.949' E 36° 55.726' E. Cabi 1307, 1310; Gökpınar to Gürün N 38° 40.289' E 37° 18.308' E. Cabi 1354; **Sivas**, Deligazili to Kızıenişli, around Deligazili 39° 07.492' N 37° 24.520' E 1688 m Stony slopes E Cabi 1337; **Sivas**: Kangal to Gürün Böğrügedik pass, stony slopes 1729 m 38°58'02.7" N 37°16'46.2 E, E. Cabi 2432. **Sivas** Kangal to Gürün roadside slopes 1720 m, 39°00'07.2" N, 37°17'10,3" E. Cabi 2429; **Adana** Saimbeyli, Bozoğlan mount. Above Obruk wold, 2300 m., 07 07 1952 Davis 19762 (BM, K) **B6 Adana**: Saimbeyli cascades,Obruk plateau, step, 1300-1400 m, 26.05.2008, B.Bani 5957 **Adana**: Saimbeyli, over Obruk plateau, Karlık hill, 1800-1900 m, 20.06.2008, B.Bani 6116. **Maraş**, Göksun, Binboğa Mount in revine above Yalak 2300 m. 14 Jul 1952 Davis 19925 (BM, K). **B7 Malatya**: Beydağ above Malatya 1865 Haussknecht (BM). **Malatya/Elazığ**: Ak Mount.between Malatya and Kahta, 17 07 1910 Handel-Mazzetti *2343* (BM). **Erzincan**: İliç to Kemaliye, before 22 km to Kemaliye, Rocky slopes and scree 1244 m. 39°24'670" N 38°27'344"E E. Cabi 3690; **C2 Antalya**:Elmalı, 14.06.1860 Bourgeau (BM!) **C5 Adana**:Tekedağ 2000 m, Jun. Jul 1970 Quezel (BM!). **C7: Malatya** Doğanşehir to Reşadiye pass 1468 m. N 37°58'40" E 38°00'49" E. Cabi 2136

Distribution: Endemic. **Ir-Tur. elementi**. Threat category. **LC**

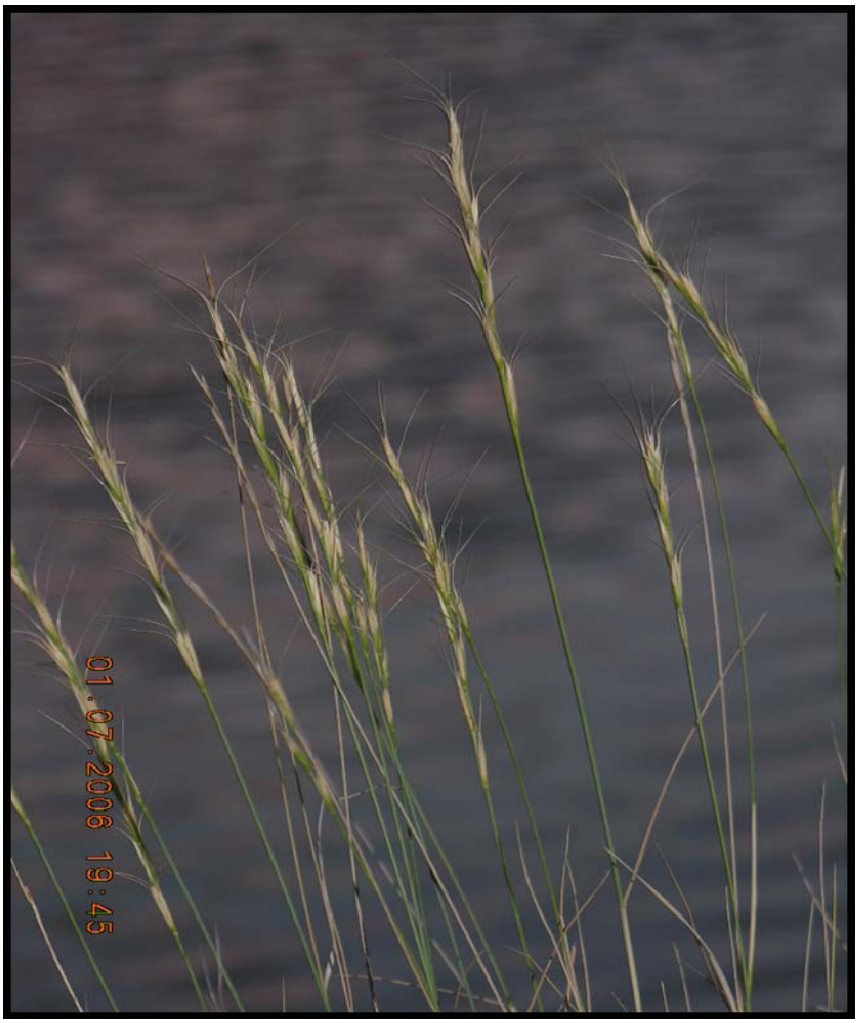

Figure 49. Spikes of *Elymus divaricatus* subsp. *divaricatus*

Subsp. ***lomatolepis*** (Melderis) Cabi & Doğan comb. nov.
Syn. *Elymus lazicus* (Boiss.) Melderis subsp. *lomotolepis* Melderis in Notes R.B.G. Edinb. 42:79 (1984).

Spikelets 11-14 mm. Glumes 9-11 mm bifid or abrubtly tapering with a short awn up 1,5-4 mm, glumes glabrous, the lower glume as long as lower body of lemma or shorter than lower lemma, lemma more or less pilose along margins, with obsolute lateral veins and more conspicuous midvein, tapering into an awn up to 4,5 mm, awn of lemma is divaricate; Caryopsis length 6,5-7 mm long. Leaves completely involute glabrous on upper surface ,puberulent beneath.

Flowering and Habitat: July, Rocky slopes, 1468 m.

Type: [TURKEY] **B7 Erzincan**: Egin, Kota, in saxosis, 1 vii 1890, P. Sintenis 2829 (holo. HAL, Hb. Hausskn. iso. BM! W!). Erzincan: Kemaliye, Munzur Mount. Doymus hill, 2150 m, Mountain step, 07.07.2007, U. Özbek 2601

Distribution: Endemic. Known only from type locality. **Ir.-Tur.element**.Threat category **CE**

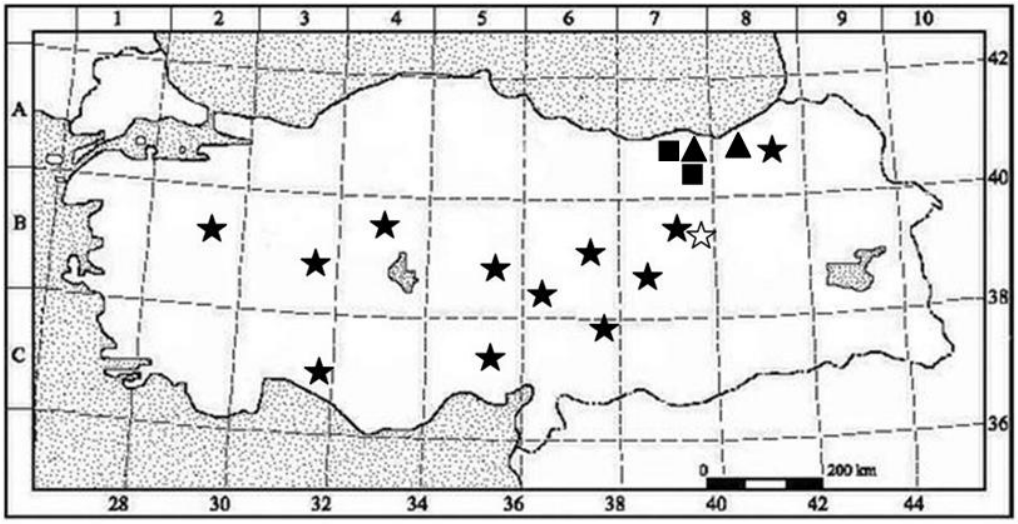

Figure 50. Distribution of *Elymus longearistatus subsp. sintenisii, E. lazicus and E. divaricatus*

Legend. (■) *Elymus longearistatus* subsp. *sintenisii,* (▲) *E. lazicus, E. divaricatus* (★) subsp. *divaricatus* and (☆) subsp. *lomotolepis*

Notes on the taxa: Boissier (1884) in his Flora Orientalis recognized *Agropron divaricatum* (Boiss.&Bal.)*, A. lazicum* Boiss. and *A. strigosum* (M. Bieb) Boiss. as separate species. In 1936, Nevski transferred *A. divaricatum* into the genus *Elytrigia* as *E. divaricata* (Boiss&Balansa) Nevski. Melderis (1984) subsumed *A. attenuatiglume,* Nevski, *A. divaricatum* and *A. lazicum* taxa as subspecies under *Elymus lazicus*. Our observations in the fields and morphological measurements showed that, density of spike, length of internodes and spikelets are diagnostic features to delimitate the *Elymus lazicus* and *E. divaricatus*. So on the basis of my treatment *E. divaricatus* is chacterized with dense spikes with 4-10 relatively short spikelets.

Table 26. Diagnostic qualitative characters for distinguishing between *Elymus lazicus and E. divaricatus*

***E. lazicus* Boiss. (Melderis)**	***E. divaricatus* Drobov**
Spike loose to fairly dense	Spike dense, more or less second
Spike 7-13 cm with 2-5 spikelets, spikelet 18-22 mm long	Spike 5,5-15 cm with 7-10 spikelets, spikelet 15-17 mm long
Glumes 9-10.5 slightly scabrid on midvein, gradually tapering into an awn; awn of glume canaliculated at base,	Glumes 10-12.5 mm, 1-or 2-dentate or sinuate at apex, with mucro or short awn in sinus.
Lemma 13-16,5 mm, scabrid towards apex, with an awn up to 6 cm	Lemma 9-10 mm, glabrous or shortly pilose along margins, often with 1 or 2 teeth at base of awn, awn of lemma up to 3,5 cm long

Figure 51. Type of *Elymus divaricatus* subsp. *lomotolepis* (W!)

3.4.2.7. *Elymus clivorum* Melderis in Notes R.B.G. Edinb. 42:77 (1984).

Laxly caespitose perennial with short rhizomes. Stems 45-50 cm, slender, glabrous. Leaves 2-3 mm broad, flat or with involute margins, conspicuously veined, shortly pubescent on upper surface, glabrous beneath, lower leaves sparsely spinulose-ciliate on margins; sheats ciliate. Spikes 5-6 cm, fairly lax; rachis sparsely and shortly scabriduluous on main angles. Spikelets 10-11 mm, usually with 3 florets. Glumes 5-6 mm, subequal, coriaceous, narrowly oblong elliptic, obscurely 3-4-veined, glabrous, abruptly apiculate. Lemma 6-7 mm, glabrous, subobtuse or with mucro 0.5-1.5 mm. Palea equalling lemma, shortly ciliate on upper part of keels.

Flowering and Habitat: July, Slopes in steppe*, c. 1750 m.*

B8 Muş: 6km from Çaylar to Varto, 1750m, slopes in steppe, 11 vii 1966, Davis 46308 (holo. E!).

Endemic. Known only from the type. **Ir.-Tur. element**. Threat category **EN.**

Notes on the taxon. Closely allied to *E. elongatiformis*, from which it can be distinguished by its lower leaves spinulose-ciliate on margins, smaller spikelets with shorter, obscurely veined glumes and lemmas, the latter being subobtuse or with a short mucro projecting beyond the apex.

3.4.2.8. *Elymus elongatiformis* (Drobow) Assadi Willdenowia 26: 268, f. 1l. 1996.

Basionym: *Agropyron elongatiforme* Drobow Vved. i. dr. Opred. Rast. Okr. Taschk. 1: 40, 42. 1923.

Syn:*Elytrigia elongatiformis* (Drobow) Nevski in Trudy Sredne-Asiatsk. Gosud. Univ., Ser. 8b, Bot. 17: 61. 1934 *Elytrigia repens* subsp. *elongatiformis* (Drobow) Tzvelev in Novosti Sist. Vyss. Rast. 10: 31. 1973; *Elymus repens* subsp. *elongatiformis* (Drobow) Melderis in Bot. J. Linn. Soc. 76: 379. 1978.

Flowering and Habitat: June-August, Banks, dried-up ditches, rocky slopes, open steppe, woodland, 800-2600 m.

Holotype: [USSR] Prov. Syr-Darja. Distr. Taschent circa urb. Taschent, Drobov 1919 (LE [few spikelets]).

Perennial, with long, creeping rhizomes. Culms 60-110 cm, glabrous. Leaf sheaths glabrous, sometimes ciliate; leaf blades 4-11 mm broad, glabrous or scabrous, rarely sparsely hairy on the upper surface. Spikes (4-)10-15(-17) cm long; internodes 6-10 mm long in the middle of spike, spinulose-ciliate on the angles. Spikelets 10-16 mm long, overlapping up to half their

length, with 3-8 florets. Glumes subequal, 5-8 mm long, lanceolate, acute or mucronate at the apex, narrowly membranous at the margin, with 5-7 veins, glabrous or the middle vein scabrous toward the apex, oblique. Lemma 6.5-8 mm long, lanceolate, obtuse or rounded or truncate-emarginate or sometimes shortly mucronate, glabrous. Palea as long as or a little shorter than the lemma, scabrous or ? ciliate along the upper half of the keels. Anthers 4-4.5 mm long. - **2n = 56**; Genome: **SSHX** (Assadi 1995)**.**

N., Inner & S. Anatolia A4 Kırıkkale: Entrance of Koçubabam, 1157 m, 40°03.489' N 033° 51.678' E, 30.06.2006 E. Cabi 1271**.** Kastamonu, Kastamonu to Tosya, around Akyaka Village , road and river sides, 927 m, 41°16'47.8" N 33°56'47.8" E, 14.06.2007 E. Cabi 2379**. A5 Çorum**: On the road of Çorum City Forest , road side and under pine grove, 1062m, 40°34.986' N 35° 02.222' E, 06.07.2006 E. Cabi 1532. **A6 Tokat**, Turhal to Amasya, 689 m, road side, calcerous and limestone soil 40°30.364'N 36°08.776'E, 06.07.2006 E. Cabi 1522**. A7 Gümüşhane:** İkisu to Karaca Cave, calcerous slopes 1051 m, 40°31.535' N 39°23.069' E, 01.08.2008, E. Cabi 3771**. A8 Erzurum**, Tortum to Narman, 1807 m, road side, 40°20.327' N 41°35.062' E, 05.07.2006 E. Cabi 1478b**. Artvin:** Lomaşen to Seyitler, 41°12.034' N, 41°51.400'E, 569 m, rocks, 25.06.2008, E. Cabi 3517**. A9 Erzurum** to Ağrı, 1 km after Horusan, around Tahirhoca , field sides, 1563 m 40°01.964' N 42°11.821' E, 28.07.2008, E. Cabi 3717. **B4 Ankara**, 4 km after Ankara-Beynam turnout , road side, 1121 m, 39°40.940' N 32°51.686' E, 28.06.2006, E. Cabi 1224. **B5 Yozgat:** Yozgat-Boğazlıyan,Kaşkışla Village, road side, 1682m, 39°30.553' N 35°06.970' E, 11.06.2008, E. Cabi 3273**. Nevşehir:** Hacıbektaş to Gülşehir, 20 km to Gülşehir , moist soils , 1320m, E. Cabi 905. **B6 Sivas**, Yıldızeli and Çırçır junction, road and field sides, 1357 m, 39°52'32.7" N 36°37'08.2" E, 16.06.2007 E. Cabi 2415 Kayseri-Sivas, 72 km to Sivas, 1308 m, cultivated fields and road sides, 39°25.046' N 36°31.803' E, 24.07.2008, E. Cabi 3669 **B8 Erzurum**: Pasinler to Erzurum, 1-2 km to Erzurum turnout near Nenehatun Villageköyü 1908-1915 m, 39°56.888' N 41°23.344' E, 04.07.2006. E. Cabi 1464. **Muş**: Çaylar to Varto, 5 km to Varto, slopes of step, 1710 m, 39°14.707' N 41°20.759' E, 26.07.2008, E. Cabi 3711**. B9 Bitlis**, Muş to Bitlis 19 km to Tatvan, step lands, 1710 m, 38°31.944' N 42°07.501' E, 3 07 2006 E. Cabi 1434. **Bitlis**: Tatvan, 1900 m, Tong 20! **Van:** Warack Dagh (Erek Mount.), Werin-Warack monastery, 2200 m, Nábelek 3323 (type of *Agropyron campestre* Gren. & Godron. f. warakensis Náb.!) **Van:** 30 km to Erciş road side steps, 1938 m, 39°08.381' N 43°06.564' E, 28 07 2008 E. Cabi 3730 **Bl0 Kars:** 5-10 km E. of Iğdir, D.Ü.Ç., 800 m, D. 43840! **C4 Konya**: Küçük Köy, 980 m, Helbaek 2601! **C10 Hakkari:** Cilo Mount., the bottom of Diz Stream. around Dezi , 1615 m, 06 08. 1954 Davis 24021(BM!)

External Distribution: SE Russia, Crimea, Ukraine, Caucasus, Iraq, Iran, Afghanistan and Central Asia, Turkestan. Ir-Tur.element. Threat category. **LC**

Figure 52. Spike of *Elymus elongatiformis*.

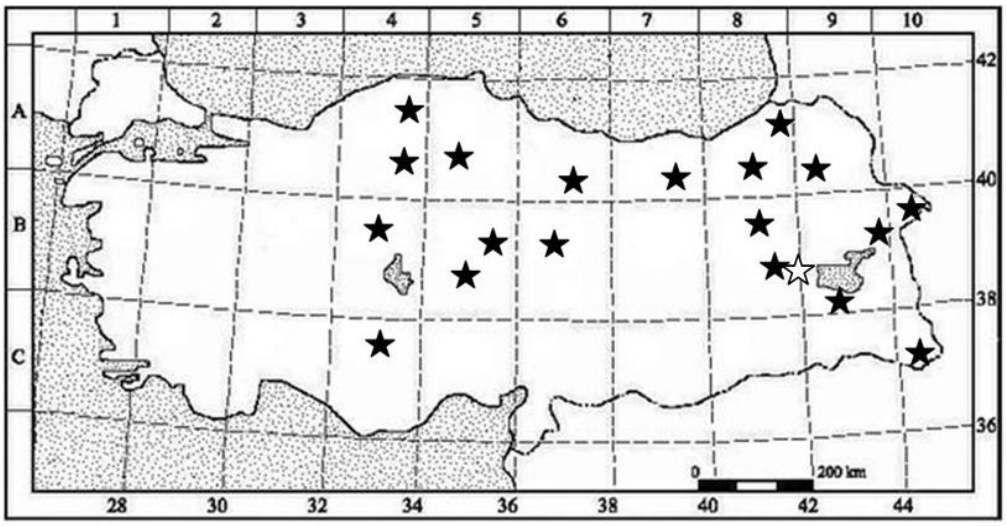

Figure 53. Distribution of *Elymus clivorum* and *Elymus elongatiformis* in Turkey.
Legend. (☆) *Elymus clivorum*, (★) *Elymus elongatiformis*.

3.4.2.9. *Elymus repens* (L.) Gould in Madrono 9:127 (1947).

Basionym: *Triticum repens* L. Species Plantarum 1: 86. 1753.

Syn*:* *Agropyron junceum* var. *repens* (L.) M. Marsson Allegmeine Botanische Zeitschrift für Systematik, Floristik, Pflanzengeographie 7: 154. 1901; *Agropyron repens* (L.) P. Beauv. Essai d'une Nouvelle Agrostographie 102, 146, 180, pl. 20, f. 2. 1812. *Elytrigia repens* (L.) Desv. ex B.D. Jacks. Index Kewensis 1: 836. 1893. *Elytrigia repens* (L.) Desv. ex Nevski Trudy Botanicheskogo Instituta Akademii Nauk S S S R. Ser. 1, Flora i Sistematika Vysshikh Rastenii. Moscow & Leningrad 1: 14. 1933. *Zeia repens* (L.) Lunell American Midland Naturalist 4: 227. 1915. *Elymus hoffmannii* K.B. Jensen & Asay International Journal of Plant Sciences 157: 758. 1996 (K!).

Flowering and Habitat: June-August. Marshy ground near lakes, eroded banks, ditches, rocky slopes, montane steppe, roadsides, nr s.l. -2350 m.

Described from Europe (Hb. Linn. 104/7).

Plants strongly rhizomatous perennials. Culms 45–90 cm, sometimes glaucous with usually 2-3 glabrous nodes. Leaf sheaths usually glabrous or rarely pilose. Leaves 10,5-21 cm X 2,5-9 mm, usually flat sometimes scabrid or sparsely pilose on both side; auricles falcate, 0.5–0.8 mm; ligules membranous 0.2–1.2 mm. Spikes usually 5–15 cm long, dense, erect, rachis internodes 4–6 mm long in the middle, spinulose-ciliate on angles. Spikelets 8.5–14 mm, laterally compressed, imbricate, with 3–6 florets; disarticulation above the glumes, beneath

each floret. Glumes nearly equal, as long as or slightly shorter than lemmas, 5-11 mm (incl. awns), oblong lanceolate or lanceolate, glabrous or slightly scabrid towards apex, keeled distally, 3-7 veined, lateral veins inconspicuous, hyaline margins present at the margins, apices acute, acuminate, mucronate or awned, awns to 3 mm. Lemmas 8–12 mm (incl. awn), usually glabrous, sometimes scabridulous distally, lanceolate, acute, mucronate or shortly awned, awns straight. Paleas as long as lemma or slightly shorter, keels ciliate. Anthers 4–7 mm. **2n = 22, 42.** Genome **StStH** (Assadi 1995)**.**

Scattered in Turkey A1 Edirne: Havsa**,** above Hacıgazi , Hüseyin Cabi wineyard, 98m, 41°33.881'N 26°48.903' E, 04.06.2006, E. Cabi 3201. **Tekirdağ**: Şarköy-Gelibolu, 31m, 40°33.377'N 26°59.380' E, 30.05.2006, E. Cabi 839, G. Akaydın & E. Karabacak. **Çanakkale**: Balayır, Çimpe Castle, dry pastures, 145m, 40° 29.496'N 26° 44.450' E, 30 05 2006 E. Cabi 849. **A2 İstanbul**: Silivri, sahil kenarları, 6m, 41°03.377' N 28°05.516' E, 30 05 2006 E. Cabi 812. **A3 Bolu**: Abant Lake., 1400 m, D. 37153! **A4 Kastamonu:** Akkirpi Village Exit of İhsangazi , 1047m, 41°15.572' N 33°31.534' E, 13 06 2007 E. Cabi 2373. **A5 Sinop:** Sinop-Gerze, around Taşmanlı Village, near roads, 67m, 41°54.389' K 35°04.007' N, 15 06 2007 E. Cabi 2393 **A7 Trabzon:** 26 km S. of Trabzon, 300 m, 16 viii 1972, Spencer 0101. **A8 Erzurum:** Dumlu road, around Hasan Tahsin Çelebi Military Post , road side, 1783m*,* 40°03.905' K 41°21.507' D, 04.07.2006 E. Cabi 1467. **Erzurum:** Erzurum- Oltu, from 12 km to Oltu , moist soil and stream side,1390 m, 40°58.517' N 41°58.697' E, 5 07 2006 E. Cabi 1498. **A9 Kars:** Yalnizçam Mountain, above Yalnizçam, 2100 m, 19.08.1957 Davis. 32486! (BM). **B4 Ankara**: METU around tennis courts, 02 06 2007 E. Cabi 2343. **B6 Sivas:** Kangal-Gürün road sides and slopes, 1660m, 39° 01.584' N 37° 15.122' E, 16 06 2007 E. Cabi 2428 **Kayseri:** Sarıkışla to Akçakışla 5 km to Akçakışla, road side, 1588m, 39° 24.588' N 36° 23.970' E, 11.06.2008 E. Cabi 3263. **B7 Erzincan***:* Refahiye-İmranlı, 49 km to İmranlı, road side 1571m, 39°57.732' N 38°46.073' E, 6 07 2006 E. Cabi 1515. **B8 Bingöl:** Kaslıova-Varta, moist soil, 1792m*,* 39°16.400'N 41°15.164'E, 03.07.2006 E. Cabi 1421. **Bingöl:** Kaslıova-Varta, moist soil, 1792m*,* 39°16.400'N 41°15.164' E, 03.07. 2006 E. Cabi 1423. **Erzurum:** Pasinler-Erzurum, km to Gölciğez Köyü, road side, 1807 m, 39° 59.036' N 41° 28.894' E, 4 Jul 2006 E. Cabi 1460. **B9 Van**: Hoşap to W. foot of Kepir Mountain, D. 23313! **B10 Ağri**: mt. Ararat (Ağrı Mount.) (Grossheim 1: map 305). Van: 5 km N.E. of Başkale, 2150 m, D. 45864! **C2 Antalya**: Elmali, Barbey 688. **C3 Burdur**: mt. Boudroun, Heldr. Antalya: Ak Mount., Bourgeau. Is: Leros, Ikono-mopoulos. **C5 İçel:** Arslanköy-Fındıkpınar,road side (calcerous rocks), 1850m, 36°57.586'N 34°18.966' E, 15.06.2006, E. Cabi 1103.

External Distribution: N. W. Europe, Mediterranean, Russia, Caucasus, Crimea, Iraq, Iran, Afghanistan, Pakistan, Central Asia and Sibiria; furthermore introduced to many parts of the world.

Figure 54. Spike of *Elymus repens*

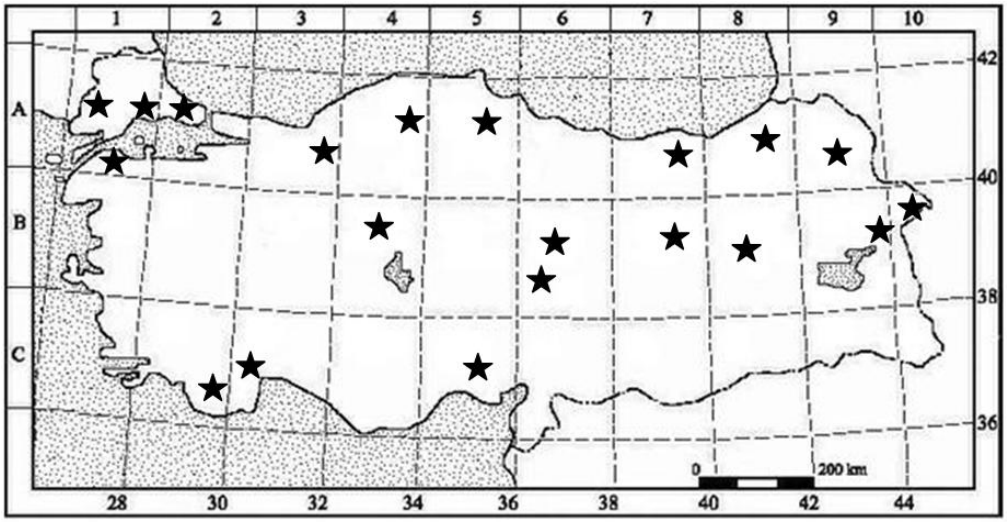

Figure 55. Distribution of *Elymus repens* in Turkey

3.4.3. *Thinopyrum* Á. Löve

The genus *Thinopyrum* is treated in here as broad sense comprising *Lophopyrum* Á. Löve, *Psammopyrum* Á. Löve and *Trichopyrum* Á. Löve. These three generic names apply to different groups of species that have been found to incorporate the **J** or **E** genome, usually in combination with at least one other genome. There has been, however, some taxonomic, nomenclatural, and cytogenetic disagreement and errors in their use. Table 27 shows a list of *Thinopyrum* species recognized for the Flora of Turkey, their chromosome numbers and genomic constitutions as far as known.

Table 27. *Thinopyrum* species occurring in Turkey, their chromosome numbers and genomic constitutions

Taxa		**Genome**	**2n**	**References**
T. flaccidifolium		$E^e E^e$	2n=4x=28	Liu &Wang 1993
T. elongatum	subsp.*elongatum*	E^e	2n=2x=14	
	subsp. *turcicum*			
	subsp. *ponticum*		2n=10x=70	
	subsp. *salsum*			
T. farctum	*subsp.bessarabicus*	E^b	2n=2x=14	
T. intermedium	*subsp.barbulatus*	SJJ, $E^b E^b$ St or E^e E^b St	2n=6x=42	Liu &Wang 1993; Chen et al 1998 Assadi 1995
T.caespitosum	*subsp. nodosum*	E^e St		Yu et al. 2008
Thynopyrum pycnathum		EStP	2n=6x=42	Refoufi et al 2001
T. gentryi		Not known	2n=6x=42	
T. erosiglumis		Not known	Not known	

THINOPYRUM Á. Löve Taxon 29(2-3): 351. 1980.

Type Species. *Thinopyrum junceum* (L.) Á. Löve. - *Taxon* 29(2-3): 351.1980.

Syn. *Lophopyrum* Á. Löve In Taxon 29(2-3): 351. 1980; *Psammopyrum* Á. Löve In Veröffentlichungen des Geobotanischen Institutes Rübel in Zürich 87: 50. 1986; *Trichopyrum* Á. Löve Veröffentlichungen des Geobotanischen Institutes Rübel in Zürich 87: 49. 1986.

Name from the Greek *thino*, a shore weed, and *pyros*, wheat.

Plants perennial; caespitose or not, sometimes rhizomatous. Culms 10-250 cm, usually erect. Leaf sheaths glabrous or ciliate; auricles 0.2-1.5 mm or absent; ligules membranous; leaf blades convolute or flat. Inflorescences terminal, distichous spikes, usually not disarticulating at maturity; middle internodes 7-30 mm; disarticulation usually below the florets and tardy, occasionally in the rachises. Spikelets 1-3 times the length of the middle internodes, solitary, appressed to ascending, often trullate and arching outwards at maturity. Glumes oblong to lanceolate, stiff, indurate to coriaceous, glabrous or with hairs, keeled or rounded at the base, usually more strongly keeled distally than below, margins often with a hyaline margin, apices truncate to acute, sometimes mucronate, unawned, without lateral teeth; lemmas 5-veined, coriaceous, glabrous or with hairs, truncate, obtuse, or acute, sometimes mucronate or awned, awns to 3 cm; anthers 3, 2.5-12 mm. $x = 7$.

Key to species

1. Rachis fragile, readily disarticulating at maturity just above each spikelet, smooth on main angles; leaves ribbed on upper surface, densely and minutely pubescent, without auricles .....**8. *T. farctum***

1. Rachis tough, not disarticulating at maturity; leaves with auricles.

2. Plants usually with long-creeping rhizomes, not forming dense tufts; spikelets falling entire at maturity

3. Glumes indurate-coriaceous, oblong, 4.5-8 mm long, obliquely truncate or obtuse to acute; leaf sheaths usually ciliate……**7. *T. intermedium***

3. Glumes coriaceous, lanceolate, 8-18 mm long, acute, mucronate or shortly awned; leaf sheaths usually not ciliate……..……**6. *T. pycnanthum***

2. Plants forming dense tufts, without or with very short rhizomes; whole spikelet breaking up at maturity; glumes persistent on rachis

4. Spikelets strongly compressed laterally; glumes indurate-coriaceous, obtuse to truncate, midveins about equal in length and prominence to the lateral veins. Lemma unawned or with a short awn to 3 mm

5. Spikelets 10-11 mm; rachis glabrous on main angles; lemma c. 6 mm; stems slender; lower leaves usually flat, soft, finely veined, often sparsely and shortly pubescent ……..……**1. *T. flaccidifolium***

5. Spikelets 12-25 mm; rachis usually ± scabrid or rarely glabrous on main angles; lemma 7-13 mm; stems robust; leaves usually convolute, rigid, prominently ribbed, with sparse rigid spinules, sometimes lower densely and minutely pubescent on both surfaces. ……...**2. *T. elongatum***

4. Spikelets slightly compressed laterally; glumes coriaceous; leaves usually finely veined and shortly pubescent on upper surface

6. Glumes narrowly elliptic, obtuse to truncate, usually obscurely 5-veined with hyaline margin less than 0.3 mm broad; spikelets usually adpressed to rachis.....**3. *T. caespitosum***

6. Glumes oblong, usually obtuse; spike 12-22 cm, with more than 12 spikelets

7. Glumes oblong-elliptic, with hyaline margin 0.3-0.5 mm broad; palea distinctly shorter than lemma; leaves densely and shortly pilose on upper surface……..**5. *T. erosiglumis***

7. Glumes usually broadly oblong or oblong obovate, sometimes truncate, with hyaline margin 0.5-1 mm broad, usually with short triangular apiculus, or thick mucro; palea nearly as long as lemma; leaves densely scaberulous on upper surface …….……**4. *T. gentryi***

3.4.3.1. *Thinopyrum flaccidifolium* (Boiss. & Heldr.) M. Moustakas Plant Systematics and Evolution 161(3-4): 150. 1988[1989].

Basionym: *Agropyron scirpeum* var. *flaccidifolium* Boiss. & Heldr. Diagnoses plantarum orientalium novarum, ser. 2, 3(4): 142. 1859. (Diagn. Pl. Orient., ser. 2)

Syn: *A. elongatum* (Host) P. Beauv. var. *flaccidifolium* (Boiss. & Heldr.) Boiss. & Heldr. in Boiss. , Fl. Or. 5:666 (1884)! *A. flaccidifolium* (Boiss. & Heldr.) Cand. in Arch. Biol. Veg. Athénes 1:51 (1901)! *Elymus elongates* (Host) Runemark subsp. *flaccidifolius* (Boiss. & Heldr.) Runemark in Hereditas 70:156 (1972)!. *Elymus flaccidifolius* (Boiss. & Heldr.) Melderis Botanical Journal of the Linnean Society 76(4): 377. 1978.

Type: [Greece] in planitie maritima Atticae ad Phaleraeum, Heldreich, Herb. Graec. Norm. 501 (holo. G iso. BM! K!).

Caespitose perennial with three nodes. Stems 35-80 cm, glabrous. Leaf sheats glabrous. Leaves 1-2 mm broad, soft, finely veined, minutely pubescent or scabridulous on upper surface, glabrous beneath, upper often convolute. Spike 7-15 cm with 13-22 spikelets, lax; rachis glabrous or slightly scabridulous on main angles. Rachis internodes 7-9 mm. Spikelets

10-11 mm with 5-10 florets, strongly compressed. Glumes usually 4-6 mm, glabrous, 5-veined, obtuse or truncate, with all veins ending at apex. Lemma 5-6 mm, obtuse or slightly emarginated at apex, often with short apiculus, sometimes slightly projecting beyond sinus. Palea 4-5 mm, as long as or slightly shorter than lemma. Caryopsis 3-3.5 mm. Genome: **E^e E^e, 2n=4x=28**

Flowering and Habitat: June-July.. Salty marshes, s.l.- 836 m

N.W., W. Anatolia. A2(E) Istanbul: W. of Silivri, Scott 35! **B1 Izmir:** Çeşmealtı to Narlıdere, A. Baytop (ISTE 10049)! **B2 Denizli**: around Işıklı Lake, brackhish pools, 836 m, 38°19.215' N 29°51.241' E 16.07.2008 E. Cabi 3585a**, C2 Muğla** Datça, Bozbum, sea level, 36°41.508' N 28°02.809' E, 17.07.2008, E. Cabi 3592b.

External Distribution: E. Mediterranean area. **E. Medit. element**. Threat category **LC**

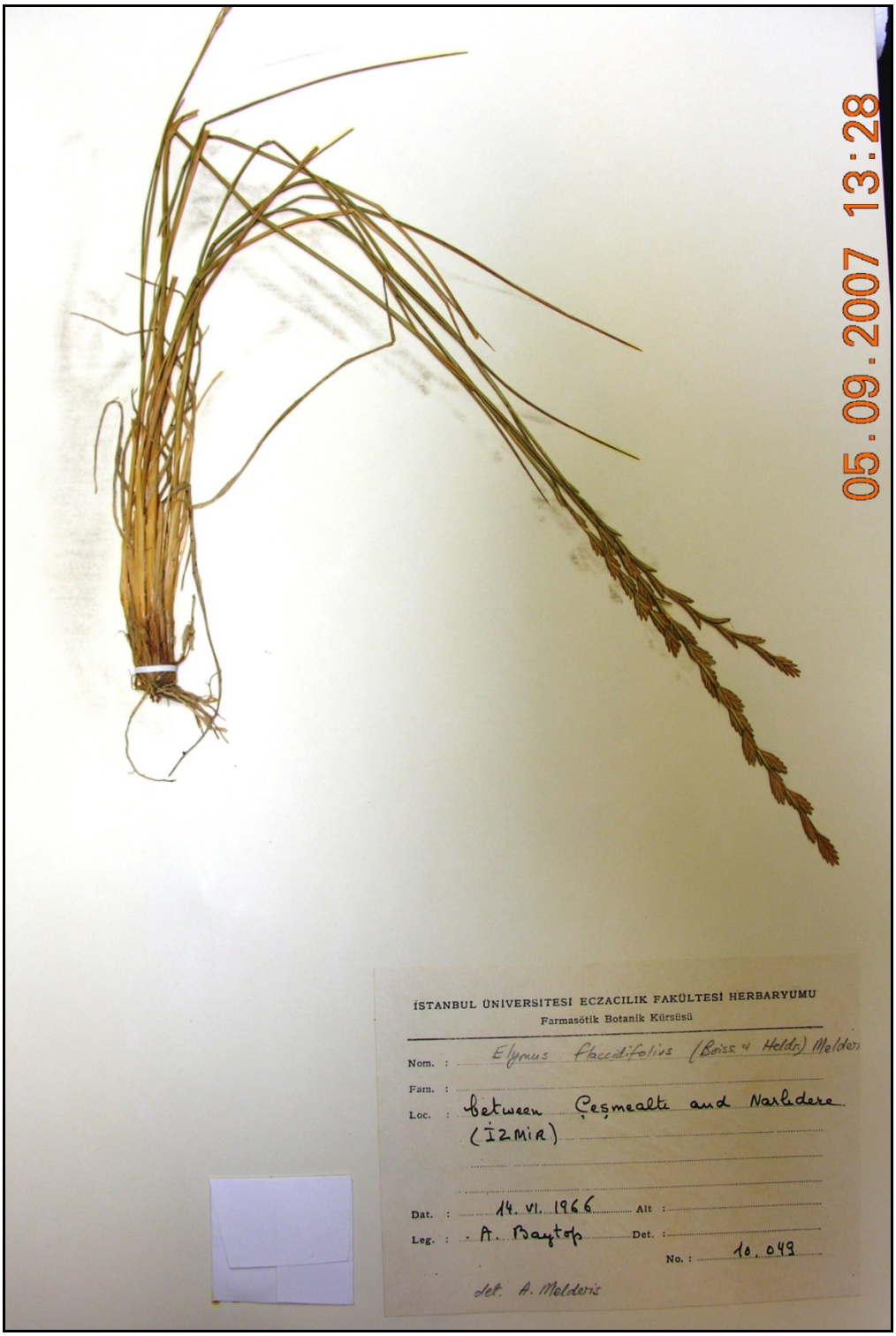

Figure 56. Herbarium photo of *Thinopyrum flaccidifolium* (ISTE)

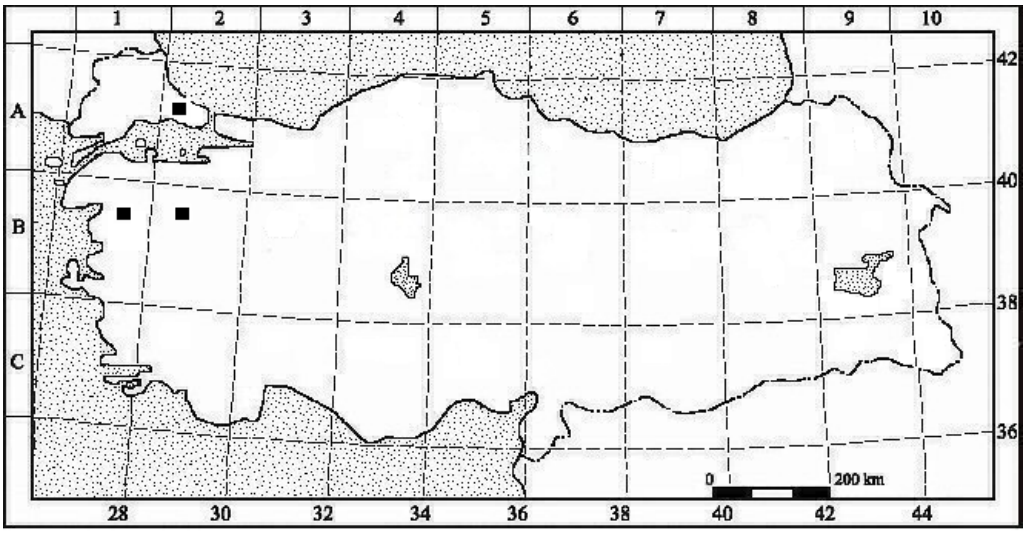

Figure 57. Distribution of *Thinopyrum flaccidifolium* in Turkey

3.4.3.2. *Thinopyrum elongatum* (Host) D.R. Dewey Gene Manipulation in Plant Improvement 274. 1984.

Basionym: *Triticum elongatum* Host Icones et Descriptiones Graminum Austriacorum 2: 18, t. 23. 1802.

Caespitose perennial. Stems 35-150 cm, robust, usually glabrous. Leaf sheaths glabrous or sparcely ciliate. Auricles falcate. Leaves 2.5-5 mm broad, when expanded, 20-45 cm long very rigid, prominently and surface closely ribbed, sparsely spinulose and with scattered short bristles on upper surface, usually glabrous beneath sometimes both sides are more or less pilose. Spikes usually 10-45 cm, erect, lax with 13-25 spikelets. Rachis internodes are flattened, smooth or scaberulous on margins. Rachis internodes 15-23 mm at the middle of spike. Spikelets up to 23 mm long, elliptic to oblong, strongly compressed laterally. Glumes usually 7-9 mm with 6-9 veins, subequal, indurate-coriaceous, oblong, broadly obtuse or truncate at apex, sometimes emarginated, glume surface glabrous or scabrous. Lemma 9-11 mm, glabrous or sparcely or densely ciliate along margins, obtuse or apiculate. Palea usually slighltly shorter or equal to lemmas, sometimes palea extending the lemmas, ciliate throughout or partly along margins. Anthers 2,5-6 mm long. Caryopsis 4-6 mm long, adherent to pericarp.

1. Plants greyish-white, especially below, pruinose; leaves on both surfaces and lower sheats densely and minutely pubescent; glumes scabrid on veins……..subsp. ***salsum***

1. Plants green or glaucous-green; leaves and sheats not minutely pubescent; glumes glabrous, only midvein slightly scabrid towards apex.

2. Leaf sheats not ciliate; rachis usually glabrous on main angles, lower internodes usually as long as spikelets; spikelets usually 15 mm, with 5-7 florets; glumes 5-7-veined; palea with cilia less than 0.1 mm on keels in upper half …….……subsp. ***elongatum***

2. Lower leaf sheats shortly ciliate; rachis sparsely spinulose-ciliate, lower internodes longer than spikelets larger; palea with cilia longer than 0.1 mm.

3. Spikelets 17-20 mm, usually with 7-9 florets; glumes 7-9-veined, sometimes glabrous on inner surface at apex; palea with cilia less than 0.3 mm in upper 2/3 of keels; anthers 2.5-3.5 mm……..……...subsp. ***turcicum***

3. Spikelets 17-25 mm, usually with 7-12 florets; glumes 5-7-veined, minutely strigillose on inner surface at apex; palea with cilia c. 0.3 mm along whole length of keels; anthers 4.5-5.5 mm……...subsp. ***ponticum***

subsp. ***elongatum* .**

Syn. *Triticum elongatum* Host, Gram. Austr. 2:18, t. 23 (1802)! *T. rigidum* Schrader, Sem. Hort. Götting. 23 (1803)! *T.rigidum* Schrader, Fl. Germ. 1:392 (1806) p.p. excl. pl. Austr. (Flügge) et Bohem. (Schkuhr); *Agropyron elongatum* (Host) P. Beauv., Ess. Agrost. 102 (1812) *Elytrigia elongata* (Host) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.), 17:83 (1934)! Map 38. 2n=14. Fl. 4-7. *Maritime sands, marshy slopes, to 100 m.*

Type: "[Jugoslavia] in siccis & locis aqua marina inundatis Tergesti alle Soule; alle Saline di Capo d`Istria, Pirano, alibique "(holo. W).

N.W.Turkey, South Anatolia. **A1 (E) Tekirdağ**: above Tekirdağ, 100m, D. 39296! 25 km from Silivri to Tekirdağ, A. Baytop (ISTE 11812)! **Çanakkale**: 25 km N. of Gelibolu, 10m, Sorger 68-2-34! **A2 (E) İstanbul**: Silivri, nr, s.l., D. 39218! **A2 (E) İstanbul**: Silivri, 0 m., 41°04.256' N 28°09.431' E 04 06. 2008 *E. Cabi 3205*.**A2(A) Istanbul**: Büyükada,1938, B. Post! **B1 Çanakkale:** Troy to Çanakkale, 54 m, 39°57.141' N 26°16.542' E, 02.06.2008 E. Cabi 3159. **C4 İçel:** Silifke, nr s.l., Vural 1402(!)

Figure 58. Habit of *Thinopyrum elongatum* subsp *elangatum* and its spike in close view.

Notes on the taxon: Subsp. *elongatum* mainly distributed in the Mediterrenean region. It differs from subsp. *ponticum* by having different ploidy level **(2n=2x=14 or 2n=4x=28)** ciliate leaf sheaths and spike characteristics (Jarvie 1992).

subsp. ***ponticum*** (Podp.) Cabi & Dogan comb nov.

Basionym:*Triticum ponticum* Podp. Verhandlungen der Zoologisch-botanischen Gesellschaft in Wien 52: 681. 1902.

Syn. *Elymus elongatus* subsp *ponticus* (Podp) Melderis in Bot. J. Linn. Soc. 76:377 (1978). *Triticum obtusiflorum* DC., Cat. Pl. Hort. Monsp. 153 (1813)!; *Agropyron incrustatum* Adamovic in Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 74:119 (1904). Map 38. 2n=70. *Elymus elongatus* subsp. *ponticus* (Podp.) Melderis Botanical Journal of the Linnean Society 76(4): 377. 1978.*Elymus elongatus* var. *ponticus* (Podp.) Dorn Vascular Plants of Wyoming 298. 1988. *Elytrigia elongata* subsp. *pontica* (Podp.) Gamisans Cat. Pl. VAsc. Corse, ed. 2, 243. 1993.*Elytrigia pontica* (Podp.) Holub Folia Geobotanica et Phytotaxonomica 8(2): 171. 1973. *Lophopyrum ponticum* (Podp.) Á. Löve Feddes Repertorium 95(7-8): 489. 1984.

2n=10x=70 (Assadi 1995)

Flowering and Habitat: May-August. Dry and saline places, nr s.l.-1800 m.

Type: [Bulgaria] auf dürren, steinigen Hügeln gegen Gerdem bei Kavaklij [Pod pera] (holo. BRNM?).

Turkey-in Europe, **C. Anatolia**. **A1(E) Edirne**: 10 km N.W. of Ipsala, Coode & Jones 2924!, Sarayiçi, A. Baytop (ISTE 14039)! **B2 Kütahya**: plain of Simav, 640m C19 (!). **B4 Ankara**: N.E. shore of Tuz G., 905 m, Darrah 173! **Ankara** ODTÜ A1 entrance of campus roadsides, 26.06.2006, E. Cabi 1549. **Ankara** Around Koçhisar , 953 m 38°57.695' N 33°31.026' E, 15.07.2006, E. Cabi 1535. **B5 Niğde**: 2 km E. of Aksaray, 1000m, Sorger 77-67-1!

External Distribution: S. E. Europe.

subsp. ***turcicum*** (McGuire) Cabi&Dogan comb. nova

Syn: *Elytrigia turcica* McGuire in Folia Geobot. Phytotax. (Praha) 18:108 (1983). Map 38. Octoploid 2n=8x=56.

Flowering and Habitat: June-August. Dry calcareous, saline places, Genista sessilifolia steppe, margins of Pinus woods, nr s.l. -1800 m

Type: [TURKEY] **C5 Niğde** 16 km occ. au. opp. Bor. Planta culta, semi ab J.R. Harlan collecta [Harlan 9269,= pl 149162] (holo. AHUC 38150-a cultivated specimen grown by Mc Guire from Harlan's collection).

N. Turkey, W. & E. Anatolia. **A1 Çanakkale**: Umurbey, Umurbey Çayı, Uotila 3035! **A2(E) Istanbul**: Silivri, A. Baytop (ISTE 11747)! **A2(A) Istanbul**: Kartal, 2 vii 1893, Azn.! Bursa: 35 km S.E. of Bandırma, nr Fevzipaşa, Kurtto 3139! **A6 Samsun**: Balik G., nr Bafra, D. 24955! **A9 Erzurum**: Akşar to Oltu 3 km before Oltu, dry pastures, 1231 m, 40°35'10.0" N 42°02'39.4" E, 9 July 2007 E. Cabi 2535 **Erzurum**: Erzurum to Pazaryolu, 1 km before Eskipolat Village, 40°03.731' N 40°55.814' E 21 06 2008 E. Cabi 3427. **Iğdır**: Tuzluca to Kağızman; around Gaziler Village, Çoruh riverside 1056 m 40°06'09.7" N 43°28'28.8' E. Cabi 2514 **B1 İzmir**: Sabuncu beli, A. Baytop (ISTE 10066)! **B2 Denizli:** Around Işıklı Lake , brackish pools 836 m 38°19.215' N 29°51.241' E 16.07.2008 E. Cabi 3585b **Denizli:** Işikli G., Kurtto 3262! **B6 Sivas**: 5 km from Ulaş to Kangal, 1400-1500m, D. 68706! **Sivas**, Ulaş, road sides, 39°27'18.7" N 37°01'18.7" E, 06.07.2007 E. Cabi 2449**. Sivas** around Ulaş , road side, 1373 m 39°27.489' N 37°01.048' E, 20.07.2008, E. Cabi 3622. **Malatya**: Kepez to Akçadağ, around Develi , 25 km to Akçadağ 38°22.529' N 37°52.986' E 1337 m, slopes 02.07.06, E. Cabi 1366. **B7 Erzincan**: East of Erzincan, 1250 m, D. 31863! **B8 Erzurum**: 29 km from Hinis to Pasinler, 1800 m, D. 46384!

External Distribution: Caucasia, Iran.

subsp. **salsum (Melderis)** Cabi&Dogan comb. nov.

Basionym: *Elymus elongatus* subsp *salsus* Melderis in Notes R.B.G. Edinb. 42:77 (1984).

Map 38.

Type: [Turkey] **B5 Kayseri**: Cappadocia, Argaeus (Erciyas Dağ.) am Salzsee vom Ewerek, Siehe 240 (holo. BM! iso. E! K! W!).

Endemic. Ir.-Tur. element.

Figure 59. Type photo of *Thinopyrum elongatum* subsp. *salsum* (BM!)

Thinopyrum elongatum is a polymorphic species consisting subtaxa which have different ploidy levels (2n=14-70).

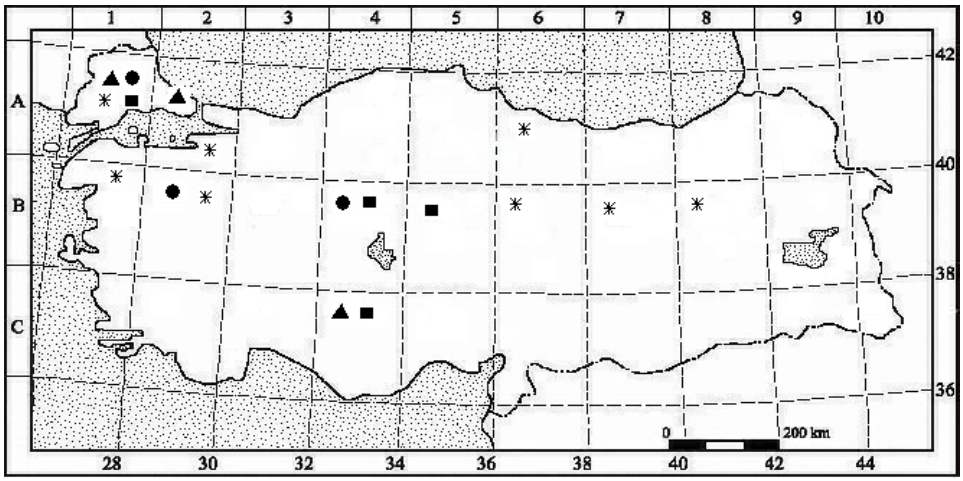

Figure 60. Distribution of *Thinopyrum elongatum* in Turkey.
Legend. (▲) subsp. *elongatum*, (■) subsp. *turcicum* (*) subsp. *ponticum*.

3.4.3.3. *Thinopyrum caespitosum* (C. Koch) Cabi &Dogan comb. nov

Basionym: *Agropyron caespitosum* K. Koch Linnaea 21(4): 424. 1848.
Syn: *Elytrigia caespitosa* (K. Koch) Nevski Trudy Sredne-Aziatskogo Gosudarstvennogo Universiteta. Seriya 8b, Botanika 17: 61. 1934; *Lophopyrum caespitosum* (K. Koch) Á. Löve Feddes Repertorium 95(7-8): 489. 1984. *Elymus nodosus* subsp. *caespitosus* (K. Koch) Melderis (Nevski) Melderis in Bot. J. Linn. Soc. 76:376 (1978).

Densely caespitose perennial. Stems 30-60 cm. Leaves usually 1-3 mm broad, convolute or flat with involute margins, with rather fine veins, scrabid or sparsely to densely shortly pubescent on upper surface; lower sheats often ciliate. Spike 6-15 cm, linear, erect, lax; rachis sparsely and shortly spinulose-ciliate on main angles. Spikelets with few floret, adpressed to rachis, usually glaucus, green. Glumes narrowly elliptic, obscurely 5-veined, with narrow (0,2-0,3 mm broad) hyaline margin, glabrous, obtuse to truncate at apex. Lemma unawned. Palea minutely ciliate near apex on keels.

1. Stems (on and below nodes), lower surface of leaves and sheats setulose; lemma usually emarginated at apex……..…… subsp. ***sinuatum***

1. Stems, lower surface of leaves and sheats glabrous and smooth; lemma not emarginated at apex.

2. Leaves usually convolute, shortly and densely pubescent on upper surface, without prominent margins; spikelets usually with 3 florets; glumes 4,5-7 mm; lemma 7-8 mm……..…….subsp. ***caespitosum***

2. Leaves flat, 4-5 mm broad, scabridulous; spikelets with 4-5 florets

3. Leaves with prominent white margins; rachis erect; spikelets adpressed to rachis; glumes 7-10 mm, obscurely veined; lemma 10-14 mm ……..…..subsp. ***gypsicolus***

3. Leaves without prominent margins; rachis slightly flexuous; spikelets not adpressed to rachis; glumes conspicuously veined……..subsp. ***platyphyllum***

subsp. ***sinuatum*** (Nevski) Cabi&Dogan comb. nova

Basionym: *Agropyron sinuatum* Nevski in Flora URSS 2: 639. 1934.

Syn: *Elytrigia sinuate* (Nevski) Nevski in Acta Inst. Bot. Acad. Sci. URSS ser. 1. 2:80 (1934); *Elytrigia caespitosa* (C. koch) Nevski subsp. *sinuate* (Nevski) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 10:30 (1973). Ic: Fl. URSS 2:t. 47 f.4 (1934). Map 38. *Elymus nodosus* subsp. *sinuatus* (Nevski) Melderis in Notes R.B.G. Edinb. 42:80 (1984).

Flowering and Habitat: May-June. Stony slopes, rock crevices, 1500-1800 m.

Type: not designated [Turkey A9 Çoruh: prov. Artvin, d.ardanucz, inter Ardanucz-su et Aravat-su, 30 v 1914, S.Turkevicz 600 (holo. LE-designated by Nevski, op. Cit. 80(1936), as type of Elytrigia sinuata].

N.E. Anatolia: A8 Çoruh: Artvin (Grossheim 1: map 306). **A9 Kars**: nr Posof, 1500-1800m, Sorger & Buchner 82-106-50! **Erzurum:** Oltu (Grossheim 1: map 306).

General Distribution: Caucasia. **Ir.-Tur. element**.

subsp. ***caespitosum*** (C. Koch) Cabi and Doğan comb nov.

Syn. *Agropyron caespitosum* (C. Koch) in Linnaea 21:424 (1848)! Non *Elymus caespitosus* Sukaczev (1913)! *Elytrigia caespitosa* (C. Koch) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.) 17:61 (1934)! *Agropyron angulare* Nevski in Fl. URSS 2:639 (1934)! *A. firmiculmis* Nevski, op. cit. 646 (1934); *Elytrigia angularis* (Nevski) Nevski in Acta Inst. Bot. Acad. Sci. URSS ser. 1, 2:79 (1936); *Elytrigia firmiculmis* (Nevski) Nevski in Acta Inst. Bot. Acad. Sci. urss ser. 1, 2:82 (1936). Map 38.

Flowering and Habitat. June-July. Calcareous rocks, dry slopes, 1600-2200 m.

Type: [Turkey A9 Çoruh] auf dem Hochlande des obern Kur- Gebietes im Gaue Artahan (Ardahan), 1680 m, auf blasigem Trachyt-Gesteine, C.Koch (holo. B, destroyed). Neotype

designated in notes R.B.G. Edinb. 42:80(1984): Turkey A8 Çoruh: Lomaşen, nr Artvin. 30 v 1907, G. Woronow (BM!).

N. Anatolia. **A5 Kastamonu:** Tossia (Tosya), Sint. 1892:4666! **A7 Gümüşhane:** Ketschikale, Sint. 1894:6155! **A8 Çoruh:** Lomaşen, 15 vii 1907, Woronow! **Erzurum,** Pazaryolu to İspir, around Kirazlı Village , 40°26.925' N, 40°52.128' E, 1232 m, stony slopes, 21 06 2008 E.Cabi 3461, **Artvin,** Lomaşen to Seyitler, 569 m, rocks, 41° 12.034' N, 41° 51.400' E, 25 06 2008 E.Cabi 3510. **A9 Erzurum:** Oltu, nr Pausner, Sosnowsky 16! Kars: Aydir G., 20 km W. of road fork from Susuz to Kars towards lake, 2200 m, Sorger 81-63-22!

External Distribution: Caucasia, Iran, Khorassan, Iraq, C. Asia. **Ir.-Tur. element.**

Figure 61. Habit of *Thinopyrum caespitosum* and its spike in close view

subsp. ***gypsicolus*** Cabi and Doğan comb nov.

Fl. 7-8. Gypsum slopes, 1500-1700 m

Type: [TURKEY] **B6 Sivas**: d. Kangal, between Çetinkaya and Kingöz Köy [sic.recte Kirkgöz Köy], gypsum slopes, 1580-1700 m, 7viii 1982, P. Davis & Ekim 68745 (holo. E!, iso ANK!).

B6 Sivas: d. Kangal, between Çetinkaya and Kırkgöz, road sides, 1490m, 39 21 623 N 37 39 977 E, 20.7.2008 E. Cabi 3638.

Distribution: **Endemic**. Known only from the type locality. **Ir-Tur. element**. Threat category **E**.

Figure 62. Type of *Thinopyrum caespitosum* subsp. *gypsicolus* (ANK!)

subsp. ***platphyllus*** Cabi and Doğan comb nov.

Type: [TURKEY] A9 Kars: E. of Kağızman, c. 20 km from Akçay to Cumaçay, dry pastures, 2200 m, 17 vii 1966, P. Davis 466692 (holo. E! iso. K!).

Endemic. Known only from the type locality. **Ir-Tur element.**

Figure 63. Type of *Thinopyrum caespitosum* subsp. *platphyllus* (BM!)

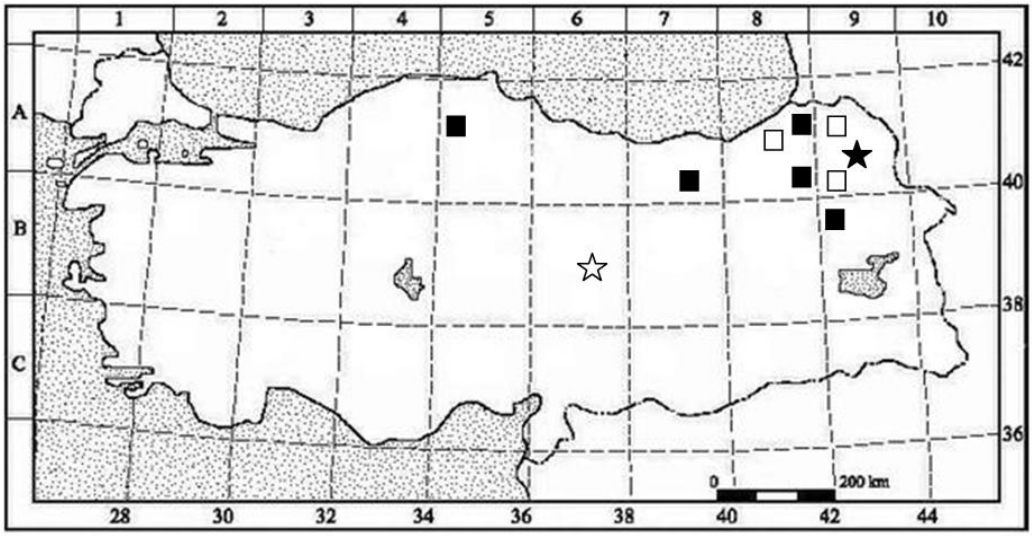

Figure 64. Distribution of *Thinopyrum caespitosum* in Turkey

Legend. (★) subsp. *platphyllus*, (☆) subsp. *gypsicolus*, (□) subsp. *sinuatum*, (■) subsp. *caespitosum*

3.4.3.4. *Thinopyrum gentryi* (Melderis) D.R. Dewey In Gene Manipulation in Plant Improvement 275. 1984.

Basionym: *Agropyron gentryi* Melderis Flora Iranica : Flora des Iranischen Hochlandes und der Umrahmenden Gebirge : Persien, Afghanistan, Teile von West-Pakistan, Nord-Iraq, (cont) 70: 165. 1970.

Syn: *Elymus gentryi* (Melderis) Melderis in Notes R.B.G. Edinb. 42:82 (1984). Syn: *Agropyron gentryi* Melderis in Rech. Fil., Fl. Iranica 70:165 (1970)! *Elytrigia gentryi* (Melderis) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 9:60 (1972)! Figure 10. Map 37! *Elytrigia intermedia* subsp. *gentryi* (Melderis) Á. Löve Feddes Repertorium 95(7-8): 487. 1984.

Type: [Iran] Bakht. [Bakhtiari ve Chaharmahall], Kuh Rang, Chaharmahal, 28 viii 1955, Gentry 15617 [grown at Pullman, Washington, U.S.A.-PI 228277] (holo. K!)

Caespitose perennial. Stems c.90 cm, glabrous. Leaves 5-6 mm broad, flat, green, with prominent white margins, closely and rather finely veined, densely scabridulous on upper surface, glabrous beneath; sheats not ciliate. Spike 12-16 cm, erect; rachis sparsely and minutely spinulose-ciliate on main angles. Spikelets 12-14 mm, with 3-6 florets. Glumes 6-8,5 mm, subequal, slightly keeled, 3-5-veined, with hyaline margin 0,5-1 mm broad, glabrous or

slightly scabrid on mid-vein towards apex, obtuse to truncate with small triangular apiculus or thick mucro. Lemma 7-8 mm, prominently veined towards apex; mid-vein and outher veins prolonged into thick mucros, projecting beyond apex, sometimes lateral mucros exceeding central one. Palea minutely ciliate in upper 2/3 of keels. **2n=6x=42** (Assadi 1995)

Flowering and Habitat: June-July. Shaley limestone slopes, c. 2000-2600 m.

S.E. Anatolia, **C10** Hakkari: Sat Mount. Above Varegöz, 1970m, D 45553! (BM)

External Distribution: W.Iran. **Ir-Tur. element**. Threat category. **CR.**

Figure 65. Type photo of *Thinopyrum gentryi*

3.4.3.5. *Thinopyrum erosiglumis* (Melderis) Cabi & Dogan comb. nov

Basionym: *Elymus erosiglumis* Melderis Notes from the Royal Botanic Garden, Edinburgh 42(1): 78. 1984. Figure 10. Map 37.

Syn. *Elytrigia erosiglumis* (Melderis) Valdés & H. Scholz Willdenowia 36(2): 661. 2006.

Caespitose perennial. Stems 70-105 cm with 2-3 nodes, glabrous. Leaves 15-40 cm x 2-4,5 mm, usually convolute rarely flat with involute margins, closely and ± prominently veined, densely and shortly pilose on upper surface, glabrous and smooth beneath; sheats usually glabrous or shortly ciliate on margins. Spike 9-24 cm with 13-22 spikelets, slender, lax; rachis sparsely and shortly spinulose-ciliate on main angles, rachis internodes 11-13 mm long. Spikelets 12-15 mm, with 5 florets. Glumes 7-10,5 mm distinctly shorter than lowest floret, subequal, glabrous and smooth on back, usually minutely scabrid on vein, conspicuously 5-6 veined, with hyaline margin 0,3-0,4 mm broad, erose or emarginated or truncate, with short apiculus. Lemma 8-10,5 mm, obscurely veined, glabrous and smooth on back, emarginated, often apiculate from sinus or bidentate. Palea distinctly shorter than lemma in the lowest floret, as long as or slightly longer in upper florets, all paleas minutely ciliate on keels in upper part. Anthers 2-4 mm long.

Flowering and Habitat: May-June. Calcerous hills, 1070-2250 m.

Type: Turkey B6 Malatya: Gürün. 3500 ft [1070m], eroded hills of calc. shale, 19 v 1954, Davis 21888 (holo. BM! iso. E! K! ANK!)

East Anatolia B6 Sivas, North of Gürün, corroded calcerous hills, 1492 m, 38° 44' 34.7" N 37° 37' 16.4" E, 16 06 2007 E. Cabi 2438. **Sivas**, Gürün, E of Gökpınar Gölü, corroded calcerous slopes, 1515 m, 38° 39' 42.5" N 37° 18' 14.6" E, 16 06 2007 E. Cabi 2439**. Sivas**, West of Gökpınar Facility, 1671 m, 38°38.810' N 37°18.487' E, 21 07 2008 E. Cabi 3648, **Sivas:** E. of Gök Pinar (S. of Gürün), 1600-1800 m, Sorger & Buchner 76-21-20! **Malatya**: Kavak Aghatch (Kavak-ağaç) to Arga (Akçadağ), 16 vii 1906, G. & B. Post! **Malatya**, Kepez-Akçadağ road, near Develi , 5 km to Akçadağ, road side, soily slopes, 1337 m, 38°22.529' N 37°52.986' E, 2 July 2006 E. Cabi 1366. C7 Adıyaman : Nemrut Mount. , 1600-2250m, Hand.-Mazz. 2079.

Endemic. Ir.-Tur. element. Allied to *Th. elongatum* but differing by the presence of pubescence on the upper surface of the leaves, by the marginal indumentum of the glumes.

Figure 66. General appearance of *Thinopyrum erosiglumis* and its spikes in close view

3.4.3.6. *Thinopyrum pycnanthum* (Godr.) Barkworth Phytologia 83(4): 304. 1997[1998].

Basionym:*Triticum pycnanthum* Godr. Mémoires, Société d'Émulation du Doubs 5: 10. 1854.

Syn. *T. pycnanthum* Godron in Mem. Soc. Emul. Doubs ser. 2, 5:10 (1854)! *Agropyron pycnanthum* (Godron) Godron & Gren. in Gren. & Godron, Fl. Fr. 3:606 (1856)!; *Elymus*

pycnanthus (Godr.) Melderis Botanical Journal of the Linnean Society 76(4): 378. 1978. *Elytrigia pycnantha* (Godr.) Á. Löve Taxon 29(2-3): 351. 1980. *Agropyron repens* subvar. *pycnanthum* (Godr.) Briq. Prodrome de la Flore Corse 1: 186. 1910.

Perennial with long-creeping rhizomes. Stems 40-140 cm with usually 2-3 nodes, rigid, glabrous. Leaf sheats glabrous. Leaf blades 2-5 mm X 19-50 cm, flat or convolute, rigid, closely and prominently veined, scabrid on veins on upper surface, glabrous beneath. Spike 5-20 cm, dense; rachis spinose-ciliate on angles, rachis internodes 4-6 mm at the middle of spike. Spikelets 12,5-15 mm long. Glumes 8-10 mm, oblong-lanceolate, prominently 5-7 veined, asymmetrically keeled, scabridulous on keel, acute. Lemma 7-11 mm, kelled towards apex, scabrid on keel near apex, unawned, mucronate or awned with a short awn up to 2,5 mm long. Palea as long as or slightly shorter than lemma, scabrid on keels especially on the upper half. Anther length 4-4,5 mm. Genome: **EStP, 2n = 6x = 42** (Refoufi et al 2001)
Flowering and Habitat: June-September. Maritime sands, nr s.l..
Type: "[S. France] sables maritimes a Pérols et a Mireval, prés de Montpellier" (holo. P).

1. Apex of lemma with a short awn up to 2,5 mm long…….var. ***aristatum***
1. Apex of lemma unawned or mucronate…….var. ***pycnanthum***

var. *pycnanthum*
N.W. Turkey, N.E. Anatolia. A1 Çanakkale, Lapseki, 0 m, Salty marshes, Limonium ve Juncus birlikleri, 25.06.2003, G. Akaydın 7981. **Çanakkale**: Gelibolu to Eceabat, around Burhanlı, 0m, 05.08.2003, G Akaydın 8015. **A2(E) İstanbul:** Silivri to Marmara Ereğlisi, Gümüşyaka coast, 41° 02.827' N 28° 03.180' E 04.06.2008, E. Cabi 3209. **A3 Bolu**: W. of Akçakoca, Wagenitz & Beug 217. **A5 Sinop:** W of Sinop, Akliman dune, sands, 42° 01' 34.6" N, 35° 04' 51.2" E, 1 m, 15.06.2007, E. Cabi 2392. **A7 Gümüşhane**: nr Gümüşhane, Bourgeau. Is: Lesvos,Cand.

var. *aristatum* Cabi &Dogan var. nov.
N.W. Turkey A1 Tekirdağ: Şarköy, around Kumbağ, sedges, 0 m, 05 Aug 2003, G. Akaydın 7986
External Distribution: Coasts of W.& S.Europe, introduced in C.Russia (islands of Kotlin) and N.America. **Medit element**. Threat category. **LC**

Figure 67. Habit of *Thinopyrum pycnanthum* and its spike in close view

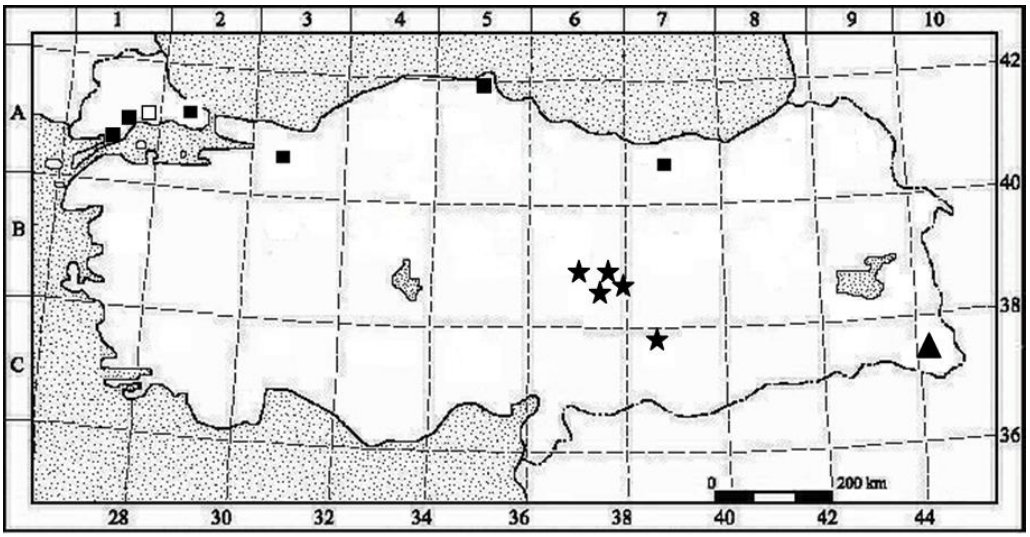

Figure 68. Distribution of *Thinopyrum pycnanthum, Thinopyrum erosiglumis,* and *Thinopyrum gentryi* in Turkey.

Legend. (■)*Thinopyrum pycnanthum,* (★)*Thinopyrum erosiglumis,* (▲)*Thinopyrum gentryi* in Turkey.

3.4.3.7. *Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey

Basionym: *Triticum intermedium* Host Icones et Descriptiones Graminum Austriacorum 3: 23, t. 22. 1805.

Syn: ***Agropyron glaucum* var. *intermedium*** (Host) Beck Wissenschaftliche Mitteilungen aus Bosnien und der Herzegovina 9: 460. 1904; ***Agropyron intermedium*** (Host) P. Beauv. Essai d'une Nouvelle Agrostographie 102, 146, 180. 1812; ***Elytrigia intermedia*** (Host) Nevski Trudy Botanicheskogo Instituta Akademii Nauk S S S R. Ser. 1, Flora i Sistematika Vysshikh Rastenii. Moscow & Leningrad 1: 14. 1933; ***Trichopyrum intermedium*** (Host) Á. Löve Veröffentlichungen der Geobotanischen Institutes der ETH, Stiftung Rübel, Zürich 87: 49. 1986.

Perennial with often long-creeping rhizomes. Stems 40-80 cm, usually glabrous, sometimes densely and minutely pubescent on nodes. Leaves 2-6 mm broad, usually flat, glaucous-green, closely and rather prominently veined, with conspicuous marginal veins, scabrid, often also sparsely long-pilose on upper surface, usually glabrous beneath; sheats usually long-ciliate. Spike 10-20 cm erect, rather dense to lax; rachis spinulose-ciliate on main angles. Spikelets with 4-6 florets, compressed laterally. Glumes 5-8.5 mm, subequal, oblong

or lanceolate-oblong, usually 5-veined, scabrid on keel towards apex, usually obtuse or obliquely truncate, with small triangular point or mucro at apex, sometimes subacute. Lemma 8-11 mm, keeled at apex, usually obtuse or mucronate. Palea ciliate on keels.

1. Lemma prominently awned, awns up to 8 mm long; glumes usually subacute ……..……..subsp. ***pulcherrimum***

1. Lemmas obtuse or mucronate ……..… subsp ***intermedium***

2. Spikelets glabrous ……. var. ***intermedium***

2. Spikelets pubescent

3. Glumes usually glabrous; lemmas ciliate along margins ……...var. ***podyerae***

3. Glumes and lemmas ± densely pilose ……var. ***barbulatus***

subsp. *intermedium* var. *intermedium*

Syn: *Triticum glaucum* Desf., Cat. Hort. Paris ed. 1:16 (1804) nom. Nud.; *T. intermedium* Host, Gram. Austr. 3:23, t. 22 (1805)! Sub *T. Junceum*, non *Elymus intermedius* Bieb. (1808); *Agropyron intermedium* (Host) P. Beauv., Ess. Agrost. 102 & 146 (1812)! *T. glaucum* Desf. ex DC. in Lam. & DC., Fl. ed. 3, 5:28 (1815) non Honckeny (1782); *A. glaucum* (Desf. ex DC.) Roemer & Schultes, Syst. Veg. 2:752 (1817) non *Elymus glaucus* Buckl. (1863); *A. hispidum* Opiz in Bercht. & Seidl, Ökon.-Techn. Fl. Böhm. 1:413 (1836)! *A. validum* Opiz, loc. cit. (1836)! *A. laevifolium* Opiz, op. cit. 414 (1836); *Triticum truncatum* Walk, in Linnaea 14:544 (1840); *T. latronum* Godron in Mem. Soc. Emuls. Doub. ser. 2,5:19(1854) *A. latronum* (Godron) Cand. in Arch. Biol. Veg. Athenes 1:55 (1901)! *Elytrigia intermedia* (Host) Nevski in Acta Inst. Bot. Acad. Sci. URSS ser. 1, 1:14 (1933)!
Flowering and Habitat: June-July. Scree below cliffs, shaley limestone slopes, arid places, field margins, 1400-2300.
Type: [Çekoslovakya] um Prag, Opiz [413] (holo. PR).

N.W., N, Inner and South Anatolia **A1(E)** Çanakkale: Gelibolu, Sirjaev. **A2(E)** Istanbul: Yedikule, 17.06.1900, Azn.! **A2(A)** Istanbul: Maltepe, Azn.! **A3** **Bolu**:Bolu-Ankara, 110 km to TEM road of Ankara 13.06.2008, E. Cabi 3291 **A4** **Kırıkkale:** Balışeyh, Beyobası to Bıyıkaydın,around cemetery, 1038 m, 40°03.084'N 33°43.987'E, 30.06.2006, E. Cabi 1269 **A5** **Kastamonu:** Tosya, Gavur Mount., under Quercus-Pinus mixed forest, 1443m, 41°03'12.4"N 34°00'25.9"E, 14.06.2007, E.Cabi 2382 **A6** **Tokat:** Tokat-Sivas, Kızıliniş Pass, limestone slopes, 1230m, 40°12'35.6"N 36° 29' 47.8"E, 15.06.2007, E.Cabi 2403 **Tokat:** Tokat-Artova, above Altınbaş village, 1220m, 40°10'54.2"N 36°25'21.6"E, 16.06.2007, E.Cabi 2409. **A7** **Gümüşhane:** Bayburt-Gümüşhane, Vauk Mount. Pass, 1875m, 40°22.220'N 39°50.339'E, 31.07.2008, E. Cabi 3767 **Gümüşhane:** Süleymaniye

District, around Aysimi trout facility, 1681 m, 40°27.174' N 39°25.545' E 01.08.2008, E. Cabi 3780**. Gümüşhane:** around Süleymaniye District., around İnceoğlu family graveyard, 1410m, 40°27.615'N 39°27.103'E, 01.08.2008, E.Cabi 3776 **A8 Erzurum:** Erzurum-Tortum, 24 km to Tortum, 1915-1925m, 40°07.971'N 41°25.508'E, 05.07.2006, E.Cabi 1472 **B3 Ankara:** Polatlı to Sivrihisar, 32 km to Sivrihisar, 870 m, 39°33.843' N 31°48.627' E 16.06.2008, E. Cabi 3321. **B4 Ankara:** Entrance of Beynam Forest, 1405 m, 39°40.722'K 32°54.792'D, 28.06.2006, E. Cabi 1236 **Konya:** Kulu, Kulu to Konya'ya~7-8 km, 1136m, 39°01.149'N 33°01.744'E, 11.05.2007, E.Cabi 2242 **B5 Kırıkkale:** Delice-Sungurlu, 38 km to Sungurlu, around Hacıobası Village, 784 m, 39°58'35.5"N, 34°04'30.4" E , gypseous rocky slopes, 17.06.2008, E. Cabi 3322. **Yozgat:** 7 km from Yozgat to Yerköy village, roadsides, 39°46.154'N 34°44.704'E, 12.07.2005, E.Cabi 1551**. B6 Sivas:** Kangal-Gürün, roadsides and slopes, 1660 m, 39°01.584'N 37°15.122'E, 16.06.2007, E. Cabi 2428. **Sivas**; Etyemez-Dürmepınar, 1377 m 38°58.646' N 37°25.981' E 01.07.2006, E. Cabi 1346 **Sivas:** Sivas-Malatya, exit of Mescidli, plain slopes, 1281-1320m, 39°39.568'N 37°00.608' E, 01.07.2006, E.Cabi 1294 **Sivas:** Zara to İmralı, 1638m, 39°52.294'N 37°56.984' E, 20.07.2008, E.Cabi 3620. **Sivas:** Sivas-Erzincan,.5km to the turning of Eskieşlik Village, road side, 10 km to Beğendi, 1537m, 39°52.307'N 37°57.573'E, 25 07 2008, E.Cabi 3672 **Sivas:** around Kangal, Çetinkaya Municipality, 1423m, 39°15.209'N 37°37.509' E, 01.07.2006, E.Cabi 1329. **Kayseri:** Sarız, rocky slopes , 2145 m, 38°39.796'N 36°23.675'E, 21.07.2008*,* E.Cabi 3658 **Maraş**: d. Göksun, Binboğa Mountain., above Yalak, 2200-2300 m, D. 20141! **B7 Tunceli**: Pertek to Hozat 1143 m, 38°55.588' N 39°14.805' E, 02.07.2006 E. Cabi 1371 **Erzincan:** Refahiye-İliç, 5 km after Refahiye, 1753m, 39°50.747'N 38°45.044'E, 25.07.2008, E.Cabi 3687 **Elazığ:** Arapgir to Elazığ, 5 km from Arapgir, limestone slopes, 1381m, 38°59.069'N 038°30.706' E, 25.07.2008, E.Cabi 3692 **B8 Muş:** 6 km S. of Varto, 39°07.601'N 41°28.027'E, 1463m, 03.07.2006, E. Cabi 1428 **Bingöl:** Bingöl to Karlıova, 6 km from Sudurağı village, 1756-1761 m, 39°09.375' N 40°53.862' E, 03.07.2006, E. Cabi 1409 **Bingöl**: Bingöl to Karlıova, 3 km to Karlıova, steps, 1787m, 39°16.180'N 040°59.440'E, 26.07.2008, E.Cabi 3709. **B9 Erzurum**: Karayazı-Erzurum, 6 km after Yeniköy Village, 2303 m, road sides , calcerous valley, 39°45.453' N 42°17.553' E, 04.07.2006, E. Cabi 1455 **Van:** Erek Dağı, exit of Yedi Kilise Village, 2178 m, 38°26.832'N 43°27.827'E, 29.07.2008, E Cabi 3733 **Van:** Erek Dağı, Exit of Yedi Kilise Village, 2178 m, 38°26.946'N 43°28.029' E, 29.07.2008**,** E Cabi 3737 **Van:** 30 km to Erciş road side,steps, 1938 m, 39°08.381'N 43°06.564'E , 28.07.2008, E.Cabi 3728 **Bitlis**: Nemrut Mount., 2300 m, D. 23515! **C1 İzmir:** N. of Kuşadası, 5-30 m, Sorger 67-43-4! **C4 Karaman**: Gülnar-Ermenek, Olukpınar Village, 1403 m, 36°31.554' N 32°59.701' E 15 06 2006, E. Cabi 1127 **İçel:** Ermenek- Balkıran, 1606m, 36°40.422'N 32°55.875'E, 18 07 2008, E.Cabi 3605 **İçel:**

Ermenek-Karaman, 100 km to Karaman, near Karaçeşme , 1476m, 36°43.127'N 32°55.904'E, 18 07 2008, E.Cabi 3610

External Distribution: C. Europe, Mediterranean area, C. & S. Russia, Caucasia, Iran, N. Iraq; C. Asia, W. Pakistan.

Figure 69. Habit of *Thinopyrum intermedium* subsp. *intermedium* var. *intermedium* and its spike in close view

subsp *intermedium* var. ***podperae*** (Nabelek) Cabi & Dogan comb et stat. nov.

Syn: *Elymus hispidus* subsp. *podpyerae* (Nâb.) Melderis in Notes R.B.G. Edinb. 42:78 (1984). Syn: *Agropyron podperae* Nâb. in Publ. Fac. Sci. Univ. Masaryk Brno 111:24, f. 9 (1929)! *A. ciliatiflorum* Roshev. apud Kq'ie in Beitr. Fl. S.W.-Irans 1:52, f. H(1945)! Map 40.

Flowering and Habitat: June-August. Eroded slopes, steppe, dry banks, Quercus scrub, 1500-2600 m.

Type: [TURKEY] C9 Siirt Turc, distr. Ramôran: mons Mirgamira ad pagum Sernach (Şırnak) ad orientem ab oppido S'ert, inter frutices quer-cuum, c. 1500 m, 24 vii 1910, Nâbelek 3313 (holo. BRA).

Widespread **A1** **Çorlu:** Lüleburgaz, 1 km to Yenibedir Village , 89 m, 41°21.186'N 27°25.392'E, 28.05.2006, E.Cabi 780, G. Akaydın & E. Karabacak. **Edirne** Keşan-Enez, 30 km to Enez 132 m., 40°40.571' N 26°20.785' E 03 06 2008 E. Cabi 3180 **A4 Ankara:** near Ayaş road , Ayaş Municipalty, 1000m, 40°01.371'N 032°20.482' E, 04 06 2005, E.Cabi 1590 **A6 Tokat:** Tokat-Sivas, Kızıliniş Pass , limestone slopes and pastures, 1230m, 40°12'35.6"N 36°29'47.8"E, 15 06 2007, E.Cabi 2403. **A7 Gümüşhane:** near Süleymaniye district around İnceoğlu family graveyard, 1410m, 40°27.615'N 39°27.103'E, 01 08 2008, E.Cabi 3776 **Gümüşhane:** Süleymaniye Mh., Eski Gümüşhane Kırkbavli, 1456m, 40°26.901'N 39°27.177'E, 1 08 2008, E.Cabi 3772 **A8 Erzurum:** Torhum-Narman, 1807m, 40°20.327'N 41°35.062'E, 5 07 2006, E.Cabi 1478 **Erzurum:** Aşkale- Bayburt, Kop Pass, the hills at the back of the Karayoları Bakımevi , 2415 m, 40°01.569'N 40°01.339'E, 31 07 2008, E. Cabi 3756 (with *E.repens*) **Erzurum:** Aşkale-Bayburt, Kop Pass, the hills at the back of the Karayolları Bakımevi , 2415-450m, 40°01.569' N 40°31.339' E,31 07 2008, E.Cabi 3756 **A9 Artvin:** Ardanuç-Arevet, Torbalı Village, around Arevet , 655m, 41°05.754'N 42°03.104'E, 25 06 2008, E.Cabi 3536. Çoruh: 26 km E. of Demirkent, 2100 m, Sorger 81-81-41 Kars: d. Kağizman, valley of Akçay by Novo-Nikolajevka, Woronow 12556. **B5 Yozgat:**Yozgat-Kayseri, around Büyükincirli Village , rocky slopes and road side, 1047 m, 39°38.338'N 34°55.082'E, 19 06 2008, E. Cabi 3693**. B6 Sivas**: Ulaş to Gürün, the crossroad of Deliilyas and Altınyayla Villages , slopes, 39°23'47.2"N, 37°04'59.3"E, 1434 m, limestone slopes, 19.vi.2008 E. Cabi 3387 **Sivas:** Zara to İmralı 20 km, 1638m, 39° 52' 294"N 37° 56' 984"E, 20 07 2008, E.Cabi 3620 **Tokat:** Yıldızeli-Tokat, road side 5 km around Yıldızeli, 1386m, 39°54.428'N 36°32.961'E, 20 07 2008, E.Cabi 3612 **B8 Erzurum:** Pasinler-Erzurum, east of Nenehatun Village, 39°56.888'N 41°23.344'E, 1908 m, road side and steps, 4 07 2006 E. Cabi 1465. **Erzurum:** Aşkale-Bayburt, 60 km to Bayburt, calcerous slopes, around Pırnakapan Village, 1642m, 39°57.755'N 40°34.439'E, 31 07 2008, E.Cabi 3751 **B9 Ağrı:** Demirtaş Village, road side, 1699m, 39°31.437'N 42°37.872'E, 4 07 2006, E. Cabi 1446.

B10 Kars: 6 km S. of Iğdir towards Doğubayazit, 1720 m, Kyôto Univ. Exped.7-8-2-F! **C2 Antalya**: between Fethiye-Antalya, Söğüt and Korkuteli arası, 1395 m, 37°03.234' N 29°51.253' E 17 07 2008 E. Cabi 3594 **C4 İçel:** Ermenek to Balkusan ~ 5-7 km, calcerous field side, light colored soil,1655m 36°40.694'N 32°56.000' E, 15 06 2006, E.Cabi 1140. **C6 Maraş**: Ahır Mount., 15 vii 1865, Haussk n. (syntype of Agropyron aucheri Boiss.)!. **C9 Hakkari**: Elkiyayla Mount. at top of Morinos De., 2000 m, D. 45330! **C10** Hakkari: Ispiriz Mount., 2600 m, D. 23729!

External Distribution. Iran, Iraq. **Ir.-Tur. element**.Threat category **LC**

subsp. *intermedium* var. *barbulatum* (Schur) Cabi & Dogan comb. et stat. nov.

Basionym: *Agropyron barbulatum* Schur Verhandlungen und Mittheilungen des Siebenbürgischen Vereins für Naturwissenschaften zu Hermannstadt 4: 91. 1853. (Verh. Mitth. Siebenburg. Vereins Naturwiss. Hermannstadt)

Syn. *Elymus hispidus* subsp. *barbulatus* (Schur) Melderis Botanical Journal of the Linnean Society 76(4): 381. 1978. *Agropyron glaucum* subsp. *barbulatum* (Schur) K. Richt. Plantae Europeae 1: 124. 1890. *Agropyron glaucum* var. *barbulatum* (Schur) K. Richt. Plantae Europeae 1: 124. 1890. *Agropyron trichophorum* fo. *barbulatum* (Schur) Anghel & Morariu Flora Republicii Socialiste Romania 12: 615. 1972. *Elytrigia intermedia* subsp. *barbulata* (Schur) Á. Löve Taxon 29(2-3): 350. 1980. *Elytrigia intermedia* subsp. *barbulata* (Schur) Soják Časopis Národního Muzea v Praze, Řada PYírodovědná 150(3-4): 140. 1982. *Thinopyrum intermedium* subsp. *barbulatum* (Schur) Barkworth & D.R. Dewey American Journal of Botany 72(5): 772. 1985. *Trichopyrum intermedium* subsp. *barbulatum* (Schur) Á. Löve Taxon 35(1): 198. 1986. *Triticum trichophorum* Link in Linnaea 17:395 (1843); *Agropyron aucheri* Boiss., Diagn. ser. 1 (5):75 (1844)! *A. trichophorum* (Link) K. Richter, op. cit. 124 (1890); *A. intermedium* (Host) P.Beauv. subsp. *trichophorum* (Link) Aschers. & Graebn., Syn. Fl. Mitteleur. 2:658 (l90l); *Elytrigia trichophora* (Link) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.) 17:61 (1934); *Elytrigia intermedia* (Host) Nevski subsp. *trichophora* (Link) Tzvelev in Novit. Syst. PL Vasc. (Leningrad) 10:31 (1973).

Ic: Fl. Iraq 9: t. 75 (1968), as. *A. trichophorum.* Map 40.

Flowering and Habitat: June-August. Pinus nigra woods, limestone slopes with *P. sylvestris* and Juniperus, steppe, stony slopes, rocky hills, scree, dry banks, cornfields, 500-2895 m.

Type: [Romania] Transylvania (iso.W).

Widespread A3 Bolu: Bolu-Ankara, 110 km before Ankara, TEM road 13 06 2008 E. Cabi 3291(with var. *intermedium*) **A4 Kırıkkale:** After 500m of Aşağıkaraışık, the entrance of Koçubabam, 1157m, 40°03.489'N 33°51.678'E, 30 06 2006, E.Cabi 1271 **Ankara:** Soğuk Su

National Park, 3 km to Kızılcahamam, 1189m, 40°26.922' N 32°36.829' E, 27 06 2006, E. Cabi 1183 **A7 Gümüşhane;** Süleymaniye around district Aysimi trout facility 1681 m 40°27.174' N 39°25.545' E 01 08 2008 E. Cabi 3780 **Gümüşhane:** near Süleymaniye Mh., 1410m, 40°27.615'N 39°27.103'E, 1 08 2008, E.Cabi 3780 **A8 Erzurum:** Erzurum to Tortum, 24 km to Torum, 1915-1925 m, 40°07.971'N 41°25.508' E, 5 07 2006, E.Cabi 1472 **Erzurum:** Tortum, Above Balıklı Village, white stony slopes,40°38.480'N 41°37.029'E, 1373m, 22 06 2008, E.Cabi 3479 **Erzurum :** Uzundere to Oltu, Kargapazarı Mountains, Aksu to Başbağlar Village, 40°26.173'N 41°36.171' E, 2089m, 22 06 2008, E.Cabi 3483 **Erzurum:**Aşkale to Bayburt, Kop Pass, the hills at the back of Karayolları Carehouse, 2415-2450m, 40°01.569' N 40°31.339' E, 31 07 2008, E.Cabi 3756 **Erzurum:** Aşkale to Bayburt, Kop Pass, 2415-2450 m, 40°01.569'N 40°31.339'E, 31 06 2008, E.Cabi 3757 **Erzurum:** Erzurum to Pazaryolu-İspir, junction of Elmalı Village, 40° 08.948' N, 41°01.866' E, 1981 m, slopes and scree, 21.06 2008 E. Cabi 3433 **A9 Kars:** Digor to Iğdır, 40 km before Tuzluca, 40°18.666' N, 43°29.860' E, 1638 m, dry pastures, calcareous rocks, 26 06 2008 E. Cabi 3570 **Artvin:** Ardanuç, Gevhernik Castle, 582m, 41°07.605' N 42°03.397' E, 25 06 2008, E.Cabi 3546 **B3** Eskişehir: Eskişehir, Warburg & Endlich 677! **B4 Ankara:** 33 km from Gölbaşı to Haymana, dry calcerous rocky hills, 1073m, 39°37'41"N 32°42'05.2" E, 16 06 2008, E.Cabi 3300 **B5 Kırıkkale:** Delice to Sungurlu, 38 km before Sungurlu, near Hacıobası village, 39°58'35.5" N 34°04'30.4" E , 784 m, gypsious rocky slopes, 17 06 2008 E. Cabi 3322 **Nevşehir**: 20 km from Gülşehir to Kirşehir, 500m, McNeill 380! **B6 Sivas:** Kangal to Gürün, Böğrügedik Pass, stony slopes, step, 1729m, 38°58'02.7"N 37°16' 46.2" E, 16 06 2007, E.Cabi 2433 **Sivas:** W. of Gökpınar,1611m, 38°38.810'N 37°18.487'E, 21 Jul 2008, E.Cabi 3645 **Sivas;** Etyemez to Dürmepınar, 1377 m 38°58.646' N 37°25.981' E, 01 Jul 2006 ,E. Cabi 1346 (with var. *intermedium*) **Sivas:** Zara to Divriği, 25 km before Divriği, gypsum area, 1441m, E. Cabi 1561 **Sivas:** Kangal to Kırkgöz Village, after Kızbeli Pass, about 500-600 metres after, 1516-1575m, 39°23.628'N 37°40.662'E, 1 Jul 2006, E. Cabi 1331 **B7 Erzincan:**Refahiye to Erzincan, near Sakalsultan Pass, gypsum rocks, slopes, 1932 m, 39°52'19.1"N 39°04'57.8"E, 07.07.2007, E.Cabi 2465. **Erzincan:** Erzincan to Sivas, 29 km to Refahiye, 2023m, 06.07.2006, E. Cabi 1514. **B8 Erzurum:** Aşkale to Bayburt, 60 km to Bayburt, calcerous slopes of hills, near Pırnakapan Village, 1642m, 39°57.755'N 40°34.439'E, 31 July 2008, E. Cabi 3751 **Erzurum:** Pasinler to Erzurum, East side of Nenehatun village, 39°56.888'N 41°23.344'E, 1908 m, near the road and step, 4 Jul 2006, E. Cabi 1465 **Erzurum**:Pasinler to Erzurum, about 2 km before the turning of the Erzurum road, about Nene Hatun Village, 1908-1915m, 39°56.888'N 41°23.344'E, 4 July 2006, E.Cabi 1464 **Bingöl**: Bingöl to Karlıova, 6 km after Sudurağı village, 1756-1761 m, 39°09.375' N 40°53.862' E, E. Cabi 1409 (with var. *intermedium*) **Bingöl:** Tunceli to Bingöl, 15 km to Bingöl, 2 km to Çevrimpınar Village, 1327m, 38°55.782'N 40°22.325'E, 3 July

2006, E.Cabi 1399 **Bingöl:** Bingöl'den Karlıova'ya , 6 km from Sudurağı Village, 1756-1761m, 39°09.371'N 40°53.862'E, 3 July 2006, E.Cabi 1410 **Muş**; 6 km S. of Varto, 1600 m, D. 46317! Varto, Goschkar, 1830 m, Kotschy 1859:356 (syntype of *A. aucheri*). **B9 Van:** Erek Mountain, near the enterance of Yedi Kilise village, Yukarı Bakraçlı, 2165m, 38°27.020'N 43°25.981' E, 29 July 2008, E.Cabi 3738 **Van:**30 km to Erciş road side,step, 1938 m, 39°08.381'N 43°06.564'E, 28 July 2008, E.Cabi 3728 **Van:** Adilcevaz, Yıldız Village, 1999m, 38°50.789' N 42°49.582'E, 4 July 2006, E.Cabi 1442 **Erzurum:** Horasan to Eleşkirt, rocky mountain slopes, after 16km from Horasan, 1690m, 39°57.384' N 42°17.108'E, 28 July 2008, E.Cabi 3722 **Erzurum:** After entering the city calcerous slopes on left, about Daragut Village, 36 km to Karayazı, Tutak to Erzurum, 1723m, 39°34.731' N 42°28.798'E,4 July 2006, E.Cabi 1449 **Bitlis**: Süphan Mount., 2895 m, D. 24634! **B10 Kars**: mt. Ararat (Ağrı Mount.), S. ascent, 2500 m, Allen 57! **C2 Antalya**: Avlan G., vi-vii 1970, Quezel. **C5 İçel**: Gülek Boğaz 10 km N. of Tarsus, Bal. 1855:756 (syn-type of *A. aucheri*)\ **C8 Mardin**: Mardin, G. Post 40. **C10 Hakkari**: Samdi Mount., 2130 m, Rix 207!

External Distribution: C. Europe, Mediterranean area, S. Russia, Caucasia, Iraq, Iran, Afghanistan, C. Asia, W. Pakistan.

Figure 70. Spike of *Thinopyrum iintermedium* var. *barbulatum* in close view

subsp. ***pulcherrimum*** (Grossh.) Cabi&Doğan comb nov.

Syn: *Agropyron pulcherrimum* Grossh. in Monit. Jard. Bot. Tiflis 13-14:42, t. 4 f. 1-5 (1919); *A. intermedium* (Host) P. Beauv. var. *ambigens* Hausskn. ex Hal., Consp. Fl. Graec. 3:437 (1904)! *A. ambigens* (Hausskn. ex Hal.) Roshev., Fl. Turkm. 1:191 (1932)! *Elytrigia pulcherrima* (Grossh.) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.) 17:61 (1934); *Elytrigia intermedia* (Host) Nevski subsp. *pulcherrima* (Grossh.) Nevski subsp. *pulcherrima* (Grossh.) Tzelev in Novit. Syst. Pl. Vasc. (Leningrad) 10:31 (1973). Map 40. Fl. 6-8. *Steppe, scrub, stony slopes, c. 2285 m.*

Type: [TURKEY] A9 Kars, d. Ardahan prope Güljabert, in locis stepposis, 25 viii 1914, A. Grossheim (holo. TBI, iso. LE!).

East Anatolia; **A8 Erzurum:** Oltu'ya 10 km kala, Dualar köyü yakınları, 1541m, 40°29.269'N 41°55.956'E, 5 07 2006, E.Cabi 1502. **B6 Sivas:** Sivas-Erzincan road, 10 km to Beğendi Village, 1537m, 39°52.307'N 37°57.573'E, 25 July 2008, E.Cabi 3674 **Sivas:** Zara to Divriği, 25 km before Divriği, gypsum area, 1441m, E. Cabi 1564. **Sivas:** Kangal to Kırkgöz Village, after Kızbeli Pass, about 500-600 metres after, 1516-1575m, 39°23.628'N 37°40.662'E, 1 July 2006, E.Cabi 1331. **B7 Erzincan:** Spikör mount, 1 km before Kolçekmezdağı pass, 39°49.080'N 39°31.057'E, 2099 m, 07 Jul 2007, E. Cabi 2472 **Erzincan:** Refaiye to Erzincan, near Sakalsultan Pass, gypsum rocks, slopes, 1932 m, 39°52'19.1"N 39°04'57.8"E, 7 July 2007, E.Cabi 2465 **B8 Erzurum:** Aşkale, 1662 m, 39°55'10.1"N 40°40'56.3"E, 7 Jul 2007, E.Cabi 2491 **B9 Van:** Erek Mountain, exit of Yedi Kilise village, 2178 m, 38°26.946'N 43°28.029' E, 29 Jul 2008**,** E Cabi 3737 **Van:** Van to Erciş, exit of Erciş, Çakırbey to İşbaşı village, slopes, 1815 m, 39°09.429' N 43°21.622' E, 30 Jul 2008, E.Cabi 3756 **Van:** Adilcevaz, Yıldız Village, 1999m, 38°50.789' N 42°49.582'E, 4 July 2006, E.Cabi 1442 Van: Erek Mount., 2285m, D. 22899! **Erzurum:** 17 km from Horasan to Ağrı, calcerous soil slopes, 1715m, 39°42'03.7"N 42°17'21.8"E, 8 July 2007, E.Cabi 2497.

External Distribution: C. Europe, Balkans, Caucasia, Turkestan, N. Iran.

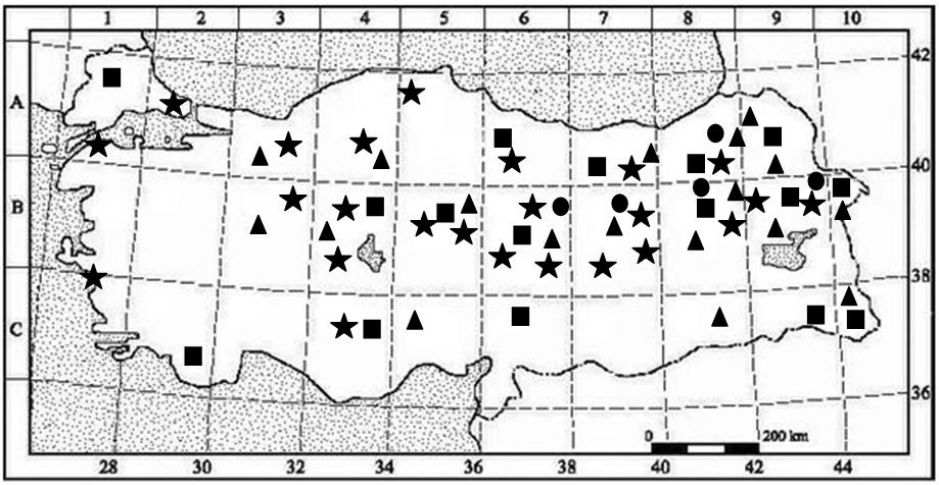

Figure 71. Distribution of *Thinopyrum intermedium* in Turkey

Legend. (★)subsp. *intermedium* var. *intermedium* ,(■) subsp *intermedium* var. *podperae*,(▲) subsp. *intermedium* var. *barbulatum*, (●)subsp. *pulcherrimum*.

3.4.3.8. *Thinopyrom farctum* (Viv) Cabi&Dogan comb. nov.

Basionym: *Triticum farctum* Viv. Annals of Botany 1(2): 159. 1804.

Syn: *Agropyron farcatum* (Viv.) Rothm. Feddes Repertorium 53: 271. 1943; *Agropyron farctum* (Viv.) Rothm. Feddes Repertorium 52: 271. 1943. *Elytrigia farcta* (Viv.) Holub Folia Geobotanica et Phytotaxonomica 8(2): 171. 1973. *Elymus farctus* (Viv.) Runemark ex Melderis in Bot. J. Linn. Soc. 76:382 (1978).

Rhizomatous perennial. Stems 30-60 cm, rigid, glabrous. Leaves 2-5 mm broad, ± convolute of flat with inrolled margins, rigid, glaucous-green, densely and minutely pubescent on ribs of upper surface, glabrous beneath; auricles absent. Spike 15-25 cm; rachis fragile, glabrous on main angles. Glumes 10-18 mm, narrowly lanceolate or oblong, 5-12-veined, keeled, glabrous, obtuse. Lemma 10-18 mm, glabrous, obtuse. Anthers 4-10 mm.

Flowering and Habitat: June-August. Maritime sands, nr s.l.

1. Rhizomes usually long-creeping; palea ciliate nearly throughout whole length of keels ……...…….subsp. ***farctum***

2. Leaf sheaths glabrous; glumes 6-12-veined; lower floret usually 12-18 mm ……..…..……..var. ***farctum***

2. Leaf sheats densely and minutely pubescent; glumes c. 5-veined; lower floret usually 10-12 mm ……..…….var. ***sartorii***

1. Rhizomes few, shortly creeping, forming tufts, or absent; palea ciliate only in upper half of keel.

3. Rhizomes absent; culms and vegetative shoots usually conspicuously swollen at base; ligule short (c. 0.5 mm); spikes 2-10 cm; rachis internodes usually shorter than lower spikelets; glumes 5-12 mm, 4-5-veined…...…….subsp. ***rechingeri***

3. Rhizomes shortly creeping or absent; culms and vegetative shoots usually not swollen at base; ligule to 2.5 mm; rachis internodes usually longer than lower spikelets……...……..……..subsp. ***bessarabicum***

4. Ligule usually 2-2.5 mm; rachis internodes considerably longer than lower spikelets; glumes 15-20 mm, 7-12-veined…….var. ***bessarabicum***

4. Ligule 0.5-1 mm; rachis internodes as long as or slightly longer than lower spikelets; glumes 7-12 mm, 3-5-veined ……..var. ***striatulus***

subsp. ***farctum*** var. ***farctum.***

Syn: *Triticum farctum* Viv. in Ann. Bot. (Genoa) 1(2):159 (1804) & Fl. Ital. Fragm. 1:28, t. 26 f. 1(1808)! *T. junceum* L., Cent. Pl. 1:6 (1755) p.p. non *Elymus junceus* Fischer (1806); *Agropyron junceum* (L.) P. Beauv., Ess. Agrost. 102 & 146 (1812); *A. junceum* (L.) P.

Beauv. subsp. *mediterraneum* Simonet & Guiochet in Bull. Soc. Bot. Fr. 85:176 (1938); *Elytrigia juncea* (L.) Nevski in Acta Inst. Bot. Acad. Sci. URSS ser. 1, 2:83 (1936) subsp. *juncea*.

Mainly N.W. Turkey, **Islands.** **A1(E) Çanakkale**: Dardanelles, Forsskal. **A2(E)** Istanbul: Makrikeuy (Makriköy, Bakirköy), 27 vi 1890, Azn.! **A2(E) İstanbul:** Silivri, İSKİ social facility establishment, sandy soils, 0 m, 41°04.128'N 28°08.468'E, 04 06 2008 E. Cabi 3202. **İstanbul:** Silivri to Marmara Ereğlisi, Gümüşyaka beach, sea level, 0 m, 41° 02.827'N 28° 03.180'E, 4 06 2008 E. Cabi 3206. **İstanbul:** Silivri exit, around seaside places, Basın Konut 1 site, 6m**,** 41°03.377'N 28°05.516' E, 30.05.2006 E. Cabi 813, G. Akaydın & E. Karabacak. **C3 Antalya:** Manavgat to Alanya, around Alara river, 0 m, 18.07.2008, E. Cabi 3600.

External Distribution: Coasts of Mediterranean Sea. **Medit. element**

Figure 72. Habit of *T. farctum* subsp. *farctum* var. *farctum* and its spike in close view

var. **sartorii** (Boiss. & Heldr.) Melderis in Notes R.B.G. Edinb. 42:78 (1984).

Syn: *agropyron junceum* (L.) P. Beauv. var. *sartorii* Boiss. & Heldr. in Boiss., Diagn. ser. 2 (4):142 (1859)! Map 41.

Syntypes: [Greece] in insula Teno, Sortor (G); in littoribus Atticae ad Phalerum, Spruner, Heldreich (G, K!); [Crete] in maritimis Cretae ad Kissamos, Heldreich (G, K!).

Islands: Kos, Kephalos, Rech. 8059! Rodhos, 19 vi 1870, Bourgeau!

External Distribution: Coasts of Portugal, Gibraltar, Spain, Balearic Isl., Sardinia, Italy, Greece, Aegean, Crete, Egypt. **Medit. element**.

Figure 73**.** Type of *Thinopyrum farctum* subsp. *farctum* var. *sartorii*

subsp. ***bessarabicum*** (Savul & Rayss) Cabi&Dogan stat. nova.

Basionym: *Agropyron bessarabicum* Săvul. & Rayss in Bulletine de la Section Scientifique de l'Academie Roumaine 8(10): 282, pl., test f.. 1923.

Syn: *Elymus farctus* subsp. *bessarabicus* (Săvul. & Rayss) Melderis in Bot. J. Linn. Soc. 76:383 (1978). *Elytrigia juncea* (L.) Nevski subsp. *bessarabica* (Savul & Rayss) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 10:32 (1973). Ic: Savul & Rayss, op. cit. 284, f. 1 (1923). Map 41. 2n=14.

var. ***bessarabicum***

Type: [USSR, Moldovia] in arenosis maritimis ad Pontum in Bessarabia prope "Zolocari" et "Jebriani" (Zhebriyany), distr. Ismail, 19 vi 1922, Savulescu & Rayss (holo. BUCA?).

Turkey-in-Europe, **N., W. & S. Anatolia**. **A2(E)** Istanbul: Yaleköy, A. Baytop (ISTE 11627)! **A6** Samsun: Samsun, Krause, 16 vi 1965, Sorger 65-7-1! **C5 İçel**: 27 km E. Of Silifke, Sorger 73-8-10! **A5 Sinop:** Akliman dune, sands, 1 m, 42° 01.346'N 35° 04.512'E, 15 06 2007 E. Cabi 2387**. B1 İzmir:** Dikili, soily beaches , 0 m, 39°05.011'N 26°53.106'E, 2 06 2008, E. Cabi 3149. **İzmir:** Kabalak to Çeşmealtı, beachside, 5 m, 38°21.327' N 26°47.825'E E. Cabi 3136**. İzmir:** Seferihisar, Gümüldür beachside, G. Akaydın 7831 **C1 İzmir:** Kuşadası to Çeşme, 45 km before Seferihisar, 9 m, 37°59.219'N 27°09.122'E 1 06 2008 E. Cabi 3135 **Aydın:** Didim Bozbükü, behind Yar-Sav cooperative houses, 17 Jul 2008 E. Cabi 3589**.**

External Distribution. Coasts of Black Sea, Azovskoye More (Sea of Azov), Aegean and N.E. Mediterranean Seas.

var. ***striatulus*** (Runemark) Melderis in Notes. R.B.G. Edinb. 42:82 (1984). Syn: *Agropyron elongatum* (Host) P. Beauv. var. *aegea* Rech. fil.in Bot. Jahrb. 69:544 (1939)! *Elymus striatulus* Runemark in Bot. Not. 125:419, t. 1(1972). Map 41. 2n=28.

Type: [Greece] Graecia, Cyclades, Mikonos, [the bay E. of Ormos Ornos, 18 vi] 1960, Runemark & Nordenstam 16157 (holo. LD).

Thrace. A1(E) Edirne: Enez, Coode & Jones 2893! **Edirne:** Enez beach, 40°41.397'N 26°03.519'E, 3 06 2008 E. Cabi 3193

External Distribution: Coasts of Greece (Thrace, Macedonia), Cyclades, Crete. E. **Medit. element**.

subsp. ***rechingeri*** (Runemark) Melderis in Bot. J. Linn. Soc. 76:383 (1978). Syn: *Agropyron rechingeri* Runemark apud Rech. fil. İn Bot. Jahrb. 80:442 (1961); *Elymus rechingeri* (Runemark) Runemark in Hereditas 48:548, f. 2 & 3 (1962). Map 41. 2n=28.

Type: [Greece] Cycladum insula Naxos, [25 km N. Of Mitria, in littoral schistose rocks, 18 v 1957], Runemark (holo. LD).

W. Anatolia, Islands. **A1(A) Çanakkale:** Denizkent, shore of Sea of Marmara, Kurtto 3191! Is: Psara, Runem. 3630; Khios, Runem. 3626; Samos, Runem. 3625; Fournoi, Rech. 4555! Nisiros, Papatsou 14(!).**Çanakkale:** Eceabad, 36 km to Gelibolu, near Atatürk house, 5 m, 40°12.056'N 26° 53.872'E, 3 06 2008 E. Cabi 3160 **Çanakkale:** Gelibolu to Kavak delta, sea level, 0 m, 40° 37.002'N 26° 49.968'E, 3 06 2008 E. Cabi 3168.

External Distribution: Coasts of Greece, Cyclades, Crete, N.W. Egypt. **E. Medit. element.**

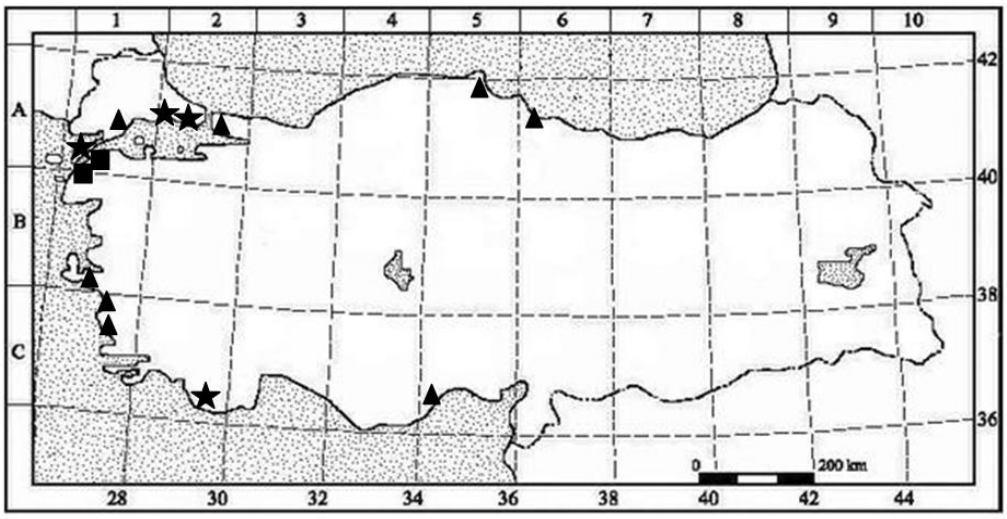

Figure 74. Distribution of *Thinopyrum farctum* in Turkey

Legend. *Thinopyrum farctum* (★) subsp. *farctum* var. *farctum*, (▲)subsp. *bessarabicum* var. *bessarabicum*, (■) subsp. *bessarabicum* var. *striatulus*.

3.4.4. *Pseudoroegneria* (Nevski) Á. Löve

The limits of *Pseudoroegneria* are not well established, whether it is treated as a genus, as here, or included in *Elytrigia* (Tsvelev 1976) or *Elymus* (Melderis 1980).

PSEUDOROEGNERIA (Nevski) Á. Löve Taxon 29(1): 168. 1980

Type species: *Pseudoroegneria strigosa* (M. Bieb.) Á. Löve. - *Taxon* 29(1): 168.980.

Basionym: *Elytrigia* sect. *Pseudoroegneria* Nevski Trudy Sredne-Aziatskogo Gosudarstvennogo Universiteta. Seriya 8b, Botanika 17: 60. 1934.

Plants perennial, densely caespitose. Culms usually erect. Leaf blades flat or involute. Spike rather lax; rachis tough, glabrous or margins scabrous. Spikelets 1 per node with 3-6 florets; rachilla glabrous. Glumes subequal, lanceolate or narrowly obovate, obtuse to acute acuminate-subulate at apex, 3-5 (7) veined. Lemma lanceolate, acute to acuminate with or without awn , usually 5 veined glabrous to strigillose. Callus usually obscure. Palea shorter or nearly as long as lemma, sparsely and minutely ciliate on keels. Caryopsis adherent to palea and lemma. Haploid genome **St**

1. Glumes lanceolate, narrowly lanceolate, acute or acuminate subulate

  2. Glumes lanceolate, 3-5 veined, acute ……..……. 1**. *P. libanotica***

  2. Glumes narrowly lanceolate , 3 veined, acuminate subulate……...…2. ***P. sosnovskyi***

1. Glumes narrowly ovate, narrowly obovate or oblong, subobtuse to obtuse

  3. Stem, leaf sheaths and lower surface of leaves glabrous; rachis glabrous or nearly so on main angles; lemma sometimes shortly awned; palea minutely ciliate on keels near apex ……..…….3..***P. tauri***

  3. Stem, leaf sheats and lower surface of leaves densely and minutely pubescent; rachis scabridulous on main angles; glumes sometimes narrowly obovate; lemma always unawned; palea ciliate on almost whole length of keels ……...…….4. ***P. koshaninii***

3.4.4.1. *Pseudoroegneria libanotica* (Hack.) D.R. Dewey Gene Manipulation in Plant Improvement 272. 1984.

Basionym: *Agropyron libanoticum* Hack. Allegmeine Botanische Zeitschrift für Systematik, Floristik, Pflanzengeographie 10: 21. 1904.

Syn. *Elymus libanoticus* (Hack.) Melderis Botanical Journal of the Linnean Society 76(4): 377. 1978; *Elytrigia libanotica* (Hack.) Holub Folia Geobotanica et Phytotaxonomica 12(4): 426. 1977. *Pseudoroegneria tauri* subsp. *libanotica* (Hack.) Á. Löve Feddes Repertorium 95(7-8): 445. 1984.

Caespitose perennial with rhizomes up to 10 cm long. Culms with 1-2 prunose nodes, up to 55 cm, slender, glabrous. Leaves 8-15 X 1-2 mm, usually convolute, rigid, glaucescent sometimes basal ones flat, shortly and densely pubescent or puberulent on upper surface, glabrous or strigillose beneath; sheats often slightly shortly pubescent on surface. Auricles falcate. Spike short 5-10 cm with 4-7 spikelets, linear; rachis ± shortly spinulose-ciliate on angles, rachis internodes 12-14 mm long in the middle of spike. Spikelets 12-20 mm, with 4-7 florets. Glumes persistent 8-12 mm, subequal, with rather broad hyaline margin up to 0,5mm broad, lanceolate, 3-5-veined, glabrous, acute to acuminate; lower glume usually 3/4 or nearly as long as lower floret, upper one scabrid on veins towards apex. Lemma 7-13 mm, prominently 3 veined in upper part, smooth on back, lanceolate, glabrous, rarely minutely strigillose along margins and towards apex, smooth on back, unawned, emarginated mucronate or bidentate. Palea distinctly shorter than lemmas. Palea distinctly shorter than lemma, sparsely and minutely ciliate on keels in upper half. Genome **St, 2n=2x=14 (**Assadi 1995).

Flowering and Habitat: June-July Dry igneous mountain slopes, limestone ravines, 1600-2800 m.

Type: [Lebanon] in declivibus montes Djebel Sannin, Hartman 16 (holo. W! iso. S!).

S. & S.E. Anatolia. **C4 İçel**: Sara, nr Ermenek, Péronin 212 (with *E. tauri*)! **İçel:** near Ermenek, limestone slopes, 1304 m, 36°37.697' N 32°54.643' E, 18.07.2008, E.Cabi 3602. Kuşuçuran mevkii, 1358 m, 36°32.871' N 32°20.835' E, 18.07.2008, E.Cabi 3601**.** Ermenek to Balkusan c. 5-7 km, 1655 m, calcerous rocks, 15.06.2006, E. Cabi 1142. **C5 Içel**: Bolkar M., 2400 m, vi-vii 1970, Contandr. et. al.! Adana: E. of Gülek Boğaz, 2000 m, Sorger 62-71-19! **Niğde**: Kızıl Tepe, 2800 m, Siehe 1896:615 (with *E. tauri*)! **Niğde:** Çamardı, Emli Boğazı, Sarı Mehmetler mevkii, Çukurbağ köyü üzeri, 14.06.2006, E.Cabi 1047. **C10 Hakkari**: nr junction of Van-Hakkari/Yüksekova roads, ravine in Zab gorge, 1700 m, D. 44707! Nehil Çayi, 48-55 km from Hakkari to Yüksekova, 1600-1700 m, D. 44899!

External Distribution: Iran, N.Iraq, Lebanon, **Ir.-Tur. element**. Threat Category: **LC**

Figure 75. Type photo of *Pseudoroegneria libanotica* (BM!)

Notes on the taxon: Closely related to *E. tauri,* differing mainly in the 3-5-veined, acute to acuminate glumes, the lower usually 3/4 as long as the lower floret (in *E. tauri* usually 5-veined, subobtuse, the lower 1/2- 2/3 the length of the lower floret); rachis usually sparsely

spinulose-ciliate (not glabrous and smooth); and palea as long as the lemma, sparsely and minutely spinulose-ciliate on keels at least in the upper half (in *E tauri* the palea is distinctly shorter than the lemma, and minutely ciliate near the apex). E. Anatolian specimens closely match *E. libanoticus* from Lebanon, while S. Anatolian material, collected together with *E. tauri,* approaches the latter more closely in the length of the lower glume in relation to the lower floret. Péronin 212 has lemmas minutely setulose along the margins and towards the apex, glabrous on the back, while in the other gatherings cited they are glabrous and smooth.

3.4.4.2. *Pseudoroegneria sosnovskyi* (Hack.) Á. Löve Feddes Repertorium 95(7-8): 445. 1984.

Basionym: *Agropyron sosnovskyi* Hack. Věstnik Tiflisskago Botanicheskago Sada 29: 26. 1913.

Syn. *Elymus sosnowskyi* (Hack.) Melderis Notes from the Royal Botanic Garden, Edinburgh 42(1): 80. 1984. *Elytrigia sosnovskyi* (Hack.) Nevski Trudy Botanicheskogo Instituta Akademii Nauk S S S R. Ser. 1, Flora i Sistematika Vysshikh Rastenii. Moscow & Leningrad 2: 82. 1936.

Syntype: Turkey **A8 Erzurum:** in Prov. Kars. Distr. Olty (Oltu), in collibus siccis ad Bora-Chane, 29.v.1912, *D.Sosnowsky* 11 (BM!, TBI, W!); Turkey **A9 Erzurum:** in Prov. Kars. Distr., et in rupestribus Olty (Oltu), *D.Sosnowsky* 17 (W!).

Perennial caespitose herbs. Culms slender, 35-70 cm long, glabrous, slightly papillose, glaucous at nodes, generally 2 nodes on the culm. Leaf blades flat, or convolute, 6-12 cm long and 1.5-2 mm wide, stiff, glaucous, puberulous on upper surface of leaf blades, lower surface and sheaths glabrous, leaf blade apex attenuate. Inflorescence interrupted spike, single, bilateral, 10-15 cm long, bearing 9-16 fertile spikelets on each spike, rachis flattened, scabrous on margins, and minutely spinulose ciliate on angles. Spikelets packing broadside to rachis, lax. Spikelets solitary. Fertile spikelets sessile. Spikelets comprising 3-4 fertile florets with diminished florets at apex. Spikelets lanceolate, slightly compressed laterally, 10-12 mm long, breaking up at maturity, disarticulating below each fertile floret. Glumes persistent, similar, shorter than spikelet; lower glume narrowly lanceolate, 4-5 mm long, coriaceous, without keels, 3-veined, acute at apex; upper glume narrowly lanceolate, 4.5-6 mm long, coriaceous, without keels, 3-4-veined, acute to acuminate at apex. Fertile lemma elliptic, 8-9 mm long, coriaceous, keeled above, 5-veined, attenuate at apex, mucronate, mucro 0.5-1 mm; palea nearly as long as lemma, sparsely and minutely ciliate on keels in upper half; apical sterile florets resembling fertile, though underdeveloped; lodicules 2, elliptic, membranous. Anthers 3, 3.5-4 mm long. Ovary pubescent on apex. Caryopsis with adherent pericarp. Genome: **Not designated**. Chromosome: **Not known**.

Phenology, Habitat and ecology: Flowering occurs in May to June and fruiting from June to July. *Elymus sosnowskyi* grows on dry mountain slopes, in red soils, and on rocks. Its altitudinal range varies between 1400 and 1690 m

East Anatolia. A8 Erzurum: Oltu, Çamlıdere (Borahan), 40°31.037' N, 41° 59.603' E, 1401 m, slopes, 22.vi.2008, E.Cabi 3485 [topotype]; **A8 Erzurum:** Narman to Pasinler, Fairy chimneys place, 40°18.050' N, 41°52.608' E, 1608 m, red soil slopes, 22.06.2008, E.Cabi 3496; **A9 Kars:** Kuyucuk G., N.W. of Başgedikler railway station, 1800 m, F.Sorger 81-49-11!

Endemic. It was previously known only from 3 localities in north-eastern Turkey (Figure 3). The area in which *P. sosnovskyi* was discovered is in the **Irano-Turanian** phytogeographical region. *P. sosnovskyi* is closely related to *E. libanoticus,* from which it may be distinguished by its narrowly lanceolate, acuminate-subulate, 3-veined glumes.

Figure 76. Spike of *Pseudoroeneria sosnovskyi* and its native habitat

3.4.4.3. *Pseudoroegneria tauri* (Boiss. & Bal.) A. Löve Feddes Repertorium 95(7-8): 445. 1984..

Syn: *Elymus tauri* (Boiss. & Balansa) Melderis Notes from the Royal Botanic Garden, Edinburgh 42(1): 81. 1984. *Agropyron tauri* Boiss. & Bal. in Bull. Soc. Bot. Fr. 4:307

(1857)! *Elytrigia tauri* (Boiss. & Bal.) Tzylev in Novit. Syst. Pl. Vasc. (Leningrad) 10:30 (1973)! Map 37.

Caespitose perennial with short rhizomes. Stems 35-55 cm, slender, glabrous. Leaves 6-15 cm long x 2-3 mm broad when expanded, convolute or involute, shortly pubescent or setulose on upper surface, glabrous beneath. Spike 3-8 cm, lax, with 4-7 spikelets, slightly flexuous; rachis usually glabrous on main angles, rachis internodes 8-11 mm at the middle of spike. Spikelets 10-12 mm with 4-6 florets. Glumes 5-10.5 mm, unequal, with rather broad hyaline margins (0,3-0,5 mm broad), 5(-7)-veined, subobtuse to obtuse, lower 1/2-2/3 as long as lower floret. Lemma 8-9 mm, glabrous, usually subacute to subtruncate or emarginated at apex. Palea shorter than lemma, minutely ciliate near apex. Anther c. 4-4.5 mm. Genome **StP or St, 2n=2x=14 or 4x=28 (**Wang et al 1986; Yen et al 2005; Zhang et al 2009)

Flowering and Habitat. June-July. Rocky slopes, mountain pastures, 950-2800 m.

Type: [Turkey] C5 Içel région alpine et sous-alpine du Taurus, prés du défilé des Portes Ciliciennes (Gülek Boğaz), 1700 m, [11 vi 1855], Balansa 826 (holo. G! iso. BM! E! K!).

Mainly S. Anatolia. **A5 Kastamonu**. d. Tossia (Tosya), Sint. 1892:4666! **C2 Muğla:** Çal Mount., 35 km N. of Fethiye, Lambert & Thorp 585! **C3 Antalya**: Teke Mount., 2000 m, vi-vii 1970, Contandr. et al.! **B7 Erzincan**, İliç to Kemaliye, İliç'ten sonra 2 km yol kenarı, 937 m, 39°32.442' N 038°34.069' E, 25 07 2008 E. Cabi 3689. **C4 Karaman**: Ermenek to Balkusan about 5-6 km, 1655 m, calcerous rocks field side, 36°40 694' N 32°56.000' E, 15 06 2006 E. Cabi 1142. **Karaman**: Ermenek to Karaman 100 km to Karaman (çeşme başı) 1476 m, 36°43.127' N 32°55.904' E 18 07 2006 E. Cabi 3608. **Karaman**: Anamur side, the entrance of Ermenek , calcerous rocks, road sidesı,1279 m, 36°37.151' N 32°55.333' E, 15 06 2007 E. Cabi 1133. **Karaman**: Ermenek, on the way to Ermenek , Balkusan road, km from Ermenek, 1491 m, 36°38.199' N 32°55.510' E, 15.06.2006, E. Cabi 1137. **C5 Niğde**: Çamardı, Çukurbağ Village to Emli Boğazı around and opposite of Sıyırma Yaylası Parmak Kayası 2300-2600m 14 06 2006 E.Cabi 1057.

Figure 77. Type photo of *Pseudoroegneria tauri*

3.4.4.4. *Pseudoroegneria kosaninii* (Nábělek) Á. Löve. Feddes Repertorium 95(7-8): 445. 1984.

Syn. *Agropyron koshaninii* Nab. in Publ. Fac. Sci. Univ. Masaryk Brno 111:25, t. 2 f. 8/4-7 (1929)! *Triticum kosaninii* Nab., loc. cit. (1929) pro syn.! *T. intermedium* Host subsp. *koshaninii* Nab., op. cit. 26 (1936) pro syn.! *A. intermedium* (Host) P. Beauv. subsp. *koshaninii* Nab. op. cit. 26(1929) pro syn.! Map 37!. *Elymus koshaninii* (Nab.) Melderis in Notes R.B.G. Edinb. 42:79 (1984).

Caespitose, very glaucous perennial with short rhizomes. Stems, leaves and sheats densely and minutely pubescent. Stems 35-40 cm, erect, slender. Leaves 2-4 mm broad when expanded, convolute; sheats minutely to shortly ciliate on margins (cilia very similar to indumentum on surface of sheats). Spike 5-12 cm, slender, lax. Spikelets with 5-8 florets. Glumes 5-9 mm, unequal, narrowly obovate, obtuse to subobtuse, with broad hyaline margin, usually 4-5-veined, with slightly scabrid veins. Lemma 8-9 mm, subacute, glabrous, unawned. **Haploid Genome: Not designated, 2n=8x=56** (Yu et al., 2009)

Flowering and Habitat. June-August. Calcerous rocks, 1500-2400 m.

Type: [TURKEY] C9 Siirt Kurdist. Turc. distr. Ramoran: mons Halakur-Dar ad septentr. ab oppido Geziret-ibn-Omar(Cizre), in fissuris rupium calcar, 2400m, 25 vii 1910, Nabelek 3336 (holo. BRA).

S. & S.E. Anatolia; disjunct. **C4 İçel**: Ermenek, 1500m, vi-vii 1970, Quezael. Çamardı, Çukurağ village 1500 m., 09.06.2000, Savran ve Bağcı 556. **Konya:** Ermenek, Tekeçatı ağaçlandırma alanı, c. 1450 m, M. Vural 1082!.

External Distribution. Iran, Iraq. **Ir.-Tur. element**.

Melderis (1985) stated that this species is closely allied to *Pseudoroegneria tauri* Syn. *Elymus tauri,* differing mainly in the densely and minutely pubescent stems, leaves and sheats. In addition, its leaves are more conspicuously veined on the upper surface, and the sheats minutely to shortly ciliate on the margins. Assadi (1996) recognized this species under *P. tauri* as a variety .

Figure 78. Herbarium photo of *Pseudoroegneria kosaninii*

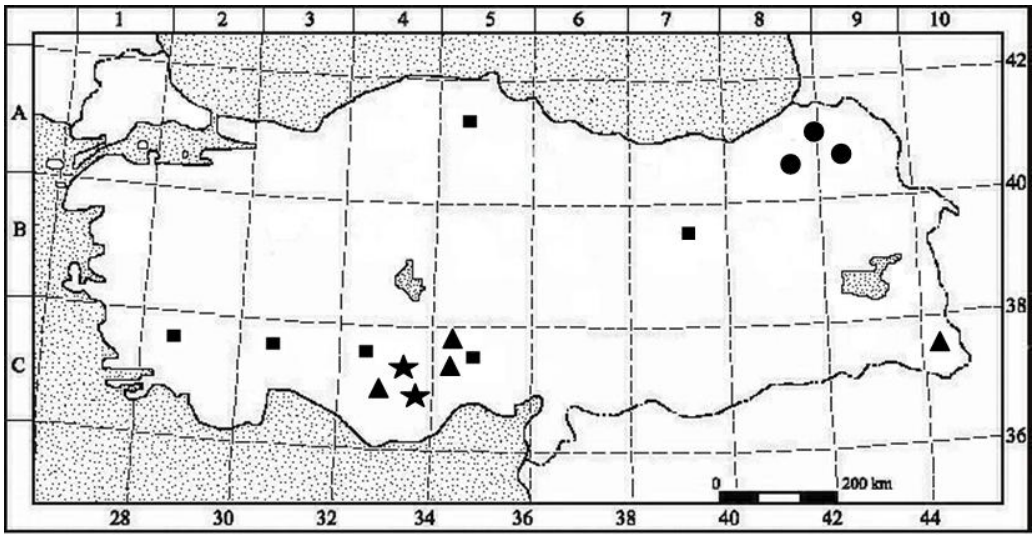

Figure 79. Distribution of *Pseudoroegneria. libanotica, P. sosnovskyi, P. tauri* and *P. kosaninii* in Turkey.

Legend. (▲) *Pseudoroegneria. libanotica,* (●) *P. sosnovskyi,* (■) *P. tauri* (★) *P. kosaninii.*

3.4.5. *Eremopyrum* (Ledeb.) Jaub & Spach

As a part of this thesis the most recent revisional study on the genus was accomplished by Cabi and Doğan (2010). In contrast to Frederiksen (1991), our results indicated clear differences among the subgroups found in *Eremopyrum bonaepartis* complex. In Turkey, I recognized 5 species including the *E. confusum* for the Flora of Turkey.

***Eremopyrum* (Ledeb.) Jaub. &Spach** Annales des Sciences Naturelles; Botanique, sér. 3 14: 360. 1851.

III.Pl. Or. 4: 26 (1851) p.p –*Triticum* L. sect. *Eremopyrum* Ledeb.,Fl. Alt. 1: 112 (1829) p.p. –*Agropyron* Gaertner sect. *pycnopyrum* K. Koch, Linnea 21: 425(1848) p.p. –Type: *E. orientale* (L.) Jaub. & Spach (lectotype, selected by Nevski, Trudy Bot. Inst. Akad. Nauk SSSR, ser. 1,2:63 (1936))

Annuals. Stem fasciculate or geniculate. Leaf blades linear acuminate, flat, becoming folded when dried; auriculate, auricles very small or inconspicuous. Inflorescence a dense terminal spike; rachis tough or fragile, with short internodes. Spikelets solitary, laterally compressed, alternately and distichously arranged at rachis nodes, widely divergent, with 2-6 florets, upper florets ± rudimentary. Glumes boat-shaped, coriaceous, becoming indurated at maturity, with prominent asymmetric keel, gradually tapering into a ± sharp point or more or less distinct awn, the edges of glume with broad hyaline margins. Lemma coriaceous, rounded on back, keeled above, 5 veined, unawned or awned with a more or less distinct awn. Palea 2 keeled with more or less conspicuously cleft between keels. Anthers yellow, 0.4-1.4 mm long. Caryopsis adherent to palea at maturity.

Key to the species and varieties of *Eremopyrum* recognized in this study

1. Rachis tough, not breaking off at maturity; spikes up to 1.7 cm ……**1. *E. triticeum***

1. Rachis fragile, breaking off at maturity; spikes longer than 1.5 cm.

2. Glumes strongly curved…….**3. *E. orientale***

2. Glumes not curved or slightly curved at maturity

3. Paleas with terminal two short awns (0.7-2 mm) with deep cleft between them …….**4. *E. distans***

3. Paleas with two very short teeth (up to 0.4 mm) with shallow or moderately cleft between them

4. Spikelets imbricate; glumes distinctly shorter than lemmas, there is gradual increase in the length of awn of lemma..……...**2. *E. bonaepartis***

5. Glumes and lowest lemma gradually tapering into a sharp point ……..…….**2a var. *sinaicum***

5. Glumes and lowest lemma have a distinct awn ……..…**2b var. *aristatum***

4. Spikelets spreading; glumes subequal or equaling to lemmas, awn of lemmas are subequal, there is not any gradual change…….……..…**5. *E.confusum***

6. Glumes and lemmas gradually tapering into a sharp point ……..…….**5a var. *sublanigunosum***

6. Glumes and lemmas distinctly awned

7. Spikelets glabrous ……...**5b var. *glabrum***

7. Spikelets covered densely with more or less long white hairs or with short rigid bristles…….…….**5c var. *confusum***

3.4.5.1. *Eremopyrum triticeum* (Gaertner) Nevski In Acta Univ. Asiae Med. ser. 8b (Bot.) 17:52 (1934).

Basionym: *Agropyron triticeum* Gaertn. Novi Commentarii Academiae Scientiarum Imperalis Petropolitanae 14(1): 539-540. 1770.

Syn. *Secale prostratum* Palas, Reise Abh. 1: 485 (1771); *Triticum prostatum* (Pallas) L. fil., Suppl. 114 (1781); *Agropyron prostatum* (Pallas) P. Beauv., Ess. Agrost. 102 & 146 (1812). Ic: Fl. URSS 2: t. 47a ("67a") f. 7 (1934); Sakamoto in Mem. Coll. Agr. Kyoto Univ. 114:9, f. 1i, j, 11 f. 3, i, j (1979).-Type: Pallas, in desertis caspiis (LINN 104,18 lectotype selected by Frederiksen (1991).

Stems 4-30 cm, geniculate at base, scabrid or retrorsely pilose towards spike. Leaf blades 1.4-5 x 0.15-0.4 cm, scabrid or shortly pilose above; sheaths partly covers the spike. Spike 0.9-1.7 cm, elliptic-ovate or nearly orbicular in outline. Spikelets 6-10 mm, usually with 3-4 florets; rachilla fragile, except lowermost. Glumes 4-6.5 mm, broadly lanceolate, prominently inflated at base, strongly curved, glabrous and subulate at apex. Lemma 5-7.5 mm with an awn up to 2 mm, keel prominent on upper half of lemma. Palea 3.5-4 mm with a low cleft at apex, slightly shorter than body of lemma. 2n=14.

Flowering and Habitat: May-June. Steppe, sandy arid places, **Alt.** 850-1715 m. This species grows sympatric with other *Eremopyrum* species such as *E. orientale*, *E. distans*. Described from the valley of the river Yaika (in the Ural Mts., URSS).

North and Inner Anatolia. **A7 Gümüşhane**:, Bourgeau. A9 Kars: ruins of Ani, 27 vi 1967, J.G. Ross **B2 Uşak**: Uşak, 915 m, Bal. 1857:1339 **B4 Konya**: Yavşan Memlehanesi nr Salt Lake 908 m E. Cabi 1706; Ankara: 15 km W. of Ankara, 900 m, Ehrend. 62-1/79-1. **B5 Yozgat**: Yozgat to Boğazlıyan, Kaşkışla village, 1682 m. E. Cabi 3274; **B7 Erzincan**: Egin (Kemaliye), Sint 2370!. **B8 Erzurum**: nr Erzurum, vi 1853, Huet (with *E. distans*)! **B9 Erzurum**: Horasan town centre, 1715 m E. Cabi 2492; Van: nr Van, Sakamoto (Kyoto Univ. Bot. Expend.); Van Canik Tuzlası 1750 m L. Behçet 4597!. **B10 Kars**: 27 km from Iğdır to Aralik (Aras valley), 880 m, D. 43654! **C3 Burdur**: Burdur, Heldr. **C4 Konya**: Küçük Köy, 980 m, Helbaek 2423!

External Distribution. S. E. Europe, Crimea, Caucasia, Iran, Central Asia, Siberia. **Ir.-Tur. element**

Figure 80. Habit of *Eremopyrum triticeum*

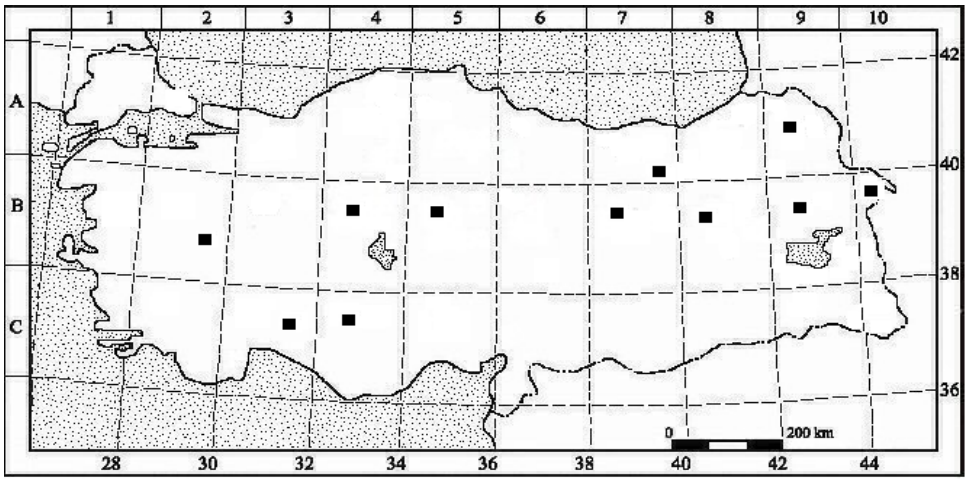

Figure 81. Distribution of *E. triticeum* in Turkey

3.4.5.2. *Eremopyrum bonaepartis* (Sprengel) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.) 17:52 (1934)

Syn: *Triticum bonaepartis* Sprengel, Erst. Nachtr. Bot. Gart. Halle 40 (1801); *T. squarrosum* Both, Neue Beitr. Bot. 128 (1802); *Eremopyrum squarrosum* (Roth) Jaub. & Spach, III. Pl. Or. 4: t. 320 f. 2 (1851); *Agropyron kotschyanum* Boiss. & Hohen. in Boiss., Diagn. ser. 1(13); 69 (1854)! *A. squarrosum* (Roth) Boiss., Fl. Or. 5:668 (1884). Ic: Fl. URSS 2: t. 47a ("67a") f. 8a-c (1934), as *E. Buonapartis*; Fl. Iraq 9:t. 78 f. 2 (1968), as var. *bonaepartis*; Sakamoto, op. cit. 9, f. 3a (1979). 2n=14. – Type: Schimper 157, Bastan ad radices montis Sinai, 1835 (P ex herb. Steudel., lectotype, selected by Frederiksen (1991), G, G-herb. Boissier, K, M, P, TUB paralectotypes

Stem 1.5-32.5 cm, geniculate at base, glabrous but scabrid below either spike and nodes, 2-3 noded. Leaf blades 2-10 x 0.2-0.4 cm, flat to folded, convolute when dried, scabrid above; uppermost sheath slightly inflated, partly enclose the spike. Spike 1.3-4 X 1.1-1.5 cm, oblong, elliptic to ovate with obtuse or truncate at apex. Spikelets 8.5-15 mm with 3-4 florets, the lower 2-3 florets fertile the upper one rudimentary; rachis fragile, rachilla tough. Glumes strongly keeled asymmetrically, more or less scabrid on keel, lanceolate, distinctly shorter than lemmas, obtuse or acuminate at apex. Lemma 8.5-15 mm (incl. awn), glabrous or scabrid, linear lanceolate, keeled rounded at the back, awn 0-6 mm sometimes the lowest lemmas with a mucro (c.0.5-1 mm) sparsely scabrid all over at the back, upper ones with an awn (2-6 mm but generally the lowest lemma has shorter awn than upper ones. Palea 4.5-5.5 mm, distinctly shorter than lemmas, apex with a short cleft, scabrid on keels.

var. ***sinaicum*** (Steudel) Cabi & Doğan *comb. nova*

Syn: *Triticum sinaicum* Steudel. Syn. Pl. Glum. 1: 346 (1855). – *Dasypyrum sinaicum* (Steudel) Candargy, Arch. Biol. Vég. Pure Appl. 1: 35, 62 (1901). – Type: Schimper 157, Bastan ad radices montis Sinai, 1835 (P ex herb. Steudel lectotype, selected by Frederiksen (1991), G, G-herb. Boissier, K, M, P, TUB paralectotypes.

Flowering and Habitat: April-June Salty dry steppes, slopes, roadsides, field margins. **Alt.** 454-1200 m. Grows with *Aegilops cylindrica* Host*, Ae. speltoides* Tausch*, Hordeum murinum* L.*, Leymus cappadocicus* (Boiss. & Balansa) Melderis, *E. orientale* and *E. confusum.*

Inner, South and East Anatolia. B3 Eskişehir: 29 km from Polatli to Sivrihisar, 800 m, Coode and Jones 2265 (with *E. confusum*)! **B4 Ankara**: Ankara to Kochisar, 12 km before Koçhisar, shore of Salt Lake 912 m. E. Cabi 3059; **Konya:** Cihanbeyli Tuz işletmesi içi, shore of Salt Lake 909 m. E. Cabi 2246 (with *E. orientale* and *E. confusum*) **B7 Malatya**: nr Gözene, 1970, Sakamoto (Kyoto Univ. Bot. Exped.). **B8 Erzurum**: Kassuklu valley between Bayburt and Erzurum, v 1853, Huet! **B10 Kars**: nr Aralık (Grossheim 1: map 312). **C3 Antalya**: 36 km from Elmali to Korkuteli, Alava 5257. **C5 Konya**: Ereğli to Ulukışla, 1200 m, It. Leyd. 1959:1014 (with *E. confusum*)! **C7 Urfa**: Ceylanpınar Agriculture facility Şeyh Nasr stream bed 454 m. E. Cabi 2241 Urfa: Urfa to Akçakale, 13 km from Urfa, 500 m, D. 28141! **C8 Mardin**: 10 km from Gercüş to Hasankeyf, 792 m. E. Cabi 2254 **Diyarbakır**: Diyarbakır, nr Kupri, Kotschy 1841:142.

External Distribution: N. Africa, Iran, Syria, Sinai. **Ir.-Tur.element**.

Figure 82. Spikes of *E. bonaepartis* var. *sinaicum*

var. ***aristatum*** Cabi & Doğan *var.nova* (Fig)

Var. *sinaicum* smilis, ab ea diversa: glumae ab infima lemmatum vel aristata

Type: [Turkey] B3 Ankara: 26 km from Polatlı to Sivrihisar 39° 33' 417" N 31° 47' 173" E 814 m Step, E. Cabi 339 (holotype: GAZI; isotypes ANK, E).

Flowering and Habitat: April-May. Step, roadsides, gypsium areas, 810-1140 m

Etymology The name derived from its aristate lowest lemma

Orta Anadolu B4 Konya:Kulu to Konya c. 7-8 km before Konya 39°01.149' N 33°01.744' road side, step, 1136 m E. Cabi 2243. **B6 Malatya**: 1 km from Darende to Malatya 38°30' 32" N 37° 31' 24" E 1011 m roadsides, gypsum fields AK1103.

Figure 83. Spikes of *E. bonaepartis* var. *aristatum*

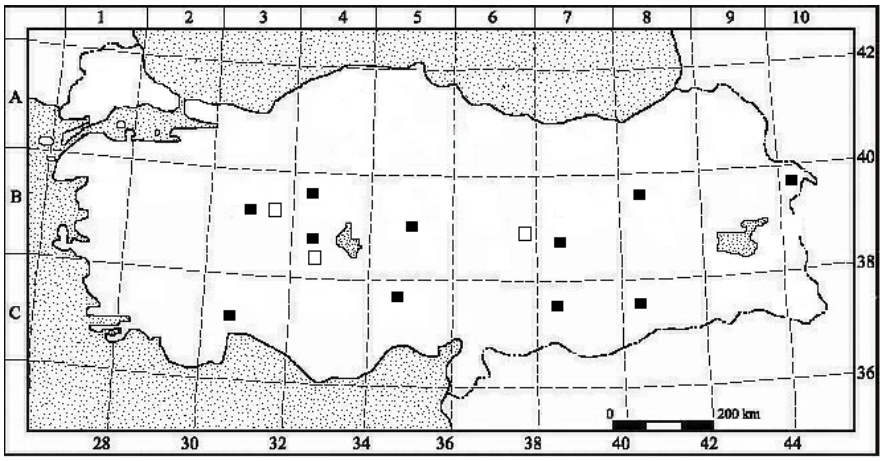

Figure 84. Distribution of *Eremopyrum bonaepartis* populations

Legend. *Eremopyrum bonaepartis* (□)var. *aristatum* and (■) var *sinaicum*

3.4.5.3. *Eremopyrum orientale* (L.) Jaub. & Spach, I11. Fl. Or. 4:26, t. 319 (1851). Syn: *Secale orientale* L., Sp. PL 84 (1753); *Agropyron orientale* (L.) Roemer & Schultes, Syst. Veg. 2:757 (1817); *A. bourgaei* Boiss., Fl. Or. 5:669 (1884)! Ic: Fl. URSS 2: t. 47a ("67a") f.

9 a-d (1934); F1. Iraq 9: t. 81 (1968); Sakamoto in Mem. Coll. Agr. Kyoto Univ. 114:9, f. lh, 11, f. 3h(1979).

Flowering and Habitat: Steppe, lake margins, canal banks, hill-sides, usually on clayey and muddy ground, 980-1825 m.

Stems 4-17 cm. Leaf blades 2-3 mm broad, ± scabrid on both surfaces, sometimes shortly pilose above. Spike to 2.5 cm, usually ovate-elliptic, long-exserted. Spikelets 10-15 mm, pilose, with 2-3 florets; rachilla tough. Glumes 5-6.5 mm (excl. awn), more or less covered by white long hairs, lanceolate, strongly curved, prominently veined, gradually tapering into a short awn 2-5 mm. Lemma as long as glumes, with prominent keel and short awn 2-4 mm. Keels of palea prolonged into 2 short teeth 0.4-0.6 mm, with deep cleft between them.

Described from islands of the Aegean Sea.

Central, North and East Anatolia. **A5 Amasya**: Merzifon to Kamışlı, A. Baytop (ISTE 9124)! **A7 Trabzon**/Erzurum: 'Armenia', Calvert & Zohrab (with *Agropyron cristatum* subsp. *incanum*)\ **A8 Erzurum**: W.of Ispir, 1400m, Barclay 784! **Gümüşhane:** Bayburt, Bourgeau (type of A. bourgaei)! **A9 Kars**: Kağizman (Grossheim 1: map 313). **B4 Ankara**: 12 km to Koçhisar nr Tuz G., 912 m. E. Cabi 3055; Konya: Cihanbeyli Tuz işletmesi içi, shore of Salt Lake 909 m. E. Cabi 2244a (with *E. bonaepartis* and *E. confusum*) Konya: Yavşan Memlehasi, nr Tuz G., D. 18697! **B5 Yozgat**: Yozgat to Boğazlıyan, Kaşkışla Köyü, 1682 m. E. Cabi 3273; **Kayseri**: Karapınar, 1000 m, 1902, Penther & Zederbauer! Nevşehir: Sulusaray, edge of cultivated fields, 1100 m, 18.05.1989, M. Vural 4606 (GAZI) **B7 Elazığ**: Baskil, Karabaş village, 1500 m L. Behçet 5211!. **B8 Erzurum:** Erzurum to Pazaryolu-İspir, 1 km before Eskipolat village, 1825 m, E. Cabi 3429 **B9 Ağrı**: Ağrı to Doğubeyazıt, 21km before Diyadin, 1805 m. E. Cabi 2501 **Bl0 Kars**: 3-5 km E. of Aralik (Aras valley), 850 m, D. 43671!; Van: Özalp, north of Damlacık village 2425 m, F. Özgökçe 613! **C4 Konya**: 1,5 km NW of Alemdar köy,1008 m. E. Cabi 631; Konya: Küçük Köy, 980 m, Helbaek 2462! **C5 Konya**: Pertek, nr Niğde, 1300 m, Siehe 1912:580!

External Distribution: N. Africa, S. Russia, Crimea, Caucasia, Iran, Iraq, W. Syria, Arabia, Afghanistan, C. Asia, W. Pakistan, N.W. India, Siberia**. Ir.-Tur. element**.

Figure 85. Habit of *Eremopyrum orientale* and its spike in close view

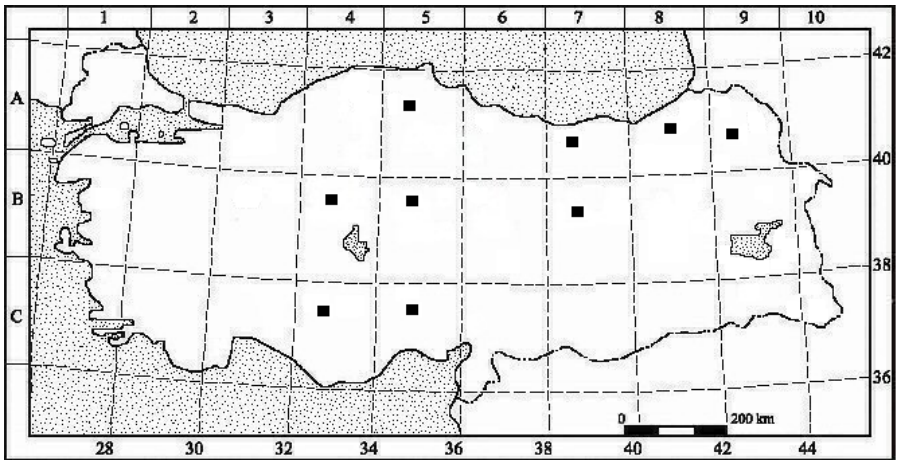

Figure 86. Distribution of *Eremopyrum orientale* in Turkey

3.4.5.4. *Eremopyrum distans* (C. Koch) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.) 17:52 (1934).

Syn. *Agropyron distans* C. Koch in Linnaea 21:426 (1848), *A. lasianthum* Boiss., Diagn. ser. 1(13):68 (1853); *A. orientale* (L.) Roemer & Schultes var. *lasianthum* (Boiss.) Boiss., Fl. Or. 5:668 (1884)! Ic: Fl. URSS 2: t. 47a ("67a") f. 6a-b(1934); Fl. Iraq 9: t. 80(1968). *Eremopyrum orientale* var. *lanuginosum* (Griseb.) Candargy, Arch. Biol. Veg. Pure. Appl. 1:

59 (1901).- *Triticum orientale* var. *lanuginosum* (Griseb.) in Ledeb., Fl. Ross: 4:337 (1853)!. – *Agropyron orientale* var. *lanuginosum* (Griseb.) Richter, Pl. Eur. 1: 126 1890 selected by Frederiksen isolectotype K!

Flowering and Habitat. May-August**. S**andy gravel plains, steppe, igneous slopes, red soils. 850-2500 m.

Type: "[Soviet Armenia, Erevan] aus der Provinz Eriwan, 915 m, auf basal-tisch-trachytischen Boden, [C. Koch]" (holo. B, destroyed).

Stems up to 15 cm. Leaf blades 2-3 mm broad, scabrid or sparsely pilose on upper surface. Spike 2.5-5 X 1.5-2.5 cm, oblong, elliptic oblong. Spikelets 15-17 mm, densely villous, with 3-5 florets, the lower florets hermaphrodite the upper more or less reduced; rachilla tough. Glumes 11.5-16 mm (incl. awn), narrowly linear-lanceolate, gradually tapering into a short awn 4-7 mm, villous densely on bodies' scabrid towards the apex. Lemmas 7.5-13 mm (incl. awn) as long as or shorter than glumes, elliptic-acuminate, with prominent keel and short awn 4-7 mm, body of upper lemmas are wider than lower ones. Palea protruding during flowering, keels of palea prolonged into 2 short awns (0.7-2 mm), with deep cleft between them, palea as long as body of lemma.

NE. and Inner Anatolia. **A8 Gümüşhane:** Bayburt, Bourgeau 254 (with *E. orientale*)! **A8/9 Erzurum**: Oltu (Grossheim 1: map 314). **A9 Kars**: Iğdir to Tuzluca (Aras valley), 920 m, D. 43567b! Erzurum: Karakilise (Grossheim 1: map 314). **B4 Konya**:Yavşan memlehanesi nr Tuz G., Andrasovszky 911! **B5 Konya**: nr Ereğli, 18 v 1902, Zederbauer. **B8 Erzurum**: nr Erzurum, vi 1853, Huet (with *E. triticeum*. **B9 Van**: 7 km from Van to Erçek, 1850 m, D. 44251!; Van: Gürpınar, Koçgüden village 2100 m. M. Ünal 5356! **Bl0 Kars**: 3-5 km from Aralık (Aras valley), 850 m, D. 43671! **Ağrı:** 17 km N. of Doğubeyazıt towards Iğdır, 1600 m, Sorger & Buchner 82-62-45! Van: nr Ozal (Özalp), Sakamoto (Kyoto Univ. Bot. Exped., 1970). **C9 Hakkari**: 80-86 km S. of Gürpınar, Yalınca to Hakkari, 2500 m, Sorger & Kit-Tan 84-78-19!

External Distribution: S.E. Russia, Caucasia, Iran, Iraq, Afghanistan, C.Asia, W.Pakistan. **Ir.-Tur. element**.

Figure 87. Spikes of *Eremopyrum distans* in close view

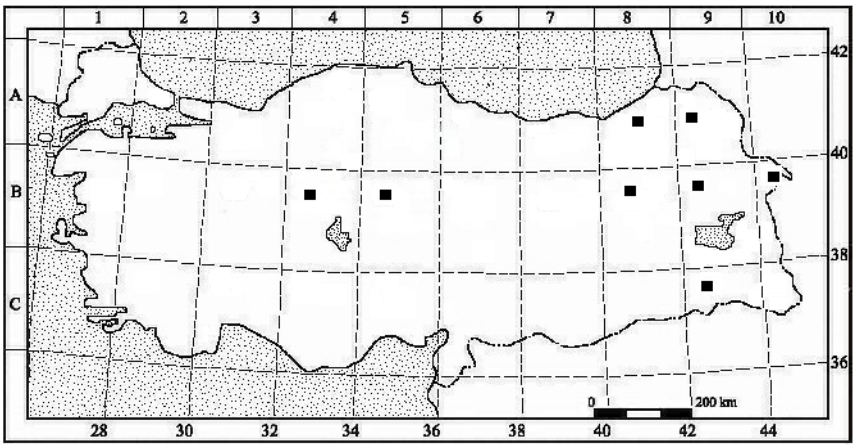

Figure 88. Distribution of *Eremopyrum distans* in Turkey

3.4.5.5. *Eremopyrum confusum* Melderis. In Rech. F., in Anz. Math.-nat. Oesterr. Akad. Wiss. 1964 (1): 15 (1964); Bor in Rech. f., Fl. Lowland Iraq: 119 (1964); Rawi in Dep. Agr. Iraq Tech. Bull. 14: 207 (1964)

Syn. *Eremopyrum bonaepartis* subsp. *hirsutum* (Bertol.) Melderis in Notes r.b.g. Edinb. 42:81 (1984). *Hordeum hirsutum* Bertol., Misc. Bot. 1:11 (1842)! *Eremopyrum squarrosum* (Roth) Jaub. & Spach var. *hirsutum* Cand. in Arch. Biol. Veg. Athenes 1:33 (1901)!

Agropyron orientale (L.) Roemer & Schultes var. *sublanuginosum* Drobov in Trv. Mus. Bot. Acad. Sci. Petersb. 16:135 (1916); *Eremopyrum hirsutum* (Bertol.) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.) 17:52 (1934)! *E. bonaepartis* (Sprengel.) Nevski var. *sublanuginosum* (Drobov) Melderis in Ark. Bot. ser. 2, 2:305 (1952). Ic: Fl. Iraq 9: t. 7 f. 3-10 (1968).

Stem 1.5-32.5 cm long, geniculate, densely hairy below spike, 2-3 noded. Leaf blades up to 10 cm long and 4 mm broad, flat to folded, convolute when dried, scabrid above; sheaths partly enclose the spike. Spike 2.7-4 X 1-2.3 cm, oblong, elliptic, obtuse or truncate at apex. Spikelets covered with long white hairs or glabrous with 4-6 florets, the lower 3-5 florets fertile, the upper one rudimentary; rachilla tough. Glumes 10.5-14.5 mm, curved slightly towards apex, narrowly lanceolate, keeled asymmetrically, slightly shorter than lemmas or equal to lemmas, usually gradually tapering or distinctly awned at apex with an unconsciously awn 0.5-1.5 mm. Lemma linear lanceolate, 13.5-15 mm (incl. awn), awn of lemma up to 2 mm long. Palea distinctly shorter than lemmas, 6.5-8 mm, apex of palea with a short cleft, scabrid on keels.

Described from Euphrates (Upper Euphrates), Chesney Exped. 196 (holo. BOLO, iso. K!).

var. *sublanigunosum* (Drob.) Cabi & Dogan comb nov.
Syn: *Agropyron orientale* var *sublanigunosum* Drob. in Trav. Mus. Bot. Acad. Sc. Petersb 16: 135 (1916) *E. bonaepartis* var. *sublanigunosum* (Drob.) in Ark. Bot. ser. 2, 2: 305 1952 *Eremopyrum bonaepartis* subsp. *hirsutum* (Bertol.) Melderis in Notes R.B.G. Edinb. 42:81 (1984)
Glumes gradually tapering, sharp pointed, covered more or less hirsute hairs

Central and East Anatolia.; **B4 Aksaray**, Aksaray to Şereflikoçhisar around Tuz Lake, 970 m. G. Akaydın 7764; **Konya**, Kulu to Konya c.7-8 km, 39°01.149' N 33°01.744' E roadside, step.1136 m E. Cabi 2242. B5 Nevşehir: 4 km west of Göreme 1130 m GAZI 5091 **B6 Sivas**: Gürün, E. of Gökpınar lake, 38°39'42.5" N, 37°18'14.6" E, elev. 1515 m.; Sivas; Boğazlıdere to Kutlukaya, 4 km after Kutluköy 39°22.949' N 36°55.726' D 1471 m E.Cabi 1306**;** Sivas**,** Ulaş to Kangal, 2 km before Kangal, 39°12.111' N 37°14.537' 1534 m (with *Henrardia persica*) E. Cabi 3632 **B7 Elazığ**; Hazar Lake ANK 28969 **B9 Ağrı** to Doğubeyazıt 17 km before Doğubeyazıt E.Cabi 2508. **B9 Van:** Van to Erciş 10-15 km 1800 m. G.Akaydın 7690. **C4 Konya** Cihanbeyli, Tersakan lake. around Alkim, Salty marshes 1025 m G.Akaydın 7724
Flowering and Habitat: April-July. Eroded calcerous slopes, salt marshes . 950-1800 m

var. *confusum*

Glumes and lemmas distinctly awned, covered more or less long white hairs or with short rigid bristles

Central Anatolia. **B4** **Ankara**: Ankara to Şereflikoçhisar around Tuz Lake G.Akaydın7727b **B5** **Kayseri**: Sultanhanı to Bünyan 5km from Sultanhanı 1203 m. 38° 57' 39" N 35° 53' 19" E E.Cabi 2249 **B6** **Sivas:** Ulaş to Gürün, junction of Deliilyas and Altınyayla Villages, 39° 23' 47.2" N, 37° 04' 59.3" E, 1434 m, limestone hills, 19.06.2008, E. Cabi 3383 **C4** Konya; Cihanbeyli Tuz İşletmesi; near Tuz lake, E.Cabi 2245

Flowering and Habitat. May–June. Sandy and salty soils , slopes and limestone slopes. 950-1450 m

var. *glabrum* (Meld.). in Taxon 16:68 (1967)

East Anatolia B10 Ağrı: 9.5 km from Doğubeyazıt to Iğdır, 39° 39' 26.8" N, 44° 02' 34.6" E, 1545 m. E. Cabi 2255

Flowering and Habitat: June-July, dry volcanic rocks, slopes. 1545 m

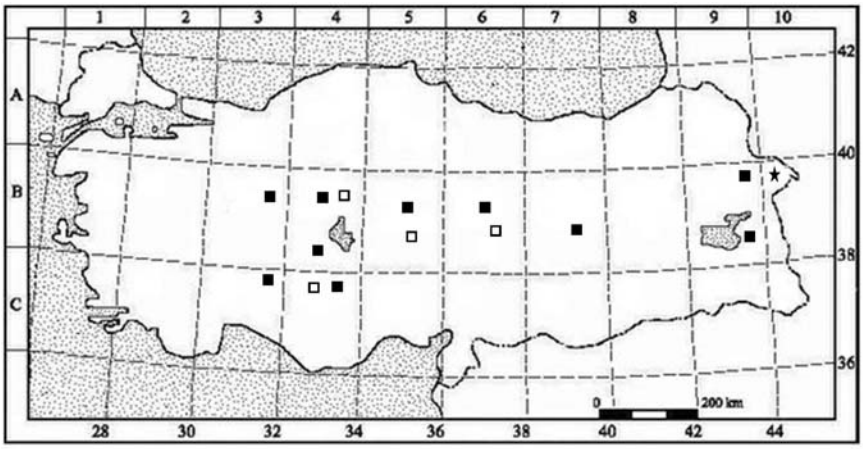

Figure 89. Distribution of *E. confusum* with three varieties.

Legend. *E. confusum* (■) var. *sublanuginosum*, (□) var. *confusum* and (★)var. *glabrum* in Turkey

3.4.6. *Heteranthelium* Hochst. Hochst.

HETERANTHELIUM Hochst. Hochst.In Kotschy (ed. Hohenacker), Pl. Aleppo exsiccatae 130a. 1843.

Type Species *Heteranthelium piliferum* (Banks & Sol.) Hochst. - *Pl. Aleppo* 1843.

Annual. Inflorescence a spike with flattened, partly fragile rachis disarticulating at maturity into joints, each bearing a solitary fascicle of spikelets lowermost spikelet fertile, the succeeding fertile or sterile, upper sterile, reduced to awn like structure. Fertile spikelets hermaphrodite, with 1-2 florets, glumes subulate, pilose below, scabrid above; lemma ovate, inflated, tuberculate and pilose below, gradually tapering into long awn, pilose in flattened part, scabrid above; rachilla with terminal tuft or reduced lemmas; palea with keels prolonged into short awnlike appandages at apex. -Monotypic. (2n=2x=14, **QQ**)

3.4.6.1. *Heteranthelium piliferum* (Banks & Sol.) Hochst. Pl. Aleppo exsiccatae 130a. 1843.

Basionym: *Elymus pilifer* Banks & Sol. The Natural History of Aleppo 2: 244. 1794.
Type: "[Syria] Aleppo, Russel" (holo. BM!).

Syn. *Agropyron piliferum* (Hochst.) Benth. Transactions of the Linnean Society of London, Botany 3: 126. 1888. *Eremopyrum olgae* (Regel) P. Candargy Archives de Biologie Vegetale Pure et Appliquee 1: 33. 59. 1901; *Heteranthelium aleppicum* Gand**.** Bulletin de la Société Botanique de France 66(7): 300. 1919[1920]. *Heteranthelium assyriacum* Gand. Bulletin de la Société Botanique de France 66(7): 300. 1919[1920]. *Heteranthelium hermoneum* Gand. Bulletin de la Société Botanique de France 66(7): 300. 1919[1920]. Ic: Jaub. & Spach, III. Pl. Or. 4: t. 318 (1851); Fl. Iraq 9: t. 84 (1968).

Stem to 30 cm, usually fasciculate, decumbent at base, erect above. Leaf sheaths , slightly inflated retrorsely pilose in lower part; blades to 2.5 mm broad, shortly pilose. Spike to 4.5 cm. Lemma 4-7 mm.

Flowering and Habitat: April-June. Limestone step, fallow fields, calcerous wineyards, roadsides. 400-1850 m.

S. & E. Anatolia; Scattered **B7 Elazığ**: Kharput (Harput), Jarbaschi, Sint. 1890:2040! Malatya: S.E. side of Malatya, Alava 6852 (!). **B8 Diyarbakır**: Mermer, E.S. Brown 2548! **B9 Van**: Kurbaş, 6 km S.E. of Van, 1850 m, D. 44568! **C6 Adıyaman**: Besni to Keysun, 918 m, 37°41'05" N 37°52'38" E, 20.05.2007, E. Cabi 2181. **Malatya**: Gölbaşı to Erkenek, above Karanlıkdere vilage, roadsides, 1343 m, 37°54.807' N 37°46.867' E, 04.05.2008, E. Cabi 2830. **Kahramanmaraş**: Nurhak to Umutlu, c. 14 km, 1424 m, 37°53.578' N 37°19.665' E, 11.06.2006, E. Cabi 976. Nurhak, S of Engizek Mountain, Umutlu village to Çağlayan Cerite 1578 m, 37°50.901' N 37°18.668' E, 11.05.2006, E. Cabi 982. Ahır Mount. Küçükgöl-İncebel slopes, step, 1400-1700 m, 26.06.1992, Z. Aytaç & H Duman 4850 (GAZI) **C7 Şanlıurfa**: Şanlıurfa to Viranşehir, 22 km from Urfa, edge of cultivated fields and steps, 484 m, 37°09.635' N 39°00.689' E, 14.05.2008, E. Cabi 2940. Siverek to Karacadağ, c. 15 km from Siverek, 910 m, 08.05.2007, M. Vural 8519 (GAZI!) **C8 Mardin**: Gercüş to Hasankeyf, 10 km from Gercüş, roadsides 792 m, 37°39'04" N 41°06 25' E, 23.05.2007, E. Cabi 2300. **Mardin**: Mazıdağ-Derik, 9 km to Derik, 1055 m, 37°25'17" N 40°19'30" E, 23.05.2007, E. Cabi 2324.

External Distribution: Transcaucasia, Iran, Iraq, W. Syria, Sinai, Afghanistan, C. Asia, W. Pakistan. **Ir.-Tur. element**.

Figure 90. Spikes of *Heteranthelium piliferum* in close view

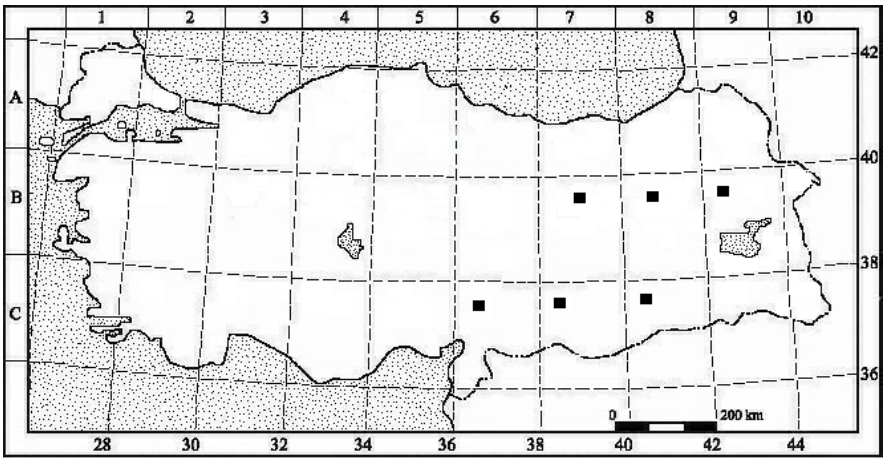

Figure 91. Distribution of *Heteranthelium piliferum* in Turkey.

3.4.7. *Crithopsis* Jaub. & Spach

***CRITHOPSIS* Jaub. & Spach** Illustrationes Plantarum Orientalium 4: 30. 1851.

Type Species: *Crithopsis rhachitricha* Jaub. - *Illustrationes Plantarum Orientalium* 4: 30, t. 321.1851.

Annual. Culms slightly geniculate at base then ascending or strongly decumbent. Auricles present, falcate shaped. Ligule membranous. Inflorescence a dense spike with very fragile rachis, rachis segments densely and rigidly pilose on margins. Spikelets in pairs at each rachis node, with 2 florets, lower floret hermaphrodite, upper rudimentary; rachilla disarticulating below florets. Glumes coriaceous, strap-shaped, longer than florets, scabrid. Lemma of fertile floret oblong-lanceolate, flattened dorsally, scabrid, often slightly verrucose below, scabrid and ± hirsute above, gradually tapering into flattened, scabrid awn. -One species. Haplomic genome **K.**

From the Greek *krithe* (barley) and *opsis* (appearance), from fancied resemblance of inflorescence (Watson and Dallwitz 1992)

3.4.7.1. *Crithopsis delileana* (Schultes) Roshev., Zlaki 319(1937).

Basionym: *Elymus delileanus* Schult. Mantissa 2: 424. 1824.

Syn. *Elymus geniculatus* Delile, Fl. Egypt 30,t.13 f. 1 (1812) non Curtis (1790); *E. delileanus* Schultes, Syst. Veg. ed. 15, 2 Mant. 424 (1824); *Crithopsis rhachitrichus* Jaub. & Spach, I11. Pl. Or. 4:30, t. 321 (1851). Ic: Fl. Iraq 9: t. 77(1968).

Stems 6.5-49 cm long, usually fasciculate, geniculate at base. Leaf blades 2.5-8 mm X 1.5- 3 mm broad, scabrid, sparsely pilose, leaves are becoming folded towards apex. Spike to 3.5 cm (excl. awns). Glumes equaling, scabrid or shortly pilose especially on veins, 17-25 mm long (inc awns) gradually tapering into a short awn. Lemma of fertile floret 5.5-7.5 mm, with awn 6-12.5 mm long. Palea as long as or slightly shorter than body of lemmas. Anthers are short up to 1 mm long.

Flowering and Habitat: April-May. Sandy, calcareous soils, arid steppe*,* 11m- 1003m *C. delileana* grows on sandy arid areas, pastures, roadsides, edges of cultivation. Other species grow within habitat of *C. delileana* are *Cynosurus cristatus* L., *Taeniatherum caput-medusae* (L.) Nevski, *Hordeum spontaneum* K. Koch, *H. murinum* L.*, Aegilops geniculata* Roth*, Ae. crassa* Boiss.*, Ae. tauschii* Coss.*, Echinaria capitata* (L.) Desf.*, Cynosurus echinatus* L.

Type: [Egypt] â Alexandrie dans les champs d'orge, entre le lac Mareotis et la mer, iii 1800, *Delile* (holo. MPU).

S.& S.E. Anatolia C4 Mersin:, Silifke, Mersin-Tarsus, 11 m, 36°20.357' N 33°54.892' E 01.05.2008, E.Cabi 2751 **(new record for C4 square). C6 Gaziantep**: Doğanpınar-Karkamış, cemetery of Arıkdere village, 2 km to Akçaköy, 439 m, 36°49.394'N 37°50'692' E, 21.04. 2007, E.Cabi 1757. **Hatay**: Reyhanlı, around Cilvegözü village, 265 m., 36°14.878' N 36° 37.889' E, 03.05.2008, E.Cabi 2805. **Kilis**: Islahiye to Kilis, after Musabeyli, 478 m, 36°48.452' N 36°59.992' E, 21.04.2007, E.Cabi 1747. **Adıyaman**: Besni, Çakırhöyük district, 610 m., 37°33'22" N 37°48'33" E, 20.05.2007, E.Cabi 2154. **C7 Urfa**: Ceylanpınar State Farm, South of Horozviran, 471 m., arid environments, 36°51.904' N 39°34.410' E 22.05.2007, E.Cabi 2229. **Urfa:** Urfa to Akçakale, 8 km to Büyükhan, 600 m., 37°04.618' N 38°50.550' E 22 04 2007 E.Cabi 1790. **Urfa**: Birecik to Urfa, 20 km before to Urfa, calcerous steppes, 654 m., 37°05.093' N 38°36.606' E, 22.04.2007, E.Cabi 1785, **Urfa**: 3km before Birecik hydroelectric power station, 379 m., 37°03.537' N 37°55.870' E 22 04 2007 E.Cabi 1770, **Urfa**: Ceylanpınar State Farm, Güzelyat area, N. of Avea base station, E.Cabi 1871, **Urfa**: Ceylanpınar State Farm, 8 km from Yassıtepe gendarme station to Büyükyıldız, 442 m., 36°42.806' N 39°32.928' E 23 04 2007 E.Cabi 1868. **Urfa**: Ceylanpınar State Farm, Kazıktepe sheep enterprise, 419 m., 36°48.927' N 39°51.270' E, 23 04. 2007, E.Cabi 1852, **Urfa**: Ceylanpınar State Farm, Gökçayır cattle enterprise, 417 m., 36°48.927' N 39°51.270' E, 23 04 2007, E.Cabi 1845. **Urfa**: Urfa to Antep, 5 km from Urfa, 661 m., 37°03.113' N

38°14.411' E 23.04..2006, E.Cabi 113. **Urfa**: Suruç to Birecik, 750 m., roadsides, 37°03.286' N 38°07.992' E, 29.04.2006, E.Cabi 244. **Urfa**: Ceylanpınar State Farm, Gökçayır işletmesi, 384 m, 36°49.080' N 39°57.227' E, 23.04.2007, E.Cabi 1823. **Urfa**: Viransehir to Urfa, 66 km to Urfa, 627 m., 37°13'34" N 39°26'21" E, 22.05.2007, E.Cabi 2220. **C8 Mardin**: Around train station, 666 m, 37°17'10" N 40°44'06" E, 23.05.2007, E.Cabi 2289. **Mardin**: S. of Gercüş, 1003 m., 37°33'52" N 41°22'35" E 23.05.2007, E.Cabi 2295 **(new record for C8 square).**

Figure 92. *C. delileana* in its native habitat

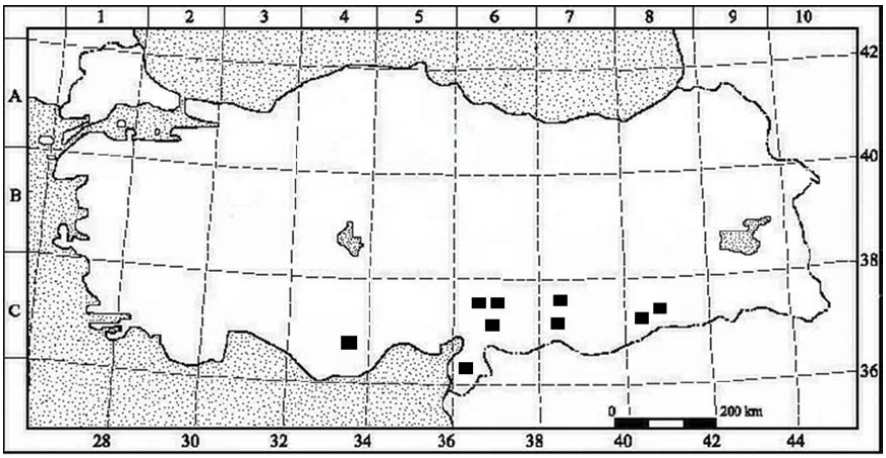

Figure 93. Distribution of *Crithopsis delileana* in Turkey.

Notes on the taxon: In Turkey the distribution of this taxon is confined to the eastern parts of South Anatolia. It distribution range especially extends from C4 to C8 squares. The genus is a typical lowland genus with just only one accession from 1000 m is gathered during the revision. The general altitudinal distribution of the genus varies from 11 m (accession gathered from Mersin) to 1003 m (accession gathered from Mardin, Gercüş). During the revisional study on the tribe *Triticeae* throughout the Turkey, two new records for C4 and C8 are gathered (Cabi et al 2010).

It should be noted that the populations belonging to *C. delileana* do not show any differentiation with respect to their geographical distribution. Quantitative characters such as culm length and glume length are the most variable characters among the studied characters. The observations and measurements showed that culm length may show variability even among the representatives of the same populations collected at different times (Cabi et al 2010).

3.4.8. *Amblyopyrum* (Jaub. & Spach) Eig

***AMBLYOPYRUM* (Jaub. & Spach) Eig.** In Agric. Rec. P.Z.E. Inst. Agric. Nat. Hist. (Tel Aviv) 2: 199. 1929.

Type species: *Amblyopyrum muticum* (Boiss.) Eig. - *Agric. Rec. P.Z.E. Inst. Agric. Nat. Hist. (Tel Aviv)* 2: 200.1929.

Basionym: *Aegilops* subgen. *Amblyopyrum* Jaub. & Spach Illustrationes Plantarum Orientalium 4: 23. 1851.

Slender loosely tufted annual with long slender, narrowly cylindrical spikes. Culms erect with 3-4 nodes. Leaves vey shortly auriculate, ciliate; ligule obsolescent. Leaf blades flat, linear-acuminate. Spikelets all alike, oblong cylindrical, edge-on to hollowed-out rachis segments, not awned, as long as or longer than though segments, 5-8-flowered, laterally compressed, upper florets ± reduced. Glumes cuneate-oblong, bluntly and unevenly toothed above, veins diverging from base to apex. Lemmas exserted and imbricate, oblong, obtuse or subemarginate, coriaceous, more strongly veined above. Lodicules 2. Stamens 3. Styles 2, plumose. Caryopsis elliptic-oblong, adaxially grooved, adherent to lemma and palea; hilum linear, as long as caryopsis; embryo 1/2-2/3 x caryopsis.-One species.

Treated by K. Hammer (Feddes Rep. 91:229,1980) as a monotypic subgenus of *Aegilops*, but well distinguished in spikelet structure and inter-sterile with *Aegilops*.

3.4.8.1. *Amblyopyrum muticum* (Boiss.) Eig in P.Z.E. Inst. Agr. Nat. Hist., Agric. Rec. no. 2:200 (1929).

Culms 35-80 cm tall, glabrous. Leaf blades 6-19 cm long, linear-acuminate, usually shorter than sheath, glabrous or pilose. Auricles falcate, long ciliate at base. Spike 18-32 cm long, 3-4 mm wide with 12-20 spikelets. Spikelets all alike 5-13 mm, each eventually falling attached to concave internode below it. Glumes 4-9 mm. Lowest lemma 7-10 mm. **2n=28.**

Flowering and Habitat: May-July. Step, igneous hills, alluvium, chalky slopes and fields, 500-1480 m.

1. Spikelets hispidulous……..var. ***muticum***
1. Spikelets glabrous……..var. ***loliaceum***

var. ***muticum.*** Syn: *Aegilops mutica* Boiss., Diagn. ser. 1(5):73 (1844); *Ae. Tripsacoides* Jaub. & Spach, III. Pl. Or. 2:121, t. 200 (1847). Ic: Fl. Iraq 9: t. 76 (1968).
Type: [Turkey B7] in Cappadocia ad Euphratem, Aucher 2977 (holo. G!).

Inner and East Anatolia: A3 Ankara: 10 km W. of Beypazarı Çayı, Çayırhande 40˚04.705'N 031˚45.943' E 2045 ft. 04.06.2005, E. Cabi 1598. **A4 Ankara**: 15 km N. of Ankara, Coode & Jones 2129b! **A5 Kastamonu**: d. Tosya, at Sabadja (Sapanca), Sint. 1892:4352! **A9 Erzurum**: Akşar to Oltu near Yolboyu village, dry calcareous soil slopes, 1170 m, 40˚39'40,1"N 42˚10'14,1"E, 09.Jul.2007, E.Cabi 2531 **(new record for A9 square) B1 Çanakkale**: 50 km W. of Edremit, 500 m, Sorger 64-71-11! **B2 Denizli:** Sarıgöl to Buldan, 35 km to Buldan, 38˚14.627' N 28˚46.120' E 31 05 2008 E. Cabi 3816 **Denizli:** Manisa to Denizli, 10 km to Denizli 37˚49.781' N 29˚03.053' E 31 05 2008 E. Cabi 3818 **B3 Ankara**: Polatlı-Sivrihisar road, 18 km after Polatlı, 39˚34.546' N 31˚55.330' E 751m 27 05 2006 E. Cabi 651 **Ankara**: Eskişehir to Sivrihisar, 40 km before to Sivrihisar, 2 km before Kaymaz turn, 934 m 39˚.34.639' N 30˚.55.630' E 31 05 2006 E. Cabi 880 **Ankara**: Polatlı to Sivrihisar, 42 km before Sivrihisar, ahead the road sign. 39˚ 34.546' N and 31˚ 55.338' E 30 05.2008 E. Cabi 3085-3086 **Ankara**: Polatlı to Sivrihisar, 32 km before Sivrihisar, 870 m, 39˚ 33.843'N 31˚ 48.627' E 16.06.2008 E. Cabi 3311. **B5 Nevşehir:** Göreme, around Topraktepe, volcanic tras, edge of cultivated fields, 980 m., 22.06.1989, M. Vural 5393 (GAZI!) **B6 Malatya**: Darende to Kabakağaç, 14.06.1906, B. Post! **B7 Elazığ**: S. of Hıdırbaba, roadside. 1149 m, 38˚46'05" N 38˚57'57" E, 24.05.2007, E. Cabi 2280 **C2**

Denizli: Denizli to Aci Tuz G., 500-800 m, Wall 2858! **C5 Niğde**: 1 km N. of Ulukışla, 1480 m, Holtz 00.616 et al.! **C6 Adıyaman**: Erkenek to Gölbaşı, c. 10 km before Gölbaşı, roadside and slopes, 815 m, 37˚51'12" N 37˚43'49" E, 19.05.2007, E. Cabi 2145.
External Distribution: Armenia.

Figure 94. Spikes of *Amblopyrum muticum* in close view
(Left var. *muticum*, Right var. *loliaceum*)

var. ***loliaceum*** (Jaub. & Spach) Eig in Bull. Soc. Bot. Geneve ser. 2, 19:329 (1928). Syn: *Aegilops loliacea* Jaub. & Spach, III. Pl. Or. 4:23, t. 317 (1851).
Type: [Turkey B7] Cappadocia, ad Euphratem, Aucher 2977 (holo. P, photo!).

Inner and East Anatolia. A3 Ankara: 10 km W of Beypazarı Çayı,Çayırhande 40˚ 04.705'N 031˚ 45.943' E 2045 ft. 04.06.2005, E. Cabi 1599. **A4 Ankara:** 15 km from Ankara to Çankiri, Coode & Jones 2129a! **A9 Erzurum**: Akşar to Oltu near Yolboyu village, dry calcareous soil slopes, 1170 m, 40˚39'40,1"N 42˚10'14,1"E, 09.07.2007, E.Cabi 2532 **(new record for A9 square) B2 Denizli:** Sarıgöl to Buldan, 35 km to Buldan, 38˚14.627' N 28˚46.120' E 31.05.2008, E. Cabi 3816 **B3 Ankara**: Polatlı to Sivrihisar, 18 km from Polatlı, 39˚34.546' N 31˚55.330' E, 751m, 27.05.2006, E. Cabi 651 & G. Akaydın.

B3 Ankara: Polatlı to Sivrihisar, 42 km before Sivrihisar, 39˚34.546' N 31˚55.338' E 30.05.2008, E. Cabi 3086 **B3 Ankara**: Polatlı to Sivrihisar, 32 km before Sivrihisar, 870 m, 39˚33.843'N 31˚48.627' E 16.06.2008, E. Cabi 3311 **B3 Ankara** Ankara 29 km from Polatlı to Sivrihisar. 39˚33.845' N 31˚48.664' E 30.05.2008, E. Cabi 3094. **B4 Ankara**: Kayaş, Bayındır Dam, Step, 985-995 m, 25.06.1995, M. Soydemir 1369 (GAZI) **B5 Nevşehir:** Göreme, around Topraktepe, volcanic tras, edge of cultivated fields, 980 m, 22.06.1989, GAZI5393 **B7 Elazığ**: S. of Hıdırbaba, roadside, 1149 m, 38˚46'05" N 38˚57'57" E 24.05.2007, E. Cabi 2280. **C6 Adıyaman**: Erkenek to Gölbaşı, c. 10 km before Gölbaşı, roadside and slopes, 815 m 37˚51'12" N 37˚43'49" E, 19.05.2007, E. Cabi 2145.

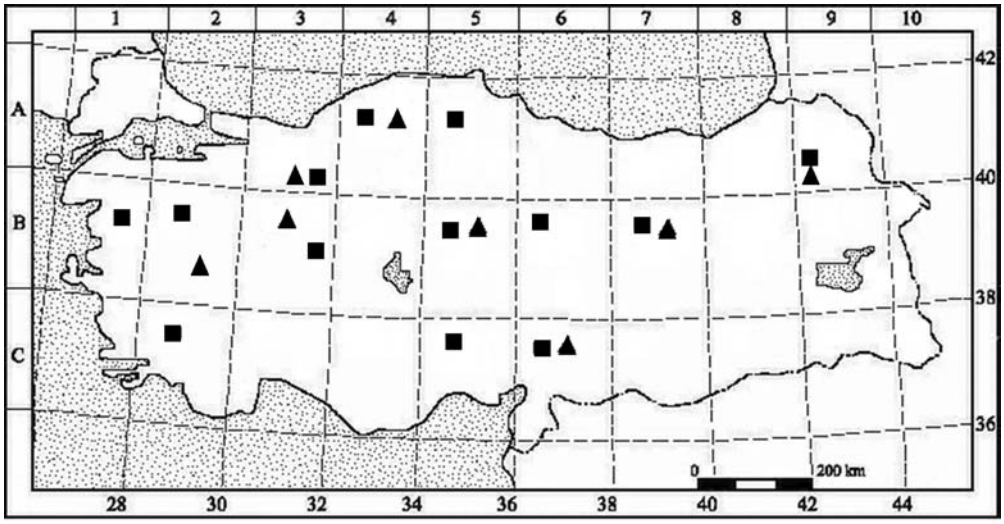

Figure 95. Distribution of *Amblyopyrum muticum* with two varieties in Turkey.

Legend. *Amblyopyrum muticum* (■) var. *muticum* and (▲) var. *loliaceum*.

3.4.9. *Aegilops* L.

The genus *Aegilops* is represented with 17 species in Turkey. A list os Aegilops species recognized in Turkey are given below.

Table 28. *Aegilops* species occurring in Turkey and theirs' genomic formulas proposed by Waines & Barhart (1992).

Species of Aegilops	**Genomic formula**
Aegilops biuncialis Vis.	**U<u>M</u>**
Aegilops markgraffii (Greuter) Hammer	**C**
Ae. columnaris Zhuk.	**U<u>M</u>**
Aegilops comosa Sm. in Sibth. & Sm.	**M**
Aegilops crassa Boiss.	**D<u>M</u>; DD<u>M</u>**
Aegilops cylindrica Host	**DC**
Aegilops geniculata Roth	**<u>M</u>U**
Aegilops juvenalis (Thell.) Eig	**DMU**
Aegilops kotchyi Boiss.	**SU**
Aegilops neglecta Req. Ex Bertol.	**U<u>M</u>; U<u>M</u>N**
Aegilops peregrina (Hack. in J. Fraser) Maire & Weiller	**SU**
Aegilops speltoides Tausch	**S**
Aegilops tauschii Coss.	**D**
Aegilops triuncialis L.	**UC; CU**
Aegilops umbellulata Zhuk.	**U**
Aegilops uniaristata Vis.	**N**
Aegilops vavilovii (Zhuk.) Chennav.	**DMS**

Genome symbols and formulations are given according to Waines & Barhart (1992). Underlined ones are different modifications of the same genome type.

Aegilops L. Species Plantarum 2: 1050. 1753.

Type Species: LT: *Aegilops triuncialis* L. - *Species Plantarum* 2: 1051. 1753. LT designated by Hammer, Feddes Repert. 91: 225-228 (1980); see also Jarvis, Taxon 41: 555-556 (1992)

Annuals, usually tufted or geniculate at base. Leaf sheaths and blades usually hairy or sometimes glabrous; ligule membranous, short. Inflorescence a spike with at least the uppermost spikelet awned, whole inflorescence shed in fruitas a unit or breakin up at the

rachis nodes into separate spikelets; vestigial spikelets 1-4 (rarely absent). Spikelets sessile, laterally compressed, with 2-8 florets. Glumes rounded on back, leathery, 6 to many veined, upper margin subtruncate, subentire, muticous, toothed or 1-5 awned. Lower lemmas thin below, hardened and veined above, awned and toothed. Palea 2 keeled. Lodicules 2, hairy Stamens 3. Caryopsis compressed, ovate, elliptic or oblong, with a ventral groove throughout its length; hilum short; terminal appendage pubescent.

Sectional Key in the genus *Aegilops*

1. Spike disarticulation barrel type (breaking up into spikelets with the rachis segment of the next higher spikelet remaining attached); spike stout, cylindrical or moniliform; plants stout ……...……..…….Sect.***Vertebrata***

1. Spike disarticulation entire (whole spike falls as one unit) or wedge type (breaking up into spikelets with their supporting rachis internode remaining attached); spike slender, (narrowly cylindrical or moniliform, or narrowly ovoid; plants slender

2. Spike disarticulation wedge type; spike slender, narrowly cylindrical but somewhat dorso-ventrally flattened; lateral spikelets with lemma awns (5-7) kılçıklı ……..…….Sect**. *Sitopsis***

2. Spike disarticulation entire.

3. Glumes of apical spikelets obtuse, acut to apiculate, toothed or with a short, up to 1 cm long central awn, lemma of lateral spikelets awnless, lemma of apial spikelets with two long awns; spike narrowly cylindrical at least 30 times as long as wide ……..…….……..Sect**. *Sitopsis***

3. Glumes of apical spikelets well developed, spike narrowly cylindrical (at least 10 times as long as wide) or moniliform, or narrowly ovoid (less than 10 times as long as wide)

4. Spike narrowly cylindrical at least 10 times as long as wide (usually more than 20 times)…...……...…….Sect. ***Cylindropyrum***

4. Spike narrowly cylindrical or moniliform, or narrowly ovoid- spike up to 10 times as long as wide but usually less.

5. Spike narrowly cylindrical or moniliform, with all spikelets of smilar shape ……..Sect. ***Comopyrum***

5. Spike narrowly ovoid with an inflated, ovoid ellipsoid basal part, gradually or abruptly narrowing into a subcylindrical upper part ……....Sect. ***Aegilops***

Section *Aegilops*

Type Species: *Ae. triuncialis* L.

Species: *Ae. biuncialis, Ae. columnaris, Ae. geniculata, Ae. kotschyi, Ae neglecta, Ae peregrina, Ae triuncialis, Ae umbellulata.*

Section *Comopyrum* (Jaub.& Spach) Zhuk.

Type Species: *Ae. comosa* Sm. In Sibth.&Sm.

Species: *Ae. comosa, Ae uniaristata*

Section *Cylindropyrum* (Jaub.& Spach) Zhuk.

Type species: *Ae. cylindrica* Host.

Species: *Ae. cylindrica, Ae caudata*

Section *Sitopsis* (Jaub.& Spach) Zhuk.

Type species: *Ae. speltoides* Tausch.

Species: *Ae. speltoides*

Section *Vertebrata* Zhuk. emend. Kihara

Type species: *Ae. tauschii* Coss.

Species: *Ae. crassa, Ae. juvenalis, Ae. tauschii, Ae vavilovii,*

Key to Species

1. Plants robust; Spike narrowly cylindrical or moniliform, barrel type spike disarticulation present

2. Spike distinctly moniliform……**6. *Ae. crassa***

2. Spike more or less cylindrical or slightly moniliform

3. Lateral spikelets glumes with 2 awned, 0.5-2 (-3.5) cm long, awns spaced at 2-3 mm from each other, one of which may sometimes reduced to asharp tooth, spike with 3-6 spikelets ……..**7. *Ae. juvenalis***

3. Lateral spikelets glumes with 2 or 3 teeth, one of which may develop into a short awn or apex with a single mucro, spike narrowly cylindrical, 4-15 cm long, 3-6 mm wide, with (5-)6-12 spikelets

4. Spike 4-8 cm; Glumes glabrous or scabrid, apex of glumes of lateral spikelets truncate with a thickened rim and an adaxial mucro, apex of glumes of apical spikelet obtuse with a central mucro, apex of lemmas of the apical spikelet with a slender, up to 5.5 cm long triangular awn…...……....**4. *Ae. tauschii***

4. Spike 8-15 cm; Glumes closely adpressed-velutinous, apex of glumes of lateral spikelet with 2 or 3 teeth, apex of apical glumes obtuse with a central awn flanked by two lateral teeth; apex of apical spikelet lemma with a 5-8 cm long flat awn ……...……**5. *Ae. vavilovii***

1. Plants relatively slender; Spike narrowly cylindrical or moniliform or narrowly ovoid, wedge type or entire spike disarticulation at maturity.

5. Whole spike falls as one unit, spike moniliform or narrowly cylindrical

6. Spike moniliform

7. Glumes of apical spikelet with one broad 3-5 cm long awn and two lateral teeth or more slender 2-2.5 cm long awns; glumes of lateral spikelets with a broad, triangular tooth and a short awn up to 4 mm long ……..……**8. *Ae. comosa***

7. Glumes of apical spikelet with a flat 3-5 cm long awn without lateral teeth or awns, glumes of lateral spikelets distinctly ventricose, bifid into a sharp tooth and an increasing shorth awn towards apex…….……**9. *Ae. uniaristata***

6. Spike narrowly cylindrical, subcylindrical or narrowly ovoid

8. Spike narrowly cylindrical, c.30-65x as long as broad

9. Glumes unawned, lemmas conspicuously exserted c. 2 x glumes ……....**1. *Ae. speltoides***

9. Glumes (at least those of uppermost spikelet) distinctly awned

10. Spike (excl. awns) 1.5-3 cm long; lateral spikelets 1-3, glumes oblong lanceolate c. 2 mm wide; uppermost spikelet 6 awned…….**8. *Ae. comosa***

10. Spike (excl. spikes) 4-11 cm; lateral spikelets 4-9, glumes relatively wide; uppermost spikelet 2-4 awned

11. Uppermost spikelet with 2-awned, each glume attenuate into a divergent awn flattened below and not 2 toothed at base…….……**2. *Ae. markgrafii***

11. Uppermost spikelet with 3-4 setaceous awned, at least one of the glumes 2-toothed at the base of awn….…….……**3. *Ae. cylindrica***

8. Spike subcylindrical or narrowly ovoid, widest in basal part, then gradually and abruptly narrowing into a more slender, cylindrical upper part, usually less than 10 times as long as wide (except *Ae. triuncialis*).

12. Glumes of lateral spikelets (3-)4(-5) awned

13. Lower 2 fertile spikelets constricted in upper 1/3; vestigial spikelets (2-)3…….**10.*Ae. umbellulata***

13. Lower 2 fertile spikelets broadest at or below middle; vestigial spikelets 1(-2).....**17. *Ae. geniculata***

12. Glumes of lateral spikelets 1-3 awned

14. Spike (excl. awns) slender and attenuate, (4-)5-9 x as long as broad; spikelets ± superimposed and all fertile, awns 3 (or 2 + a tooth); vestigal spikelets (2-)3

15. Spike (2.5-)3-6 cm, subcylindrical (excl. awns); spikelets (3-)4-6(-7), lower with glumes 6-10 mm, 1.5-2 x as long as broad, with close-set

veins of unequal thickness; awns 1-3, setaceous, 1-6 cm, one or two reduced to sometimes reduced to tooth (widespread)……...**13. *Ae. triuncialis***

15. Combination of characters not as above (S. Anatolian psammophytes)

16. Veins of glumes unequally spaced and bowed outwards above base; awns stouter and flattened below, 0.5-2 mm broad at base. ……..……..……**11. *Ae. peregrina***

16. Veins of glumes equally spaced and nearly paralel; awns filiform, 3, scarsely widening below, 0.5 mm broad at base…….. **12. *Ae. kotschyi***

14. Spike (excl. awns) c. 5 x as long as broad, with long diverging awns giving an obconical outline, upper spikelets forming a fertile or sterile column

17. Spikelets 2-3(-4), all usually fertile, internodes of rachis becoming successively longer upwards; vestigal spikelets 1-2(-4). ……..……..……....**14. *Ae. biuncialis***

17. Lower 2(-3) spikelets fertile, upper ones forming a narrow sterile column; vestigal spikelets (2-)3.

18. Lower fertile spikelets 8-11 mm, oblong-elliptic; total number of awns in spike 25-c. 50, those of lemmas more than half as long as those of glumes….……**15. *Ae. columnaris***

18. Lower fertile spikelets 7-9 mm, obovate-elliptic; total number of awns in spike c. 15-35, those of lemmas c. half as long as those of glumes…….**16. *Ae.*neglecta**

3.4.9.1. *Aegilops speltoides* Tausch Flora 39:109 (1837).

Syn. *Sitopsis speltoides* (Tausch) Á. Löve Feddes Repertorium 95(7-8): 491. 1984; *Triticum speltoides* (Tausch) Gren. Mémoires, Société d'Émulation du Doubs 2: 434. 1857.

Slender, tufted annuals. Culms 20-70 cm (excl. spikes), geniculately ascending. Upper leaf blades linear-lanceolate, 5-10 cm long, 2-3 mm wide, glabrous, pilose or ciliate. Spike 6-20 cm (excl. awns), linear-oblong or narrowly cylindrical, with 6-13 spikelets ; rachis disarticulating in fruit or spike falling entire. Vestigial spikelets 1. Lateral spikelets oblong-lanceolate, 8-14 mm; glumes oblong, truncate and muticous, 5-9 mm, c. half as long as rachis segments, asymmetrical, veins parallel and of unequal width; florets 4, lemmas c.2x glumes, muticous or 1-awned. Uppermost spikelet with 2 lower lemmas each attenuate into a setaceous 2-12 cm awn. **2n=2x=14** Genome **S** (Waines & Barnhart, 1992).

1. Spike narrowly cylindrical, axis persistent in fruit; rachis segments abruptly incurved at base, c. 2 x glumes, lateral spikelets lacking awn…….....**var. *speltoides***

1. Axis disarticulating in fruit; rachis segments scarcely curved at base, c. as long as glumes; lateral spikelets with awned lemmas……**var. *ligustica***

var. ***speltoides***

Syn. *Ae. aucheri* Boiss., Diagn. ser. 1(5):74 (1844)! *Triticum speltoides* (Tausch) Gren. ex K. Richter, Pl. Eur. 1:129 (1890). Ic: Fl. Iraq 9: t. 63 (1968).

Flowering and Habitat: May-June. Quercus scrub, rocky limestone hills, plains, nadasa bırakılmış alanlar, edge of cornfields, 100-1200 m.

Type: "coritur in hortis, Tausch" (holo. PRC).

Marmara, Central Anatolia. **A1**(E) **Edirne**: d. Keşan, Şehitler-Abdürrahim, 100 m, Coode & Jones 2885 (var. *ligustica* ile birlikte)! **A4** Kastamonu: Kavak Çeşme, Sint. 1892:4543! **A5** Çorum: Alaca to Çorum, 900-1200 m, Bornm. 1890:1735! **B7** Diyarbakır: 15 km after Çermik to Diyarbakir, 800 m, Kit-Tan 1837! **C4 İçel**: d. Mut, Kizilalan köyü, 600 m, Vural 777 (ANK)! Konya: Ermenek, Peronin 1872:210! **C5 Adana**: Pozantı to Gülek Boğazı, around Tekir wold, 1169 m., 37°20.734' N 34°78.747' E, 14 06 2006, E. Cabi 1065. **İçel** Aslanköy, the exit of Fındıkpınarı , roadsides, 1415 m, 36°59.721' N 34°16.672' E 15 06 2006 E. Cabi 1099**. C6 Kahramanmaraş**: Ahır Mount., road of Sarıçukur-Kılavuzlu Village , Ceyhan Valley, 37°37.693' N 36°48.747' E, 541 m, road sides 11 06. 2006 E. Cabi 1002. **Kahramanmaraş**: the road of K.Maraş-Andırın , Döngele town , 484 m, road sides ,

37°34.739' N 36°39.149' E, 11 06 2006, E. Cabi 1009**. Gaziantep**: the road of Araban-G.Antep , 30 km to G.Antep, roadsides , 650 m, 37°16'04" N 37°32'53" E, 20 05 2007 E. Cabi 2162 (*Ae biuncialis* ile birlikte). **Gaziantep**: 7 km after Çamlıhüyük Village, Çamlıhüyük to G. Antep, 830 m., 37°31'28" N 37°42'50" E, 20 05 2007, E. Cabi 2175**. Hatay**: Kırıkhan-Hamam road, 100 m, Coode & Jones 580! **C7 Şanlıurfa**: 18 km to Ş.Urfa, 645 m., 37°06.263' N 38°38.701' E 12 05 2008 E. Cabi 2890c**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Cevri mainroad, 478 m, 36°58.254' N 39°38.642' E 22 05 2007 E. Cabi 2231. **Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Gümüşsu Beyazkule border , Şıhanlı Valley 467 m., 37°01.815' N 39°44.503' E 22 05 2007 E. Cabi 2236**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Ateşoğlu, 356 m, 36°49.647' N 39°59.758' E 22.05.2007, E. Cabi 2227. **Adıyaman**: Bozova to Hilvan, 690 m, 37°22'16" N 38°34'27" E 21 05 2007 E. Cabi 2198**. C8 Mardin**: Gercüş to Savur, 5-6 km from Gerçüş, slopes and roadsides, 833 m., 37°34'52" N 41°20'01" E 23 05 2007 E. Cabi 2306**. Şanlıurfa**: Ceylanpınar, Ceylanpınar to Kızıltepe, roadsides, 435 m 37°01'28" N 40°14'49" E 23 05 2007 E. Cabi 2284**. Mardin**: Gercüş to Hasankeyf, 10 km from Gercüş, roadsides, 37°39'04" N 41° 26' 25" E 792 m, 23 05 2007 E. Cabi 2303**.**

Figure 96. Habit of *Aegilops speltoides* var. *speltoides* and its spike in close view

var. ***ligustica*** (Savignone) Bornm. In Beih. Bot. Centr. 26(2):438 (1910).

Syn: *Agropyron ligusticum* Savignone, Diar. Atti Congr. Sc. Gen. 1846:138 & 602 (1847); *Aegilops ligustiica* (Savignone) Cosson in Bull. Soc. Bot. Fr. 11:164 (1864); *Ae. aucheri* Boiss. var. *polyathera* Boiss., Fl. Or. 5:678 (1884)! *Ae. speltoides* Tausch subsp. *ligustica* (Savignone) Zhukovsky in Trudy Prikl. Bot. Selekt. 18:530 (1928); *Triticum speltoides* (Tausch) Gren. ex K. Richter subsp. *ligtusticum* (Savignone) Chennaveeraiah in Acta Horti Gotob. 23:163 (1960). Ic: Feddes Rep. Beih. 55: t. 2 f. d (1929); Acta Horti Gotob. 23: facing p. 178, t. 1 (1960), as *Triticum speltoides* subsp. *ligusticum*. **2n=2x=14** Genome **S**.

Flowering and Habitat. May-June(-July). Quercus scrub, plains, field margins, littoral dunes, s.l. -1400 m.

Type: "[Italy] Genuae (Genoa) in collibus secus aquaeductum, Savignone".

Widespread, mainly in Inner Anatolia **A1 (E) Edirne**: d. Keşan, Şehitler to Abdürrahim, 100 m, Coode & Jones 2884 p.p. (with var. *speltoides*)! **A4 Kastamonu** d. Tosya, Kavak-Çeşme, Sint 1892:4543 p.p. (with var. *speltoides*)! **A5 Çorum**: Alaca to Çorum, 900 m, Bornm. 1890:1734! **B3 Eskişehir**: Türkmen M., Gemis Köyü, Ekim! **B4 Ankara**. METU, around Department of Biology, 25.06.2006, E. Cabi 1547. **B5 Kahramanmaraş**: the east of Göksun Çardak road, after Ahmetçik Village ,step, 1496 m, 38°01.409' N 36°39.626' E 10 06 2006 E. Cabi 955**. B8 Tunceli:** Kovancılar-Bingöl road, 35 km to Bingöl, 1539 m, road side 38°57.650'N 40°09.869' E 03 06 2006 E. Cabi 1388**. C5 İçel** Aslanköy, the exit of Fındıkpınarı , road sides, 1415 m, 36°59.721' N 34°16.672' E 15 06. 2006 E. Cabi 1099**. C6 Gaziantep**: Araban-G.Antep road, 30 km to G. Antep, 650 m, 37°16'04" N 37°32'53" E, 20 05. 2007, E. Cabi 2162**. C7 Şanlıurfa**: Ceylanpınar to Viranşehir, 6 km to Viranşehir, edge of fields, 520 m, 37° 10.865' N 39° 48.083' E 13 05 2008 E. Cabi 2906 (*with Ae triuncialis*). **Şanlıurfa**: Ceylanpınar, Hemitaş to Hofa 379 m, 36°55.033' N 39°59.456' E, 13 05 2008, E. Cabi 2896**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Cevri mainroad, 478 m., 36°58.254' N 39°38.642' E, 22.05.2007, E. Cabi 2233**. Şanlıurfa:** 3-5 km from Karacadağ township, road sides, 1157 m, 37°45'21" N 39°41'52" E, 21.05.2007, E. Cabi 2217. **C8 Mardin**: 5-10 km from Nusaybin to Mardin, 600 m, D. 28415 (with var. *speltoides*, D. 28419)!

Figure 97. Habit of *Aegilops speltoides* var. *ligustica* and its spike in close view

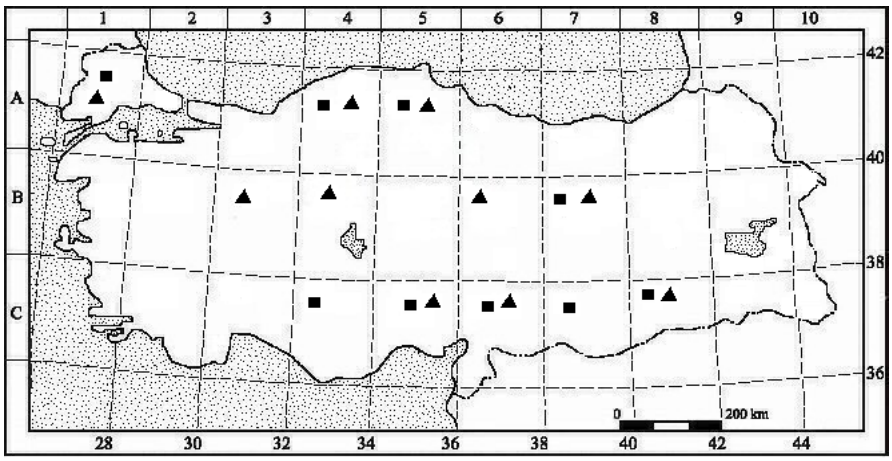

Figure 98. Distribution of *Aegilops speltoides* with two varieties.

Legend. (■) var. *speltoides* and (▲) var. *ligustica* in Turkey.

3.4.9.2. *Aegilops markgrafii* (Greuter) Hammer in Feddes Rep. 91:232 (1980).

Syn. *Ae. caudata* L., Sp. Pl. 1050 (1753) p.p. quoad syn. Tournefort et auct. plur.; *Ae. cylindrica* Sm. in Sibth. & Sm., Fl. Graec. Prodr. 1:72 (1806) non Host (1802); *Triticum dichasians* (Zhukovsky) Bowden in Can. J. Bot. 37:667 (1957) nom. ambig.; *T. markgrafii* Greuter in Boissier 13:172 (1967). Ic: Sibth. & Sm., Fl. Graeca 1: t. 95 (1808), as *Ae. cylindrica*; Feddes Rep. Beih. 55: t. 6 f. c, d (1929), as *Ae. caudata*; Fl. Iraq 9: t. 59 (1968), as *Ae. caudata*; Kulturpflanze 28:73, t. 10 (1980), as *Ae. markgrafii* var. *markgrafii*.

Tufted annual, glaucescent, 25-50 cm. Upper leaf blade linear lanceolate, 1-2 mm broad, ciliate or sparsely pilose. Spike 4-11 cm (excl. awns), narrowly cylindrical with (3-)4-7(-9) spikelets, spike in fruit falling entire. Vestigial spikelets 2. Lateral spikelets with glumes oblong, as long as rachis segments, 9-10 mm, asymmetrical, veins parallel and of unequal width, apex usually two toothed (var. *markgrafii*) or one of the teeth setaceous awned (var. *polyathera* (Boiss.) Hammer. Florets 4, 2 lower lemmas shortly 2-3 toothed and subexserted. Uppermost spikelet with each glume tapering into a flattened divergent 4-10 cm awn 1-1.5 mm broad at the base and lacking basal teeth; lemmas nearly hidden by glumes but conspicuously toothed. **2n=2x=14.** Genome **C** (Waines & Barnhart, 1992).

Flowering and Habitat: May-June. Open woodland, rocky hills, dry river banks, stepe, nr s.l.-1230 m.

Type: [Crete] in insula Creta, Sibthorp (holo. OXF).

W. S. & S.E. Anatolia A1 Edirne: Keşan, Abdürrahim to Şehitler, 110 m, 40°40.582' N 26°18.299' E 03.06.2008, E.Cabi 3190**. A2(A)** Istanbul: Kartal to Yakacik, 14 vi 1896, Azn.! **B1 Çanakkale**: Ezine, Harlan 10291 (cult. USDA, Ames, lowa)! **B2 Uşak**: 29 km S. of Uşak towards Sivaşli, 800 m, Coode & Jones 2442! **B3 Isparta** 52 km NE of Eğridir, on Akşehir road, 38°10'N 31°07'E, 1000m 17.06.1994, RMN 4605**. Eskişehir**:Sivrihisar to Polatlı, 1 km to Oğlakçı, stony slopes, 824 m, 39°32.526' N 31°42.152' E 12 05 2007 E.Cabi 2063**. B5 Kayseri**: plain of Caesarrea (Kayseri), 1100 m, 1856, Bal.! **B7 Erzincan**: Egin (Kemaliye), Szanduk (Sandik), Sint. 1890:3580! **C1 Aydın:** N. of Kuşadası, under olive trees, 18 m, 37°52.977' N 27°16.557' E 01.06.2008, E.Cabi 3133. **C2 Denizli:** Üçler Municiplaity , around Konutkent II, 534 m, 37°47.706' N 29°01.064' E, 31 05 2008, E.Cabi 3822**. C3 Antaya**: Korkuteli, 1050 m, E. & G. Wangsjö 2729! **C4 Konya**: NE of Alemdar Village , 1015 m, 37°40.285' N 32°49.391'E, 14.05.2006, E.Cabi 638**. Karaman**, Bucakkışla, Dedetepe, rocky zone slopes and scrubs, c. 600 m 29 05 1979 **M. Vural 1852**

(GAZI!). Karaman: Ermenek-Mut 5 km E of Ermenek 1500 m 10.07.1976 Max Nydegger 11078 (G!) **İçel:** Silifke to Gülnar, 10 km from Gökbelen village, edge of cultivated fields 1028 m, 36°20.875' N 33°34.563' E, 15 06 2006, E.Cabi 1117**.** **C6 Gaziantep**: G. Antep to Nizip, the exit of Antep , edge of cultivated fields, 833 m, 37°05'07" N 37°27'30" E, 21 05 2007, E.Cabi 2185**. Gaziantep**: G. Antep to Nizip, Küllü Village , Uluyol field, 809 m, 37°02'42" N 37°33'43" E, 21 05 2007, E.Cabi 2187**. Kahramanmaraş**: the entrance of Çağlayancerit, on Erincek Village, Erincek Hill, 1500 m, 37°44.929' N 37°24.452' E, 11 06 2006, E.Cabi 994. **C7 Şanlıurfa**: Suruç to Urfa, 1 km before TOKİ Şanlıurfa housing estate , 677 m, arid land , 37°08'24" N 38°43'21" E, 21 05 2007, E. Cabi 2190**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm Şıhanlı Village, rocky lands, 22 05 2007 E.Cabi 2239. **Şanlıurfa** 18 km to Urfa, Kıraç arid land, 645 m., 37°06.263' N 38°38.701' E, 12 05 2008, E.Cabi 2890a**. Şanlıurfa:** Viranşehir to Urfa, 62 km to Urfa, before Karakaş cemetery , 658 m, 37°13.515' N 39°23.325' E 14 05 2008 E.Cabi 2930**. C8 Mardin**:Mardin to Midyat, edge of wine yards, 16 km from Mardin, 933 m, 37°20'46" N 40°49'28" E, 23 05 2007, E.Cabi 2292**. Mardin:** Kızıltepe to Mardin, 15 km to Mardin, waste places, 536 m, 37°14'37" N 40°38'44" E 23 05 2007, E.Cabi 2286**.**

External Distribution: Jugoslavia, Bulgaria, Greece, Crete, Karpathos, Lebanon. E. Medit. element.

Notes on the taxon: Intermediate states between awned and unawned lateral spikelets are common.

Figure 99. Spikes of *Aegilops markgrafii*

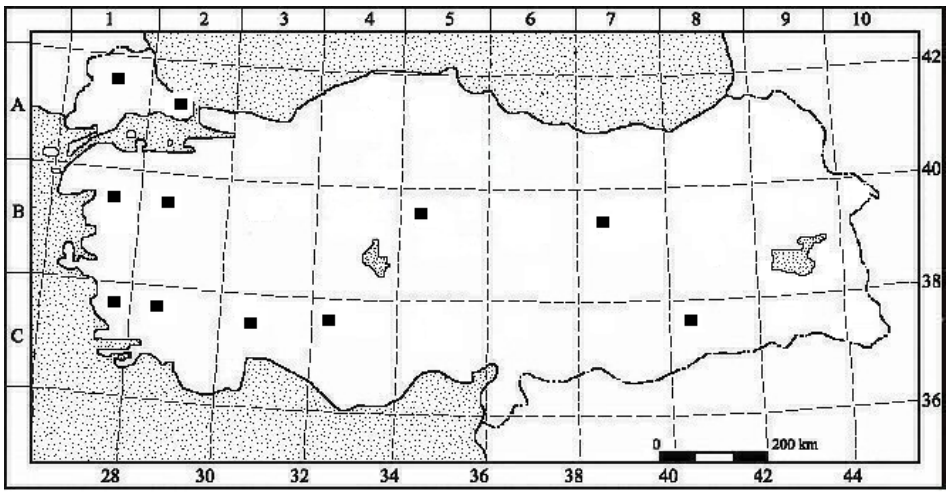

Figure 100. Distribution of *Aegilops markgrafii in* Turkey

3.4.9.3. *Aegilops cylindrica* Host, Gram. Austr. 2:6, t. 7 (1802).

Syn. *Ae. caudata* Link in Linnaea 9:131 (1834) non. L. (1753); *Triticum cylindricum* (Host) Ces. in Ces., Pass. & Gib., Compl. Fl. Ital. 1(4): 86 (1869). Ic: Feddes Rep. Beih. 55: t. 6, f. a, b (1929). Map 42.

Tufted annual, flowering stems, slender 20-50(-80) cm long and 1.5-2mm wide with usually 3 glabrous nodes. First internode length 3.5-6.5 cm long. Upper leaf blades usually flat involute when dried, linear lanceolate, 4-11.5 cm long, 2-5 mm broad, pilose, ciliate or scabrid towards apex. Leaf sheaths ciliate on margins. Spike narrowly linear lanceolate (excl. awns), 5-7(11.5) cm; rachis markedly sinuate, bearing 5-8(-11) spikelets, rachis internodes 9-12 mm long in the middle of spike. Spike falling entire or ultimately disarticulating into broadly cylindrical spikelets 2-3 x as long as broad. Vestigial spikelets 1-2. Glumes of lateral spikelets ovate oblong, 9-10 mm long, 3-3.5 mm wide, asymmetrical, veins (9-10) parallel but of unequal width, with a terminal triangular tooth and a slender awn usually 1-2 x florets. Lemmas of lateral spikelets, oblong, 9.5-12 mm long slightly exceeding body of glumes, veins prominent only in upper part. Paleas 8.5-10 mm long, membranous, slightly ciliate on margins especially on upper part. Uppermost spikelet bearing 3-4 slender ± strict awns arising from glumes and lemmas and usually shorter than spike; outer glumes 7-9.5 mm long, 2-.2.5 mm wide, 2-toothed at the base of awn (up to 7 cm); 2 lower lemmas 9-9.5 mm long, prominently veined, bearing 2 small teeth at the base of awn; paleas 8-9.5 mm long. Anthers 3-3.5 mm. **2n=2x=28** Genome **DC**

Flowering and Habitat: May-June(-July). Stony and sandy slopes, fallow fields, step, 400-1850 m.

Syntype: "[Romania] in apricis, ad vias, vinearum & agrorum margines agri pesthinensis, budensis; in praedio szilidensi versus Coloscam; infra Szarvas in Comitatu bekesiensi; & in Banatu inter vineas versetzenses, Waldestein & Kitaibel (all PR)."

Widespread **A3** **Ankara**: 10 km west of Beypazarı stream, Çayırhande, mountain step, 40°06.705' N 31°45.943' E, 611 m, 04.06.2005 E. Cabi 1602, **Ankara**; 2 km from Çayırhan to Beypazarı on left of road, 583 m, 40°06.389' N 31°46.850' E, 14.05.2007, E. Cabi 2127. **A4** **Kastamonu:** Kastamonu to Tosya, near Akyaka village, road and stream side, 41°16.478' N 33°56.478' E, 848 m, 14.06.2007, E. Cabi 2381 **Ankara**: Ankara to Kızılcahamam, 14 km after Kazan, roadside ,limestone hills, 40°21.483' N 32°40.713' E, 1016 m, 27.06.2006, E. Cabi 1169. **Çankırı**: Çankırı to Ilgaz, exit of Akçavakıf village, road sides, red soils, 815 m 40°41'41.2" N 33°33'35.4" E, 13.06.2007, E. Cabi 2358. **Kırıkkale:** 500 m after Aşağıkara Işık, Kuçubabam entrance, field margin 40°03.489' N 33°51.678' E,

1157 m, 30.06.2006, E. Cabi 1276. **A8 Erzurum:** İspir to Yusufeli, near Bahçeli village, Çoruh stream side, 40° 33.698' N, 41°05.056' E, 1044 m, slopes, 21.06.2008, E. Cabi 3466. **Erzurum:** 2 km from Pazaryolu to İspir, 40° 26.186' N, 40° 48.750' E, 1852 m, field sides, 21.06.2008, E. Cabi 3456 (with *Ae. neglecta*) **A9 Kars:** Digor to Iğdır, 40 km before Tuzluca, 40°18.666' N, 43°29.860' E, 1638 m, dry pastures, calcareous rocks, 26.06.2008, E. Cabi 3574**. B3 Eskişehir:** Eskişehir to (5 km before) Sivrihisar, 39°34.639' N 30°55.630' E, 907 m, 31.05.2006, E. Cabi 874 & G. Akaydın. **Eskişehir:** c. 10 km east of Eskişehir, Eskişehir-Alpu road after Sevinç village, 793 m, 27.05.2006, E. Cabi 716a & G. Akaydın. **B4 Ankara**: Haymana to Polatlı, about 12 km to Polatlı, 39° 32.146' N 32° 14.113' E, 1038 m, 14 05 2007 E. Cabi 2114 (with *Ae neglecta*), Ankara to Konya road, at the corner of Yenice road division near Balahisar, 1069 m, 39° 24' 49" N, 32° 52.112' E, 14 05 2007 E. Cabi 2109*,* **B4 Ankara:** exit of Beynam village, roadside and hillsides, 1217 m, 39° 41.172' N, 32° 54.031' E, 28.06.2006, E. Cabi 1228. **B4 Ankara:** Beynam village exit, road and hill sides, 39°41.172' N 32°54.031' E, 1217 m, 28.06.2006, E. Cabi 1228. **B5 Yozgat**: Yozgat to Sivas 5 km pass Sorgun, roadside, 39° 44.952' N 35° 16.586' E, 1064 m, 19.07.2008, E. Cabi 3700. **B6 Sivas**: Sivas to Ulaş, 100 m after Boğazkaya village turn, roadside, 39°26.048' N 37°02.321' E, 1380 m, 01.07.2006, E. Cabi 1301. **B8 Bingöl**: Tunceli to Bingöl, 15 km before Bingöl, 2 km before Çevrimpınar village, 38°55.782' N 40°22.325' E, 1327m, 03.07.2006, E. Cabi 1402. **Erzincan**, Çayırlı to Tercan, crossroad of Çağlayan castle, field margins, 1458 m, 39°49'32.9" N 40°11'23.3" E 07.07.2007, E. Cabi 2489. **B9 Bitlis:** Muş to 19 km before Tatvan, step, 38° 31.944' N 42° 07.501' E, 1710 m, 03.07.2006, E. Cabi 1432**. Van**: Dilkaya Höyük, c. 30 km W of Van, on shore of Lake Van, field edge shaded by trees, 31.07.1986, R.M.A. Nesbitt 940 (GAZI!) **C4 Konya:** Northeast side of Alemdar village, field margin, 37° 40.355' N 32° 47.695' E, 1008 m, 14.05.2006, E. Cabi 638. **İçel:** Silifke to Gülnur, 5 km after Gökbelen village, limestone areas, 36°20.774' N 33°37.595' E, 1028 m, 15.06.2006, E. Cabi 1112**. C5 İçel**: Aslanköy to Fındıkpınarı, road sides, between limestones, 36°57.484' N 34°20.398' E, 1691 m, 15.06.2006, E. Cabi 1107. **C6 Kahramanmaraş:** South of Nurhak town, Umutlu village road, field margin, 37°55.082' N 37°20.612' E, 1297 m, 11.06.2006, E. Cabi 971.

External Distribution. S.E. & C. Europe, Crimea, S.W. & C. Asia. **Ir.-Tur. element**.

Figure 101. Habit of *Aegilops cylindrica* and its spike in close view

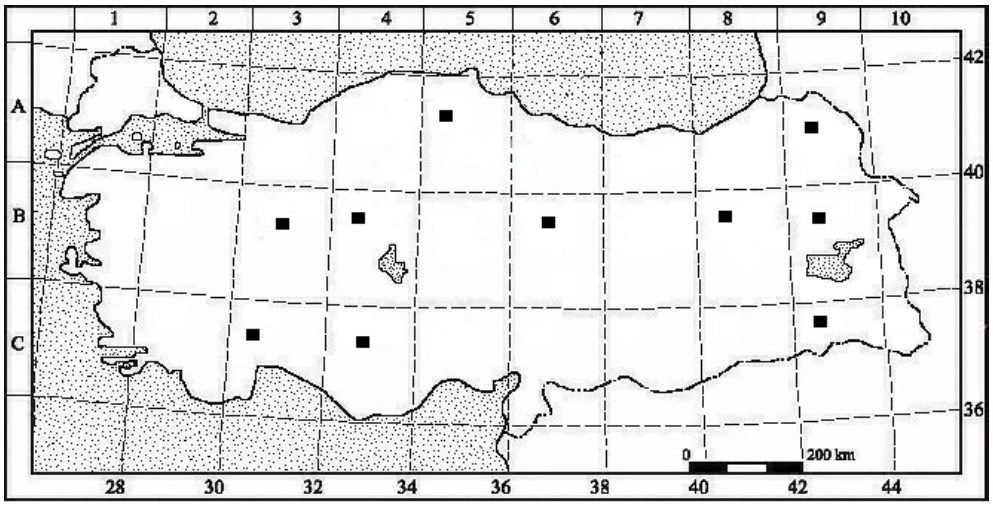

Figure 102. Distribution of *Aegilops cylindrica* in Turkey.

***Aegilotriticum sancti-andreae* (Degen) Soo**

=*Ae. cylindrica* Host x *T. aestivum*

B3 Eskişehir: 20 km to Eskişehir, rocky slopes, field margins, 930 m, 39°41.465' N 30°43.223' E, 27 05 2006 E. Cabi 704, **A4 Ankara**, Ankara to Kalecik, 8 km before crossroad, field sides, calcareous rocks and sloping hills, 1302 m, 40° 08' 10.4" N 33° 11' 19.8" E, 13 06 2007 E. Cabi 2349a.

Figure 103. *Aegilotriticum sancti-andreae*

3.4.9.4. *Aegilops tauschii* Cosson, Not. Crit. 3:69 (1850).

Syn: *Ae. squarrosa* auct. non L. (1753); *Triticum tauschii* (Cosson) Schmalh., Fl. Mittl. Sudl. Russl. 2:652 (1897). Ic: Feddes Rep. Beih. 55: t. 4 f. d (1929), as *Ae. squarrosa* L.; Kulturpflanze 28:75, t. 12 (1980).

Tufted annual (or stem solitary). Culms geniculately ascending, 20-40 cm (excl. spikes). Leaf blades linear-lanceolate, 4-15 cm x 3-5 mm, scabridulous to pilose. Sheaths ciliate at margins. Spike narrowly cylindrical tapering towards apex or distinctly moniliform (subsp. starngulata), 5-7 cm (excl. awns); 0.3-0.5 mm broad, rachis markedly sinuate, spike more or less constricted between the 9- 11 spikelets. Vestigial spikelets absent or only 1. Lateral spikelets barrel-shaped, 6-8 x 3-4 mm, breaking up at rachis joints at maturity and falling with joints adpressed to spikelets (barrel type disarticulation); glumes subequal, broadly

oblong, 5-6 x 2.5-3 mm, veins parallel and of unequal width, apex rounded-truncate, awnless; lower lemmas ovate-oblong, slightly longer than glumes, at least those of upper lateral spikelets bearing subadpressed awns to 3 x glumes. Uppermost spikelet with unawned truncate glumes; lower 2-3 lemmas bearing a suberect slender awn to 3-4 cm. **2n=2x=14** Genome **D**

Flowering and Habitat: May-June, 450-800 m.

Syntype: "[USSR] In Iberia (Buxbaum, Wilhelms). In Tauria (Crimea), Tausch. In graminosis et ridis prope Elisabethpol Georgiae Caucasicae, 1834, Hohenacker. - In horto Parisiensi culta (all P)".

South and East Anatolia A9 Artvin: Ardanuç, Gevhernik castle, 582 m, 41°07.605' N, 42°03.397' E, roadsides, 25.06.2008, E.Cabi 3542**. Artvin:** Ardanuç to Arevet (Torbalı village), near Ekşiler village, 560 m, 41°06.142' N, 42°03.316' E, 25.06.2008 E. Cabi 3525**. B8 Erzurum**: Erzurum, Calvert & Zohrab 460 (as *Ae. squarrosa* L. locality doubtful)! **B10 Kars**: Aras valley near Iğdır, [800 m]. 28 vi 1967, J.G. Ross!. **C7 Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Cevri Anayolu, 478 m, 36°58.254' N 39°38.642' E 22 05 2007 E. Cabi 2235. **Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Gürgürbaba area, 229 nolu parcel, 457 m, 25.04.2007 E. Cabi 1941**. C8 Mardin:** Gercüş to Hasankeyf, 10 km after Gercüş ,roadsides, 792 m, 37°39'04" N 41°26'25" E, 23.05.2007, E. Cabi 2302**.**

External Distribution: Syria, Iraq, Iran, Caucasia, Afghanistan to C. Asia. **Ir.-Tur. element**. Diploid.

Notes on tha taxa: Infraspecific classification of *Ae. tauschii* ,D genome progenitor, is still under dispute. Van Slageren (1994) stated that there is morphologically and genomically intermediate forms that link the two subspecies. Until now two subspecies have been described within this species. Subsp. *strangulata* (Eig) Tzvelev characterized by having distinctly moniliform spikes (Matsuoka et al 2009).

Figure 104. Habit of *Aegilops tauschii* and its spikes in close view.

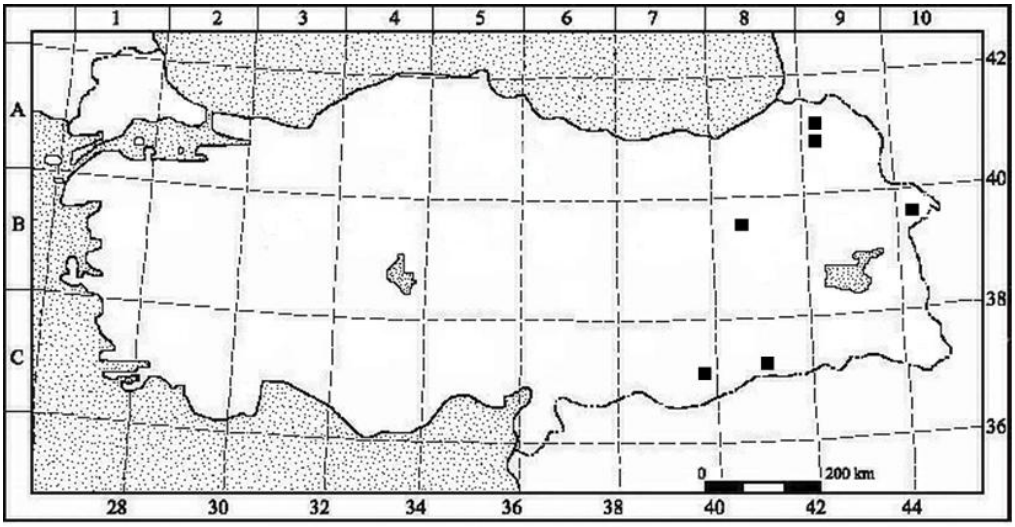

Figure 105. Distribution of .*Aegilops tauschii* in Turkey.

3.4.9.5. *Aegilops vavilovii* (Zhuk.) Chennav. In Acta Horti Gotoborg. 23:167 (1960, "*Vavilovii*"); Migushova& Chakimova, Bull. WIR 119:76 (1982); Chaudary, Grasses of Saudi Arabia 179 (1989, as *Ae.* "aff. Crassa"; see at Distribution).

Basionym: *Ae. crassa* Boiss. Ssp. *vavilovii* Zhuk., Bull. Appl. Bot., Gen. & Pl. Breeding 18(1): 554 (1928, "*Vavilovii*"); Hammer, Feddes Repert. 91: 234 (1980b); Feibrun-Dothan, Fl. Pal. 4: 173 (1986).

Lectotype (nov.): Syria, Salamie ("Salamich") near the road, 30.IX. 1926, *Vavilov* 29028 (WIR 747!).

Robust, tufted annuals. Stems usually erect sometimes ± geniculate at base, 8-30 cm (excluding spikes). Leaf blades linear-acuminate, flat or involute, 8-20 cm long, 0.3-0.5 cm wide; margins of sheats hyaline, long ciliate. Spikes 5-10 cm, narrowly cylindrical, gradually tapering towards the apex, disarticulating barrel type at maturity into individual spikelets with the rudimentary spikelets remaining attached to the culm; with 5-10 fertile spikelets, rudimentary spikelets usually absent, but rarely 1-2 developed . Spikelets narrowly ovoid, 8-15 mm long excluding awns. Glumes of lateral spikelets 8-10 mm long, coriaceous, adpressed velutinous; truncate, with 2-3 teeth, the adaxial one acute and strongest developed, extending up to a short setulose awn up to 1 cm, the other teeth broadly triangular, sometimes indistinct, depressions between teeth hyaline; the apical glume ovate rectangular, 7-9 mm long, the apex truncate with a central awn, up to 3.5 cm long, flanked by 2 triangular, lateral teeth. Lemmas of fertile florets exserting the glumes, 8-11 mm long, narrowly ovate, coriaceous, apex of lateral lemmas with a sharp, setulose tooth at the keel, up to 5 mm long subapicaly, and 2-3 sometimes indistinct lateral teeth, apical region of lemmas of apical spikelet flat, extending into a long, flat awn, 7-9.5 cm long, diverging and curving outward, with or without 2 sharp lateral teeth at the base. Paleas 8-8.5 mm long, elliptical, with 2 setose keels, each ending in a sharply acute apex. Caryopsis 6-8 mm long, adherent to lemma and palea.

2n=6x=42 Genome **DMS** (Chennaveeraiah, 1960; Waines & Barnhart, 1992).

Flowering and Habitat: April-May. Step, roadsides and edge of fields, 381-1055 m. It grows with *Taeniatherum caput medusae*, *Hordeum bulbosum*, *Heranthelium piliferum*, *Crithopsis delileana* and *Aegilops crassa*.

Distributed in S.E. Anatolia, **C7 Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, South of Horozviran area, dry meadows, 471 m, 36°51.904' N 039°34.410' E 22 05 2007 E. Cabi 2228b (with *Ae. crassa*); **Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Kazıktepe area, calcerous soils and meadows, 381 m, 36°49.163' N 039°57.238' E, 23.04.2007, E. Cabi 1839.

C8 Mardin: Mazıdağı to Derik, 9 km to Derik, 1055m., 37°25'17"N 040°19'30" E, roadsides, 23 05.2007 E. Cabi 2322.

External Distributon: Western arc of the Fertile crescent: Jordan, Palestine, Syria and Lebanon. Uncommon throughout its range and rare in Turkey and Iraq.

Figure 106**.** Habit of *Aegilops vavilovii*

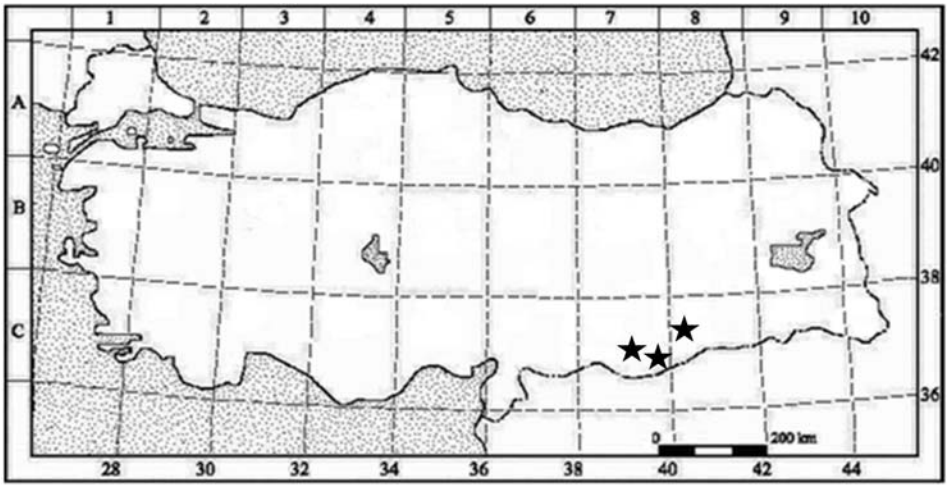

Figure 107. Distribution of *Aegilops vavilovii* in Turkey.

Notes on the taxon: *Aegilops vavilovii* was mentioned as uncommon throughout its range and rare in Turkey (van Slageren, 1994). Maxted et al (2008) reported that this species is represented by only 109 unique germplasm accessions worldwide, suggesting that this species was also inadequately represented in ex situ collections and therefore it should have been given conservation priority.

A. vavilovii grows in the steppes of Southeast Anatolia where it is found at the edges of cultivated fields, roadsides at an altitudes between 381 and 1055 m. It flowers in April and May. The other grass species growing in the area are as follows: *Taeniatherum caput medusae*, *Hordeum bulbosum*, *Heranthelium piliferum*, *Crithopsis delileana* and *Aegilops crassa* (Cabi et al. 2010c).

3.4.9.6. *Aegilops crassa* Boiss., Diagn. ser. 1 (7): 129 (1846).

Ic: Feddes Rep. Beih. 55: t. 4 f. a (1929); Fl. Iraq 9: t. 6 1 (1968); Kulturpflanze 28 :77, t. 14 (1980). Map 43.

Robust tufted annuals, 20-40 cm (exc. spikes) Leaf blades linear-lanceolate, 8-25cm long 6-8 mm wide, usually glabrous. Spike distinctly moniliform, 6-9 cm long (excl. awns), 0.5-0.7 cm broad, adpressed-velutinous, constricted between the large spikelets. Spikelets 6-12, usually all fertile, rarely 1(-2) rudimentary spikelets developed, lateral ones urceolate, wider than the apical one, c. 6.0-11 mm long (excl. awns), finally disarticulating barrel type. Glumes of lateral spikelets somewhat asymmetrical, 8-10 x 4-5 mm, broadly ovate-subtruncate but for 2-4 small teeth, veins of unequal width, surface closely adpressed

velutinous; lemmas subexserted and 2-toothed, those of upper spikelets often broadly awned. Uppermost spikelet narrower than lateral ones, glumes unequally short-toothed, each of 2 lower spikelets elongated into a laterally flattened 5-8 cm awn 1-2 mm broad at base, overtopping similar awns (when present) of upper lateral spikelets.

2n=4x=28 or 2n=6x=42. Genome **DM or DDM**

Flowering and Habitat: April-May. Steppe, fallow fields, roadsides and edge of cultivated lands, 450-1100 m.

Type: "[Iran] in canales In planitie prope ruinas urbis Persepolis, Kotschy 248" (holo. G, iso. BM!).

S.E. Anatolia C7 Şanlıurfa: Ceylanpınar, Ceylanpınar State Farm, Şeyh Nasr stream bed after Cevri stream bed canals or slopes, 454 m, dried stream bed, 36°55.741' N 39°38.869' E 24.04.2007, E. Cabi 1923**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, near 500 m east of Gellegeç genderma station, field side , 511 m, 36°58.368' N 39°34.759' E 24.04.2007, E. Cabi 1908**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Cevri mainroad, 478 m, 36°58.254' N 39°38.642' E 22.05.2007, E. Cabi 2230**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, the south of Horozveren, arid land , 471 m, 36°51.904' N 39°34.410' E 22 05 2007 E. Cabi 2228**. Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Kazıktepe area, calcerous soils and pastures 36°49.163' N 039°57.238' E, E. Cabi 1839. **Şanlıurfa**: Ceylanpınar, Ceylanpınar State Farm, Güzelyat area, north of avea bas station. 23.04.2007, E. Cabi 1879. **C8 Mardin:** Gercüş to Hasankeyf, 10 km after Gercüşten road sides, 792 m, 37°39'04" N 41°26'25" E 23.05.2007 E. Cabi 2301**. C8 Mardin**: Mazıdağı to Derik, 9 km to Derik, 1055 m, 37°25'17" N 40°19'30" E, 23.05.2007, E. Cabi 2322**.**

External Distribution: W. Syria, Iraq, Iran, Afghanistan, C. Asia. **Ir.-Tur. element**.

Natural hybrids between *T. aestivum* and other *Aegilops* species can easily recognized in the field. Davis (1985) reported a specimen collected in fallow fields 13 km S. of Urfa (D. 28155!) has been determined by D. Zohary as a natural hybrid between *Ae. crassa* and *Ae. speltoides*, both of which grow in the same locality.

Figure 108. Habit of *Aegilops crassa* and its spikes in close view

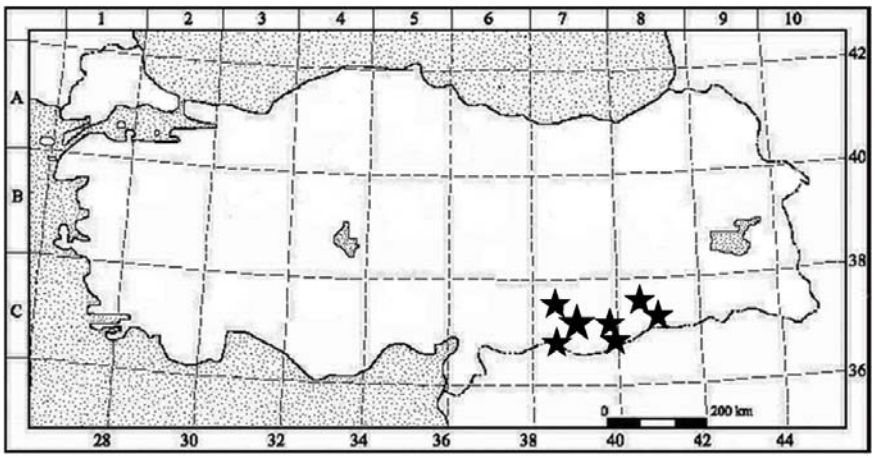

Figure 109. Distribution of *Aeilops crassa* in Turkey.

3.4.9.7. *Aegilops juvenalis* (Thell.) Eig. Feddes Repert., Beih. 55:93 (1929a): Nevski in Komorov, Fl. URSS 2: 672(1934 Russian) /535 (1963, English): Parsa, Fl. Iran, Suppl. Gen. 3:608 (1952); Chennaveeraiah, Acta Horti Gotoborg. 23: 167(1960); Mouterde, Nouv. Fl. Liban, Syrie 1:152 (1966); Bor, Fl. Iraq 9: 182 (1968); Bor, Fl. Iranica 70/30: 194 (1970); Tzvelev in Vassilczhenko, Nov. Syst. Pl. Vasc. 10:37 (1973), in Federov, Zlaki SSSR: 158 (1976, Russian)/226 (1984, English) (Figure 1).

Basionym. Triticum juvenale Thell., Feddes Repert. 3: 281 (1907), Fl. Adv. Montpellier 151 (1912): Bowden, Can. J. Bot. 37: 676 (1959); Feldman&Sears, Sci. Am. 244: 102 (1981); Kimber&Feldman, Wild Wheat74 (1987).
Type: [France, Herault] Port Juvenale, V 1857, Touchy *s.n.* (holo: MPU; iso W)

Robust, tufted annuals. Culms erect, up to 20 cm. Leaves linear acuminate, 3.5-4.0 cm long, 0.3-0.5 cm wide, with scabrous surface; margins of sheaths densely ciliate especially at base. Spike (inflorescence) cylindrical to slightly moniliform, tapering towards the apex, 3.0-4.5 cm long excluding awns, 0.5-0.7 cm wide; with 2-3 fertile spikelets disarticulating barrel type at maturity, and 1-2 spikelets attached to the culm. Spikelets cylindrical to urceolate, 8-13 mm long, the apical spikelet obconical, 9-10 mm long and 2.5 mm wide; rachilla internodes 8-10 mm long; with 3-5 florets of which the upper 2-3 sterile. Glumes coriaceous, broadly ovate, truncate, 6-7 mm long; covered with adpressed velutinous indumentum on surface and long hairs; veins unequally wide, sunk into the surface, ± parallel, apex with 2 short to longer, setulose awns. Awns 2-3 mm, spaced apart; adaxial awn 5-20 mm, abaxial awn often shorter, sometimes reduced to a sharp tooth; apex of apical floret with a central awn of 7-25 mm, flanked by 2 sharp, lateral teeth, each of which may develop into a shorter awn (mostly 1 awn and 1 tooth present). Lemmas of fertile florets slightly exceeding glumes, 8-10 mm long, narrowly ovate, truncate, with 2-3(-4) cm central awn flanked by 2 teeth, 1 of which develops into a shorter awn; awn of lemmas flat at base. Paleas narrowly ovate to elliptical, with 2 sharp, setulose keels ending in an acute apex. **2n=6x=42** Genome **DMU**

Flowering and Habitat: April-May. Steppe and edge of cultivated fields, 400-450 m.

S.E. Anatolia. C8 Şanlıurfa: Ceylanpınar, Ceylanpınar State Farm, Güzelyat area, around GSM base station, 437 m, 23 04 2007, E. Cabi 1879.

Aegilops juvenalis (Figure 112A) can be confused with *A. crassa* (Figure 112B), but it seems quite different from it. Morphological differences between *A. juvenalis* and *A. crassa* are given in the Table 29.

Table 29. Differences between *Aegilops juvenalis* and *A. crassa*

Characters	***Aegilops juvenalis***	***Aegilops crassa***
Spike	Erect, cylindrical and slightly moniliform	Erect, distincly moniliform
Glume Apex	Apex of lateral glumes truncate with two distinct awn.	Apex of lateral glumes truncate with two unequally wide teeth, sometimes one of these teeth may develop into a short awn
Glume Indumentum	Glumes covered densely with silky adpressed pubescence and longer hairs	Glumes covered densely with short silky adpressed pubescence

Figure 110**.** Habit of *Aegilops juvenalis*.

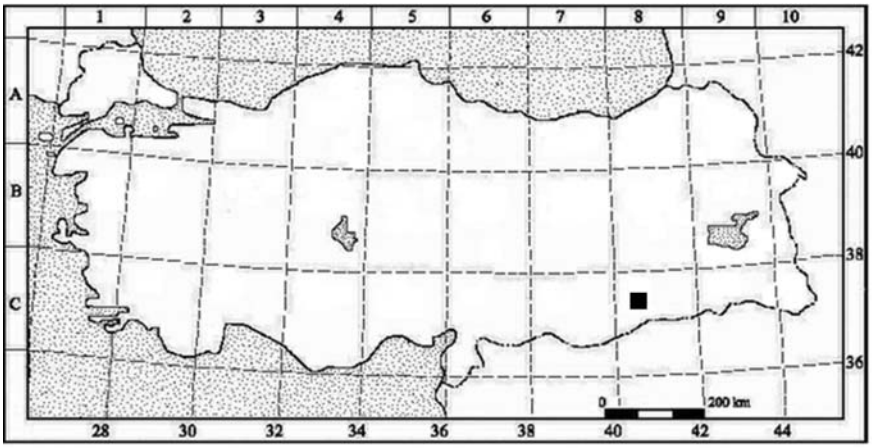

Figure 111. Distribution of *Aegilops juvenalis* in Turkey**.**

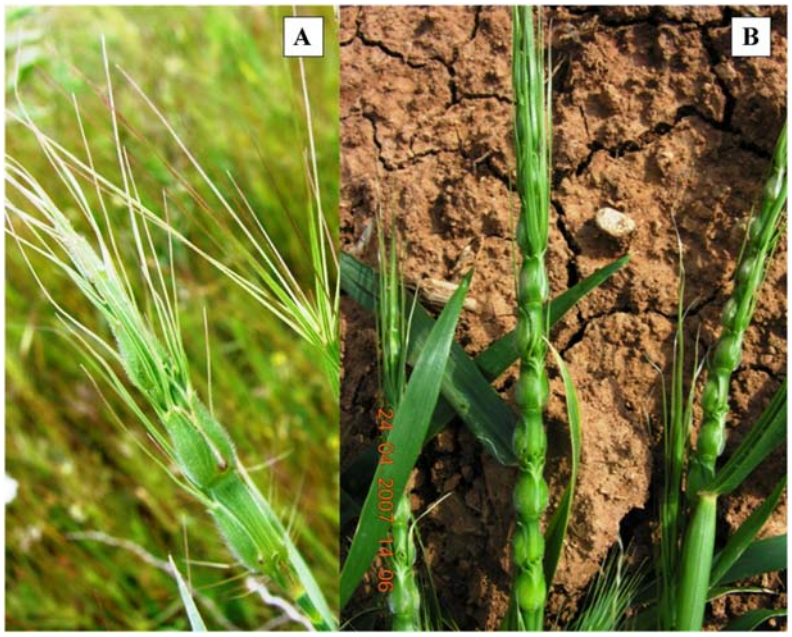

Figure 112. Spikes of *Aegilops juvenalis* (A) and *A. crassa* (B).

Notes on the taxon. This species is known from Iraq, Syria, Turkmenistan, Uzbekistan, and Azerbaijan. Although van Slageren (1994) mentioned an adventive collection from İzmir, (JE) and Kiziltan et al. (1990) suggested one possible germplasm collection from Adıyaman, (C7) which is not vouchered, the species has not been previously recorded wild from Turkey until our study. The specimens of this rare species were collected and vouchered for the first time during the timeline of the thesis (Cabi & Doğan 2009).

3.4.9.8. *Aegilops comosa* Sm. In Sibth. &Sm., Prodr. FI. Graeca 172 (1806).

Syn. *Comopyrum comosum* (Sibth. & Sm.) Á. Löve Biologisches Zentralblatt 101(2): 207. 1982. *Triticum comosum* (Sibth. & Sm.) K. Richt. Plantae Europeae 1: 128. 1890.

Slender, usually tufted annual, 15-40 cm. Upper leaf blade Iinear-Ianceolate, 1-2 mm broad, pilose or ciliate. Spike cylindrical, 1.5-3 cm (excl. awns), with 1-3 lateral spikelets, only top spikelet long-awned, the whole spike in fruit breaking off above the 1 vestigial spikelet. Lateral spikelets narrowly oblong-lanceolate or urceolate, few-veined. Glumes of lowest spikelet 9-12 mm, incl. two 1-5 mm acute or acuminate teeth. Uppermost spikelet lanceolate or ovate, each glume gradually attenuate into 3 awns, the middle one 3-10 cm, longer and broader than the lateral awns; lemmas shortly bidentate or awned. **2n=2x=14** Genome **M** Fl. 5-6.

1. Spikes narrowly cylindrical, with 2-3 narrowly oblong-lanceolate spikelets; glumes with veins slender, close and parallel……..……...**var. *comosa***

1. Spikes stout, with only 1-2 urceolate lateral spikelets; glumes with veins prominent and bowed outwards……...**var. *subventricosa***

***var. comosa*.**

Syn. *Triticum comosum* (Sm.) K. Richter, Pl. Eur. 1: 128 (1890). Ic: Sibth. & Sm., Fl. Graeca l: t. 94 (1806); Feddes Rep. Beih. 55: t. 7 f. a-k (1929); KulturpfIanze 28:81, f. 18, left (1980). 2n = 14. *Hills, calcareus coast, dry places, 200-300 m.*

Described from Greek Islands

W. Anatolia. Lydia, Percival 1932 (2n = 14). **B1 İzmir**: Smyrna (İzmir), Bal. 1854:131 Bunarbaschi, Bornm. 1906:10211! **B2 Balıkesir** : Balıkesir to Dursunbey, 7 km West of Kepsut, 250 m., 31.05.1989 HUB 32530!, **C2 Denizli**: in Üçler Municipalty just before Konutkent 2 housing state, 534 m, 37°47.706' N 29°01.064' E, 31.05.2008, E. Cabi 3820**.** Muğla: Milas-Yatağan w. Stratonikea 19 06 1976 420 m, Max Nydegger 10160 (G!)

External Distribution: S. & S.E. Greece, Aegean. **E. Medit. element.**

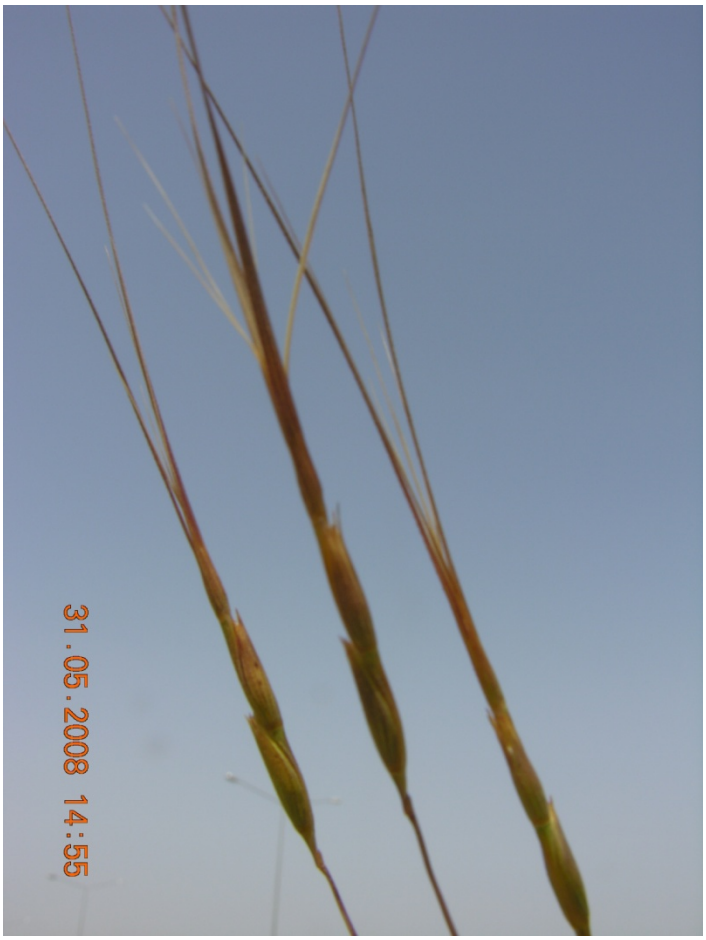

Figure 113. Spikes of *Aegilops comosa* var. *comosa* in close view

var. *subventricosa* Boiss.

Syn: subsp. *heldreichii* (Boiss.) Eig in Feddes Rep. Beih. 55: 109 (1929).; *Ae. caudata* L. var. *heldreichii* Boiss., FI. Or. 5:675 (1884)! *Triticum heldreichii* (Boiss.) K. Richter, Pl. Eur. 1:128 (1890). Ic: Kulturpflanze 28:81, f. 18, right (1980).

Type: [Greeee] in regione inferiore montis Parnes prope Dekeliam, Heldreich (holo. G!).

N.W. Turkey. **A2(E)** Istanbul: Domuzdere (Belgrad forest), 9 vi 1901, Hb. B. Post! **A2(A)** Istanbul: Kartal to Soğanli, 02.07.1893, Azn. (as *Ae. turcica* Azn.)! Istanbul/Kocaeli: Yakacik to Dolaiba, 27 06.1897, Azn.!

External Distribution: N.E. Greece. E. Medit. element. The two subspecies appear very distinct in Turkey, but less so in Greece.

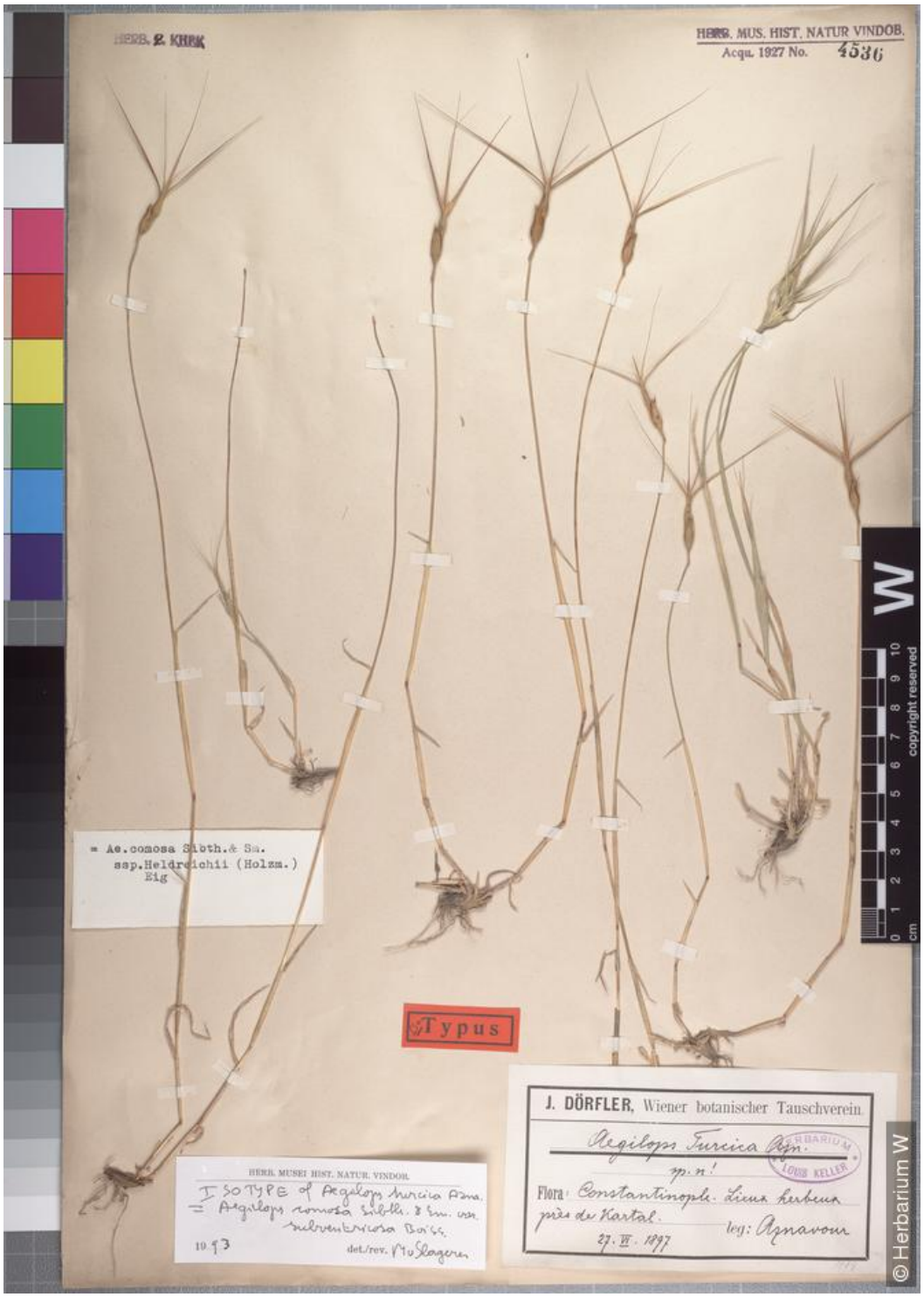

Figure 114. Type photo of *Aegilops comosa* var. *subventricosa* (W!)

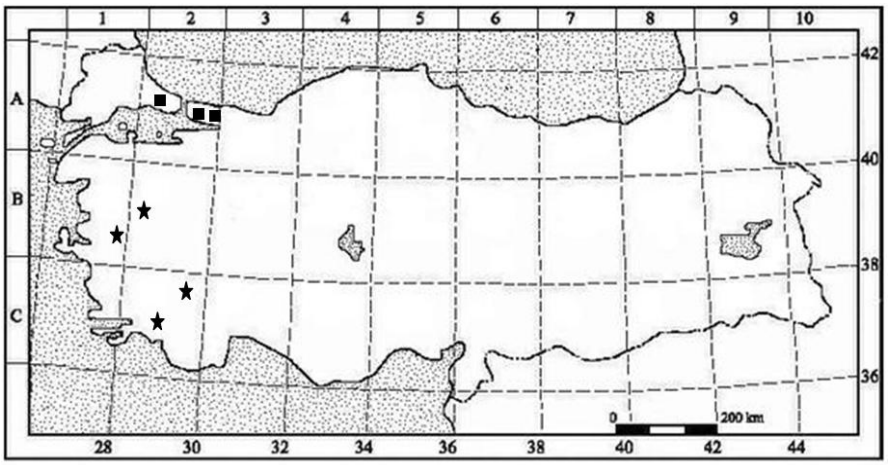

Figure 115. Distribution of *Aegilops comosa* in Turkey

Legend. (■) var. *subventricosa* Boiss., (★) var. *comosa*

Notes on the taxon. *Aegilops comosa* var. *subventricosa* was not found in detailed floristic researchs conducted in the given localities in the former accounts and other potential locations during the timeline of the thesis. Therefore, I have not got inadequate information to make a direct or indirect assessment of its vulnerability. This might be due to extinction of the species in the area, or habitat destruction in its given localities so the threat category of this taxon is evaluated as Data Deficient (DD). Slageren (1994) stated that most locations in Turkey is probably historic.

3.4.9.9. *Aegilops uniaristata* Vis., Fl. Dalm. 3:345 (1852).

Syn. *Ae. notarisii* Clem., Sert. Or. 99 (1855); *Triticum uniaristatum* (Vis.) K. Richter, PI. Eur. 1:128 (1890). lc: Feddes Rep. Beih. 55: t. 8, f. f (1929); Kulturpflanze 28:82, t. 19 (1980).

Tufted annuals, Culms 20-40 cm (excl. spikes), geniculately ascending. Leaf blades linear-lanceolate, 3-8 cm long, 1-2 mm broad, pilose. Spike moniliform, tapering towards apex, 1-3.5 cm (excl. awns), with usually 3-5 fertile spikelets and 2 (-3) rudimentary spikelets, the whole spike breaking off as a unit at maturity. Lateral spikelets urceolate, with prominent bowed veins; glumes coriaceous, bifid, with a triangular-lanceolate tooth less than half as long as rest of glume, awn much longer than glume; lemmas shortly exserted and unequally bifid. Uppermost spikelet narrowly ovoid-oblong; each glume narrowly attenuate into linear subulate 3-4 cm awn with 2 small lateral teeth at base, awn overtopping those of lateral

spikelets; lemmas slender-awned. Paleas narrowly ovate elliptical with caryopsis c.5 mm long. **2n=14.** Genome **N**

Flowering and Habitat: May-June Hills and grassy places, nr s.l.

Type : [Jugoslavia] in herbidis circa Zara, unde communicavit Prof. Alschinger (holo. PAD).

N.W.Turkey. A2(E) Istanbul: Maslak, 17.06.1891, Azn.! Şişli to Kiathane (Kağıthane), 20.06.1896, Azn.! **A2(A)** Istanbul: Çamlica, 22.05.1918, Azn.! Alem Mount., 2 vi 1895, Azn.! Maltepe, 1932, Percival (2n=14). **A2 (E)** İstanbul: Zekariyaköy, Ovid kulesine çıkan sırtlar, 19. 6. 1975 A. Baytop 32054 (ISTE!)

External Distribution: Italy, Balkans. **E. Medit element**. The species is apparently allied to *Ae. comosa* var. *subventricosa.*

Figure 116. Spikes of *Aegilops uniaristata* in close view. A. Baytop 32054 (ISTE)

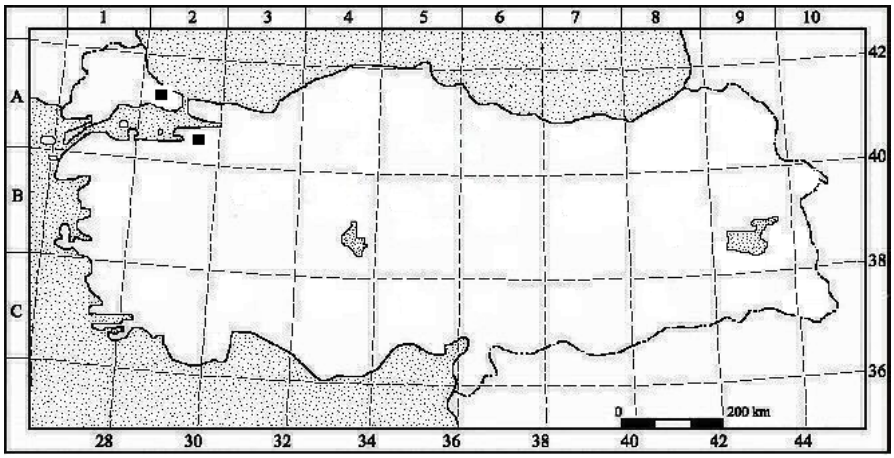

Figure 117**.** Distribution of *Aegilops uniaristata* in Turkey.

3.4.9.10. ***Aegilops umbellulata* Zhukovsky** in Trudy Prikl. Bot. Selekt. 18:447 (1928).

subsp. **umbellulata.** Ic: Feddes Rep. Beih. 55: t. 15 f. g-i (1929); Fl, Iraq 9: t. 66 (1968); Kulturpflanze 28:83, t. 20, left (1980). Map 42.

Tufted annual, 10-30 cm. Upper leaf blade linear-lanceolate, short, 1.5-3 mm broad, glabrous, pilose or ciliate. Spike (incl. long awns) obconical, 3-5(-6) cm in fruit, breaking off as a unit. Vestigial spikelets usually 3. Fertile spikelets only 2, divergent; glumes obovate, subventricose, 5-8 mm, veins scabridulous, apex truncate and bearing 3-5 setaceous, 20-35 mm awns; two lower lemmas exserted from glumes, awns as long as or shorter than those of subtending glumes. **2n=2x=14** Genome **U**

Flowering and Habitat: May-June. Mainly on calcareous soils, in steppe, open Quercus scrub, Pinus brutia woods, vineyards, corn and nadasa bırakılmış alanlar, s.l.-1500 m.

Type: Asia Minor [Turkey], meum iter, 1925-27, M. Dizgurt Dagh, Zhukovsky.

Widespread. A1(E) Çanakkale: 21 km N. of Eceabat, 50 m, Sorger 63-3-9! Al(A) Çanakkale: Renkoci (Erenköy), Sint. 1883: 187! **A2(A)** Bursa: 22 km N. of Bursa, 100 m, Sorger 63-53-29 **A3 Bilecik**: Vezirhan, Bornm. 1929:14742 **A4 Ankara:** nr Ankara, Kavaklidere, 900 m, Bornm. 1929:14740! **A5 Çorum**,opposite of Çorum city forest , 1062 m, under Pinus forest, road sides, 40°34.986' N 35°02.222' E, 06.06.2006, E. Cabi 1527**. B1 İzmir:** Kemalpaşa, Nif Da, 38°25.054' N 27°23.740' E, 620 m., 12.05.2006**,** E. Cabi 486**. B2 Uşak**: 5km below of Kışla road gold mine, slopes, 964 m, 38° 28.159' N 29° 09.027' E, 11.05.2006, E. Cabi 411. **B3 Eskişehir:** 23 km from Polatlı to Sivrihisar roadside, calcareous hills, 880m., 39°33.845' N 31°48.664' E, 30.05.2008, E. Cabi 3106. **B4 Ankara:** Ankara to

Kırıkkale, c. 15 km to Kırıkkale, 673 m gypsium areas, 39°56.380' N 33°24.737' E, 30.06.2006, E. Cabi 1253. **Kırıkkale** Kırıkkale to Kayseri, 690 m, 39°50'20" N 33°28'35" E 18.05.2007, E. Cabi 2071. **B5 Kayseri**: lower parts of Ali Mountain , after passing Ali Mountain promenade on the right, 1300 m, 38°40.437' N 35°33.452' E 10.06.2008, E. Cabi 3246. **B6 Sivas:** Cumhuriyet University campus, 1269 m, grassland, 39°42' 28.1" N, 37°01'05.4" E, 18.06.2008 E. Cabi 3369 (with *Ae. biuncialis*). **B7 Diyarbakır:** Çermik to Ergani, road sides, inclined slopes, 902 m, 38°14.151' N 39°40.670' E, 16.05.2008, E. Cabi 3023**. B8 Bitlis**: 13 km from Baykan to Bitlis, 1150 m, D. 43150! **C1 Aydın**: ruins of Priene, Townsend 69/84! **C2 Denizli**: 12 km E. of Geyre on road to Tavas, 22 km E. of Karacasu, Pine forest on red soil, lime and marble, 850m., 37°40' N, 28°50' E, 15.06.1994, RMN4551. **Muğla:** Fethiye to Kaş, the entrance of Kumluova , calcerous rocky slopes and road sides, 28 m, 36°20.480' N 29°17.833' E, 28.04.2008, E. Cabi 2650**. C3 Antalya**: Korkuteli to Antalya 500 m to Düzlerçamı, road sides Pinus birlikleri, 36° 59.589' N 30° 33.616' E, 14.05.2006, E. Cabi 598**. C4 Konya**: Erenler Mountain, Bozkır, sivri , 1134-1180 m, 37°11.594' N 32°14.768' E, 11.05.2007, E. Cabi 2024 **C5 Adana**: from Bakırdağ ~7 km to Saimbeyli, step, 1390 m, 38° 12.678' N 35° 52.015' E, 09.06.2006, E. Cabi 928**. Niğde**, Çamardı, Aladağlar, on the way of Çukurbağ Village, 37°47.601' N 35° 03.793' E 14.06.2006, E. Cabi 1038**. C6 Kahramanmaraş**: Elbistan, after passing Tatlar Village, pınarın gözünde, 1288 m, grassland and slopes, 38°00.716' N 37°32.032' E, 10.06.2006, E. Cabi 968**. Kahramanmaraş,** on the way of Sarıçukur Village ,~500 m up, 685 m, road side, 37°36'30" N 36°49'38" E, 27.04.2006, E. Cabi 156. **C7 Şanlıurfa**: Urfa to Viranşehir, 22 km from Urfa, edge of wheat fields and steppes, 484 m, 37°09.635' N 39°00.689' E, 14.05.2008, E. Cabi 2942a**. C8 Mardin**: Mardin, 1100 m, D. 28368!

External Distribution: Crete, Latakia, Transcaucasia, Iraq, Iran. **Ir.-Tur. element**. Easily confused with *Ae. geniculata* Roth. *Ae. umbellulata* Zhukovsky subsp. *transcaucasica* Dorof. & Migusch. is Transcaucasian.

Figure 118. Spikes of *Aegilops umbellulata* in close view

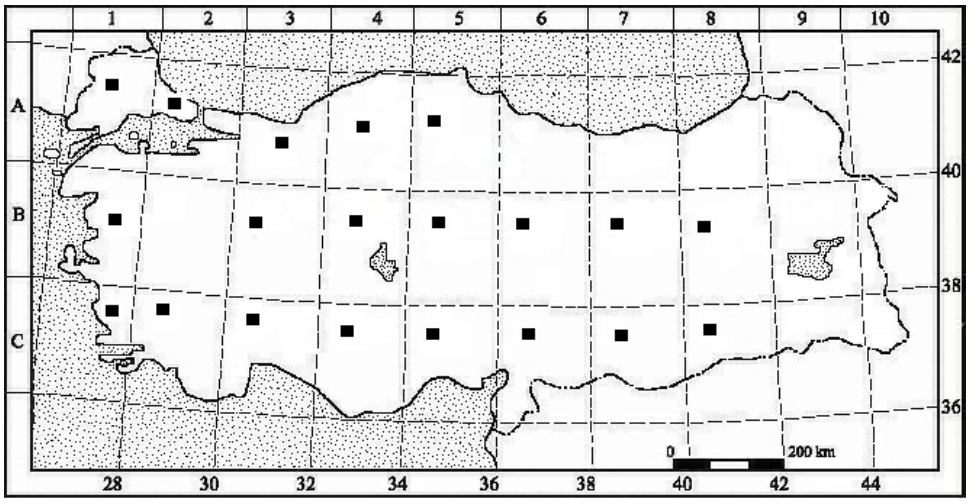

Figure 119. Distribution of *Aegilops umbellulata* in Turkey

3.4.9.11. *Aegilops peregrina* (Hackel) Maire & Weiller in Maire, FI. Afr. Nord 3:358 (1955).

Syn. *Triticum peregrinum* Hackel apud Fraser in Ann. Scott. Nat. Hist. 16(62):101 (1907)! *Ae. variabilis* Eig in Feddes Rep. Beih. 55:121 (1929); *Ae. peregrina* (Hackel) Maire & Weiller var. *brachyathera* (Eig & Feinbrun) Hammer in Feddes Rep. 91:237 (1980). lc: Feddes Rep. Beih. 55: t. 10 (l929), as *Ae. variabilis* subsp. *eu-variabilis* Eig & Feinbrun; Kulturpflanze 28:84, t. 21, left (1980), as *Ae. peregrina* subsp. *peregrina* var. *variabilis* (Eig) Hammer.

Tufted annual, 9-13 cm tall (in Turkey). Spikes c. 2 cm (excl. awns), narrowly obconical-cylindrical, not disarticulating at maturity. Vestigial spikelets 2-3, appearing superimposed to form a fertile column. Glumes 3-5 mm, obovate-oblong, truncate, with scabrid veins somewhat unequally spaced; awns 2-3, 9-24 mm, straighter and stouter than in *Ae. kotschyi*. Lemma 1.5 x glumes, very unequally awned, the longer awns shorter than those of the subtending glumes, stouter and stiffer than in *Ae. kotschyi*. **2n=4x=28** Genome **SU**

Flowering and Habitat: April-May. sandy coasts, open forests and calcerous rocks . s.l.-90 m

Type: "[Scotland] Patria ignota, introductam in Scotia prope Edinburgh (Slateford et Leith Docks), invenit J. Fraser" (holo. E!).

S. Anatolia A2(E) İstanbul, Belgrad forest , 90 m, 41°11.522' N 28°57.646' E, 05.06.2008, E. Cabi 3212. **C2** Muğla: Akyaka County, road sides, 16 m, 37°02.940' N 28°18.116' E, 27.04.2008, E. Cabi 2605. Antalya: entrance of Antalya from Kemer, old camping area, salty soils, near beach 36° 49.553' N, 30° 35.897' E, 30.04.2008 E. Cabi **C4** Içel: near Anamur, Peronin 1872:104 (determined as *Ae. ovata* L. & *Ae. variabilis* Eig, K!). Mersin: Silifke, around Silifke castle, 50-60 m, 36°22.373' N 33°54.921' E, 01.05.2008, E. Cabi 2762, Mersin: Silifke to Taşucu, calcerous rocks 11 m, 36°20.357' N 33° 54.892', E. Cabi 2753**. C5** Hatay: Arsuz, on the way of Hacıahmetsu Village, 95-300 m, road sides, 36°22.439' N 35° 56.486' E, 02.05.2008, E. Cabi 2783. **C6** Hatay: İskenderun to Antakya, 4-5 km from Belen, calcerous rocks, 635 m, 36°28.643' N 36°15.455' E, 02.05.2008, E. Cabi 2767**.**

General Distribution: N. Africa, Cyprus, W. Syria, Transcaucasia, Iran, Kuwait. An exceptionally variable (and probably introgressed) tetraploid species. The above description refers to the depauperate S. Anatolian gathering of subsp. *peregrina* var. *brachyathera* which differs from the more robust Syrian and Palestinian material of this very variable species. Both *Ae. peregrina* and *Ae. kotschyi* occur in Cyprus, probably as aliens.

Figure 120. Habit of *Aegilops peregrina* and its spike in close view

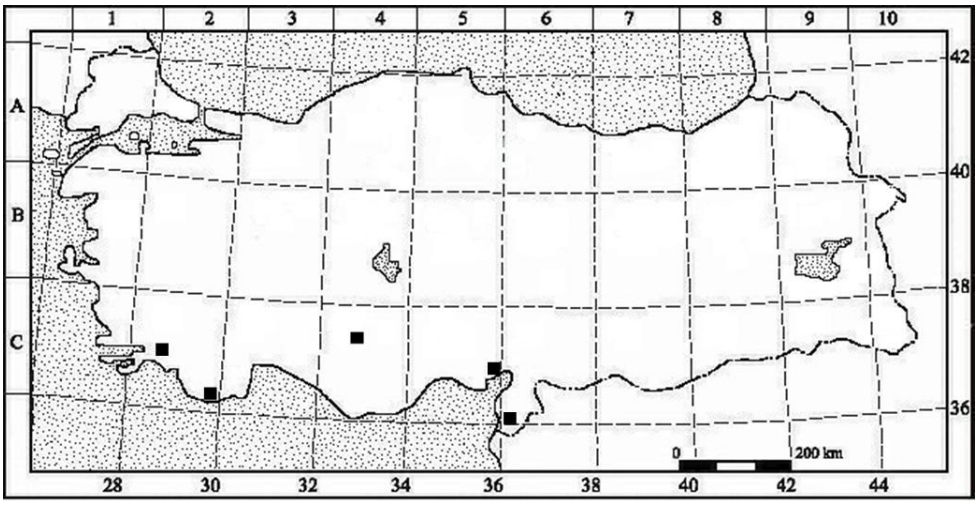

Figure 121. Distribution of *Aegilops peregrina* in Turkey

3.4.9.12. *Aegilops kotschyi* Boiss., Diagn. ser. 1(7):129 (1846). Ic: Feddes Rep. Beih. 55: t. 12 f. b (1929), as var. *typica*.

Tufted 12-25 cm annual. Upper leaf blade lanceolate or linear-lanceolate, 1.5-4 mm broad, sparsely pilose or glabrous. Spike 0.5-4 cm (excl. awns), subcylindrical. Spikelets (1-)2-6, all fertile, appearing ± superimposed, forming a regular ± tapering column; internodes of rachis 1-1.25 x glumes; fruiting spike shed as a unit. Vestigial spikelets (1-)2-3. Glumes of lower spikelet broadly ovate-oblong, 4-6 x 2-3.5 mm, truncate, veins parallel, equally spaced and scabrid. Awns usually 3 (rarely 2, with or without a middle tooth), linear-setaceous, 3-6 x glumes, suberect to divergent in fruit, less than 1 mm broad at base. Florets 3, the 2 lower lemmas slightly exserted from glumes, each bearing an awn half as long as those of glumes and with two small lateral teeth; third floret sterile, stipitate. Glumes of terminal spikelet slightly smaller than those of lateral spikelets. **2n=4x=28** Genome **SU**

Flowering and Habitat: May. Open coastal Pinus forest, littoral plain and low dunes, nr s.l. to 450 m

Syntype. "[Iran] in Persia australi prope Schiraz ad radices montis Sabst-Buschom, [v 1842], Kotscdy 366a" (E! G!) & 1003 (G!).

S. Anotolia. **C3 Antalya**; the entrance of Antalya from Kemer , old camping area, salty soils, near beach, 0 m**,** 36°49.553' N, 30°35.897' E, E.Cabi 2700 .Antalya: Kiremithaneler c. 12 km S.W. of Antalya, 3 m, lt. Leyd. 1959:574 **C5 İçel**: c. 3 km E. of Mersin, 2 m, lt. Leyd. 1959:1181! İçel: Mersin, Silifke, Göksu Deltası, 36° 17.854' N 33° 55.521' E 0 m E. Cabi 66 **C6 Hatay**: Antakya around St. Peter's Church, calcerous rocks**,** 121 m**,** 36°12.584' N, 36°10.684' E, 02.05.2008, E. Cabi 2791. **C7 Şanlıurfa:** Ceylanpınar State Farmland, Sarnıçtepe distinct, 2 km north of Sarnıçtepe, 450 m, 36° 47.652' N 39° 41.378' E, 24.04. 2007, E. Cabi 1933. Ceylanpınar State Farmland, N. of Gümüşsu distinct, 457m, 36°50.269' N 39°39.740' E, 24.4.2007, E. Cabi 1892.

External Distribution: N. Africa westwards to Tunisia; Cyprus, W. Syria, Transcaucasia, Iraq, Iran, Kuwait. **Medit. element.**

Figure 122. Spikes of *Aegilops kotschyi* in close view

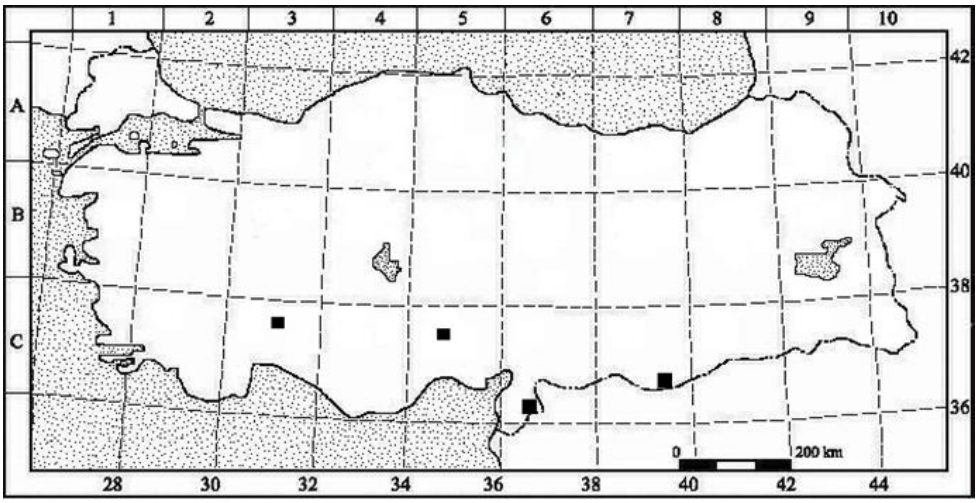

Figure 123. Distribution of *Aegilops kotschyi* in Turkey

3.4.9.13. *Aegilops triuncialis* L., Sp. PI. 1051 (1753).

Syn. *Triticum triunciale* (L.) Raspail) in Ann. Sci. Nat. ser. 1, 5:435 (1825); *Ae. bushirica* Rozhev. in Koie, Beitr. Fl. Sudwest-Irans I (Dan. Sci. Invest. Iran 4):54 (1945). Ic: Feddes Rep. Beih. 55: t. 13 f. a & e (1929); FI. Iraq 9: t. 65 (1968); Kulturpflanze 28:86, t. 23, left (1980). Map 43.

Tufted annuals. Stem 20-35 cm (excl. spikes). Leaves linear-lanceolate, 1.5-3 mm broad, pilose or glabrous. Spike 3-5 cm, subcylindrical (excl. awns). Spikelets (3-)4-5(-7), all fertile, appearing ± superimposed on the sinuate rachis, forming a regular though slight1y tapering column, internodes c. as long as glumes; fruiting spike shed as a unit. Vestigial spikelets 3 (rarely 2). Glumes of lateral spikelets oblong, 6-10 mm, 1.5-2 x as long as broad, subglabrous to antrorsely scabridulous or pubescent, with pallid c1ose-set veins; awns 2-3, 1-6 cm setaceous or middle awn sometimes reduced to a tooth; at least lowest lemma setaceous-awned, the others shortly awned or spine-toothed. Uppermost spikelet with glumes bearing 3 long setaceous awns overlopping awns of lateral spikelets; lemma of florets bearing 3 setaceous awns shorter than those of glumes, lateral pair much shorter than middle awn. 2n = 28 **2n=4x=28** Genome **UC; CU**.

1. Glumes of lateral spikelets unawned, with 3 teeth up to 0.5 cm long and the middle one is shorter than the others…….....…….**subsp. *bozdagensis***
1. Glumes of lateral spikelets distinctly 1-3 awned

2. Glume of lateral spikelets with 1 tooth and 1 short, up to 1.5 cm long awn; apical glumes with a well developed central awn and 2 short lateral awns, or lateral awns reduced to teeth……**subsp *persica***

2. Glumes of lateral spikelets with 2-3 well developed, 1.5-6 cm long, awns; apical glumes with a well developed, central awn of 5-8 cm that is the longest awn of the spike, and 1-3 cm long lateral awns…….s**ubsp *triuncialis***

subsp. ***triuncialis*.**

Flowering and Habitat: May-June. Step, open meadow on basalt, faIlow fields, rocky limestone slopes, waste places, nr s.l.-1900 m.

Type: "Described from Monspelii (Montpellier), Massiliae (Marseille), Smyrnae aridis [Turkey B1 Izmir]. Lectotype (designated by Bowden in Can. J. Bot. 37: 675, 1959): Hb. Linn. 1218/8, collected in Spain by Loefling".

Widespread. A1 Kırklareli: İğneada, on the beach, 41° 53.013' N 27°59.333' E 29 05 2006 E. Cabi 789, **Tekirdağ:** Gaziköy to Kumbağ, 5 km to Kumbağ, open oak areas, under pinus trees 234 m, 40°50.472' N 27° 26.101' E, 28.05.2006, E. Cabi 760 & G. Akaydın & E. Karabacak**. Edirne**: Havsa, Hasköy, 167 m, road sides, fallow fields, 41°40.829' N 27°06.208' E, 29.05.2006 E. Cabi 785 & G. Akaydın & E. Karabacak**.** Edirne: Keşan to Enez, 30 km to Enez, 132 m, 40°40.571' N 26°20.785' E, 03.06.2008 E. Cabi 3185**.** Around Keşan , open *Quercus* areas, steppes , 114 m, 40°48.564' N 26°39.437' E 02 06 2008 E. Cabi 3175**. A2(E) Istanbul**: Flamour, 15 v 1900, Azn.! **A2(A)** Bursa: Bursa to Mudanya, 3 km N. of Bademli, Holtz 00.285 & Hanel! **A3 Ankara**: Mudurnu to Nallıhan, 10 km toNallıhan,the edge of stream, 708 m, 40°14.463' N 31°20.663' E 27 06 2006 E. Cabi 1223. **A4 Kırıkkale**, 500 m after Aşağıkara ışık the entrance of Koçubabam, 1157 m, 40°03.489' N 033°51.678' E 30 06 2006 E. Cabi 1273**. Ankara**, Çığır to Akçaören Village, 946 m, road sides, cultivated field sides, 40°15.689' N 32°42.462' E, 27.06.2006, E. Cabi 1159**. Çankırı**, Kalecik to Çankırı, 1 km after border of Ankara and Çankırı, roadside, 791 m, 40°19'28.3" N 33°30'48.9" E 13.06.2007, E. Cabi 2356. **A5 Amasya**: Amasya, 400-600 m, Bornm. 1889:470! **A6 Amasya**, Ladik to Taşova, Borabay streamside, 598 m, 40° 47' 58.3" N 36° 12' 51.0" E, 15.06.2007, E. Cabi 2339**. A7 Sivas**, Gölova, Aşağıtepecik Village, limestone, soil slopes, 40°01'46.5" N 38°35'05.9" E 07.06.2007 E. Cabi 2456**. A8 Erzurum**, Erzurum to Oltu, 12 km to Oltu, 1390 m, 40°28.517' N 41°58.697' E 05.06.2006, E. Cabi 1496. **A9 Artvin:** Ardanuç, Gevhernik castle, 582 m, 41° 07.605' N, 42° 03.397' E, roadsides, 25 06 2008, E. Cabi 3543**. Artvin:** Ardanuç to Arevet (Torbalı village), near Ekşiler Village, 560 m, 41° 06' 142" N, 42° 03' 316" E, 25.06.2008, E. Cabi 3526**. B1 İzmir**: Kemalpaşa, the lower parts of Nif Da, under Pinus trees , slopes, 620 m, 38°25.054' N 27°23.740' E

12.05.2006, E. Cabi 485. **B1 İzmir**: Hills above Pınarbaşı, 500 metre to Radar, 517 m, 38°24'54" N 27° 15.998' E 01.06.2008, E. Cabi 3141**. Manisa**, Turgutlu-Çıkrıkçı ,1 km to Çıktıkçı Village, 129 m, under Pinus trees, slopes, 38° 28.933' N 27°48.607' E, 12.05.2006 E. Cabi 500. **B2 Manisa**: Salihli to Bozdağ, after Bozdağ turn, 240 m, 38°27.361' N 28°03.088' E, 11.05.2006, E. Cabi 464, **Uşak** Kışla road, 5 km below gold mine inclined slopes, 964 m, 38° 28.159' N 29° 09.027' E, 11.05.2006, E. Cabi 409**. B3 Eskişehir**: 20 km to Eskişehir , rocky slopes, 930 m, 39°41.465' N 30°43.223' E, 27.05.2006, E. Cabi 701 & G. Akaydın. **B4 Kırıkkale**, Kırıkkale to Kayseri road first cemetery on the rigth,690 m, 39° 50' 20" N 33° 28' 35" E, 18.05.2007, E. Cabi 2070 (with *Ae. biuncialis*). **Kırşehir:** Kaman to Kırşehir, on Demirci Village Kalkanlı Mountains ,1430 m, 39° 17.567' N 33° 56.859' E, 10.06.2008, E. Cabi 3226. **B5 Yozgat** 2-3 km from Yozgat,the down of Sivas Muslubelen Pass, 1400 m, 39°49.971' N 34°51.757' E, 12.07.2005 E. Cabi 1554**. Kayseri**, Mucur to Kayseri ~20 km to Kayseri the hils on the right, slopes and steppes, 1103 m, 38°46'03" N 35°16'53" E, 18.05.2007 E. Cabi 2073**. Nevşehir**: 12 km from Nevşehir to Gülşehir near historical sites , 950 m, 38°44' 155" N 34°40.299' E, 29.05.2008, E. Cabi 3063**. B6 Sivas**: Etyemez to Dürmepınar , near Dürmepınar, 1377 m, stony slopes, moisty areas, 38°58.646' N 37°25.981'E, 01.07.2006, E. Cabi 1348. **B7 Tunceli**, Pertek to Hozat, 1143 m, calcerous areas, 38°55.588' N 39°14.805' E, 02.06.2006, E. Cabi 1373**. Malatya**: Darende to Malatya, 27 km to Malatya road sides, 912 m, 38° 21' 05" N 38° 02' 47" E 18 05 2007 E. Cabi 2083**. Erzincan**, Refahiye to İmranlı 49 km to İmranlı the exit of Refahiye , 1571 m, road sides, 39° 57.73" N 38° 46.073' E 6 07 2006 E. Cabi 1516**. B8 Siirt**: 6 km west. of Bekirhan, 700 m, Watson et al. 1140! B9 Van: S. shore of Erçek G., 1900 m, D. 44266! **B9 Van**, Erek Mountain, the exit of Yedikilise Village, 2178 m, 38° 26.832' N 43° 27.827' E 29 07 2008 E. Cabi 3734**. C1 Izmir**: c. 10 km N. of Kuşadasi, 40m, Sorger 65-9-60! **C2 Aydın**: Eskiçine to Muğla 29 km to Yatağan, 154 m, road sides, 37° 30.691' N 28° 05.834' E 13 05 2006 E. Cabi 559**. C3 Antalya** S. outskirts of Isparta town centre. In wine yard with Taeniatherum 37° 45' N, 30° 33' E 950 m 16.06.1994 RMN 4598. **C4 Konya**: Keskin, before Köprülü Village the exit of Keskin , Çelebi road ~1 km, road side , 1132 m 36° 39.909' N 33° 26.712' E 9 06 2006 E. Cabi 891, **C4 Karaman**:from Anamur to the entrance of Ermenek , 1279 m, road sides, 36°37'151" N 32°55'333" E 15.06.2006, E. Cabi 1132**. C5 Niğde**: Çamardı, Aladağlar, N. of Çukurbağ village, 1613 m Step 37° 47.601' N 35° 03.792' E 14 06 2006 E. Cabi 1039, **Mersin**, Silifke,around Silifke Castle road, 50-60 m, 36°22.373" N 33°54.921' E, 01.05.2008, E. Cabi 2763. **Adana**, Pozantı, Gülek Boğazı makilik alan, 1149 m, 37° 17.250' N 34° 47.072' E, 14.06.2006, E. Cabi 1068**. C6 Adana**: Halbur Yaylası, Andırın to Goben, Göksun road, 1444 m, 37°39.437' N 36°26.622' E, 12.06.2006, E. Cabi 1012. **Kahramanmaraş**: Çağlayancerit entrance, 965 m, 37° 44.474' N 37° 22.341' E, 11.06.2006 E. Cabi 988**. C7 Şanlıurfa**: Ceylanpınar farm state, TUEM road sides, 415 m, roadside and

field margins 36°43.518' N 039°37.358' E, 23.04.2007, E. Cabi 1861. **C8 Mardin**: Gercüş-Savur, c. 5-6 km to Gerçüs, slopes and roadsides, 833 m, 37°34'52" N 41°20'01" E, 23.05.2007, E. Cabi 2306b,

External Distribution: S. Europe & N. Africa, S.W. Asia eastwards to Transcaucasia

Notes on the taxon: Subsp. *triuncialis* is accepted as invasive species in many parts of the world due to its characteristics such as large seed size, distinctive adaptations to herbivory and animal dispersal, winter annual growth habit, poor palatability for livestock and allopolyploid origin. It is thought to be derived from diploid parents *Ae. umbellulata* and *Ae. markgraffii* via allopolyploidization (Meimberg et al 2005).

Figure 124**.** Spike of *Aegilops triuncialis* subsp. *triuncialis* in close view

Subsp. *persica* (Boiss.) Zhuk. Trudy po Prikladnoj Botanike i Selekktsii. 18: 500. 1928.

Basionym: *Aegilops persica* Boiss. Diagnoses plantarum orientalium novarum 17: 129. 1846.

Syn. *Aegilopodes triuncialis* subsp. *persica* (Boiss.) Á. Löve Feddes Repertorium 95(7-8): 501. 1984. *Aegilops triuncialis* var. *persica* (Boiss.) Eig Repertorium Specierum Novarum Regni Vegetabilis, Beihefte 55: 134, t. 13c. 1929. *Aegilops triuncialis* var. *persica* (Boiss.) Eig Bulletin de la Société Botanique de Genève 19: 323. 1928. *Triticum persicum* (Boiss.) Aitch. & Hemsl. Transactions of the Linnean Society of London, Botany 31: 127. 1888.

S.E. Anatolia: C6 Gaziantep: Nizip to Birecik, 446-450 m, 37°00.720' N 37°51.989' E 12.05.2008 E. Cabi 2880. **C7 Şanlıurfa**:Viranşehir, 22 km from Urfa, 484 m, 37°09.635' N 39°00.689' E, 14.05.2008, E. Cabi 2939, **Şanlıurfa**: Viranşehir to Urfa, c. 21-22 km to Urfa, field margins, 610 m, 37°09'39" N 39°01'10" E, 22.05.2007, E. Cabi 2221**. Ş.Urfa** to Viranşehir, 484 m, 37°09.635' N 39°00.689' E 14.05.2008. E. Cabi 2943.

Flowering and Habitat: May, field margins, steps, 400-700 m.

Figure 125. Spike of *Aegilops triuncialis* subsp. *persica*

External Distribution: Caucasia, N. Iraq, Iran and Afghanistan.

Subsp *bozdagensis* Cabi&Dogan subsp nov.

Subsp *bozdagensis* differ from other morphological entities in the complex by having uawned glumes on the lateral spikelets. The apex of the glumes is characterized with 3 teeth up to 0.5 cm long and the middle one is shorter than the others.

Type: [TURKEY] C2 Denizli: Bozdağ, Geyran yaylası, roadsides, open woody areas, 30.06.2009, E. Cabi 4050

Figure 126. Spike of *Aegilops triuncialis* subsp *bozdagensis*

General Distribution: Endemic. Known only type gathering. Threat category **CR.**

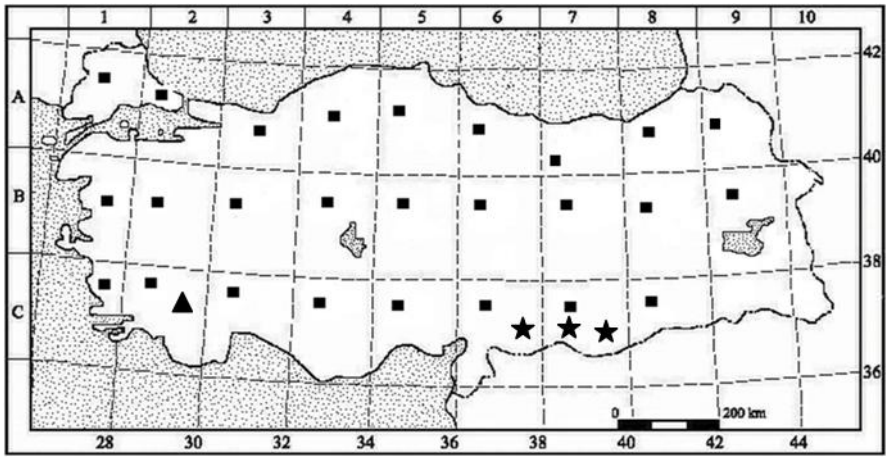

Figure 127. Distribution of *Aegilops triuncialis* in Turkey

Legend. (■) subsp. *triuncialis*., (★) subsp. *persica,* (▲) subsp. *bozdagensis*

Notes on the taxon: *Aegilops triuncialis* L. is one of the most widespread species of the genus and can easily adopt a wide range of habitats (van Slageren, 1994). Since its recognition by Linneaus (1753), many infraspecific taxa have been described under this species (Popova 1923; Eig 1928; Zhukovsky 1928; Hammer 1980). Zhukovsky (1928) recognized 6 subspecies under *Ae. triuncialis,* namely subsp. *brachyathera* Boiss., subsp. *caput-medusae* Zhuk., subsp. *fasicularis* Zhuk., subsp. *kotschyi* Boiss. subsp. *persica* (Boiss.) Zhuk. and subsp. *typica* Zhuk. In the Flora of Turkey, Davis (1985) reported only typical subspecies of *Ae. triuncialis* in Turkey. He also indicated that subsp. *persica* (Boiss.) Zhukovsky grows further east, in Caucasia, N. Iraq, Iran and Afghanistan. Later on van Slageren (1994) determined the presence of subsp. *persica* from Turkey. Van Slageren (1994) stated that *Ae triuncialis* varies greatly in some characters, such as length of spike, number of spikelets and length of glume awns and he recognized two morphologically distinct subgroups ranked as variety. *Ae triuncialis* subsp. *persica* which is characterized by having glumes of lateral spikelets with 2 teeth or 1 tooth and 1 short awn only; apical glumes with a well developed central awn and 2 short lateral awns or lateral awns reduced to teeth, while subsp *triuncialis* was characterized by having glumes of lateral spikelets with 2-3 well developed awns and apical glumes with a well developed, central awn of 5-8 cm that is the longest awn of the spike, and 1-3 cm long lateral awns. According to Waines *Aegilops triuncialis* L. occurs in two forms, one with *Ae. umbellulata* Zhuk. as the female parent (ssp. *triuncialis)* and the other with *Ae. caudata L.* as the female parent (ssp. ***persica*** (Boiss.) Zhuk.).

3.4.9.14. *Aegilops biuncialis* Vis., FI. Dalm 1: t. 1 f. 2 (1842); op. cit. 3:344 (1852).

Syn. *Ae. lorentii* Hochst. in Flora 28:25 (1845); *Ae. intermedia* Steudel, Glum. 1:354, no. 8 (1854); *Triticum lorentii* (Hochst.) Zeven in Taxon 22:321 (1973). **Ic:** Feddes Rep. Beih. 55: t. 14 f. d-g (1929); Kulturpflanze 28:88, t. 25 (1980), as *Ae. lorentii* var. *lorentii.* Map 44.

Tufted annuals, Culms 15-32 cm (excl. spikes), slightly geniculate at base. Leaf blades linear-lanceolate, 3-4.5(-5) cm long, 2-3 mm broad, glabrous, ciliate or pilose. Spike narrowly ovoid, 1.5-3 cm long (excl. awns), with 2(-3) fertile and 1 (-2) rudimentary spikelets; whole spike disarticulates as one unit at maturity. Spikelets 6-9 mm long, ellipsoid with 2-3 fertile and 1-(-2) sterile florets. Glumes of lower spikelet obovate-oblong or broadly elliptic, truncate, conspicuously veined, 7-10 mm, setulose, subadpressed-pubescent or velutinous, awns 2-3, 2-7 cm, erecto-patent to deflexed, gradually widening to a 1-1.5 mm base; lemmas bearing 1-2 setaceous awns (shorter than those of glumes) and 1-2 teeth. Anthers 3 mm. Uppermost spikelets 1/2-1/3 x size of lowermost spikelet, internode bearing uppermost spikelet usually as long as or longer than those of spikelets below it; awns of uppermost spikelet to 7 cm, overtopping those of lateral spikelets. **2n = 28**. Genome **U<u>M</u>**

Flowering and Habitat: May-June, Locally abundant in dry rocky limestone slopes, open Pinus nigra-Quercus woods, intermediately disturbed steppe, field margins, roadsides, vineyards etc., s.l.-1200 m. This species usually grows sympatric with other *Aegilops* species such as *Ae. crassa*, *Ae. triuncialis, Ae neglecta, Ae, geniculata*.
Type: “the illustration (with dissection) given in R. de Visiani, Flora Dalmatica 1: t.1 f. 2 (1842)”.

Widespread, **especially W., S. & S.E. Anatolia**. **<u>A1(A)</u>** Çanakkale: Erenköy, Dumbrek valley, Sint. 1883:207! **<u>A2(E)</u>** Istanbul: Belgrad forest, Topuzlu Bend, Yalt. 2437! **A2(A)** Istanbul: Yakacik, 23 vi 1901, Azn.(G!) **<u>A3</u>** Ankara: Çayırhan to Beypazarı, roadsides, 583 m, 40°06.329' N 31°43.281' E, 14.05.2007, E. Cabi 2126. **<u>A5</u>** Amasya, Bornm.1889:469!. Amasya: Çırçır valley, 16.06.1956, Tamker 4543 (ISTE!) **<u>B1</u>** Çanakkale, Ayvacık to Ezine, 133 m, 39°40.183' N 26°23.488' E, 02.06.2008, E. Cabi 3153. Çanakkale: Kazdağı to Çanakkale, inside the old city of Troy, 26 m, 39°57.401' N 26°14.468' E, 02 06 2008 E. Cabi 3157. **<u>B2</u>** Uşak to Sivaslı, 5 km from Uşak, 910 m, inside the Pinus plantation, 38°37.745' N 29°28.927' E, 30.05.2008, E. Cabi 3114. Kütahya (Phyrigien): Gediz-Kütahya, 22 km N of Gediz, 1100 m, 25.06.1954, Huber Morath 12466 (G!) **<u>B3</u> Eskişehir:** Polatlı to Sivrihisar, 42 km to Sivrihisar, 743 m, 39°34.546' N 31°55.338' E, 30.05.2008, E. Cabi 3089**. <u>B4</u>** Ankara: Beynam village to the forest, 1291 m, 39°40.849' N 32°54.528' E, 28.06.2006, E. Cabi 1234.

B5 Kırşehir: N. of Kırşehir, 1505 m, 39°10.122' N 34°16.060' E, 17.05.2008, E. Cabi 3043. **B6** Kahramanmaraş: Elbistan, after Tatlar village, pastures, 1288 m, 38°00.716' N 37°32.032' E, 10.06.2006, E. Cabi 965. **B7** Malatya: Darende to Malatya, 20 km to Malatya, roadsides, 912 m, 38°21'05"N 38°02'47" E, 18.05.2007, E. Cabi 2082. **C1 Aydın**: Söke, 8 km NW of Didim, 05.06.1967, Huber Morath 17593 (G!) **C2** Denizli: 19 km S. of Acıpayam on Denizli road, 37°20' N 29°34' E, 925 m, 15.06.1994, RMN 4574. Denizli: Üçler Belediyesi, Konutkent 2 Toplu Konut yakınları, 534 m, 37°47.706' N 029°01.064' E, 31.05.2008, E. Cabi 3821. **C3** Antalya: Kemer, Göynük De., s.l.-5 m, Peşmen 3718! **C4 Mersin**, Silifke Göksu Deltası, Kum mahallesi, pastures, s.l., 36°18.048' N 33°55.402' E, 22.05.2006, E. Cabi 48**. C5** Hatay: Arsuz, 95-300 m, 36°22.439' N 35°56.486' E, 02.05.2008, E. Cabi 2789. Hatay: Seleucia (nr Suvediye), Lorent (type of *Ae. lorentii*)! **Adana/Içel**: pass between Pozanti and Gülek, 1200-1400 m, Ehrend. 62-1/68-16! **C6 Hatay**: İskenderun to Antakya, 4-5 km from Belen, calcerous rocky areas, 635 m, 36°28.643' N 36°15.455' E, 02.05.2008, E. Cabi 2768. **C7 Ş.Urfa**: Birecik-Halfeti, 357 m, calcerous slopes, 37°03.511' N 37°58.506' E, 23.04.2006, E. Cabi 95 & G. Akaydın**. C8 Siirt:** Botan çay gorge 6 km S. of Siirt, 700 m, D. 43242!

External Distribution: Southeastern Europe, Crimea, N.W. Africa. Palestine, Iraq, Iran. **Multiregional element**. Threat category **LC.**

Figure 128. Spikes of *Aegilops biuncialis* in close view

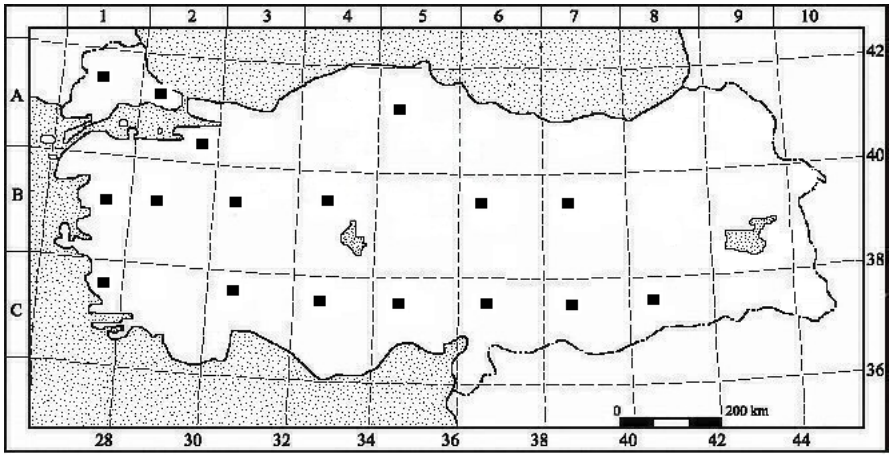

Figure 129. Distribution of *Aegilops biuncialis* in Turkey.

3.4.9.15. *Aegilops columnaris* Zhukovsky in Trudy Prikl. Bot. Selekt. 18:489 (1928).

Syn: *Triticum columnare* (Zhukovsky) Morris & Sears in Queensberry, Wheat & Wheat Improvement 20 (1967). Ic: Feddes Rep. Beih. 55: t. 13 f. f-g (1929); Fl. Iraq 9: t. 60 (1968). Map 44.

Tufted annuals. Culms slightly geniculate at base, (15-)20-40 cm long (excl. spikes). Leaf blades linear-lanceolate, 2-7 cm long, 2.5-4.5 mm broad. Spike narrowly ovoid to oblong, obconical in outline (incl. awns), 2-4 cm long (excl. awns). Lower 2-3 spikelets fertile, 7-11 mm, usually densely adpressed-pilose sometimes glabrous or scabrid and ± divergent, the upper 2 smaller and sterile; fruiting spike shed as a unit. Vestigial spikelets 3. Glumes of fertile spikelets oblong-elliptic, 7-11 mm, closely veined; awns 2-3, 3-5 cm, setaceous above the 0.5-1 mm broad base; if 2-awned then 1 awn broader than the other and often bifurcating above; lower lemmas bearing a pair of awns and a narrow tooth, upper two lemmas sterile and awnless. Sterile spikelets above 2(-3) fertile ones reduced in size, forming a slender column with internodes longer than spikelets; uppermost spikelet with each glume bearing 2-3 setaceous awns of ten overtopping those of fertile spikelets; lemmas more shortly 3-awned. **2n = 28.** Genome **U<u>M</u>**.

Flowering and Habitat: May-June, Steppe, gullies, scree, fallow fields, on igneous, shaley and calcareous substrata, s.l.-1850 m.

Syntype: "**[Turkey]** B4 Ankara? Asia Minor, Galatia, M. Dizgurt-Dagh, 980 m, Zhukovsky; **[B4 Ankara]** Tchan-Kaia (Çankaya) prope Angora (Ankara), Zhukovsky; **[B2 Uşak]** Phrygia prope Duscha (Uşak), Zhukovsky".

Widespread <u>A2(A)</u> Istanbul: Kurtköy, 11 vi 1899, Azn. p.p.! **<u>A4</u> Ankara**: Kavaklidere (N. of Ankara), 800 m, Bornm. 1929:14794b! Ankara: Ankara-Ayaş road, around Ayaşbeli area, 1000m, 40°01.371' N 32°20.482' E, 04.06.2005, E. Cabi 1595. **<u>B2</u>** Manisa**,** 24 km from Salihli to Kula, 800 m, Coode & Jones 2808! **<u>B3</u> Eskişehir**: Sündiken Mount., 400 m, Ekim 2218!. **<u>B4</u> Ankara**: Angora, 1932, Percival! **<u>B7</u> Tunceli**: Pertek to Tunceli, 40 km from Elazig, 1400 m, Davis 29108 p.p. (with *Ae. umbellulata*, K!) **<u>B8</u>** Siirt: 28 km from Siirt to Baykan, 800 m, Davis 43078!. **<u>B9</u> Van**: Erek Mount., exit of Yedikilise village, 2178 m, 38°26.832' N 43°27.827' E, 29.07.2008, E. Cabi 3735b. **<u>C1</u>** Aydın: Selçuk to Şirince, 2 km to Şirince, 250 m, 12.05.2006, E. Cabi 531. **<u>C4</u> Mersin**: Silifke: Gülnar, 5 km from Gökbelen village, 1028 m, 36°20.774'N 33°37.595' E, 15.06.2006, E. Cabi 1113. Mut to Silifke, c. 40 km to Silifke, 222 m, road sides, 36°28.609'N 33°37.129' E, 21.04. 2006 E.

Cabi 47 & G. Akaydın**.** **C6** Adıyaman: Gölbaşı to Erkenek, above the Karanlıkdere village, roadsides, step, 1343 m, 37°54.807' N 37°46.867' E, 04.05.2008, E. Cabi 2829. **Gaziantep**: Nizip to Birecik, 446-450 m, 37°00.720' N 37°51.989' E, 12.05.2008, E. Cabi 2876. **Kahramanmaraş**: Center of city, Göksun to Kılavuzlu village, c.8 km, 523 m 37°37.718' N 36°48.727' E 03.05.2008, E. Cabi 2826**.** **C7** Urfa: Karaca Mount., 1650 m, Kit-Tan 1704! **C8** Diyarbakir: Diyarbakir, D. 22139!

External Distribution: Syria, N.W. Iran, N. Iraq, Transcaucasia. **Ir.-Tur. element**. Except for the Gaziantep specimen cited above, all Turkish material seen belongs to var. *columnaris*, with antrorsely pubescent glumes.

Figure 130. Spike and habit of *Aegilops columnaris*'

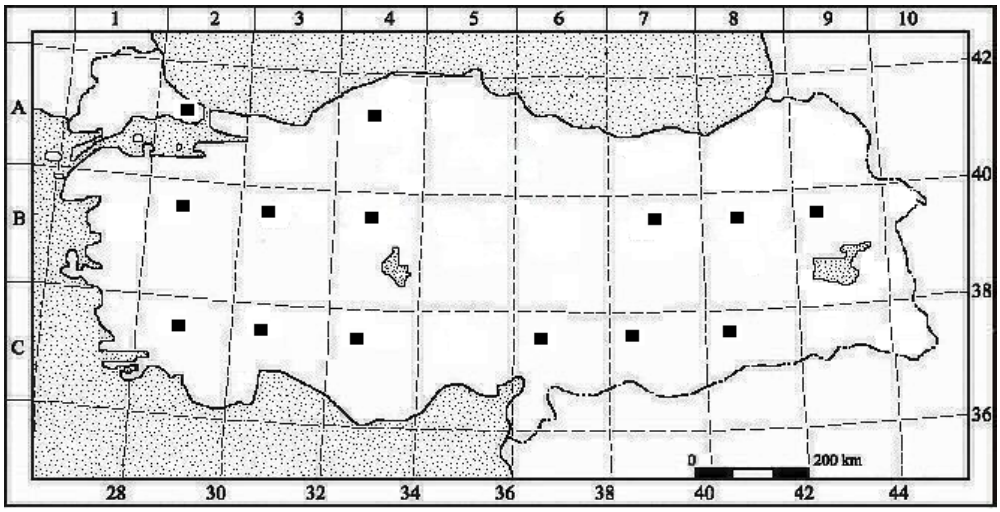

Figure 131. Distribution of *Aegilops columnaris* in Turkey.

3.4.9.16. *Aegilops neglecta* Req. ex Bertol, Fl. ltal 1:787 (1834).

Syn. *Ae. ovata* Roth in Bot. Abh. Beob. 47 (1787) nom. ambig. non L. (1753); *Ae. triaristata* Willd., Sp. PI. ed. 3, 4:743 (1805) nom illegit. (*fide* Hammer, 1980); *Triticum neglectum* (Req. ex Bertol.) Greuter Boissiera 13:171 (1967). Ic: Feddes Rep. Beih. 53: t. 14 f. a-c (1929), as *Ae. triaristata*; Kulturpflanze 28:90, t. 27 (1980). Map 44.

Tufted annuals, Culms geniculately ascending, 25-40 cm (excl. spikes). Leaf blade linear-lanceolate, 5-8 mm long, 2.5-3 mm broad, sparsely pilose. Spike narrowly ovoid, with 3-6 spikelets, 3-6 cm (incl. erecto-patent awns), 2-3 lower spikelets fertile overlapping and slightly divergent, upper 1-3 spikelets sterile; disarticulating a whole unit at maturity. Glumes of the 2(-3) fertile spikelets obovate-elliptic, slightly ventricose, those of lower spikelet 9- 10 mm, adpressed-setulose; awns 2-3, 2-5 cm, to 1 mm broad at base but setaceous above; lower 2 lemmas slightly exserted sterile spikelets 1-2, with setaceous awns slightly overtopping those of lower spikelets.

2n =4x=28. Genome **U<u>M</u>**; **U<u>M</u>N**

Flowering and Habitat: May-June. Open Pinus nigra and Juniperus excelsa forests, limestone scree, hillsides, phrygana, open meadow on basalt, 50-1600 m.

Syntype: [ltaly] Sarzanae in campis triticeis prope il Molino del Vescove, Bononiae in campis collinis di Barbiano, et sub monte Mariano in cultis al Battedizzo, Bertoloni (BOLO); Roma alla Macchia dei Mattei, Maurio (BOLO).

N.W. Turkey, W., S. & E. Anatolia A1(E) Edirne: nr Edirne, Harlan 2647! **A2(E)** İstanbul: Rumelihisar hills, 20.06.1918, B. Post! **A2(A)** Bursa: Bursa to Mudanya, 3 km N. of Bademli, 50 m, Holtz 00.284 & Hanel! **A3 Ankara**: Mudurnu to Nallıhan, 43 km to Nallıhan, 822 m, roadsides and slopes, 40°27.319' N 31°09.582' E, 27.06.2006, E. Cabi 1213. **A4 Ankara**: Ankara-Kızılcahamam, 14 km from Kazan, 1016 m, yol kenarı, kalkerli yamaç, 40°21.483' N 32°40.713' E, 27.06.2006, E. Cabi 1165. **A5 Amasya**: Amasya, Wiedemann 35 p.p.! **A6 Amasya**: Turhal, Wiedemann 35 p.p. **B2 Uşak:** Uşak to Kula, c. 2km from Güre, orman açıklıkları, 592 m, 38°39.868' N 29°07.582' E, 31.05.2008, E. Cabi 3813. **Manisa:** Salihli to Kula, 24 km to Kula, 687 m, step, gulies, scree, 38°33.155' N 28°28.217' E, 11.05.2006, E. Cabi 439. **B5 Kayseri:** Bakırdağ'dan Saimbeyli'ye Gezbeli geçidi, 1970 m, 38°12.225' N 35°59.650' E, 09.06.2006, E. Cabi 924. **B6 Kahramanmaraş**: Göksun, after Kızılöz village, slopes, 1574 m, 38°00.531' N 36°42.802' E, 10.06.2006, E. Cabi 963**. Malatya** to Adıyaman, Gözene yol ayrımında sol tarafta Quercus, yamaçlar, 1058 m, 38°11'52" N 37°54'24" E, 19.05.2007, E. Cabi 2134. **Adana**: Saimbeyli, Bozoğan Mount. above Obruk Y., 1700 m, D. 19696! **B7 Tunceli**: Pertek to Hozat, 1143 m, calcerous areas, 38°55.588' N 39°14.805' E, 02.07.2006, E. Cabi 1372 (with *Ae. triuncialis*). **Elazığ**: Çermik to Ergani, roadsides, slopes, 902 m, 38°14.151' N 39°40.670' E, 16.05.2008, E. Cabi 3022. **B8 Tunceli**, Kovancılar to Bingöl, 35 km to Bingöl, 1539 m, roadsides, 38°57'65" N 40°09' 689" E, 03.07.2006, E. Cabi 1396. **C1 Aydın** to Selçuk, Selçuk'a ~10 km kala, 133 m, 37°53.291' N 27°26.834' E, 31.05.2008, E. Cabi 3828. **C3 Antalya**, Korkuteli to Düzlerçam, 500 m to Düzlerçam, 36°59.589' N 30° 33.616' E, 14.05.2006, E. Cabi 598. **C5 Mersin**: Aslanköy to Fındıkpınarı, 1691 m, 36°57.484' N 34°20.398' E, 15.06.2006, E. Cabi 1108. **C6 Adıyaman:** Erkenek to Gölbaşı, 10 km to Gölbaşı, slopes, 815 m, 37°51'12" N 37°43'49" E, 19.05.2007, E. Cabi 2147. **C7 Adıyaman**, Bozova to Hilvan, 690 m, 37°22'16" N 38°34'27" E, 21 05 2007 E. Cabi 2196b. **Malatya:** Doğanşehir sapağını geçtikten sonra, Reşadiye geçidi, 1468 m, 37°58'40" N 38°00' 49" E 19 05 2007 E. Cabi 2138. **C8 Mardin**: Gercüş-Savur, ~5-6 km to Gercüş, 833 m, 37°34'52" N 41°20' 01" E, 23.05.2007, E. Cabi 2307.

External Distribution: Mediterranean area, Crimea, Transcaucasia, Iran. **Medit. element**.

Figure 132. *Aegilops neglecta* in its habitat and its spikes in close view

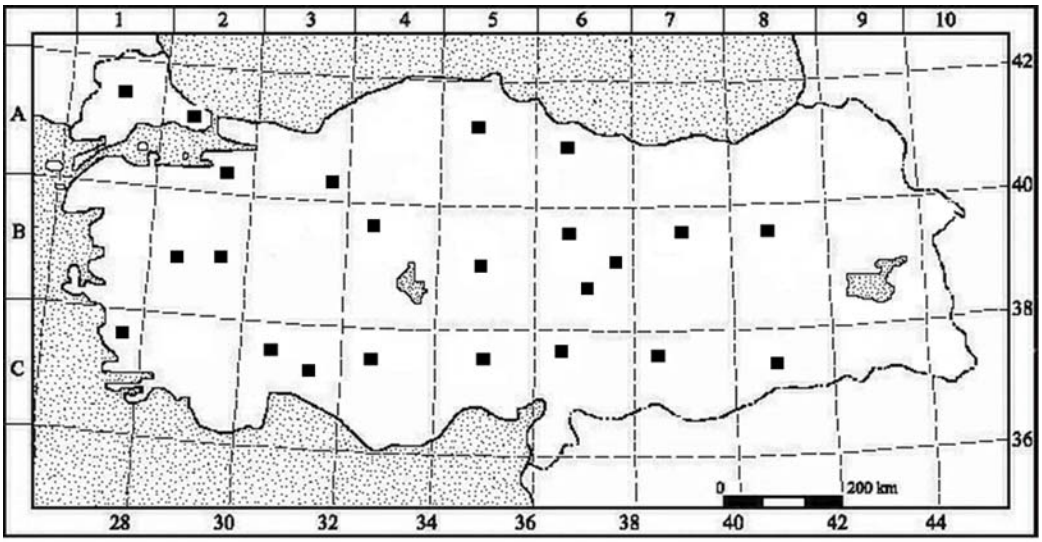

Figure 133. Distribution of *Aegilops neglecta* in Turkey.

3.4.9.17. *Aegilops geniculata* Roth, Bot. Abh. Beob. 45 (1787).

Syn: *Aegilops echinus* Godr. Florula Juvenalis 48. 1853; *Aegilops divaricata* A.J. Jord. & Fourr. In Breviarum Plantarum Novarum 2: 129. 1868; *Ae. ovata* sensu Willd., Sp. Pl. ed. 3, 4:942 (1806) et auct. plur. non L. (1753); *Triticum vagans* (Jordan & Fourr.) Greuter in Boissiera 13:170 (1967). Ic: Feddes Rep. Beih. 55: t. 15, f. a-f (1929), as *Ae. ovata* L.; Kulturpflanze 28 :91, t.28 (1980).
Type: [Almanya], Roth s.n. (holo: B-W; iso BM!, LE, TUB)

Tufted annuals, Culms geniculately ascending, 10-30 cm (excl. spikes). Leaf blades linear-lanceolate, 2-6 cm long, 1.5-5 mm broad. Spike 12-30 mm (excl. awns), narrowly ovoid, 2.5-6(-5) mm broad with (2-)3 fertile 1(-2) rudimentary spikelets; spike disarticulates as whole at maturity. Lateral fertile (lower) spikelets 2(-3), partly overlapping, subventricose, urceolate, widest at or below the middle; glumes 6-10 mm, subventricose, adpressed-pubescent or scabridulous, with truncate apex bearing 3-4 (-5) setaceous awns to 15-25 mm; awns of lower lemmas nearly as long as those of glumes. Uppermost (usually 3rd) spikelet sterile, 2-3 mm (excl. awns), borne on a rachis segment at least as long as spikelet below it; lemmas bearing awns nearly as long as those of glumes. **2n=4x=28.** Genome **MU**

Flowering and Habitat: April-June. Disturbed steppe, rocky plains, gravelly places, calcareous hillsides, seashore, nr s.l.-1200 m.

Mainly N. Turkey & S. Anatolia.. **A1 Tekirdağ**: Şarköy'den Gelibolu'ya, 91 m, 40°34.301' N 26°56.103' E, 30 05 2006 E. Cabi 844 (with *Ae. triuncialis*). **A2(E) İstanbul:** Rumelihisar, 29 iv 1936, B. Post! **A2(A)** Istanbul: Maltepe, 16 v 1897, Azn.! **Bursa**: 5 km from Sogukpinar to Keles, 1080 m, Holtz 00.349 & Hanel (depauperate)! **Kocaeli**: Kurdköy, 11 vi 1899, Azn.! **A3 Bolu**: Abant, Ömerler village, 818 m, 40°41.959' N 31°27.395' E, 27.06.2006, E. Cabi 1204**. A4 Zonguldak**: Safranbolu, 500 m, Tobey 1940! **A5 Sinop**: Boyabat, 400 m, Tobey 1940 a! **B1 İzmir**: Pınarbaşı, hills above Pınarbaşı, 517 m, 38°24.540' N 27°15.998' E, 01.06.2008, E. Cabi 3139. **Çanakkale:** Ayvacık to Ezine, 133 m, 39°40.183' N 26°23.488' N, 02.06.2008, E. Cabi 3150. **Balıkesir**, Sarmısaklı c 3 km S. of Ayvalık small freshwater lake, just behind, share, dominated by Juncus, 10 m, 39°20' N 26°40' E, 09 06 1994 RMN 4469 **B3 Eskişehir**: Polatlı to Sivrihisar'a 31 km kala, kalkerli yamaçlar, 853 m, 39°33.599' N 31°47.914' E, 10 05 2008 E. Cabi 2808 (with *Ae. biuncialis*). **C1 Aydın**, Aydın Muğla arası, Çine'ye 19 km kala, açık ağaçlık alanlar, 123 m, 37°43.147' N 27°55.079' E, 13 05 2006 E. Cabi 555b**. C2 Denizli**, Üçler belediyesi, Konutkent 2 çevresi, 534 m, 37°47.706' N 029°01.064' E 31 05 2008 E. Cabi 3823**. Muğla**: Kumluova

(Letoon) antic kent, deniz seviyesi, 36°19.927' N 29° 17'344' E, 28.04.2008, E. Cabi 2646**.** **C5 Adana**: 10 km from Adana to Ceyhan, nr s.1., Coode & Jones 368 p.p.! **C6 K.Maraş**: Center to Sarıçukur village, road sides , 682 m, 37°36.506' N 36°49.631' E, 03.05.2008 E. Cabi 2822. **Hatay**: İskenderun to Antakya, ~4-5 km from Belen, calcerous rocks, 635 m, 36°28.643' N 36°15.455' E, 02.05.2008, E. Cabi 2773. **C7 Ş.Urfa:**Viranşehir to Urfa, c. 21-22 km to Urfa, field margins, ~610 m, 37°09'39" N 39°01'10" E, 22.05.2007, E. Cabi 2223. **C8 Mardin**: Mardin to Midyat, 16 km from Mardin, 933 m, wine yards, 37°20'46" N 40°49'28" E, 23.05.2007, E. Cabi 2291

External distribution: Southern Europe, Iraq, Jordan, Lebanon, Palestine, Syria, Africa, Mediterranean area, Crimea. **Multiregional elementi**. Threat category: **LC**.

Figure 134**.** Spikes of *Aegilops geniculata* in a close view

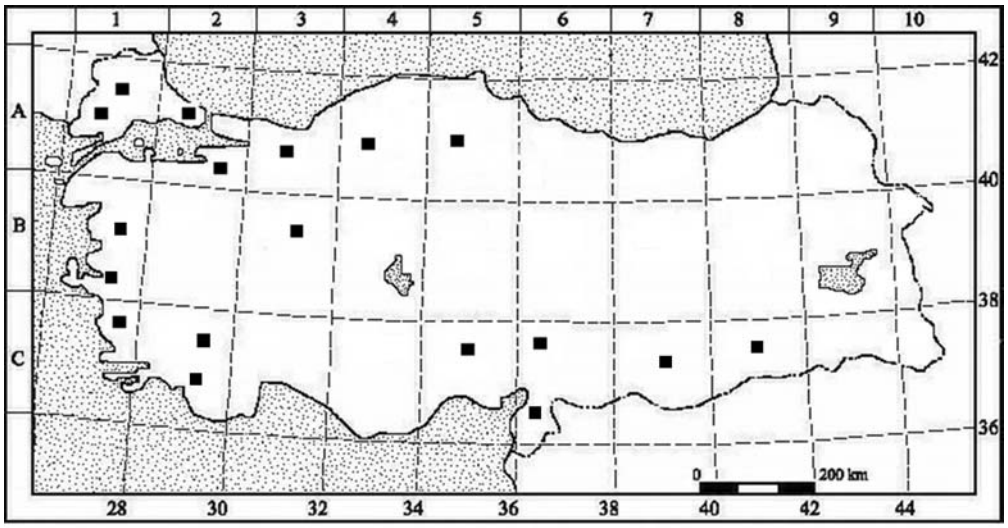

Figure 135**.** Distribution of *Aegilops geniculata* in Turkey.

3.4.10. Triticum L.

In total, eleven *Triticum* species including three diploid species (*T. urartu* Thum. ex Gandil.**,** *Triticum monococcum* L. and *T. boeoticum* Boiss.), six tetraploid species (*T. dicoccon* Schrank. ex Schubl.,*T. dicoccoides* (Korn ex Aschers. et Graebn.)Thell, *T. araraticum* Jakubz**.**, *T. turgidum* L., *T. carthlicum, T. durum* Desf. and one hexaploid species (*T. aestivum* L.) were recognized in Turkey. A taxonomic brief key to the genus *Triticum* in Turkey is presented along with updated descriptions and disribution maps for each wild species and landraces *T. monococum* and *T. dicocon*.

Triticum L. Species Plantarum 1: 85-87. 1753.
Syn: *Crithodium* Link Linnaea 9(1): 132. 1834. *Deina* Alef. Landwirthschaftliche Flora 335. *Spelta* Wolf Genera Plantarum 22. 1776.
Type Species: *Triticum aestivum* L. - *Species Plantarum* 1: 85. 1753. LT designated by Hitchcock in Amer. J. Bot. 10: 513. 1923

Annuals. Culms solitary or fasciculate at the base. Internodes usually hollow throughout the culms in hexaploids, solid under spike in diploids and tetraploids. Leaf sheaths auriculate, glabrous or hairy. Ligule membranous. Leaf blades flat, glabrous or pubescent. Inflorescence a dense terminal distichous spike. Rachis tough (domesticated taxa) or fragile (wild taxa). Spikelets usually falling with the internode below to form a wedge-shaped diaspore, sometimes falling with the adjacent internode to form a barrel-shaped diaspore Spikelets usually 1–3 times the length of the internodes, 2-6(-9)-flowered, hermaphrodite, uppermost reduced, sterile. Glumes ± equal, usually shorter than and not concealing lemma, truncate, coriaceous, chartaceous or rarely membranous, keeled, toothed or awned. Lemma keeled, chartaceous to coriaceous, ventricase, awned or unawned. Palea hyaline-membranous, 2-veined, 2-keeled, entire or splitting at maturity. Lodicules 2, ovate. Stamens 3. Styles 2, plumose. Caryopsis free or adherent to lemma and palea, ellipsoid, tufted-pilose at apex. Embryo 1/5-1/3 x caryopsis; hilum linear, ± equalling caryopsis. Endosperm f1inty or mealy. *x* = 7. **Haplomes A, B, D, and G**.

Key to species

1. Glumes 25-45 mm, membranous, ± concealing lemma ……...**9. *T. polonicum***

1. Glumes (4-)6-15 mm, chartaceous to coriaceous, not concealing lemma.

2. Rachis tough, not disarticulating at maturity

3. Glumes keeled at apex or in upper half only……...**11. *T. aestivum***

3. Glumes strongly keeled throughout

4. Glumes terminating in 10-30 mm awn ……...**10. *T. carthlicum***

4. Glumes terminating in 1-3 mm apical tooth

5. Spike slender, laterally compressed; glumes nearly equalling lowest floret; endosperm flinty……..**7. *T. durum***

5. Spike stout, oblong to nearly square in cross-section; gIumes 2/3 x lowest floret; endosperm mealy……**8. *T. turgidum***

2. Rachis fragile, disarticulating at maturity

6. Glumes 1-keeled……. **6. *T. dicoccon***

6. Glumes 2-keeled

7. Spikelets elliptical to ovate, **r**achis glabrous or sparsely ciliate, disarticulating only with pressure……**3. *T. monococcum***

7. Spikelets rectangular, rachis densely hairy, disarticulating readily at maturity.

8. Spikelets 2-flowered, one or both fertile

9. Leaf blades blue-grain, hairs stiff, those on the veins longer than those between anthers 3-6 m long……..…….**1. *T. boeoticum***

9. Leaf blades yellow green, hairs soft, of uniform length; anthers 2-4 mm long…….……..….**2. *T. urartu*.**

8. Spikelets 3-flowered, 1-2 florets fertile, uppermost rudimentary.

10. Rachis internodes 1.5-1.75 mm; glumes oblong or elliptic-oblong, 7-10 mm; fertile lemma adpressed-pilose, with 5-6(-9) cm awn…….……**4. *T. araraticum***

10. Rachis internodes (3-)4-5 mm; glumes lanceolate to elliptic-lanceolate, 10-15 mm; fertile lemma glabrous, with 10-12(-15) cm awn…….……..……..**5. *T. dicoccoides***

3.4.10.1. *Triticum boeoticum* Boiss., Diagnoses plantarum orientalium novarum 2(13): 69. 1854.

Syn. *Crithodium aegilopoides* Link in Linnaea 9:132, t. 3 (1834) non *T. aegilopoides* Forsskal (1775); *Aegilops crithodium* (Link) Steudel, Syn. Pl. Glum. 1:355 (1854); *T. aegilopoides* (Link) Bal., Pl. Or. Exs. (1857), nomen; *T. monococcum* L. var. *lasiorrhachis* Boiss., Fl. Or. 5:673 (1884); *T. aegilopoides* (Link) Bal. ex Koem. in Koern.& Werner, Handb. Getreideb.1: 109 (1885) et Hausskn. in Mitt. Thür. Bot. Ver. 13:65 (1899) non Forsskal (1775) nec Turcz. ex Griseb. (1853) nec Thurb. ex A. Gray (1863); *T. tenax* Hausskn. in Mitt Thür. Bot. Ver. 13:67 (1899)! *T. monococcum* L. proles *aegilopoides* (Link) Aschers. & Graebn., Syn. Mitteleur. Fl. 2(1):701 (1901); *T. monococcum* L. subsp. *aegilopoides* (Link) Stranski var. *baeoticum* (Boiss.) Stranski in Bull. Soc. Bot. Bulg. 3:322 (1929); *T. monoco*ccum L. var. *boeotica* (Boiss.) Kneuck. in Allg. Bot. Zeitschr. 9:34 (1903); *T. baeoticum* Boiss. subsp. *aegilopoides* (Link) Grossh. in Trudy Azerb. Otd. Zakavk. Fil. Akad. Nauk SSSR, Bot. 8:350 (1939); *T. monococcum* L. subsp. *baeoticum* (Boiss.) Hayek, Prodr. Fl. Balc. 3:228 (1932); *T. monococcum* L. subsp. *beooticum* (Boiss.) Yen in Acta Phytotax. Sinica 21(3):292 (1983) comb. superfl. subsp. *thaoudar* (Reuter ex Hausskn.) Schiemann, Weizen, Roggen, Gerste 28 (1948). *T. thaoudar* Reuter ex Hausskn. in Mitt. Thür. Bot. Ver. N.F. 13:66 (1899)! *T. monococcum* L. var. *thaoudar* (Reuter ex Hausskn.) Flaksb. in Trudy Bjuro Prikl. Bot 6:673 (1913)! *T. monococcum* L. subsp. *aegilopoides* (Link) Stranski var. *thaoudar* (Reuter ex Hausskn.) Stranski in Bull. Soc. Bot. Bulg. 3:221 (1929) ! *T. monococcum* L. subsp. *thaoudar* (Reuter ex Hausskn.) Zhuk. in Bot. Zhurn. 53(4):442 (1968) comb. illegit.! lc: FI. Iraq 9: t. 68 (1968).

Culms tufted, 30-120 cm, slender; green, pubescent or pilose at nodes. Leaf sheaths villous-pilose. Leaf blades 2-7 mm broad, villous-pilose, hairs stiff, those on the veins longer than those between, margins scabridulous. Spike erect, 5-14 cm, slender, lax, lateralIy compressed. Rachis fragile, densely hairy at nodes and margins, internodes 3-4 mm, readily disarticulating below spikelet at maturity spontaneously. Spikelets 12-17 mm, rectangular, 2-3 flowered, one or two florets fertile. Glumes (4-)6-10 mm, coriaceous, yellow blackish-purple, glabrous or pubescent-pilose, 2-keeled; keels projecting as two unequal teeth, one keel prominent, scabridulous towards apex. Fertile lemma navicular, 10-14 mm, glabrous, with scabrid awn to 8 cm. Palea 8.5-11 mm, splitting at maturity. Anthers linear, c. 3-5 mm, yellow. Caryopsis ellipsoid, 6.5-8 x 2.5-3 mm. Endosperm flinty. **Haplome A^b. 2*n* = 14.**

Flowering and Habitat: May-June (July). Basalt, calcareous soil, overgrazed steppe, fields, by roadsides and ditches, edges of cultivated fields, growing with *Dasypyrum villosum*, *T. urartu*, *T. dicoccoides*, *Taeniatherum caput medusae*, *Ae. speltoides*, 100-2000 m.

Type: [Greece] in planitie Baeotica, Spruner (holo. G!).

Widespread. **A1(E)** Tekirdağ: Tekirdağ (cult. CSIRO, Canberra, CPI 090564)! **A2(E) Istanbul**: San Stefano (Yeşilköy), 18 vi 1905, Azn. (as *T. monococcum* var. *lasiorrachis*)! **A2(A) Bursa**: Yalova to Bursa, M. & D. Zohary 3314! **A6 Tokat:** Tokat to Artova, exit of Boyunpınar village, 1316m, 40°091'46.2" N 36°23'43.1" E, 16 06 2007, E. Cabi 2411. **A9 Kars**: Kars, vii 1941, Birand! **B1 Balikesir:**4 km S. of Ayvalik, Zohary 35857 (cult. - Ottawa Cy t No. 2832-51, 2n=14)! **B2 Uşak**: Ouchak (Uşak), 910 m, Bal. 1857:1340! **Uşak** to Sivaslı, 5 km from Uşak, 910 m, 38°37.745' N 29°28.927' E 30.05.2008, E. Cabi 3109. **B3 Eskişehir**: Çifteler to Eskişehir, Birand & M. Zohary 3301! **B4 Ankara**: 5 km W. of Elmadag, 1140 m, 07.08.1972, Spencer 0101! **Eskişehir:** Polatlı to Sivrihisar, 29 km from Polatlı to Sivrihisar, 880 m, 39°33.845' N 31°48.664' E, 30 05 2008 E. Cabi 3099. **Ankara** 33 km from Gölbaşı to Haymana, dry calcerous, rocky hills, 1073 m, 39°37'41" N 32°42'05.2" E, 16.06. 2008 E. Cabi 3298. **Kırşehir**: Aydınlı to Demirci village, road sides , 1198 m, 39°20.600' N 33°57.803' E, 10.06.2008, E. Cabi 3232. **B5 Kırşehir** to Kayseri, 40 km to Kayseri, roadsides, 1150 m, 38°53.558' N 35°06.893' E, 10.06.2008, E. Cabi 3237. **B6 Sivas**: Kangal, 1000 m, M. & D. Zohary 2243! 2244! **B7 Elaziğ**: c. 40 km from Elaziğ to Hozat, 1000 m, Kyoto Univ. Bot. Exped. 6-30-7-A! & B! **Kayseri**: Pınarbaşı to Kayseri, Melikgazi, on the road to castle, 1927 m, 38°43.837' N 36°13.021' E, 11.06.2008 E. Cabi 3257.**B8 Erzurum**: 26 km N. of Muş, 1300-1500 m, M. Zohary 57130! **C3 Isparta**: Beyşehir, M. & D. Zohary 2759! **Erzincan**, Çayırlı to Tercan, crossroad of Çağlayan castle, field sides, 1458m, 39°49'32.9" N 40°11'23.3" E, 07 Jul 2007, E. Cabi 2488.**C4 Konya**: Kizilviran (Kizilören), 42 km from Konya to Beyşehir , 1400 m, Ehrendorfer et al. 787-24-3! **C6 Gaziantep**: Araban to Gümüşpınar, 534 m, 37°26.372' N 37°55.430' E 04.05.2008 E. Cabi 2846. **C7 Ş.Urfa:** Ceylanpınar to Viranşehir, 6 km to Viranşehir, edge of cultivated fields, rocky crevices, 520 m, 37°10.865' N 39°48.083' E, 13.05.2008, E. Cabi 2907. **C8 Mardin**: 6-8 km from Derik to Mazidağ, van der Maesen 2092!

External Distribution: Balkans, Crimea, Caucasia, W. Syria, N. Iraq, Iran, Afghanistan.

Figure 136. Spike of *Triticum boeoticum*

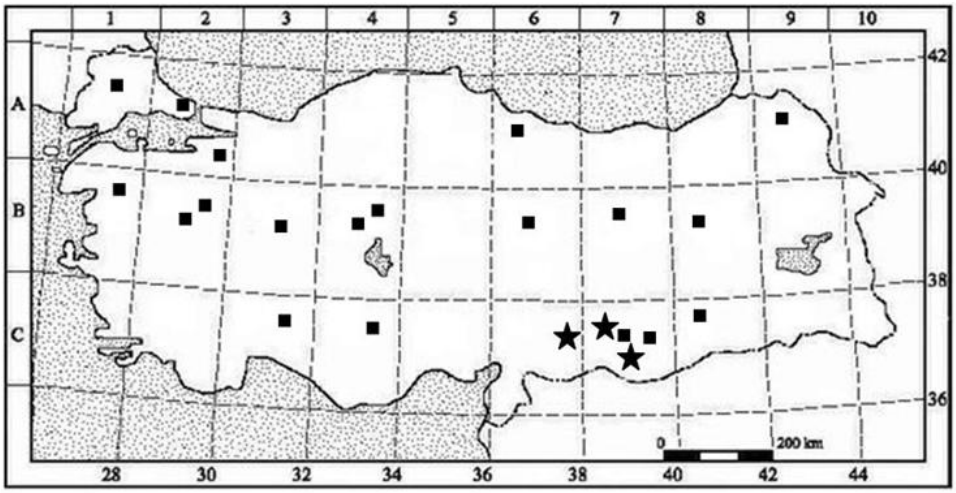

Figure 137. Distribution of *Triticum boeoticum and T. urartu* in Turkey

Legend. (■) *Triticum boeoticum,* (★) *T. urartu*

Notes on the taxa.

Triticum boeticum (wild einkorn) is morphologically similar to and, in its native range, sometimes sympatric with *T. urartu*, another wild diploid wheat. *Triticum monococcum* is the domesticated derivative of *T. boeoticum*. Boissier published the combination for this species both as "*Triticum baeoticum*" and "*T. boeoticum*". Because the type specimen is from Boeotia [Greece], "*boeoticum*" is the correct spelling of the epithet. Two main eco-geographic races of *T. boeoticum* have been recognized by Tan (1985) in the Flora of Turkey. A relatively small one-seeded type typical of the cooler Balkans and Western Anatolia usually referred to as *T. boeoticum* ssp. *boeticum*, while the larger two-seeded race in the warmer dry summer areas of Southern Turkey, Iraq and Iran is commonly referred to as *T. boeoticum* ssp. *thaoudar*. In Anatolia all inter-gradations and intermediates between these two races occur often in mixed stands (Zohary 1969). It was believed that *T. monococcum* L. var. *aegilopoides* (Link) Thell. had contributed the A genome to the macaroni and bread wheats (Kimber & Sears, 1987).

3.4.10.2. *Triticum urartu* Thumanjan ex Gandilyan Botaničnyj Žurnal 57(2): 176. 1972.
Syn. *Triticum monococcum* subsp. *urartu* (Thumanjan ex Gandilyan) Á. Löve & D. Löve Botaniska Notiser 114(1): 19. 1961. *Triticum urartu* var. *binarturutriru* Gandilyan Botaničnyj Žurnal 57(2): 177. 1972.

Culms to 145 cm, nodes pubescent; Leaf blades 7–10 mm wide, yellow-green, puberulent, hairs uniform in length, soft. Spikes erect**,** 6–12 cm, rachises densely ciliate at the nodes and margins; internodes 3–5 mm; disarticulation spontaneous. Spikelets 12–16 mm, rectangular, with 2–3 florets, 1–2 seed-forming. Glumes 8–11 mm, coriaceous, tightly appressed to the lower florets, 2-keeled, 2-toothed, second tooth not well-developed; lemmas 10–13 mm, awned, awns on the lower 2 lemmas to 7 cm, on the third lemma to 1 cm; paleas splitting at maturity; anthers 2–4 mm. Caryopses, endosperm flinty. **Haplome A^u**. **$2n = 14$**.

S.E. Anatolia C6 Gaziantep: Araban to Gümüşpınar, 534 m, 37°26.372' N 37°55.430' E 04 05 2008 E. Cabi 2846. **C7 Ş.Urfa:** Ceylanpınar to Viranşehir, 6 km to Viranşehir, edge of cultivated fields, rocky crevices, 520 m, 37°10.865' N 39°48.083' E, 13 05 2008 E. Cabi 2907.Urfa: Siverek to Çermik, Steps covered with basaltic rockies, 811m, 16.05.2008, E. Cabi 3003. Siverek to Adıyaman, edge of wineyards, 756 m, 16.05.2008, E. Cabi 3015. Siverek to Karacadağ, 882 m, 16.05.2008, E.Cabi 2994.

External Distribution. It has a more limited distribution than *T. boeoticum*. The natural populations of *T. urartu* are restricted to the fertile crescent and are distributed in Jordan, Syria, Lebanon, Turkey, Iraq, Armenia, and Iran (Johnson, 1975).

Notes on the taxa *Triticum urartu* is the wild diploid wheat that contributed the **A** haplome to the durum and bread wheat evolutionary lines. It does not have a diploid domesticated form. Because of its close morphological similarity to *T. boeoticum, T. urartu* was included in *T. boeoticum* until genetic analysis showed it to be a separate species. *Triticum urartu* was first described as a rare wild diploid wheat endemic to Transcaucasia (Jakubizner, 1959). However, many *T. urartu* accessions were found in Turkey, Lebanon, Iraq, and Iran by Johnson (1975). Morphologically, *T. urartu* and *T. boeticum* are similar, but they can be distinguished on the basis of vegetative and inflorescence characters. *Triticum urartu* specific traits are smooth, velvety leaves, compared to rough, hairy leaves of *T. monococcum* ssp. *aegilopoides*, smaller anthers, a prominent second tooth on the sterile glumes, a two awned spikelet and reddish colored kernels.

Figure 138. Spike of *Triticum urartu*

3.4.10.3. *Triticum monococcum* L., Sp. Pl. 86 (1753).

Syn. *T. pubescens* Bieb., Beschr. Land. Terek Kur. Kasp. 81 (1800); *T. monococcum* L. var. *eu-monococcum* Hayek, Prodr. Fl. Balc. 3:228 (1932) nom. illegit.

Annual. Culms tufted, rarely solitary, 45-100 cm, slender, green, glabrous, nodes retrorsely pilose. Leaf sheaths glabrous (lower pilose), margins ciliate. Ligules membranous 1-1.5 mm long. Leaf blades 2-6 mm broad, scabridulous or puberulent, margins smooth or slightly scabrid. Spike erect, (2.5-)3-5 cm long, 4.5-5.5 mm wide, shorter and more compact than in *T. baeoticum*, strongly and laterally compressed. Rachis glabrous or sparsely ciliate, internodes 2-2.5 mm, disarticulating below spikelet only with pressure. Spikelets elliptical to ovate, 2-3-flowered, usually only 1 fertile, uppermost sterile. Glumes 6-8 mm, coriaceous, 2-dentate, keels 2. Fertile lemma navicular, 8-10 mm, with (3-)6-8 cm scabrid awn. Palea as long as lemma, splitting to base at maturity. Caryopsis 5-7 mm long. **Haplome A^b**. $2n = 14$.

Flowering and Habitat: June-July. Rocky mountain slopes, open pastures, fallow fields, edge of ditches, cııltivated, 110-1000 m.

"Described without locality (Hb. Linn. 104/4!)".

N.W. Turkey, scattered in N. & S. Anatolia. **A1(E)** Kirklareli: Babaeski, Harran 2498 (cult. Iowa, Cyt No. 2248-S2, 2n=14)! **Tekirdağ**: Yenice, S. of Inecik, 610 m, E. Anglia Exped. F21 **A2(E)** Istanbul: Safraköy, I9vi 1898, Azn. **A4 Kastamonu:** İhsangazi, Kuşçalar district, Sekicek street, limestone slopes, 41°14'29.8" N, 33°31' 39.1" E, 900 m.,E. Cabi 2374. **A5 Samsun**: Ladik, 1000 m, Bornm. 1890:1856 **A9 Kars:** unloc., Birand 101! **B1** Balikesir:Karacabey, Harasi,Harlan 10294 p.p. (cult. in Iowa) **C4 Konya**: Küçük Köy, 980 m, Helbaek 2543!.

Figure 139. Spikes of landraces, (A) *Triticum monococum* and (B) *T. dicocon*

Legend. A. *Triticum monococum* B. *T. dicocon*

Notes on the taxa *Triticum monococcum* (cultivated einkorn). Its primary range extends from the Balkans and Romania through the Crimea and Caucasus to northern Iraq and western Iran, and south to northern Africa.

3.4.10.4. *Triticum araraticum* Jakubz. Sel. Seed-Gr., Mosc., (Forms & Spec. Hardy Wheats) 5: 46. 1947.

Syn. *Triticum timopheevii* var. *araraticum* (Jakubz.) Yen in Acta Phytotax. Sinica 21(3):294 (1983)*: T. dicoccoides* (Koern.) Koern. ex Schweinf. subsp. *armeniacum* Jakubz. in Trudy Prikl. Bot. selekt. 5(1):155, f. 5(1), 196 (1932) nom. nud.; *T. armeniacum* [Jakubz.] Makushima in Doklady Akad. Nauk SSR 21(7):345-348, f. 1-3 (1938) non Nevski (1934); *T. araraticum* Jakubz. in Selekt. i Semenov. 14(5):46 (1947); *T. montanum* Makushima in Uchen. Zap. Leningrad Dedag. Inst. 66(8):138, 141 (1948) nom illegit.; *T. chaldicum* Menabde, Pshen. Gruz. 196 (1948); *T. turgidum* L. subsp. *armeniacum* (Makushima) A. & D. Löve in Bot Not 114(1):50 (1961); *T. timopheevi* (Zhuk.) Zhuk. subsp. *araraticum* (Jakubz.) Mackay in Hereditas Suppl. 2:267 (1966) nom. illegit.; *T. nikolai* Fed. & Takht. ex Zhuk. in Bot. Zhurn 53(4):442 (1968) nom. nud.

Culms tufted, erect, 70-90 cm, pilose to weakly pilose, glabrous below spike. Leaf sheaths glabrous, sparsely or densely long-pilose. Ligule c. 1 mm. Leaf blades linear-acuminate, 15-45 cm x 3-5 mm, adaxial surface white-pilose, abaxial often sparsely pilose, margins smooth or scabridulous. Spike flattened, ± laterally compressed, (3.5-)5-6.5(-8.5) x 1-1.5 cm. Rachis tough but fragile at maturity, internodes 1.5-1.75 mm, densely ciliate at margins. Spikelets 3-flowered, lower 2 florets fertile, uppermost rudimentary. Glumes ± equal, oblong or elliptic-oblong, 7-10 mm, coriaceous, densely pubescent throughout, yellow, 2-keeled; one keel prominently crested near apex or in upper half, terminating in 1-1.5 mm tooth. Fertile lemma navicular, 10-13 mm, adpressed-pilose, awn 5-13 cm scabrid. Palea as long as lemma, slightly ciliate on keels. Anthers short 2.5-3 mm long **Haplomes A^bG**. $2n = 28$..

Flowering and Habitat: June. Dry mountain slopes.

Type "Described from Shorbulag, Soviet Armenia; type probably at ERE".

East, S.E. Anatolia B10 Ağri: mt. Ararat (Ağrı Mount.), Johnson (cult. CSIRO CPI No. 090600). **C6** Gaziantep: Araban to G. Antep, 30 km to G. Antep, 650 m, 20.05.2007, E. Cabi 2159.

External Distribution. Transcaucasia, Iraq, Northern Syria

Notes on the taxon: *T. araraticum* (wild timopheevi wheat) is the tetraploid free threshing, two-grained wheat described from Transcaucasia, evaluated by some workers after crossing experiments as a distinct species, by others as a separate subspecies or variety. Unlike *T.*

dicoccoides, T. araraticum does not easily cross with its tetraploid cultivated wheat, most probably due to the different genomic structure of their chromosomes(Zohary 1969).
Tan (1985) considered this taxon as a variety of *T. timopheevi* for the Flora of Turkey.

Cultivated timopheevi wheat , a restricted and rare form of cultivated tetraploid wheat found in a single district of Georgia in the former Soviet Union where no wild forms have been reported (Zohary 1969). Tan (1985) reported that *T. timopheevi* has not yet been recorded from Turkey.
I also could not record the cultivated timopheevi in botanical expeditions carried out during the thesis timeline. However, Mori et al 2009, on the basis of cpDNA data, proposed that domestication of *T. timopheevi* occurred in the region of southern Turkey or northern Syria, and not in Transcaucasia.

Figure 140. Habit of *Triticum araraticum* and its spike in close view

3.4.10.5. *Triticum dicoccoides* (Koern.) Koern. in litt. ex Schweinf. in Ber. Deutsch. Bot. Ges. 26a:309 (1908).

Syn: *T. vulgare* Vill. var. *dicoccoides* Koern. in Verh. Nat. Ver. Pr. Rheinl. 46: Sitz.-ber. 21 (1889); *T. sativum* Lam. subsp. *dicoccum* (Schuebler) Hackel var. *dicoccoides* (Koern.) Aschers. & Graebn., Syn. Mitteleur. Fl. 2(1):679 (1901). Ic: Percival, Wheat Plant f. 122 (1921); Priroda Akad. Nauk USSR 8-9: 100, f. 1 (1933).

Annual. Culms 30-150 cm, glaucous, with 3-4 glabrous or puberulent nodes. Leaf sheaths covering ¾ of the culms, usually glabrous sometimes lower leaf sheaths white-pilose. Ligule membranous up to 1.5 mm long. Auricles long up to 2.5 mm long. Leaf blades 10-30 cm long, glabrous or puberulent on abaxial and/or adaxial surface. Spike laterally compressed, 4-8(-10) x 0.7(-1.5) cm. Rachis fragile, densely hairy at nodes and margins, internodes (3-)4-5 mm. Spikelets 3-flowered; 1-2 fertile, long-awned, uppermost rudimentary, unawned. Glumes lanceolate to elliptic-lanceolate, with wide hyaline margins, 10-15 mm, coriaceous, glabrous or sericeous-pilose, 2-keeled; one keel very prominent with projecting, 1-1.5 mm tooth. Fertile lemma navicular, 10-15 mm, glabrous, with 10-13(-15) cm scabrid awn, awn of lower floret slightly longer than that of upper. Palea membranous, as long as lemma, eliptic lanceolate, 10-14 mm long, two keeled, keels ciliate throughoy the keels. Anthers short c. 2.5 mm long. **Haplomes A^uB**. **$2n$ = 28.**

Flowering and Habitat: June. *Dry mountain slopes, 440-1650 m.* It grows sympatric with *Ae. triuncialis*, *H. spontaneum* and *T. urartu*

Type: "[Palestine] am Antilibanon, 1220 m, 1855, Kotschy".

East and S.E. Anatolia B7 Tunceli. **C5 Içel** (Cllician Taurus) and C6 Maraş (fide Plant Introd. Rev. (CSIRO), Canberra , 1984). **C6 Gaziantep**: nr Gaziantep (Harlan & Zohary f. 4, 1966). **C7 Urfa**: Hilvan to Siverek (Harlan & Zohary f. 4, 1966). Diyarbakir: N. of Karaca Mount. (Harlan & Zohary f. 4, 1966). Urfa: Urfa to Hilvan, 829 m, 15.05.2008 E. Cabi 2967, Urfa Ceylanpınar Gürgürbaba area, 442 m, 13.05.2008 E. Cabi 2900

External Distribution: Transcaucasia, W. Syria, N. Iraq, W. Iran. **Ir.-Tur. element**.

Figure 141. Spikes of (Left) *Triticum dicoccoides* and (Right) *T. boeoticum*.

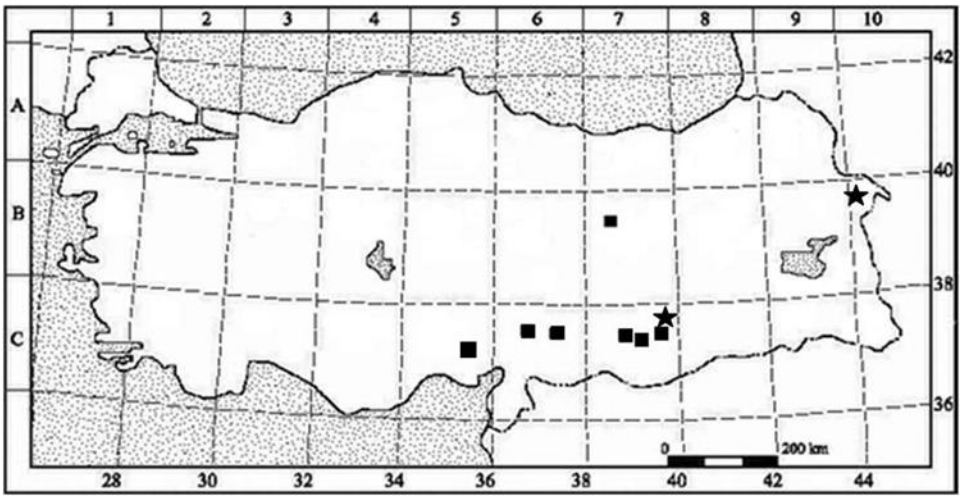

Figure 142. Distribution of *Triticum diccoccoides* and *T. araraticum* in Turkey

Legend. (■) *T. diccoccoides,* (★) *T. araraticum* in Turkey

Notes on the taxon: *T. dicoccoides* (Wild emmer) is accepted as the progenitor of cultivated emmer (*T. dicoccum*). Wild emmer has a more restricted distribution than wild einkorn. It is found in Palestine, South Syria and Transjordan. It is known that *T. dicoccoides* crosses easily with cultivated tetraploid wheats.

3.4.10.6. *Triticum dicoccon* Schrank, Baier. Fl. 1:389 (1789). Syn: *T. volgense* (Flaksb.) Nevski in Fl. URSS 2:683 (1934).

Culms 80-100 cm, glabrous or pubescent at nodes. Ligule 1-2 mm, leaf blades to 2 cm broad, scabridulous. Spike cylindrical to strongly flattened, 3-7(-10) cm x 8-13 mm, laterally compressed. Rachis fragile, glabrous or shortly ciliate at nodes and margins, disarticulating above spikelet at maturity with pressure, internodes 2-3.5 mm. Spikelets 9-12 mmm long, elliptical to ovate, 3(-4)-flowered, yellowish-green. Glumes (6-)7-10 mm, coriaceous, with single prominent keel, keel terminating in a very shorth tooth. Lemmas navicular, 8-12 mm long, awn of lemma scabrid, to 15 cm. Paleas as long as lemmas, not splitting at maturity. Anthers short 2.5-3 mm long, Caryopsis 5-8 mm long. Endosperm flinty.Haplomes 2n=28. **A^uB** *Cultivated.*

Type: "[Germany] Described from Bavaria".

N. Anatolia. **A4 Kastamonu:** 1 km from İhsangazi to Kastamonu, field and sides, 41°12'48.8" N, 33°34'31.8" E, elev. 923 m. E. Cabi 2375 **A5 Çorum**: Çorum, Hillman obs. Amasya: nr Merzifon, Hillman obs. **A9 Kars**: Kars, Hillman obs.

External Distribution: C. & S. Europe, S. Russia, Caucasia, N. Iraq, W. Iran, Arabia, N. Africa, Ethiopia.

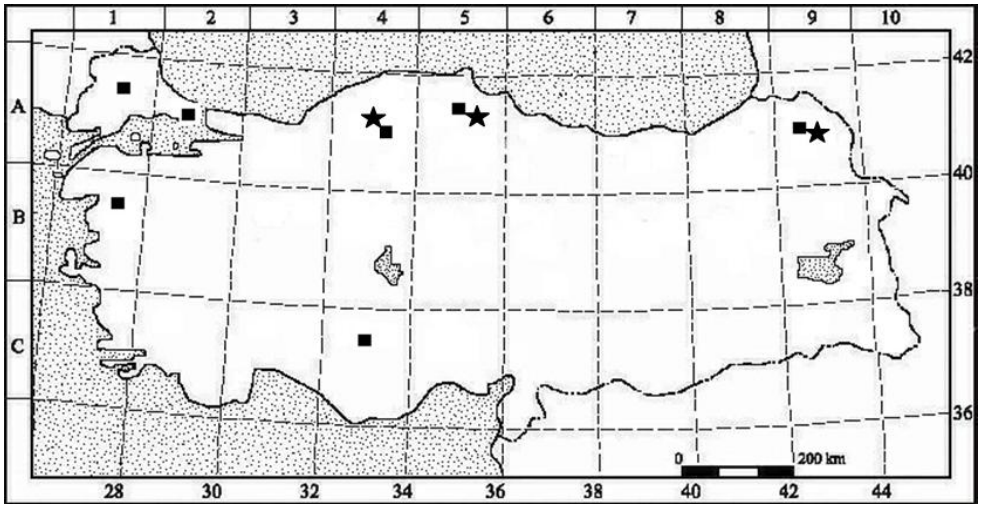

Figure 143. Distribution of *Triticum monococum* and *T. dicoccon* in Turkey

Legend. (■) *Triticum monococcum*, (★) *T. dicoccon.*

3.4.10.7. *Triticum durum* Desf., Fl. Atl. 1:114 (1798).

Syn: *T. hordeiforme* Host, Gram. Austr: 4:3, t. 5 (1809); *T. siculum* Roemer & Schultes, Syst. Veg. 2: 765 (1817)! *T. molle* Hort. ex Roemer & Schultes, op. cit. 770 (1817); *T. aestivum* L. var. *durum* (Desf.) Fiori, Fl. Anal. Ital. 108 (1896); *T. aestivum* L. subsp. *durum* (Desf.) Thell., Fl. Advent. Montpell. 243 (1912) & Mem. Soc. Sci. Nat. Cherbourg 38:143 (1912); *T. durum* Desf. var. *hordeiforme* (Host) Stolet. in Trudy Prikl. Bot. Selekt. 23(4):121, 338 (1930); *T. turgidum* L. group durum (Desf.) Bowden in Can. J. Bot. 40:1709 (1962); *T. durum* Desf. subsp. *caucasicum* V. Dorof. in Sel'skokhoz. Biol. 3(3):347 (1968).

Culms solitary or tufted, 60-140 cm, solid or with hollow pith, smooth, green, glabrous throughout. Leaf sheaths glabrous. Leaf blades linear-acuminate, (3-)7-16 mm broad, glabrous or lower leaves sometimes sparsely puberulent, margins smooth. Spike erect, 3-8 cm, dense, laterally compressed. Rachis tough, densely ciliate, internodes 3-4 mm. Spikelets 5(-7)-flowered, lowermost fertile. Glumes 8-10(-12) mm, coriaceous, glabrous or pubescent, keeled throughout. Keels 2, one prominently crested, veined, ciliate-scabridulous, terminating in 2-3 mm tooth, the other weakly developed. Fertile lemma navicular, 10-12 mm, glabrous, pale green, with (5.5-) 10-15 cm scabrid awn. Anthers oblong-linear, c. 4 mm, yellow. Caryopsis very hard, endosperm flinty. 2n= 28.

Flowering and Habitat. May-June. *Sandy places, fallow fields, also cultivated, 350-1250 m.*
Type: [N.W. Africa] Colitur in Barbaria , Desfontaines (holo. P-Desf., photo!).
Commonly cultivated as “macaroni wheat” in Turkey.

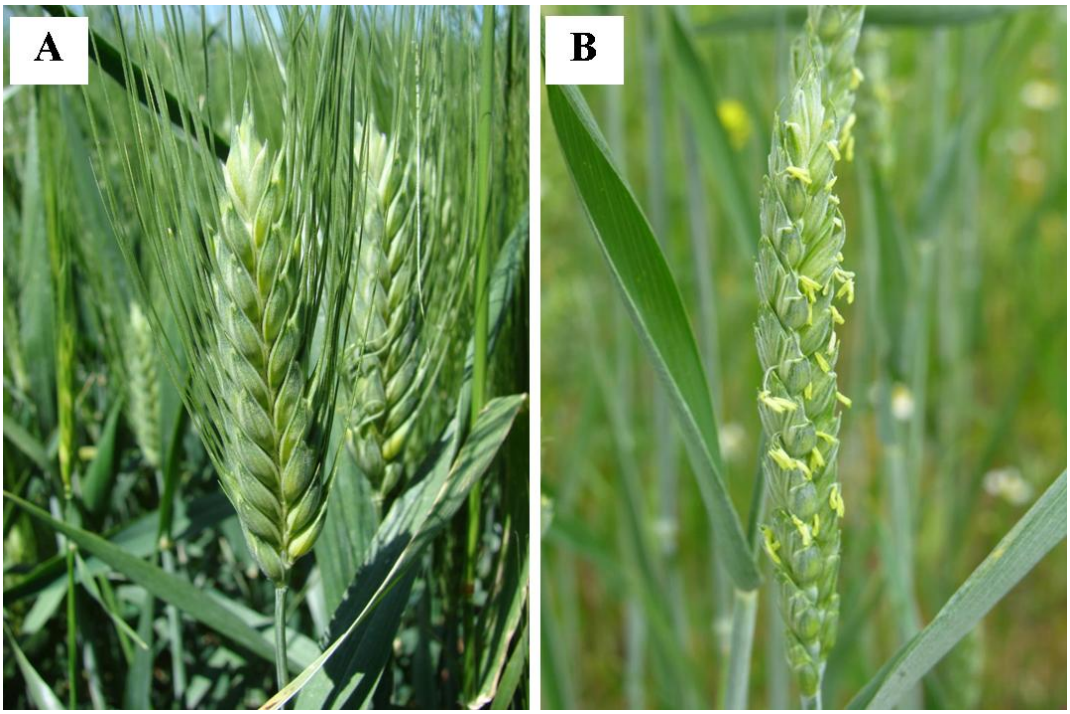

Figure 144. Spikes of (A) *Triticum durum* and (B) *T. aestivum*.

3.4.10.8. *Triticum turgidum* L., Sp. Pl. 86 (1753).

Syn: *T. compositum* L., Syst Pl. ed. 13:108 (1774); *T. sativum* Lam. var. *turgidum* (L.) Delile, Fl. Aeg. Illustr. 53 (1813) et Fl. d'Egypte Expl. t. 14 f. 2(1813); *T. aestivum* L. var. *turgidum* (L.) Fiori, FI. Anal. Ital. 1:108 (1896); *T. aestivum* L. subsp. *turgidum* (L.) Domin in Preslia 13-15:43 (1935); *T. durum* Desf. subsp. *turgidum* (L.) V. Dorof. in Sel'skokhoz. Biol. 3(3):456 (1968) comb. illegit

2n=28. Fl. 5-6. *Cultivated,*

Flowering. May-June . Cultivated*, 40-1050 m*.

Type:"Described without locality (Hb. Linn. 104/2!)".

3.4.10.9. *Triticum polonicum* L., Sp. Pl. ed. 2:127 (1762).

Ic: Fl. Iraq 9: t. 69 (1968).

Syn: *Triticum abyssinicum* Steud**.** Synopsis Plantarum Glumacearum 1: 342. 1854. *Triticum aestivum* var. *polonicum* (L.) L.H. Bailey Manual of Cultivated Plants , pl. 116. 1924. *Triticum turgidum convar polonicum* **(**L.) Mackey. *Triticum turgidum* subsp. *polonicum* Á. Löve & D. Löve

3.4.10.10. *Triticum carthlicum* Nevski in FI. URSS 2:685 (1934).

Syn: *T. persicum* Vav. in Ann. Acad. Petrovsk. 1-4:177 (1919) nom. nud. non Aitch. ex Hemsl. (1886); *T. dicoccum* (Schrank) Schübler var. *persicum* Percival, Wheat Pl. 196, f. 130 (1921); *T. persicum* vav. ex Zhuk. in Trudy Prikl. Bot. Selekt. 13:46, t. 9-12 (1923).

Type: [USSR] Transcaucasia, Zhukovsky (holo. LE).

11. *Triticum aestivum* L., Sp. PI. 85 (1753), nom. cons. prop.

Syn: *T. hybernum* L., Sp. PI. 86 (1753); *T. sativum* Lam., Fl. Fr. 3:625 (1778); *T. vulgare* Yill., Hist. Pl. Dauph. 2: 153 (1787); *T. segetale* Salisb., Prodr. Stirp. 27 (1796); *T. vavilovi* (Tuman.) Jakubz. ex Zhuk., La Turquie Agricole 705, 805, f. 379-381 (1933). Ic; Fl. Iraq 9: t. 67 (1968); Hubbard, Grasses ed. 2:415 (1968).

Lectotype designated by Bowden (1959:674, 1962:1708): specimen '*Triticum* 3' (BM-Hb. Cliff, photo).

Extinct species

T. parvicoccum Kislev in Israel J. Bot. 28 :97 (1980).

Annual. Stems erect. Spikes short, laterally compressed (the latter a feature common to all tetraploid wheats), rachis tough (the fragments found were generally broken at non-specific points on the internode), internodes very short and narrow, c.2 x 1.4 mm. Spikelets 3-flowered but 2-grained, third floret rudimentary. Glumes very short. Caryopsis free, naked, ovoid to elliptic, 3.6-4.9 x 2.3-3.1 mm (in Turkey); embryo small.

Type: "[Israel] Tel Aphek, locus 1700 (holo. Dept. of Life Sciences, Bar-Ilan University, Ramat Gan, photo). Material from Jericho, Tel Keisan and Tel Kittan (paratypes Dept. of Life Sciences, Bar-Ilan University, Ramat Gan, photo)".

General Distribution: S. & S.E. Anatolia (Mesopotamia).

S. & S.E. Anatolia. **B8** Diyarbakir: Çayönü Tepesi, Tepecik and Korucutepe (van Zeist & Bakker-Heeres, 1975); **C1 Aydin**: Beycesultan (Helbaek, 1961); **C3 Burdur**: Hacilar (Helbaek, 1970); **C4 Konya**: Çatal Hüyük (Helbaek, 1964), Can Hassan III (Hillman in French, 1972).

3.4.11. *Dasypyrum* (Coss. & Durieu) T. Durand

Cabi et al (2009) carried out morphological and palynological investigations on the genus in an attempt to revise the genus *Dasypyrum* in Turkey and to contribute to the phylogeny of this genus in the tribe, palynological features of *D. villosum* and its morphologically close species *T. monococum* L. and *S. cereale* L. are compared.

DASYPYRUM Index Generum Phanerogamorum 504. 1888.

Syn: *Anotea* Kunth Index Sem. Horto Bot. Berol. 1846: 13. 1846; *Haynaldia* Schur; . Enumeratio Plantarum Transsilvaniae 807. 1866. *Pseudosecale* (Godr.) Degen Flora Velebitica 1: 575. 1936.; *Triticum* sect. *Dasypyrum* Coss. & Durieu Exploration Scientifique de l'Algérie 202. 1855

Annuals or perennials. Inflorescence a dense spike with fragile rachis disarticulating at nodes below each spikelet at maturity. Spikelets solitary with 2-4 florets, lower two usually hermaphrodite. Glumes oblong, coriaceous, usually 5-veined, prominently 2-keeled, abruptly tapering into a long scabrid awn. Lemma broadly lanceolate, one keeled, with long awn.

3.4.11.1. *Dasypyrum villosum* (L.) P.Candargy in Arch. Bio1. Vég. Athénes 1:35, 65 (1901).

Syn: *Secale villosum* L., Sp. Pl. 1: 84 (1753); *Triticum villosum* (L.) M.Bieb., Fl. Taur. Cauc. 1:85 (1808); *Agropyrum villosum* (L.) Link, Hort. Berol. 1:31 (1827); *Haynaldia villosa* (L.) Schur, Enum. Pl. Transs. 807 (1866). Ic: Host, Graın. 2: t. 47 (1802).
Type: Secale villosum L., Sp. PI.: 84. 1 May 1753. [- Dasypyrum villosum (L.) P. Candargy]. - Lectotype (designated here by Turland): [icon] "Gramen Creticum spicatum, secalinum, glumis ciliaribus" in Buxbaum, PI. Minus. Cogn. Cent. 5: t. 41. 1740. - Epitype (designated here by Turland): [Crete], Ep. Agios vasilios: between Plakias & Lefkogia, 50 m., 12.04.1990, Turland 157 (BM!).

Tufted annual. Stems 25-100 cm with 2-5 nodes, usually decumbent or geniculate-ascending, glabrous. Leaf blades 7-22 cm. X 2-4 mm., flat, sparsely scabrous to densely pilose on upper surface, glabrous beneath. Spike 4-10 cm; rachis densely barbate on margins. Spikelets 7-20 mm (excl. awn), compressed. Glumes 5-7.5 mm long, with small fascicles of rigid hairs 2-4 mm long on keels, with 2.0-5 cm scabrid awn. Lower lemma 10-16 mm, glabrous below,

sparsely pilose above, with fascicles of rigid hairs below awn; awn 2-6 cm, scabrid. Palea 10-15 mm. long, membranous, anthers 5-8 mm long, caryopsis 4-5 mm long.

NW. and W. Anatolia. A1(E) Edirne: Enez to İpsala, 2 km N. of Enez towards the border Greece, 31 m, 40°44.033'N, 026°07.435' E, 03.06.2008, E Cabi 3199a **Kırklareli**: Hasköy to Kırklareli, 167 m, roadsides 41°40.829'N 27°06.208' E, 29.05.2006 E. Cabi 783 G. Akaydın & E. Karabacak **Tekirdağ**: Gaziköy to Uçmakdere arası 127 m., 40° 47.402' N 27°21.997' E, 28 05 2006 E. Cabi 747, G. Akaydın & E. Karabacak. **Tekirdağ:** Vize to Saray, around Çakıllı village, 184 m., roadsides, 41°28.571' N 27°53.249' E, 29.05.2006, E Cabi 801, G. Akaydın & E. Karabacak. **İstanbul:** Silivri, 0 m., 41° 04' 128" N 28° 08' 468" E, 04.06.2008 E. Cabi 3204. **Çanakkale:** Eceabat, 36 km to Gelibolu, 0-5 m, 40°12'56" N 26°22.812' E 03.06.2008, E. Cabi 3162. **A1(A)** Balikesir: Bandirma, 21 05 1976 Akman & Quézel 6217 (ANK!) **Çanakkale**: İntepe 127 m., roadsides, 40°00.534' N 26°19.534' E, 31.05.2006, E Cabi 857, G. Akaydın & E. Karabacak**. A2 İstanbul**: around Halkalı station, 21 m., 41 01.112' N 28°046.081' E 30.05.2006, E. Cabi 805, G. Akaydın & E. Karabacak **B1 İzmir**:Tire to Selçuk, 1.5 km to Belevine 38° 01.004' N 27° 28.304' E 12 05 2006 E. Cabi 515 **C1 Muğla**: Milas to Akbüke before 7 km to Kızılağaç village 37°19.418' N 27°36.410' E 160 m 04.05.2006, E. Cabi 304. **Aydın**; Selçuk to Efes, 7 m, roadside, 37°56.856'N 27°20.541' E 12.05.2006, E. Cabi 516. **C2 Denizli**: NW of Denizli, Üçler, 37°47.706' N 029°01.064' E, 31.05.2008, E Cabi 3824.

General Distribution: Turkey-in-Europe, W. Anatolia, Islands S. Europe, S.W. Russia, Crimea, Caucasia. Medit. element.

D. villosum is confined to A1 (A1 sensu Davis 1965) to C2 squares in Turkey.

Flowering and Habitat: Flowering occurs in May to June and fruiting from June to July. Sandy arid areas, rocky limestone slopes s.l.-200 m.

Figure 145. Habit of *Dasypyrum villosum* and its spike in close view

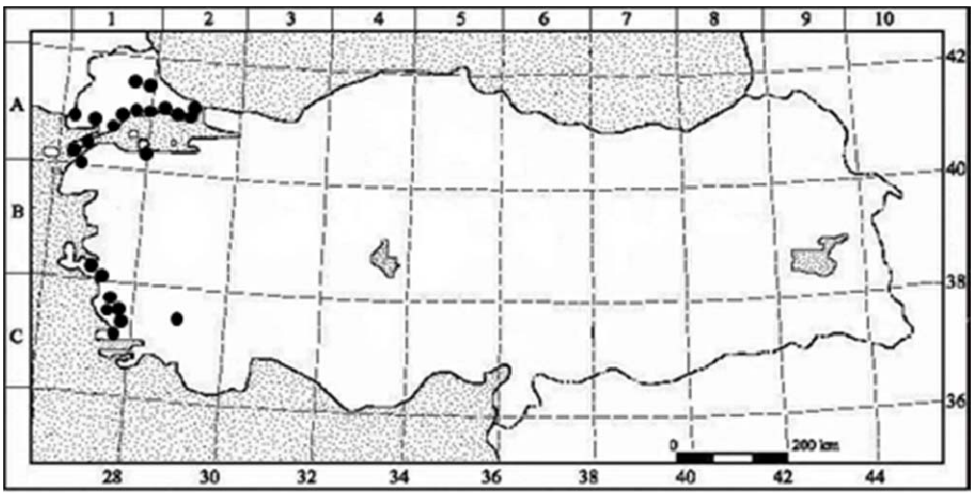

Figure 146. Distribution of *Dasypyrum villosum* in Turkey

3.4.12. *Secale* L.

SECALE L. Species Plantarum 1: 84. 1753.

Type Species: *Secale cereale* L. - *Species Plantarum* 1: 84. 1753.

Annuals, biennials or perennials. Leaf sheaths glabrous or pilose. Ligule membranous, lacerate. Leaf blades flat or drying inrolled, linear-acuminate. Inflorescence a dense terminal spike. Rachis tough or fragile, with joints densely ciliate, disarticulating below and falling away with spikelet. Spikelets sessile. 2 (rarely 3)-flowered, hermaphrodite; if 3-flowered, uppermost sterile. Glumes equal or subequal, linear-lanceolate or subulate, 1-veined, coriaceous, terminating in short or long awn. Lemma strongly and laterally compressed, carinate, coriaceous, 5-veined, keel and outer margin pectinate-ciliate, awns terminal, scabrid. Palea membranous, 2-keeled, keels scabridulous-ciliate in upper 1/3 or near apex. Lodicules 2, large, elliptic-obovate or cuneate, fimbriate at apex. Stamens 3. Styles 2, plumose. Caryopsis free within lemma and palea, obovoid- or ellipsoid-cylindrical, apex tufted-pilose. Embryo 1/4-1/3 x caryopsis; hilum linear, c. equalling caryopsis.

Key to Species

1. Awn of glumes 25-50 mm. Anthers 2.5-3.5 mm ……..……3.***S. sylvestre***

1. Awn of glumes 0-6 mm. Anthers 5-10 mm

2. Perennials. Rachis fragile ……1. ***S. strictum***

2. Annuals. Rachis semi-fragile or not ……..…….2. ***S cereale***

3.4.12.1. *Secale strictum* (C. Presl) C. Presl Flora Sicula (Presl) xlvi. 1826.

Subsp strictum

Basionym: *Triticum strictum* C. Presl Cyperaceae et Gramineae Siculae 48. 1820.

Syn: *S. montanum* Guss., Fl. Sic. Prodr. 1:145 (1827). lc: Trudy Bot Inst. Akad. Nauk SSSR ser. 1, 6:127, t. 8 (1947); Rech. fil., Fl. Iranica 70: t. 32 (1970). Map 45.; *S. anatolicum* Boiss., Diagn. ser. 1(5):76 (1844). Syn: *S. montaum* Guss. var. *anatolicum* (Boiss.) Boiss., Fl. Or. 5:670 (1884); *S. montanum* Guss. subsp. *anatolicum* (Boiss.) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 10:46 (1973). Ic: Trudy Bot. Inst Akad. Nauk SSSR ser. 1, 6:30, t. 12 (1947). Map 45.

Tufted perennials. Culms erect, (35-)50-110 cm, smooth, green, densely or weakly pilose below spike or throughout. Leaf sheaths usually glabrous or rarely sparsely pilose at the base. Leaf blades 7-26 cm x 2-5(-10) mm, glabrous or white pilose at adaxial side, margins smooth or scabridulous. Spike erect, (3.5-)5-8 x 0.6-1 cm. Rachis fragile, joints 2.5-3.5 mm. Spikelets 2-flowered. Glumes 10-11 mm, puberulent, scabrid-pilose on keel, awns 1-4 mm. Lemma lanceolate 10-18 mm, outer surface smooth or scabridulous, keeled, bristles on lemma keel 0.7-1.3 mm, awn (11) 15-35 mm. Palea c. 8-16 mm. Anthers linear oblong c. 6-8 mm, yellow.

Flowering and Habitat. May-July (-August), calcerous, volcanic slopes, serpentine, open Quercus communities, roadsides, 800-3050 m.
Type: Presl; Aug 1817; Italy: Sicily, in regione fagi Aetna (PRC)

1. Leaf blades, sheaths and culms glabrous or sparsely covered with a mixture of short and long hairs ……..……..**var. *strictum***

1. Leaf blades, sheaths and culms with a dense cover of short hairs ……..……..……**var. *ciliatoglume***

Subsp *strictum* var. *strictum*

N.E. & Inner Anatolia A3 Ankara: Beypazari, Ikizdere çay, 1680 m, Akman 19! **A4 Kastamonu**: Ilgaz to Kastamonu, near Kayı village, roadside, 1067 m, 41°13' 52.0' N 33° 47' 38.1'E, 13.06.2007, *E. Cabi 2367*. **A8 Rize**: Ikizdere, Başköy (Cimil), Cermanin Y., 2300 m, D. 21031a! **A9 Kars**: 12 km from Karakurt to Sarikamiş, 2000 m, D. 46566! **B1 Balıkesir:** Kazdağ, 29.06.06, E. Karabacak 4749. **B2 İzmir** Lydia supra Bozdagh, Boissier (holo. G!) (type of *S. anatolicum*). **B5 Nevşehir**, 20 km N of Güzelöz on road to Ürgüp, 1100m, Orchard and roadside, 38°35'N 34°55' E, 23.06.1994, RMN4700 **Yozgat:**Yozgat to Boğazlıyan, Kaşkışla köyü, 39°30.541' N 35°06.974' E 19.07.2008, E. Cabi 3697**. Kayseri:** Develi, Bakırdağ Çevresi, Gezbeli Geçidi. 14.07.2005, E. Cabi 1571 **B6 Sivas**: Ulaş, roadsides, 1373m, 39°27.489' N 37°01.048' E, 20.07.2008, E. Cabi 3621. **Sivas:** Deligazili to Kızıliniş, near Arpalı village, 39° 07' 39.6" N, 37° 24' 27.2" E, 1669 m, calcareous rocks, 19.06.2008, E. Cabi 3405**. B9 Van**: Gevaş, Artos Dağı, Aşkan yaylası, G. Akaydın 8131a. **B10 Ağrı:** 9 km from Doğubeyazıt to Iğdır, roadside, 1589 m, 39°38'55.4" N 44°02'17.8" E, E. Cabi 2509. **Kars**: 3 km S.W. of Iğdir D.U.Ç., 800 m, D. 43780! **C4 Karaman**: Ermenek to Karaman, 1476 m, 36°43.127' N 32°55.904' E 18.07.2008 *E. Cabi* 3611. **Karaman**: Ermenek, Balkusan, 1606 m, 36°40.422' N 32°55.875' E, 18.07.2008 **E. Cabi 3604 (var. *anatolicum*) C5 Niğde:** Ala Mount., on Demirkasyk, Findlay 213! C6 Adana: Amanus, Nur Mount., 5-6 km S. of Yarpuz, 1400-1450 m, Ehrend. et al. 787-40-3! Maraş: Berit Mount., above Maraş, 915 m, 11 vii 1865, Hausskn.! **C8 Mardin**: Mardin, Sint. 1888:1193! **C9**

Hakkari: Zab gorge, 32-45 km from Çukurca to Hakkari, 900-1000 m, D. 44811! **C10**
Hakkari: 9-10 km from Semdinli to Yüksekova, 1700-1800 m, D. 45039!

Figure 147**.** Spike of *Secale strictum* subsp. *strictum* var. *strictum* in close view

Subsp. *strictum* var. *ciliatoglume* Fred.&G. Petersen
Syn. *S. montanum* Guss. var. *ciliatoglume* Boiss., FI. Or. 5:670 (1884); *S. anatolicum* Boiss. var. *ciliatoglume* (Boiss.) A. Ivanov & Jakovl. in Trudy Prikl. Bot. Selekt 44:29 (1971). Map 46.
Flowering and Habitat. July-August. Mountain slopes, serpentine rocky areas 1100-2700 m.
Type: "[Iran] in monte Zagros Kurdistaniae Persicae, Haussknecht" (holo. G!).

E. Anatolia. B7 Erzincan: Erzincan to Erzurum, 13 km from Üzümlü to Tercan, 39° 38.869' N, 39° 45.306' E, 1181 m, slopes of rocky hills, 20.06.2008, E. Cabi 3413**. Tunceli**: 17 km S. of Tunceli, 1100m, 8 viii 1972, Spencer 0407! **Elaziğ:** Hazar G., c. 5 km E. of Sivrice, 1200 m, Ehrend. et al. 787-68-3! **B9 Bitlis**: Nemrut Mount., A. Baytop (ISTE 31086)! Süphan Mount., 2500 m, D. 24716! **C8 Mardin**: Mardin, Sint. 1888: 1192! Bakakri (Bakirkiri), Sint. 1888: 1326 (as *S. montanum*)!

External Distribution: N. Iraq, W. & N.W. Iran. **Ir.-Tur. element**.

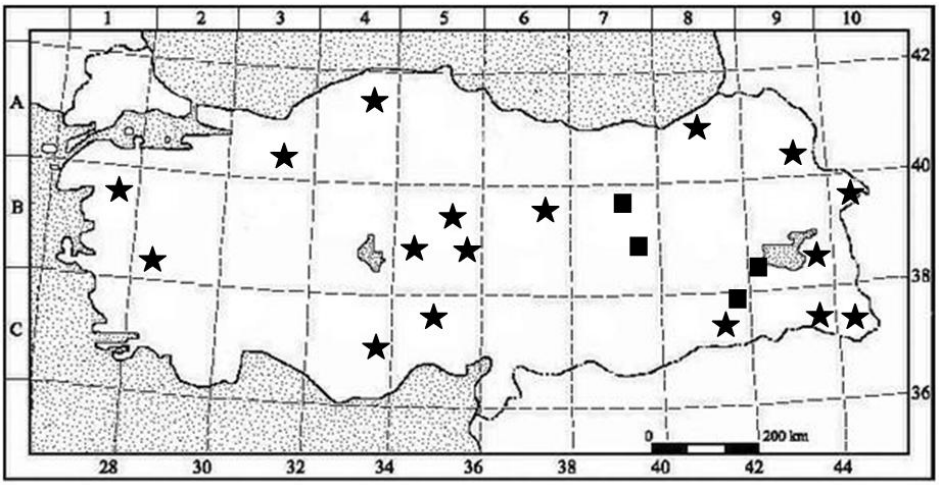

Figure 148. Distribution of *Secale strictum* subsp. *strictum* in Turkey

3.4.12.2. *Secale cereale* L., Sp. Pl. 84 (1753).

Annual or biennial. Stems solitary or tufted, erect, (35-)50-120(-300) cm, smooth, green, glabrous throughout or weakly or densely pilose below spike. Leaf sheaths glabrous or villous. Leaf blades (3-)4-12 mm broad, glabrous, rarely sparsely pilose, margins smooth or minutely scabridulous towards apex. Spike erect, (2-)4.5-12(-19) x 0.8-1(-2) cm. Rachis tough, fragile or semi-fragile, joints 3-4 mm. Spikelets 2 (rarely 3)-flowered. Glumes subequal, 8-20 mm, puberulent, keels scabrid-ciliate, awns short, 1-3 mm. Lemma 14-15(-18) mm, smooth or outer surface sparsely (sometimes minutely) scabridulous, awn 7-50 mm. Palea 10-12 mm. Anthers linear-oblong, c. 7 mm, yellow. Caryopsis obovoid-cylindrical, 8-10 mm; embryo 1/3 x caryopsis. 2n=14

1. Leaf sheaths villous or densely pilose……**var. *ancestrale***

1. Leaf sheaths glabrous

2. Mature spike (7-) 10-12(-20) cm; rachis tough, not disarticulating at maturity; awn of lemma (15-)35-50 mm……...……**var. *cereale***

2.Mature spike (2-)4.5-6(-8) cm; rachis fully fragile or semifragile (upper part disarticulating, lower remaining intact); awn of lemma 7-30(-40) mm……..…….**var. *vavilovii***

var. ***cereale***.

Syn. *Triticum cereale* (L.) Salisb., Prodr. Stirp. 27 (1796). **Ic**: Bonnier, Fl. Comp. Fr., Suisse et Belg. 12: t. 687 f. 3220 (1934); Masefield et al., Oxford Book Food Pl. t. 5 f. 1 (1969).

Flowering: (April-)May-July(-August), s.l.-1800 m.

"Described without indication of locality (Hb. Linn. 102/1!)".

Commonly cultivated in Turkey.

var. ***vavilovii*** (Grossh.) Mayss. in Appl. Sect. Tifl. Bot. Gard. 4:130 (1925).

Syn. *S. vavilovii* Grossh. in Trudy Prikl. Bot. Selekt. 13(2):473 (1924); *S. transcaucasicum* Grossh., Opred. Rast. Kavk. 717 (1949). Map 46.

Flowering and Habitat. June-July(-August). volcanic slopes, dry shores, irrigation hendekleri, 1200-2300 m.

Type: "[USSR, Soviet Armenia] distr. Nakhitschevan, inter Ordubad et Migry, in arenosis, 29 v 1923, A. Grossheim (holo. LE!, iso. TGM)".

N.E. & Inner Anatolia. A8 Gümüşhane: Caracache, nr Bayburt, Bourgeau 1862:256 (as *S. montanum* var. *breviaristatum* Boiss.)! **B5 Nevşehir**: Göreme, 1200 m, Sorger 77-68-30! Kayseri: Erciyas Mount., Tekir Y., T. Baytop (ISTE 5661)! **B7 Tunceli**: nr Pülümür, T. Baytop (ISTE 23213)! **B8 Bingöl**: Göynük to Karliova, nr Bozanköy, 1900 m, T. Baytop (ISTE 18268)! Muş: Solhan to Muş, T. Gözler (ISTE 15833!) **B9 Ağrı**: 20km S. of Iğdir, Stutz ST 549! Van: Çatak to Gevaş. Tong 345! **B10** Kars: Doğubeyazıt to Iğdir, 1550 m, Rech. 57405! Ağrı: mt. Ararat (Ağrı Mount.), nr Russian fort, 29 vi 1967, J.G. Ross J/1! halfway down Ararat, 29 vi 1967, J.G. Ross K/2 (stems shortly pilose below spike)! **Van**: 65 km N .E. of Van, 1720 m, 12 viii 1972, Spencer 010la! **C8 Mardin**: Mazıdağı to Derik, van der Maesen 2095!

External Distribution: N. Iraq, N.W. Iran, Caucasia.

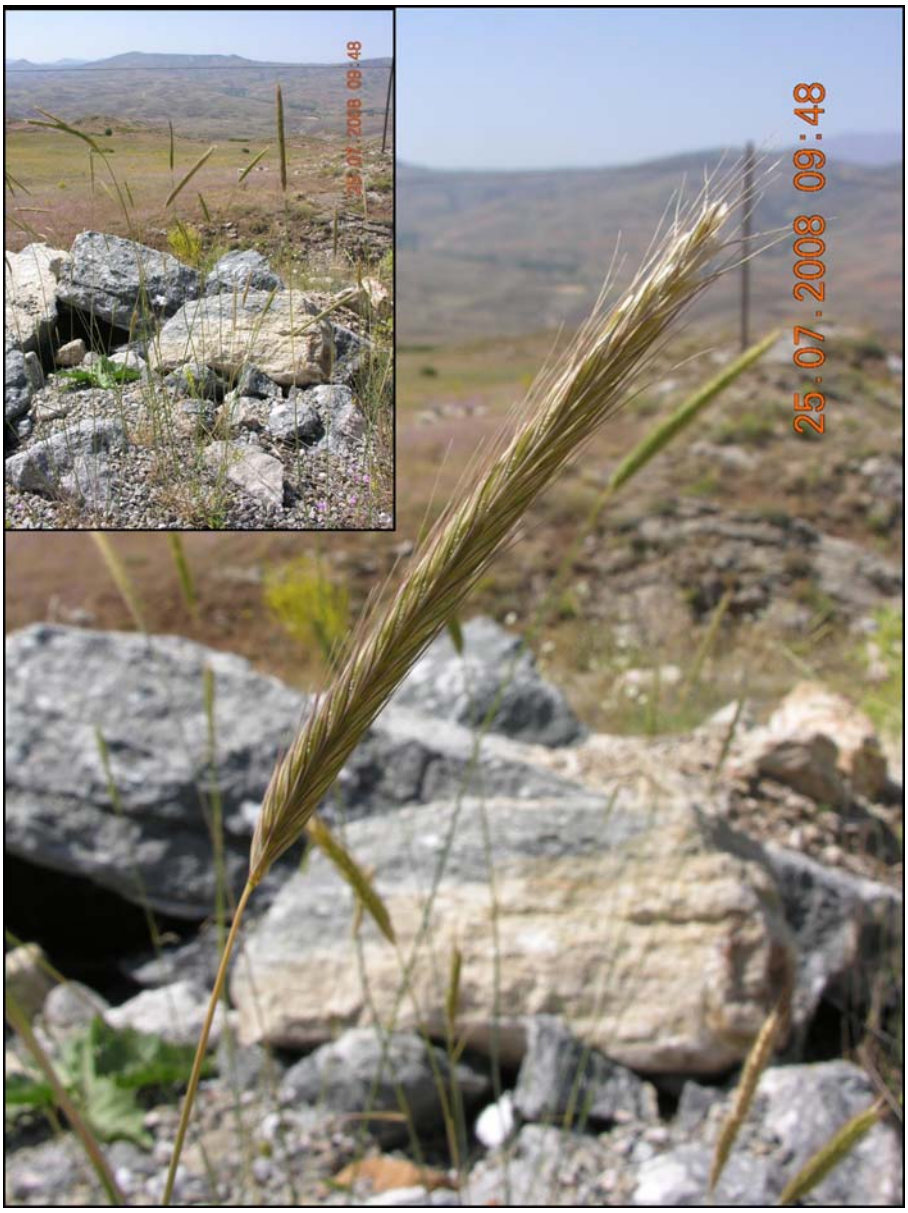

Figure 149. Spike of *S. cereale* var. *vavilovii* in close view

var. ***ancestrale*** (Zhuk.) Kit Tan, stat. nov.

Syn: *S. cereale* subsp. *ancestrale* Zhuk. in Trudy Prikl. Bot. Selekt. 19(2):54(1928); *S. cereale* L. subsp. *ancestrale* Zhuk. var. *spontaneum* Zhuk., loc. cit. (1928); *S. ancestrale* (Zhuk.) Zhuk., La Turquie Agricole 274, f. 143-145 (1933). Ic: Trudy Bot. Inst. Akad. Nauk SSSR ser. 1, 6:138, t. 17 (1947). Map 46.

Flowering and Habitat. June-July. Sandy soils, edge of fields. 100-1370 m.

Lectotype. "(effectively designated by Zhukovsky, op. cit. f. 145, 1933); [Turkey C1 Aydin] Asia Minor, Lydia, circa Aidin [Aydin] et inter Aidin Kara-Burun, in collibus arenosis, in

fruticetis Viticitis Agni Casti L. et in hortis, in vineis, 100-200 m, [24 vi] 1927, P.M. Zhukovsky [3856]" (WIR, photo!).

W. Anatolia. B1 İzmir. Kabakum village, 23 km S. of Ayvalık, 7 km N of Dikili junction. Locally abundant. Annual. Roadside gravel on quaternary deposits, with *H. murinum* 39 08 N 26 54 E 20 m 10 June 1994 RMN 4482. İzmir 6 km N of Çandarlı on Dikili road, roadside in dry chalk slopes with Quercus, Cistus, Sarcopoterium. Locally abundant 38 58 N 26 57 E 20 m 10 June 1994 RMN 4490. Balikesir: mt. Ida (Kaz Mount.), at foot of Susuz Mount., 20 vii 1883, Sint. 1883:515 p.p.! mt. Ida, Kapu Mount., 21 vi 1883, Sint. 1883:515 p.p.! Edremit, Kaz Mount., 600 m, Akman 16! Kaz Mount., on way to Sarikiz, 1370 m, A. Baytop (ISTE 20797)! **C1 Aydin:** Menderes De., D. Zohary obs.
Endemic.

3.4.12.3. *Secale sylvestre* Host, Gram. Austr. 4:7, t. 11 (1809).

Syn. *S. fragile* Bieb., Fl. Taur.-Cauc. 3:93 (1819). Ic: Trudy Bot. Inst. Akad. Nauk SSSR ser. 1, 6:119, t. 3 (1947); Fl. RPR 12: t. 121 f. 1 (1972). Map 45.

Annual. Stems tufted, rarely solitary, geniculate-ascending, to 40 cm, smooth, glabrous, pubescent-pilose below spike. Leaf sheaths minutely puberulent. Leaf blades 1.5-3 mm broad, glabrous or puberulent. Spike erect, to 3.5 cm. Rachis fragile, joints 3-3.5 mm. Spikelets 2-f1owered. Glumes linear-subulate, 11-12 mm, with 2.5-5 cm f1exuous awn. Lemma 10-12 mm, minutely scabridulous, awn to 7 cm.
Flowering and Habitat. June. Sandy shores, nr s.l.
Syntype: "[Hungary] in Hungaria in campis, & pascuis arenosis Comitatus Pesthiensis ad Czegléd, & Ketskemét, atque ad Szegedinum, & infra Kis-Telék in Comitatu Csongaradiensi, Kitaibel" (PR).

Thrace region. A1/2(E) Kırklareli: İğneada, A. Baytop (ISTE 13967)! C. Europe! **Kırklareli:** İğneada, kumsal, 0 m, 41°53 013 N 27° 59 333 E 29.05.06, E. Cabi 792. **Çanakkale** Gelibolu to Kesen, Kavak deltası kumulları, 40° 37 002 N 26° 49 968 E, 03.06.2008, E. Cabi 3169.
External Distribution: Caucasia, S. Russia, Turkestan, W. Siberia. Euro-Siberian element, Threat category **EN**

Figure 150. Habit of *Secale slyvestre*

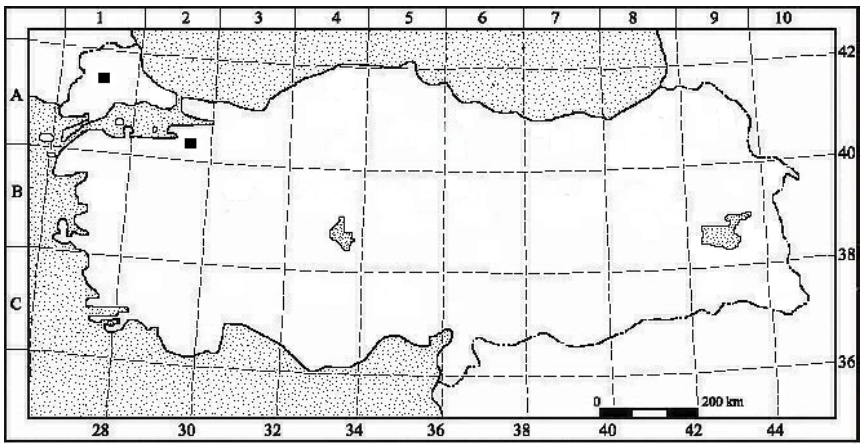

Figure 151. Distribution of *Secale slyvestre* in Turkey.

3.4.13. *Leymus* Hochst.

Leymus Flora 31: 118. 1848.

Type Species : *Leymus arenarius* (L.) Hochst. - *Flora* 31: 118. 1848

Syn. *Aneurolepidium* Nevski In Trudy Botanicheskogo Instituta Akademii Nauk S S S R. Ser. 1, Flora i Sistematika Vysshikh Rastenii. Moscow & Leningrad 2: 69. 1934; *Anisopyrum* (Griseb.) Gren. & Duval Fl. Mass. Adv. Suppl. 24. 1859; *Eremium* Seberg & Linde-Laursen Systematic Botany 21(1): 10, f. 4. 1996; *Malacurus* Nevski Trudy Sredne-Aziatskogo Gosudarstvennogo Universiteta. Seriya 8b, Botanika 17, 38. 1934.

Rhizomatous perennials. Inflorescence a spike with tough rachis. Spikelets in groups of 2-4(-7) or solitary at each node of rachis. Spikelets usually with 2-5 f1orets; rachilla disarticulating beneath each floret. Glumes narrowly lanceolate or linear in basal part, subulate towards apex, covering sides of lower florets, 1-5-veined, glabrous or hairy, unawned or shortly awned. Lemma lanceolate, 3-7-veined, unawned or shortly awned. **Genome: NsXm**

Key to species

1. Spike robust; spikelets usually in groups of 3 at each rachis node; lemma softly hairy below, glabrous towards apex ……...……..**1. *L. racemosus*** subsp. ***sabulosus***

1. Spike slender; spikelets in pairs at each rachis node, solitary in terminal part of spike; lemma glabrous ……. **2. *L. cappadocicus***

3.4.13.1. *Leymus racemosus* (Lam.) Tzvelev In Botanicheskie Materialy Gerbariia Botanicheskogo Instituta imeni V. L. Komarova Akademii Nauk SSSR 20: 429. 1960.

Basionym: *Elymus racemosus* Lam. Tableau Encyclopédique et Methodique Botanique 1: 207. 1792.

Subsp. *sabulosus* (Bieb.) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 8:65 (1971).

Syn. *Elymus racemosus* Lam., Tabl. Encycl. 1:207 (1792) non Poiret (1812). subsp. *sabulosus* (Bieb.) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 8:65 (1971). Syn: *Elymus sabulosus* Bieb., Fl. Taur.-Cauc. 1:81 (1808); *Leymus sabulosus* (Bieb.) Tzvelev in Not. Syst. (Leningrad) 20:429 (1960).

Stems 50-100 cm, robust, nearly always glabrous below spikes. Leaf blades 30-60 cm X 5 - 15 mm, rigid, scabrid on veins of upper surface, glabrous beneath. Spike 15-20 cm, rather lax. Spikelets with 4-6 florets with fragile rachilla. Glumes persistent, lanceolate, nearly as long as spikelets, 15-25 mm, coriaceous, with a distinct midrib and 1-2 ± obscure lateral veins on each side, with short awn 2-3.5 mm. Lemma 10-15 mm, oblong lanceolate, 3-7-veined, with short mucro or unawned. Palea two keeled. Genome **NsXm**, **2n=4x=28 (**Anamthawat-Jonsson and Bödvarsdöttir 2001).

Flowering and Habitat. June-September. Maritime sands, s.l.-30 m.
Lectotype "(designated by Tzvelev, Zlaki SSSR 181, 1976): [Crimea] arena mobili tam per Tauriam, Steven" (LE).

N. Turkey (coasts of Black Sea and the Sea of Marmara).A1 Tekirdağ: Tekirdağ to Silivri, 15 km from Tekirdağ, 15 m, sandy coasts, 41°00.269' N 27°41.029' E, 28.05.2006, E. Cabi 767, G. Akaydın & Ersin Karabacak. **Tekirdağ**: Yeniçiftlik, 8 km W. of Marmaraereğlisi, s.l., P. Aellen 627(!). A1(E/A.) Çanakale: Dardanelles, v 1821, Steven(!).**A2(E) Istanbul**, Terkos gölü, Kumluk bölge, göl tarafı A. Baytop 1967 (ISTE) **Istanbul** Silivri 41°04.256' N 28°09.431' E 04 Jun 2008 E. Cabi 3207 **A2(E) Istanbul**: Istanbul, vi 1904, Azn.! **A2(A) Istanbul**: Riva (Iriva), vii 1896, Azn.! **A3 Bolu**: 2 km S. of Ereğli, Kühne 3364(!). **A5 Sinop**: Sinop, Tobey 1010!. W.of Sinop, Akliman dune, sands, 1m, 42°01'34.6" N 35°04'51.2" E, 14.06.2007, E. Cabi 2390, **A6 Samsun**: Samsun, Tobey 799!

External Distribution: "Coasts of N .E. Balkans, S. Russia, Crimea, Caucasia, and the island of Mangyshlak in C.Asia".

Figure 152**.** Habit of *L. racemosus* subsp *sabulosus* and its spike in close view

Notes on the taxon: It is proposed that European *Leymus arenarius* (L.) Hochst. was closely related to, and possibly derived from, central Eurasian *Leymus racemosus* (Lam.) **(**Anamthawat-Jonsson and Bödvarsdöttir 2001).

3.4.13.2. *Leymus cappadocicus* (Boiss. & Bal.) Melderis in Notes R.B.G. Edinb. 42:81 (1984). **Syn:** *Elymus cappadocicus* Boiss. & Bal. in Bull. Soc. Bot. Fr. 4:308 (1857).

Stems 25-50 cm, slender, glabrous. Leaf blades to 3 mm broad when expanded, convolute, densely and minutely hairy on upper surface, glabrous beneath, auricles falcate shape, ligule membranous. Spike 2-7 cm, erect; rachis glabrous, flattened, cilliate on margins. Spikelets eliptic laterally compressed, in pairs at each node, fertile ones without pedicel, usually with 1-2 fertile florets with sterile florets at apex. Glumes 8-10 mm, as long as spikelets, linear-

subulate, with obscure midrib; lateral veins absent. Lemma 7-7.5 mm, lanceolate, with 3-5 veins, conspicuously ribbed towards apex, with awns 2-3 mm long. Palea two veined, veins ciliate towards apex.

Flowering and Habitat. May-August. Saline steppe, sandy shores of salt lakes, 900-1100 m.

Type: "[Turkey B5 Kayseri] prairies saleés situeés a l'ouest de Césarée (Kayseri) Cappadoce, 1100 m, Balansa 843" (holo. G!).

Inner Anatolia B3 Ankara Polatlı to Sivrihisar 32 km to Sivrihisar 870 m 39°33.843' N 31°48.627' E, 16.06.2008, E. Cabi 3313. **B4 Ankara**: Tuz Lake., 25 km N. of Koçhisar, 900 m, McNeill 300! 28.07.1956 (K!) **Ankara**: Gölbaşı to Koçhisar, 10 km to Vezirhane 1066m 39°34.610' N 32°51.317' E, 23.06.2008, E. Cabi 3662, Ankara to Koçhisar, 12 km to Koçhisar, 912 m, 39°01.557'N 33°26.873' E, 29.05.2008, E. Cabi 3054, **Aksaray**: Eşmepınar to Eskil, 3 km to Eşkil 946 m, 38°21.573' N 33°25.085' E, Salty step, roadside, 19.07.2006 E. Cabi 1541, **Niğde:** S.E. side of Tuz G., A. Baytop (ISTE 7114)! **Konya**: Yavşan Memlehasi, nr Tuz G. hollows in saline Artemisia step, D. 18705! 08.06.1954 (K!) **Konya:** Cihanbeyli to Yavşan, Tekel salt enterprise, 38°45.207' N 33°04.555' E, 912 m, 19.06.2006 E. Cabi 1544, **B5 Aksaray**: Aksaray to Adana, 970 m., salty marshes, 25.05.2003 G.Akaydın 7755 & M. Doğan. **C4 Konya**: Küçük Köy, 980 m, 07.06.1962, Helbaek 2583 (K!). **C5 Kayseri**: Soysallı to İncesu, 26 km to Kayseri 10.06.1971, A. Baytop (ISTE!).

External Distribution: Afhganistan. **Ir.-Tur. element**.

Figure 153. Habit of *Leymus cappadocicus* and its spikes in close view

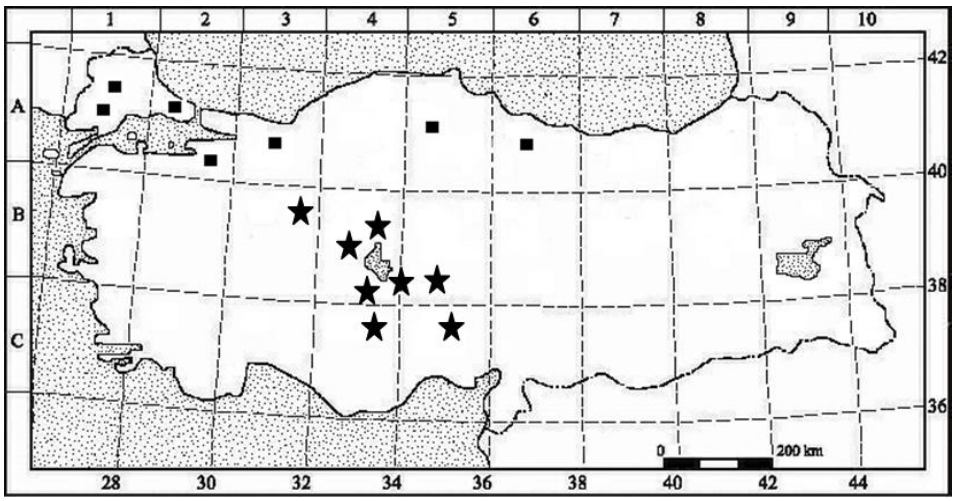

Figure 154**.** Distribution of *Leymus racemosus* subsp *sabulosus* and *L. cappadocicus* in Turkey

Legend. (■) *Leymus racemosus* subsp *sabulosus,* (★) *Leymus cappadocicus*

3.4.14. *Hordeum* L.

The genus *Hordeum* L. is revised in Turkey. Eight species of *Hordeum* grow in the Turkey: six are native, and two are cultivated.

Type Species: LT: *Hordeum vulgare* L. - *Species Plantarum* 1: 84-85. 1753. LT designated by Bowden, Canad. J. Bot. 37: 679 (1959)

Annuals or perennials. Leaves usually flat. Inflorescence a dense, compressed spike; rachis fragile, disarticulating beneath each cluster of spikelets, or tough (in cultivated species). Spikelets of 1(-2) florets, arranged in clusters of 3 at each rachis node; central spikelet usually sessile, hermaphrodite and fertile, the two lateral ones pedicellate, male or sterile in wild species but both fertile in cultivated 4 or 6-rowed Barleys. Glumes similar or dissimilar, setaceous, linear-subulate, or narrowly lanceolate or narrowly ovate, awned. Lemma narrowly ovate, 5-veined, awned or unawned.

Key to Species

1. Perennial.

2. Stems with bulbous swelling at base; awn of lemma of central spikelet 2-3.5 cm ……**5. *H. bulbosum***

2. Stems without bulbous swelling at base; awn of lemma of central spikelet 1-5 mm……...**1. *H. brevisubulatum subsp. violaceum***

1. Annual

3. Rachis tough (cultivated Barleys)

4. Lateral spikelets sterile; spike distichous (with 2 rows of fertile spikelets)……..……..**7. *H. distichon***

4. Both lateral spikelets fertile; spike tetra- or hexastichous (with 4 or 6 rows of fertile spikelets)……**8. *H. vulgare***

3. Rachis fragile

5. Awn of lemma of central spikelet 7-15 cm…….**6. *H. spontaneum***

5. Awn of lemma of central spikelet to 5 cm

6. Glumes of central spikelet and inner glume of lateral spikelets ciliate at margin ……..……..**4. *H. murinum***

6. Glumes not ciliate at margin

7. Inner glume of lateral spikelets linear-subulate or slightly swollen at base ……..**2. *H. geniculatum***

7. Inner glume of lateral spikelets narrowly ovate, winged at base ……..**3. *H. marinum***

3.4.14.1. *Hordeum brevisubulatum* (Trin.) Link subsp. *violaceum* (Boiss. & Huet) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 9:62 (1972).

Syn. *H. violaceum* Boiss & Huet In Boiss., Diagn. ser. 1(13):70 (1854). *H. nodosum* Bieb., Fl. Taur-Cauc. 1:82 (1808) non L. (1762); *H. brevisubulatum* (Trin.) Link subsp. *violaceum* (Boiss. & Huet) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 9:62 (1972)! *H. secalinum* auct. turc. non Schreber (1771). lc: Acta lnst. Bot Acad. Sci. URSS ser. 1,5: t. 32 (1941). Map 48.

Caespitose perennial. Stems 30-70 cm. Leaves 2.5-5 mm broad, scabrid, sometimes pilose above. Spike usually 4-8 cm x 4-7 mm, usually dark purple, with fragile rachis. Glumes 5-10 mm, linear-subulate; those of central spikelet slightly longer than lemma. Lemma of central spikelet 5-7 mm, sessile, glabrous or scabrid towards apex, with short awn 1-5 mm.

Flowering and Habitat. June-August. Wet meadows, damp ground near streams, 1600-3000 m.

Lectotype (designated by Tzvelev, Zlaki SSSR 195, 1976): [Iran] in pinguibus ad radices montis Demawend prope Lar, Kotschy 325 (G! iso. E!).

Inner and East Anatolia. A4 Ankara: 26 km N. of Kızılcahamam, 1300 m, Sorger 71-3-26! **A5 Kastamonu**: Tosya, Çukurhan area, c. 1800 m, 12.09.1976, M. Kılınç 6665 (ANK!) **A7** Gümüşhane: Stadodopi, Sint. 1894:6169 **A8 Erzurum:** Erzurum to Pazaryolu-İspir, junction of Elmalı village, 1981 m, 40°08.948' N, 41°01.866' E, slopes and scree, 21.06.2008, E. Cabi 3434**. A9 Ardahan:** Çamlıçatak village environs, 1791 m, fields, roadside, 41° 07.501' N, 42°50.480' E, 26.06.2008, E. Cabi 3566. **Kars**: Kağızman, Kızılca Ziyaret Mount, Akçay to Cumaçay, 2060 m, 40°02.58.0' N 43°17.34.3' E, 08.07.2007, E. Cabi 2515**. B3 Eskişehir:** Turkmen Mount., Belce area, c. 1450 m, 17.06.1976, T. Ekim 2249 (ANK!) **B4 Ankara**: Elma Mount., 1600 m, vi 1932, Kotte. **B5 Yozgat**: Akdağmadeni, Islalı Mount. pastures, c.2050 m, 05.07.1979 A. Düzenli & T. Ekim 3796 (ANK!) **B6 Sivas:** Ulaş to Kangal, 1 km from Tahtalı village, 1536 m, pastures, 39° 14'47.3" N, 37°10'25.6" E, 19.06.2008, E. Cabi 3390**. Kayseri:** Sarız- Yeşilkent, Binboğa Mount., 2121m, 38°20.824' N 36° 30.558' E 10.06.2006, E. Cabi 947**. B7 Erzincan**: Sivas to Erzincan, 39 km to Refahiye, Kızıldağ pass, 2134 m, 39°51.830' N 38°25.748' E, 25.07.2008, E. Cabi 3677**. Erzincan**: Spikör Mount, Erzinan to Çayırlı, Spikör pass, 2426m , 39°53.14.8' N 39°34'09.8" 07.07.2007 E. Cabi 2487**. B8 Erzurum:** Erzurum to Ilıca, Atatürk University-Veterinary

Faculty, 1751 m, roadsides, 39°56.352'N, 41°07.884' E, 21.06.2008, E. Cabi 3421**.** **B9 Ağrı**: E. side of Tahir pass, 19 km from Eleşkirt to Horasan, 2400 m, D. 47112! **Van**: d. Başkale, Halanduran Mount., 3000 m, McNeill 717! **B10 Kars**: Great Ararat (Büyük Ağri Mount.), 2440 m, G. & B. Post 2133! **Van**: 5 km N.E. of Başkale, 2150 m, D: 45864a!

External Distriution: Caucasia, Iran, Afghanistan. **Ir.-Tur.element**.

Notes on the taxon: *H. brevisubulatum* is one of the complex in the genus. Several taxa of different ranks have been described in the complex. Careful examinations on the collected specimens showed that only one subspecies occur in Turkey. Melderis (1985) noted that a specimen from B8 Erzurum [Erzurum airport, 11 vii 1967, J .G. Ross] identified by R. von Bothmer as cf. *H. brevisubulatum* (Trin.) Link subsp. *turkestanicum* (Nevski) Tzvelev, but he also stated that the mentioned specimen did not appear to differ from subsp. *violaceum*.

Figure 155**.** Habit of *Hordeum brevisubulatum* subsp. *violaceum* and its' spikes in close view

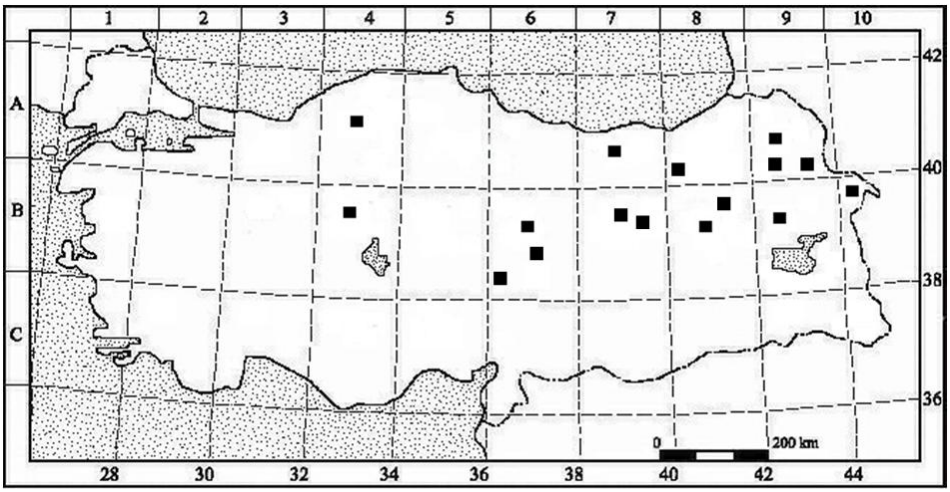

Figure 156. Distribution of *Hordeum brevisubulatum* subsp. *violaceum* in Turkey

3.4.14.2. *Hordeum geniculatum* All., Fl. Pedem. 2:259, t. 91 (1785).

Syn: *H. hystrix* Roth, Cat. Bot. 1:23 (1797); *H. gussoneaum* Parl., Fl. Palerm. 1:246 (1845). Ic: Acta Inst.Bot. Acad. Sci. URSS ser. 1, 5: t. 54 (1941); Fl. lraq 9: t. 85 (1968). Map 48.

Annual. Stems 7-32 cm, with 3-4 glabrous nodes, fasciculate. Sheaths cover ½ or ¾ of spike. Ligule short c. 0.5 mm long. Leaves 1-3 mm broad, puberulent on adaxial, scabrous or pilose on abaxial. Spike 2-5 x 1-2.5 cm, oblong, with fragile rachis but not disarticulating readily. Rachis joints scabrid on margins, 1.25-1.5 mm long. Central spikelet: glumes 1-2.5 cm, glabrous or slightly scabrid, linear-subulate, lemma usually 5-10 mm, sessile, glabrous or sparsely puberulent, with awn 6-18 mm.Palea 6-9 mm long nearly equal or slightly shorter than lemma. Lateral spikelets with short pedicels up to 1.25 mm long, glumes 0.9-2.2 cm, both linear-subulate or inner one slightly swollen at base; lemma ± rudimentary. Caryopsis 3.5-4.5 mm 2n=14, 28.

Flowering and Habitat: May-July. Damp gullies on hills, mountain meadows, steppe, sea coasts, saltmarshes, roadsides, nr s.l.-1700 m.

Type: "[S.E. France, Nice] prope Portum di Limpia in littora maris Nicaeensis, Bellardi" (holo. TO).

Mainly N.W. Turkey, Inner Anatolia, Islands. A1(E) Edirne: 10 km N.W. of İpsala, nr s.l., Coode & Jones 2926. **A1(A)** Çanakkale: Dardanelles, Sint. 1883:872! **A2(E)** Istanbul: Zekeriyaköy to Uskumruköy, v 1891, Azn. **A2(A)** Istanbul: Paşabahçe to Polonezköy, v 1939, B. Post! **A3 Bolu** Düzce, 27 km from Hendek, 241 m, 40°49.307' N 30°48.563' E

06.06.2008, E. Cabi 3214. **A4 Ankara** to Kızıcahamam, 7 km before Kızılcahamam 40°23.787' N 32°40.377' E, 1117 m, 27.06.2006, E. Cabi 1181. **Çankırı**: Çankırı, 800 m, D. 21502!. **B1** Izmir: Bergama, 100 m, Sorger 63-12-7! **B3** Eskişehir: Türkmen Mount., Belce, 1450 m, Ekim 2251(!). **B4** Ankara: shore of Tuz L. 25 km from Koçhisar, 900 m, McNeill 302!. **B6 Tokat**: Yıldızeli to Tokat, roadsides, 5 km N of Yıldızeli, 1386 m, 39°54.428' N 36°32.961' E 20.07.2008, E. Cabi 3613. **Kayseri:** 5 km from Sarıkışla to Akçakışla, roadsides, 1588 m, 39°24.588' N 36°23.970' E, 10.06.2008, E. Cabi 3262. **Malatya**: Malatya to Sürgü, roadsides, 1249m, 38°05'51"N 37°54'24"E, 19.05.2007, E. Cabi 2135**. B7 Diyarbakir**: Elaziğ to Diyarbakir, 38 km S.E. of Ergani, 700 m, It. Leyd. 1959:1494! **B8 Tunceli**, Kovancılar to Bingöl, 1664 m, 38°57.615' N 40°11.539' E, 03.06.2006, E.Cabi 1397. **Muş**: Çaylar to Varto, 1704 m, 39°14'730"N 41°20.623'E, 03.07.2006, E. Cabi 1425. **B9 Van**: Bendimahi, 1770 m, Sorger 81-9-18! **C3** Konya: 3 km N.of Beyşehir, 1120 m, Sorger 64-39-6! **C4 Konya**: Küçük Köy, 980 m, Helbaek 2588! **C5** Içel: Mersin, D. 26444! **C6 Hatay**:Hamam to Kırıkhan, 87 m, 36°26.409'N 36°29.744'E, 10.05.2008, E. Cabi 2810. **C7 Şanlıurfa**, Hilvan to Siverek, 666 m, 37°47.264' N 39°16.478' E, 15.05.2008, E. Cabi 2987, **Şanlıurfa:** Ceylanpınar, Hemitaş, Ofa 379 m, 36°55.033' N 39°59.456' E 13.05.2008, E. Cabi 2897.

External Distribution: W., C. & S. Europe, S. Russia, Caucasia, Crimea, S.W. & C. Asia, Egypt; introduced in N. America, Australia, New Zealand and tropical Africa. **Euro-Sib. element**

Figure 157. Spikes of *Hordeum geniculatum*

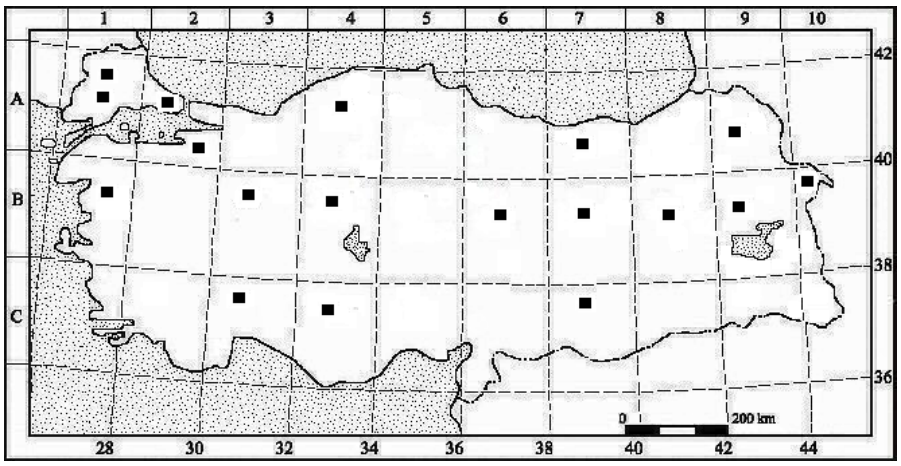

Figure 158. Distribution of *Hordeum geniculatum* in Turkey

3.4.14.3. *Hordeum marinum* Hudson, FI. Angl. ed. 2, 1:57 (1778).

Annual. Stems 10-35 cm. Leaves 2-4 mm broad, usually sparsely and shortly pilose on upper surface. Spike 2-6 x 1.5-3 cm, oblong, with fragile rachis, but not readily disarticulating. Central spikelet: glumes linear-subulate, 1.3-2.2 cm; lemma 6-8 mm, sessile, with awn 5-12

mm. Lateral spikelets male or rudimentary; glumes dissimilar, inner 3-5 mm, narrowly ovate, winged at base, with awn 1-1.8 cm, outer 1.2-2.2 cm, linear-subulate.

Flowering and Habitat: May-June. Maritime sands, saltmarshes, s.1.-100 (-830) m.

1. Spikelets glabrous ……..…… var. ***marinum***
1. Spikelets pubescent…….…..var. ***pubescens***

var. ***marinum.***
Syn: *H. maritimum* With., Nat. Arr. Brit. Pl. ed. 2, 1: 127 (1787). Ic: Acta Inst. Bot. Acad. Sci. URSS ser. 1,5: t. 52 f. 1(1941); Hubbard, Grasses ed. 2:112 (1968). Map 48.
Described from England ('Gramen secalinum maritimum minus', Morison, Hist. Oxon. 3: 179, t. 6 f. 5, 1699).

Mainly N.W. Turkey, W. Anatolia, Islands, **A1(A) Çanakkale**: Dardanelles, Sint. 1883:872 (with var. *pubescens* and *H. geniculatum*)! **A1(E) Edirne:** Keşan, Enez to İpsala, 2 km N. of Enez, on the road of border, roadside, 31 m, 40°44.033'N 26°07.435'E, 03.06.2008 E. Cabi 3199a. Enez, coasts, s.l., 40°41.397'N 26°03.519' E, 03.06.2008, E. Cabi 3195a**.** **A2(E) Istanbul**: Flamour (Ihlamur), v 1902, Azn.! **A2(A) Istanbul**: Çamlica, vi 1902, Azn.! **A3** Bolu Abant, 1448m, 40°35.517'N 31°16.753'E, 1448 m, 27.06.2008, E. Cabi 1209. **A4 Kastamonu**: İhsangazi, 1110 m, fieldsides, 41°17'49.7"N 33° 33'25.9" E, 13.06.2007, E. Cabi 2371. **A6 Tokat:** Tokat to Artova, above Altıntaş village, 1220 m, 40°10'54.2"N 36° 25'21.6"E, 16.05.2007, E. Cabi 2408. **B1 İzmir**: Halkapınar, Bornm. 1906:10200. **B3** Eskişehir: Sivrihisar to Eskisehir, 934 m, 39°33.595' N 31°05.374' E, 27.05.2006, E. Cabi 688 & G. Akaydın. **B4 Ankara**: Ankara to Polatlı, 895 m, 39°47.047'N 32°30.819'E, 10.05.2006, E. Cabi 315. **C3 Antalya**: Lara, 10 m, It. Leyd. 1959:426(!).**C5 Adana**: 6 km N. of Karataş, 20 m, Sorger 77-23-8.

External Distribution: W. Europe, Mediterranean area, S. Russia, Cyprus, S.W. Asia, Egypt; introduced in many countries. **Is:** Lesvos, Cand.; Khios, Orphanides; Rodhos, Fiori.

var. ***pubescens*** (Guss.) Nevski in Acta Inst. Bot. Acad. Sci. URSS ser. 1,5:213, t. 52 f. 2 (1941).
Syn: *H. pubescens* Guss., Prodr. Fl. Sic. 1:144 (1827). **Ic:** Fl. Iraq 9: t. 86 (1968). Map 48.
Type: [Sicily] Palermo a Mondello, Gussone (holo. NAP).

N.W., N.E. & S. Anatolia.**A1(A) Çanakkale**: Dardanelles, Sint. 1883:872 (with var. *marinum* and *H. geniculatum*)! **Çanakkale**: 8 km from Gelibolu to Keşan, roadsides, 76 m, 40°29.104' N 26°42.666' E 03 06 2008 E. Cabi 3165 **A1 (E) Edirne:** Keşan, Enez to İpsala 2 km N of Enez, on the road of border, roadside, 31 m, 40°44.033' N 26°07.435' E 03 06 2008 E. Cabi 3199b. Enez sahil, sea level 40°41.397' N 26°03.519' E 03.06.2008 E. Cabi 3195b**. A8 Rize**: 40 km W. of Hopa, 15 viii, 1972, Spencer 0301(!).**B1 İzmir**: 5 km S of Dikili on Çandarlı road 20 m 10 06 1994 RMN 4487**. C2 Aydın**: 10 km S of Nazilli on Bozdoğan road, in Akçay valley, 50 m 13 06 1994 RMN 4534 **C5 Adana**: Adana to Karataş, 8 km S. of Adana, nr s.l., Coode & Jones 208! 8 km N. of Karataş, 10 m, Coode & Jones 298!

Throughout the range of species. **Euro-Sib. element**

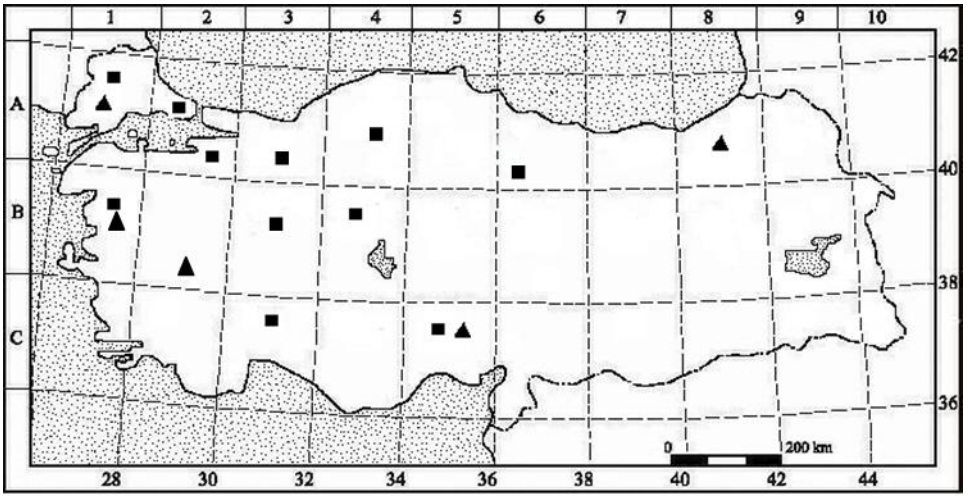

Figure 159. Distribution of *Hordeum marinum* in Turkey
Legend. *H.marinum*(■) var. *marinum* and (▲) var.*pubescens*

3.4.14.4. *Hordeum murinum* L., Sp.Pl. 85 (1753).
Syn. *Critesion murinum* (L.) Á. Löve Taxon 29(2-3): 350. 1980. *Zeocriton murinum* (L.) P. Beauv. Essai d'une Nouvelle Agrostographie 115, 182. 1812.

Annual. Stems 10-45 cm, loosely tufted or solitary. Leaves flat, 2-7 mm broad, glabrous or sparsely pubesecent. Spike 4-10 x 1-2.5 cm, oblong, compressed, with fragile rachis. Central spikelet: glumes 1.5-3 cm (incl. awns), narrowly lanceolate, ± ciliate on margins, gradually

tapering into a long awn; lemma 7-12 mm, glabrous, with awn 1.8-4.5 cm. Lateral spikelets male or empty; glumes 1.5-3 cm, slightly dissimilar, inner narrowly lanceolate, ciliate on margins in lower part, rarely glabrous; outer linear-subulate; lemma long-awned.

1. Central floret sessile or nearly sessile, with lemma exceeding lemma of lateral spikelets; palea of central floret 1-1.5 x that of lateral florets; leaves green……**subsp. *murinum***

1. Central floret pedicellate, with lemma not exceeding lemma of lateral spikelets; palea of central floret 0.7-0.8 x that of lateral florets; leaves green or glaucous

2. Anthers of central floret 0.2-0.5 mm; prolongation of rachilla of lateral florets stout, yellowish-brown; leaves glaucous ……**subsp. *glaucum***

2. Anthers of central floret 0.7-1.4 mm; prolongation of rachilla of lateral florets slender, green; leaves green……...…….**subp. *leporinum***

3. Hairs of spike rachis 0.2-0.4 mm …….**var. *leporinum***

3. Hairs of spike rachis 0.5-0.75 mm.……**var. *simulans***

subsp. ***murinum***. Ic: Acta Inst. Bot. Acad. Sci. URSS ser. 1,5: t. 48 (1941); Hubbard, Grasses ed. 2: t. 110 (1968). Map 49.

Described from Europe (Hb. Linn. 103/8; BM-Hb. Cliff.). S. Anatolia. C3 Antalya: Uzunkuyu, 2500 m, Tengwall 17!

Native of Europe; introduced in Turkey.

subsp. ***glaucum*** (Steudel) Tzvelev in Novit. Syst. Pl. Vasc. (Leningrad) 8:67 (1971).

Syn. *H. glaucum* Steudel, Syn. Pl. Glum. 1:352 (1854); *H. stebbinsii* Covas in Madrono 10:17, t. 2 f. 8 (1949).

Flowering and Habitat: April-July. Limestone steppe, dry hillsides, sand dunes, sandy river flats, fallow and cultivated fields, roadsides, nr s.l.-1750 m.

Type: [Sinai] Mons Sinai, [locis cultis circa claustrum Catharinae, 10 vii 1835, W. Schimper], Unio Itin. Arab. 383 (iso. E!).

N.W. Turkey, N & Inner Anatolia **A1(E)** **İstanbul:** Silivri to Tekirdağ, 23 m, 41°00.171' N 27°58.388' E, 30.05.2006, E. Cabi 816, G. Akaydın & E. Karabacak. **Edirne**: Gelibolu to Keşan, 114 m, 03.06.2008, E. Cabi 3179. **Tekirdağ**: Sultanköy. nr s.l., Aellen 701. **A2(E)** **Istanbul**: Rumelihisar, vii 1935, B. Post! **A2(A)** **Istanbul:** Prinkipo (Büyükada), iv 1936, B. Post! **A3** **Bolu**: Düzce, 27 km from Hendek, 241 m, 40°49.307' N 30°48.563' E, 06.06.2008,

E. Cabi 3215. **Zonguldak**: Zonguldak, vi 1947, Dijkstra(!). **A4 Ankara**: 22 km N. of Ankara, 900 m, Sorger 73-40-14! **A5 Çorum:** Çorum to Amasya, around Elvançelebi village, 40° 33' 14.4" N, 35° 10' 49.6" E, 1072 m, roadsides and slopes, 17.06.2008, E. Cabi 3328. **Samsun**: Kızilirmak, after Asar, 300 m, Tobey 1797 **A6 Samsun**: Samsun, 2 m, Tobey 791! **A9 Artvin**: Ardanuç, Gevhernik kalesi, 582 m, 41°07.625' K, 42° 03.397' D, 25.06.2008, E. Cabi 3544. **Artvin:** Lomaşen to Seyitler, 41°12.034' N, 41° 51.400' E, 569 m, rocks, 25.06. 2008, E. Cabi 3550. **B1 Manisa**: 5 km S.E. of Manisa, 100 m, Sorger 64-63-6! **B3** Eskişehir: Eskişehir to Alpu, 28 km before Alpu, roadsides, 782m, 39°46.652' K 30°40.834' E, 11.05.2008 E. Cabi 2857. **B4 Ankara**: 32 km from Ankara to Polatli, 900 m, Coode & Jones 2230a! Konya: Cihanbeyli road, 38°32.703' N 32°55.212' E, 944 m, 21.04.2006, E. Cabi 17 & G. Akaydın. Ankara: 33 km from Gölbaşı to Haymana, 39°37'41.0" N, 32°42'05.2" E, 1073 m, dry calcareous rocky hills, 16.06.2008 E. Cabi 3303 **B5** Yozgat: Yozgat to Boğazlıyan, Kaşkışla village, roadsides, 1682 m, 39°30.553' N 35°06.970' E, 11.06.2008, E. Cabi 3279. **B6** Kayseri: Pınarbaşı to Kayseri, Melikgazi yakınları, 1927 m 38° 43.837' K 36° 13.021' D, 11.06.2008, E. Cabi 3256. **B7 Erzincan**: 5 km E. of Erzincan, 1200 m, 8 viii 1972, Spencer 0101! **B8 Siirt**: 28 km from Siirt to Baykan, 800 m, D. 43195! **B9 Van**: Erciş, 1700 m, D. 44130! **B10 Ağri**: 17 km N. of Doğubayazit towards Iğdir, 1600 m, Sorger & Buchner 82-62-50! **C1 Izmir**: Kuşadasi, 40 m, Sorger 65-9-78! C2 Aydin: d. Karacasu, Aphrodisias (Geyre), 600-700 m, D. 41607! **C3 Isparta**: W. shore of Beyşehir G., 1150 m, Sorger 65-41-27! **C4 Konya**: Küçük Köy, 980 m, Helbaek 2363! C5 Içel: Kuyuluk, 10 km W. of Mersin, 2 m, D. 26532! **Karaman**: Ermenek, Topbaşından aşağı vadiye inerken, 636 m, 36° 38.217' N 32° 49.464' E 02.05.2006 E. Cabi 285. **C5** Niğde: Çamardı, Çukurbağ köyü, 1586 m, 37°49.585' N 35°02.981' E 14.06.2006 E. Cabi 1059. **C6 Hatay**: Amanus mts. 0.5 km below Nur Mount. pass, 1100 m, Watson et al. 1018! **Hatay** Kırıkhan, ceviz yokuşu, kayalık yamaçlar, 200 m, 36°29.753' K 36°20.710' E 03.05 2008 E. Cabi 2812 **K. Maraş:** Nurhak, Çağlayan cerit girişi, 965m, 37°44.474' N 37°22.341' E 11.06.2006 E. Cabi 989. **C7 Urfa**: 13 km from Urfa to Akçakale, 500 m, D. 28144! **Urfa** to Akçakale, 391 m, 36°58.779' N 38°54.108' E 28.04.2006 E. Cabi 233 **C8 Mardin**: 5-10 km from Nusaybin to Mardin, 600 m, D. 28403! **Mardin:** Mazıdağ to Derik, 9 km to Derik, 1055m, 37°25' 17" N 40° 19' 30" E 23.05.2007 E. Cabi 2320. **C9 Mardin**: Cizre, 350 m, D. 42520!

External Distribution: Mediterranean area, C. Russia, Crimea, Caucasia, Iran, Iraq, Arabia, Cyprus, C. Asia, W. Pakistan, N.W. India. Introduced in N. & S. America, S. Africa, Australia and in some European countries.

Figure 160. Habit of *Hordeum murinum* and its spike in close view

subsp. ***leporinum*** (Link) Arc., Comp. Fl. Ital. 805 (1882).

Flowering and Habitat: April-July. Step, streambeds, edge of lakes, field margins, roadsides, s.l.-900 m.

var. ***leporinum.***

Syn: *H. leporinum* Link in Linnaea 9:133 (1835); *H. murinum* sensu Boiss., Fl. Or. 5:686 (1884) p.p. non L. (1753). Ic: Acta Inst. Bot. Acad. Sci. URSS ser. 1,5: t. 50 (1941). Map 49. 2n=28. Described from Greece.

W. Turkey, W., Inner & S. Anatolia **A1(A)** Çanakkale: Gallipoli (Gelibolu), Suvla, Durham 84. **A2(E)** **Istanbul**: Eyoub (Eyüp), v 1901, Azn.! **A2(A)** **Istanbul**: Kartal to Maltepe, A. Baytop (ISTE 7679)! **A7 Gümüşhane**: Gümüşhane, Sint. 1894:5812! **B1** **Izmir**: Izmir, Bornm. **B2** Manisa: Salihli to Kula 687 m, 38°33.155' N 28°28 217' D, 11.05.2006, E. Cabi 443. **B4** **Ankara**: 25 km N. of Koçhisar, Shore of Tuz G, 900 m, McNeill 302. **C1** **Muğla**: 8 km E. of Reşadiye, s.1.-5 m, Sorger & Buchner 82-23-60(!).**C2 Muğla:** Marmaris, İçmeler to Turunç, roadsides, 34 m, 36°47.721' K 28 13 145 D 27.04.2008, E. Cabi 2616. **Muğla**: Dalaman Çiftliği, Harlan 1852. **C3** **Antalya**: Beldibi to Antalya, anayol kenarı, s,l., 36°47.717' K 30°34.403' D 29.04.2008 E. Cabi 2688 **Antalya**: outskirts of Antalya, 30 m,

Casey 1766. C5 Içel: 3 km E. of Mersin, nr s.l., It. Leyd. 1959:1179! **Hatay** Kırıkhan, ceviz yokuşu, kayalık yamaçlar, 200 m, 36°29.753' K 36°20.710' E 03.05 2008 E. Cabi 2812

External Distribution: Mediterranen area, W. & C. Russia, S.W. & C. Asia, N. India, China. Introduced in N. America, S. Africa, Australia, New Zealand and Polynesia; a casual in many European countries.

var. ***simulans*** Bowden in Can. J. Bot. 40:1694 (1962). 2n=42.

Type: Cultivated specimens grown from seed derived from the original seed collection, Afghanistan: Maimana Province: Maimana, 27 x 1953, H.S. Gentry 12910; greenhouse, Wray M. Bowden, 13 ii 1961, Bowden Cyt. no. 2475-S6 (holo. & iso. DAO).

Inner Anatolia B4 Ankara: 110 km S.E. of Ankara along route 60, Godfrey 82.

External Distribution: Afghanistan, Turcomania. **Ir.-Tur. element**.

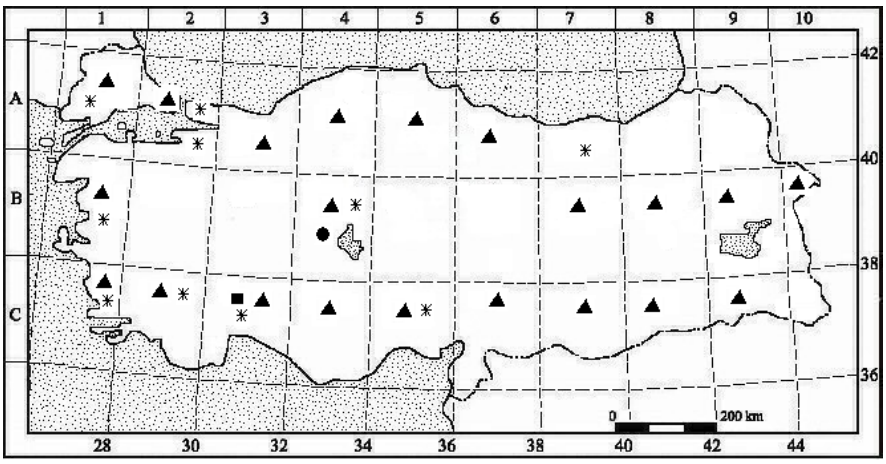

Figure 161. Distribution of *Hordeum murinum* in Turkey.
Legend. *H. murinum* subsp. *murinum* (■), subsp. *glaucum* (▲), subsp *leporinum* (★).

3.4.14.5. *Hordeum bulbosum* L., Amoen. Acad. 4:304 (1759).

Syn: *H. strictum* Desf., Fl. Atl. 1:113, t. 37 (1798); *H. bulbosum* L. var. *bourgaei* Boiss., Fl. Or. 5:688 (1884)! Ic: Acta Inst. Bot. Acad. Sci. URSS ser. 1,5: t. 65 f. 1 (1941). Map 50.

Caespitose perennial. Culms 50-100 cm, with bulbous swelling at base, internodes glaucous green. Leaf sheaths glabrous, auricles falcate ligula membranous, leaves 10-20 cm X 3-7 mm, scabrid, sometimes pilose on upper surface. Spike 6-13 cm x 6-10 mm, linear, dense, with very fragile rachis. Central spikelet: glumes 5-8 mm, narrowly lanceolate, often sparsely ciliate on margin, with awn 1-1.8 cm; lemma 8-11 mm, with awn.2-3.5 cm. Lateral spikelets male; glumes 1.3-2.5 cm (incl. awn), dissimilar, inner narrowly lanceolate, outer setaceous; lemma usually ± acuminate. 2n=28.

Flowering and Habitat: May-July. Rocky limestone or igneous slopes, steppe, forest margins, lush meadows, also a cornfield weed, s.l.-2250 m.

Described from ltaly and Orient (Hb. Linn. 103/3).

Widespread. A1 Edirne: Keşan to Enez, 30 km to Enez, 132 m, 03.06.2008, E. Cabi 3182. **Al(A)** Çanakkale: Dardanel, v 1883, Sint. **A2(E)** Istanbul: Zekeriyaköy to Üskümürköy, vii 1900, Azn.! **A2(A)** Istanbul: Soğanli to Kartal, v 1894, Azn.! A3 Bolu: 26 km W. of Gerede, 1100 m, Sorger 71-2-31! **A3 Ankara**: Nallıhan, 396 m 11.05.08 E. Cabi 2864. **A5 Sinop**: Sinop, S. promontory, 3 m, Tobey 1022! **A9 Kars**: 12 km from Karakurt to Sarikamiş, 2000 m, D. 46566! **B1 İzmir**: Kemalpaşa, 570m, 02.06.2008 E. Cabi 3143 **B2 Manisa**: Simav to Demirci, S. of Akçakertik pass, 1300 m, Coode & Jones 2752! **B3 Konya**: Akşehir to Orkenez, 1300 m, Sorger 78-19-12! **B4 Ankara**: 33 km from Haymana to Gölbaşı, 16.06.2008 E. Cabi 3301 **B5 Yozgat**: Yozgat to Sivas, road sides , 1064 m, 39°44.952' N 35°16.586' E 19.07.2008 E. Cabi 3703. **B6 Kayseri**: Melikgazi üstü, 1927 m, 11.06.2008 E. Cabi 3259. **Malatya**: Hekimhan, 1300 m, Stn. & Hend. 5443! B7 Tunceli: 20 km N. of Pülümür, 1470 m, 8 viii 1972, Spencer 0201(!). **B8 Siirt**: 35 km from Siirt to Baykan, 800 m, D. 43084! **B9 Bitlis:** Tatvan, 2010-2135 m, Tong 121! **C1 Aydin**: Kuşadasi to Söke, 250 m, Bocquet 2332(!). **C2 Antalya**: Elmali, 1860, Bourgeau! Antalya: Lara, Tengwall 497! **C4 Konya**: Küçük Köy, 980 m, Helbaek 2623! **C5 Adana**: Karataş 10 m, Coode & Jones 261 **Mersin**: Silifke, 11 m, 36° 20.357' K , 33° 54.852' D , 01.05.2008. E. Cabi 2750. **C6 K. Maraş**: Sarıçukur köyü, roadsides, 682 m, 03.05.2008, E. Cabi 2817**.** Hatay: Reyhanlı, Cilvegözü köyü, 269 m 03.05.2008 E. Cabi 2806 **C7 Urfa**: Urfa to Hilvan, 829 m 15.05.2008 E. Cabi 2972. **C8** Mardin: Derik, Van der Maesen 2090.**C9** Mardin: 5 km E. of Cizre, on N. bank of Tigris, 350 m, D.42720! **C10** Hakkari: Sat Mount. above Varegöz, 1970 m, D. 45548!

External Distribution: N. & tropical Africa, Meditereanean area, Caucasia, Crimea, Iran, Iraq, Afghanistan, C. Asia. Specimens from C3 Antalya (Antalya, 1860, Bourgeau 294 sub *H. lycium* Boiss., nom. nud.!) have been named var. *bourgaei* Boiss., charaeterised by having lateral spikelets acuminate at the apex, not obtuse as in var. *bulbosum*. Intermediates occur

and it is clear1y impossible to draw a distinct line between typical *H. bulbosum* and var. *bourgaei*.

Figure 162. Habit of *Hordeum bulbosum* and its spike in close view

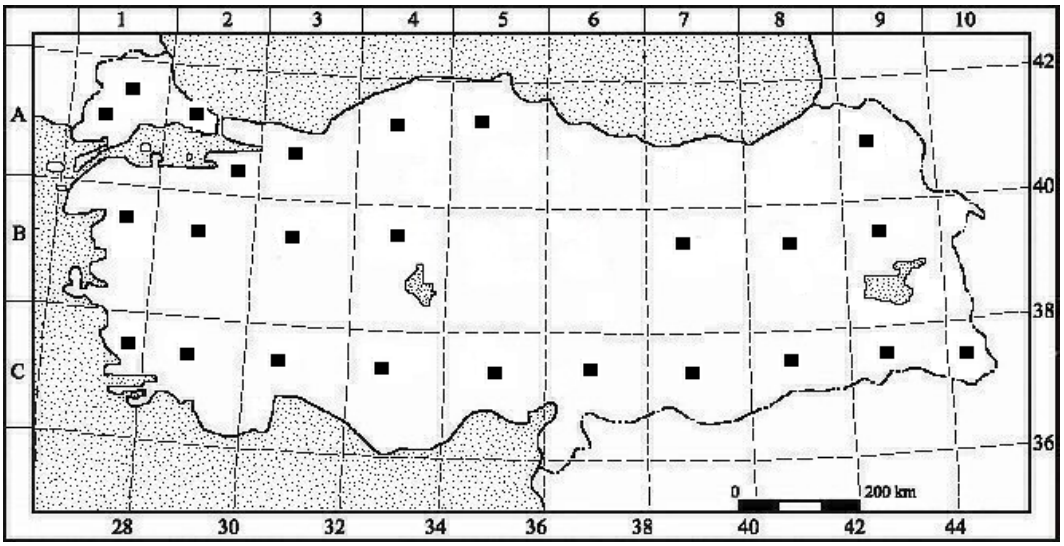

Figure 163. Distribution of *Hordeum bulbosum* in Turkey

3.4.14.6. *Hordeum spontaneum* C. Koch in Linnaea 21:430 (1848), emend. Bacht. in Bot. Zhurn. 47:846 (1962).

Syn: *H. ithaburense* Boiss., Diagn. ser. 1(13):70 (1854) *H. ithaburense* Boiss. var. *ischnatherum* Cosson in Bull. Soc. Bot. Fr. 11:163 (1864); *Hordeum ischnatherum* (Coss.) Schweinf Czerepanov, S. K. 1981. Sosud. Rast. SSSR 509 pages.

Type: "[Caucasia] auf den steppenartigen Matten des schirwan'schen Theiles des Kaukasus, 150-300 m, C. Koch (holo. B, destroyed)".

Annual. Growing in rather loose tufts or solitary. Culm 20-80 cm, slender to stout, erect. Culm nodes 3-5, glabrous. Leaf sheats covering 1/2- 1/1 of the culm. Uppermost internode 10-20 cm long. Leaves usually flat, 4-15 cm long. 1.5-8 mm broad. Leaf surface glabrous to scabrid at bot sides. Auricles present, falcate, up to 6.5 mm long, whitish yellow. Ligule membranous up to 1 mm, Spike 30-100 mm long and 4-10 mm broad, pale green, oblong-linear, distichous, with rachis densely white-ciliate at margins, very fragile at maturity. Rachis joints 4-5 mm long, oblong. Glumes similar, 4-6 mm, linear-lanceolate, silky-pubescent, dense at the lower half of glumes, gradually tapering into an awn 1-1.5 cm. Lemma of central spikelet 1.5-1.6 cm, ovate-lanceolate, glabrous on back, scabrid towards apex, with awn 7-15 cm. Lemma of lateral spikelets slightly smaller, usually obtuse at apex, unawned, rarely mucronate or aristate with an elongated awn up to 5mm long. 2n=14

Flowering and Habitat. April-June (-September). Quercus forests, scrub, rocky limestone slopes, marly banks, waste places and cultivated land, 30-1650 m.

Key to varieties

1. Keels of palea produced as 2 very short teeth (to 0.5 mm), with shallow or moderately deep cleft between them……..……....**var. *anatolicum***

1. Keels of palea do not teethed, apex of palea obtuse……..…….2

2. Lemma of lateral spikelets rounded obtuse at the apex…….**var. *spontaneum***

2. Lemma of lateral spikelets mucronate or shortly awned up to 8 mm long..... ……..**var. *proskowetzii***

var. *spontaneum*

Syn. *Hordeum vulgare* subsp. *spontaneum* (K. Koch) Asch. & Graebn. In Synopsis der Mitteleuropäischen Flora 2(1): 723. 1900. (Syn. Mitteleur. Fl.): *H. ithaburense* Boiss., Diagn. ser. 1(13):70 (1854)!

Flowering and Habitat. April-June, Step, field margins, road sides, calcerous slopes, 7-1650 m

W. Turkey, S. & E. Anatolia; **A1**(A) Çanakkale: Renkoei (Erenköy), Sint. 1883:336! A2(E) Istanbul: Yarimburgaz, 20 vi 1901, Azn.! **A2(**A) Istanbul: Jeum Burnu, Nemetz. A10 Kars: N. of Orta Alican, 800 m, Sorger & Kit-Tan 84-72-65(!). **B1 Çanakkale**, inside the city of Troy 26 m., 39°57.401' N 26°14.468' E 02 06 2008 E. Cabi 3155**, İzmir**: Kemalpaşa Nif Dağı, slopes, 949m., 38°23.283' N 27°23.720' E 12 05 2006 E. Cabi 488**, İzmir** Bornova to Pınarbaşı, 200m., 38°25.124' N 27°16.387' E, 12.05.2006, E. Cabi 472**, B6 Kahramanmaraş**: Göksun to Elbistan, 1412 m, 38° 06' 39" N 36° 38' 15" E, 27.04.2006, E. Cabi 188a**, B7 Malatya**: Malatya to Elazığ, 1018 m., 38°20'56" N 38°23'01" E, 28.04.2006 E. Cabi 194**, B8 Bitlis**: Kermet, 4 vii 1967, J.G. Ross(!). **C1 Aydın** Selçuk to Efes, roadsides, 7m, 37°56.856' N 27°20.541' E, 12.05.2006, E. Cabi 518. **C6 Adıyaman**: Suvarlı to Eminhaydar, roadsides and edge of wheat fields, 888m., 37°30.741' N 37°41.065' E, 04.05.2008, E. Cabi 2841. **Hatay**: İskenderun to Antakya, 4-5 km from Belen 635 m., 36°28.643' N 36°15.455' E, 02.05.2008, E. Cabi 2772. **Kahramanmaraş**: around Sarıçukur village, 685m., 37°36'30" N 36°49'38" E, 27.04.2006, E. Cabi 160. **Gaziantep:** Kazıklı village, 474 m., slopes and roadsides, 36°50.183' N 36°42.475' E, 21.04.2007, E. Cabi 1743. **Kilis:** Öncüpınar, 607 m, 36°39.159' N 37°05.350' E, 21.04.2007, E. Cabi 1751. **C7 Şanlıurfa**: Birecik to Halfeti, calcerous slopes, 357 m., 37° 03' 511" N 37° 58' 506" E, 23.04.2006, E. Cabi 101 & G. Akaydın. **Gaziantep**: Araban 534 m, 37°26.372' N 37°55.430' E, 04.05.2008, E. Cabi 2849. **Malatya**: Doğanşehir to Reşadiye pass, 1468m., 37°58'40" N 38°00'49" E, 19.05.2007, E. Cabi 2137. **C8 Mardin**: Savur, 900m, D.28549! Siirt: 10 km S. of Siirt, 4 vi 1967, J .G. Ross(!).

External Distribution: N.Africa (Cyrenaica, Egypt), Caucasia, Iran, Iraq, Cyprus, W. Syria, Afghanistan, C. Asia, W. Pakistan, N.W. India. **Ir.-Tur. Element**. Threat category **LC.**

Figure 164**.** Spike of *Hordeum spontaneum* var. *spontaneum* in close view

var. *proskowetzii* Nab. in Publ. Fac. Sci. Univ. Masaryk Brno 111:32 (1929). Ic: Acta Inst. Bot. Acad. Sci. URSS ser. 1,5: t. 67, 68 f. 1-2 (1941); Fl. Iraq 9: t. 87 (1968). Map 48.
Flowering and Habitat. April-May, Steppe, edge of fields, 650-665 m
S. E. Anatolia C7 Şanlıurfa: Viranşehir to Ş.Urfa, Urfaya 62 km kala 658 m., 37° 13' 515" N 39° 23' 325" E 14 05 2008 E. Cabi 2928**,** Urfa to Antep, 4-5 km from Urfa 37° 03' 113" N 38° 14' 411" E 661 m 23 04 2006 E. Cabi 104**.**

Notes on the taxon. This taxon is known from Iraq, Turkmenistan, has not been previously recorded from Turkey. The specimens of this new variety record were compared to material housed at various European (E, BM, and K) and Turkish herbaria (ANK, GAZI, ISTE, HUB and VANF).

Var. *anatolicum* Cabi & Doğan var. nov.
Flowering and Habitat: April-May, Step, field margins, road sides, calcerous slopes, 416-1238
E.& S. E. Anatolia B7 Elazığ Ergani to Hazar lake, around Hazar lake, 1238 m, 38°28' 855" N 39° 34' 621" E 16.05 2008 E. Cabi 3026 **C6 K. Maraş**, City center to Sarıçukur village, road sides , 682 m, 37° 36' 506" N 36° 49' 631" E 03 05 2008 E. Cabi 2818, **C7 Ş.Urfa:**

Ceylanpınar State Farm, Beyazkule, 254 nolu parsel, 448m 37° 02' 589" N 39° 57' 509" E 13 05 2008 E. Cabi 2905 **Ş.Urfa**: Viranşehir to Demirci 416 m 37° 16' 990" N 39° 46' 002" E 14 05 2008 E. Cabi 2918**, Ş.Urfa**: Eyüp Nebi yol güzergahı, roadsides, 565 m 37° 13' 908" N 39° 41' 526" E 14 05 2008 E. Cabi 2960**, Ş. Urfa**: Hilvan to Siverek 587 m 37° 36' 432" N 39° 03' 657" E 15 05 2008 E. Cabi 2982**,** Ş.Urfa: Urfa to Viranşehir, near Karakeçi, 561 m 37°13.414' N 39°36.322' E, 22.04.2007, E. Cabi 1819. **Ş.Urfa** Ceylanpınar State Farm, Şeyh Nasr Deresi yatağı, 454 m., 24.04.2007, E. Cabi 1927. **Ş.Urfa** Ceylanpınar State Farm, Sarnıçtepe bölgesi, 450 m., 36°47.652' N 39°41.378' E, 24.04.2007, E. Cabi 1932.

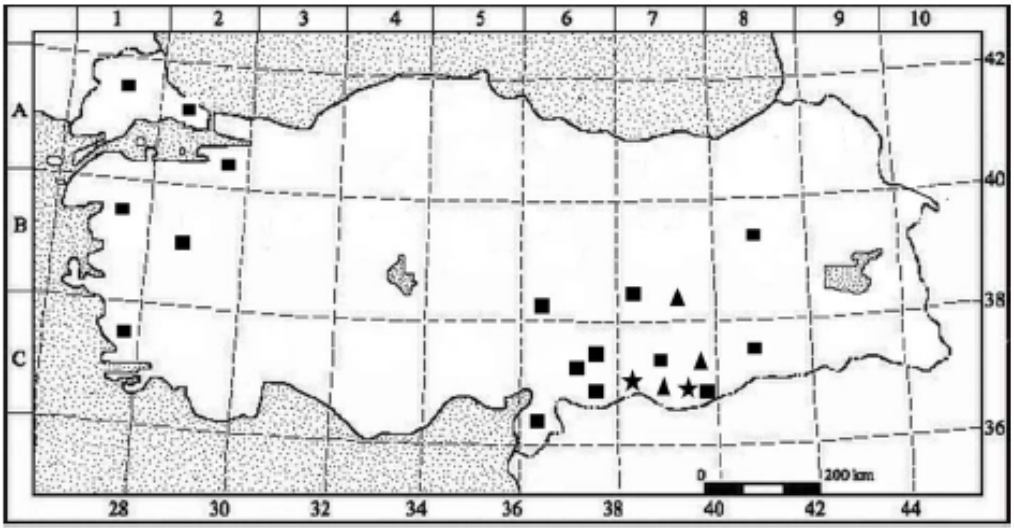

Figure 165. Distribution of *Hordeum spontaneum* with three varieties in Turkey.

Legend. *H. spontaneum* (■) var. *spontaneum*, (▲) var. *anatolicum* and (★) var. *proskowetzii*

Notes on the taxa: Wild barley, *Hordeum spontaneum*, the sole progenitor of cultivated barley, *H. vulgare*, is often seen growing on the edges of cultivated fields and roadsides from where it has been extensively collected.

3.4.14.7. *Hordeum distichon* L., Sp. Pl. 1:85 (1753). Ic: Host, Gram. Austr. 3: t. 36 (1805); Husnot, Gram. t. 28 (1899); Acta Inst. Acad. Sci. URSS ser. 1,5: t. 70 (1941).

Type: Hordeum distichon L., Sp. PI.: 85. 1 May 1753. - Neotype (designated here by Cope): [France], "PI. de l'Ouest de la France", 29 06 1879, Gadeceau s.n. (BM). Hordeum distichon L. var. nudum L., Sp. PI.: 85. 1 May 1753. [= Hordeum distichon L.]. -

Flowering ve Habitat: April. Cultivated*;* 50-700 m.

Widespread and common. Cultivated as cereal.

3.4.14.8. *Hordeum vulgare* L., Sp. Pl. 84 (1753). Syn: *H. hexasti*chon L., Sp. Pl.. 85 (1753); *H. sativum* Pers., Syn. Pl. 1:108 (1805). Ic: Fl. Iraq 9: t. 88 (1968).

Resembling *H. distichon* in habit, leaves and spikelet morphology, but spikes tetra- or hexastichous in section; lateral spikelets nearly sessile, hermaphodite and fertile like the central one.

Flowering and Habitat: April-May. Cultivated. nr s.l.-1700 m.

"Described without indication of provenance (Hb. Linn. 103/11)".

Cultivated as cereal commonly.

3.4.15. *Psathyrostachys* Nevski

The genus *Psathyrostachys* Nevski is revised in Turkey. Furthermore multivariate analysis have been carried out in order to understand the delimitation of the taxa of *Psathyrostachys.* For this reason, 20 quantitative, qualitative and multi-state morphological characters (Table 28) were scored for the accessions representing 10 populations of the genus. The data were subjected to numerical taxonomic analysis.

Table 30. List of characters scored for clustering analysis in the genus *Psathyrostachys*

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1. Habit; caespitose forming dense tufts (0), forming loose tufts (1)
2. Stem length (cm)
3. Nodes number on stem
4. Length of upper internodes
5. Stem indumentum: glabrous throughout (0), pilose just below the spike (1)
6. Length of basal leaves (cm)
7. Leaf shape of basal leaves: involute (0), flat (1)
8. Leaf indumentum of basal leaves: glabrous (0), scabrid (1), pilose (2)
9. Length of uppermost leaf on stem (cm)
10. Stem leaves indumentum: glabrous 0, scabrid 1, pilose 2
11. Spike length (cm)
12. Spike width (mm)
13. Number of spikelets per node
14. Florets number per spikelet
15. Glume length: more than 30 mm (0); not more than 20 mm (1)
16. Lemma length (inc) awn; more than 31 mm (0); not more than 29 mm (1)
17. Awn of lemma: more than 20 mm (0); not more than 10 mm (1)
18. Palea length of central spikelet (mm)
19. Glume indumentum: scabrid or puberulent (0); pilose (1)
20. Lemma indumentum: glabrous (0), scabrid (1), pilose in lower half scabrid in upper half (2), pilose densely throughout (3)

The results showed that the genus is represented by 3 species one of which is new species for Turkey. An account of 3 species and 4 subspecies recognized in the genus is given including

the genus description, a key for the species as well as the subspecies, species descriptions, flowering times, habitats, altitudes, type citations, distributions, phytogeography and their conservation status. However, three new taxa, namely *P. narmanica* sp. *nov*.**,** *P. fragilis* subsp. *artvinense* subsp. *nov.* and *P. daghestanica* subsp *erzurumica* subsp. *nov.* are described for the first time.

As the diagnostic characters the most authors have used length of glumes and lemmas, number of spikelets per node, number of florets per spikelet, and pubescence of glumes and lemmas (Nevski 1934; Keng 1965; Bor 1970; Tzvelev 1983; Baden 1991).

During the field studies conducted in Erzurum in East Anatolia, a few interesting specimens were collected from three localities. After a close examination of the specimens and cross-checking with the *Psathyrostachys* accounts given in various floras (Bor 1968, 1970; Tzvelev 1976; Humphries 1980) and Baden's revisional study (1991), we have recognized a new species and two new subspecies for *Psathyrostachys* for Turkey. The new material was also compared with the type accessions of the related species.

P. fragilis densely caespitose perennial characterized by its spikes with very long lemmas and glumes. Glumes and lemmas (including awn) are longer than 30 mm. Baden (1991) divided this species into three subspecies namely subsp. *secaliformis*, subsp. *villosus* and subsp. *fragilis*. Former two are found naturally in Turkey. The altitudinal distribution range of these subspecies were given as between 1300 and 3500 m. During one of the excursions conducted in Artvin in N. E. Anatolia. We collected a specimen identified as *P. fragilis* at an altitude of 560 m. The specimen looked like subsp. *secaliformis* at first glance because of its scabrous glumes. After a closer examination of the specimen and cross-checking it with the type specimens of subsp. *secaliformis* and subsp.*villosus* it was realized that the specimen were quite different from subsp. *secaliformis* by having densely pilose lemmas. This specimen is also found in a very narrow area in Artvin, at the altitude of 560 m. Because of the above facts we proposed this specimen as a new subspecies which occurs in a very restricted area in the Artvin province N.E. part of Turkey.

P. daghestinica subsp *erzurumica* is characterized by obtuse paleas contrary to *P. daghestenica.* Löve (1984) in his genomically based study, transferred *P. daghestanica* into *P. rupestris* as a subspecies. Later, Baden (1991), followed the same treatment of Löve, he also treated *P. daghestanica* as a subspecies of *P. rupestris* contrary to Nevski (1934), Grossheim (1939) and Tzvelev (1983). Both taxa are confined to rather small geographical areas in Daghestan. The main differences between the taxa are as follows: The spikelets

number at each node, palea apex and indumentum of glumes and lemmas, leaf shape characteristics, length of lemma awn. The spikelet numbers at each node as diagnostic character is useful not only for the species delimitation but also the generic delimitation as well. Because of the above facts, we treated *P. daghestanica* as separate species. The populations collected from two different localities in Erzurum province, morphologically fits the description of *P. daghestanica.* The only morphological difference between the taxa is related the apex of paleas. Apex of paleas is obtuse in our collection contrary to *P. daghestanica*. Baden (1991) indicated that *P. daghestanica* grows at low altitudes between 400-600 m. Our specimens were also gathered from 1400-1800 m. Considering the ecological differences such as altitude difference and morphological differences of palea apex, we proposed a new subspecies *P. daghestanica* subsp. *erzurumica* Cabi & Dogan subsp. nov.

The phenogram (Fig. 166) resulted from the cluster analysis showed that two major groups are recognizable. The characters that distinguish these two groups are length of glume and lemmas and their awns. The first group included the populations of *P. daghestanica* subsp. *erzurumica* subsp. nov and *P. narmanica* sp. nov. populations. The second main group included the *P. fragilis* populations. It consisted three subgroups representing the subspecies of *P. fragilis* in Turkey. The indumetum types of the glumes and the lemmas helped the separation of the subgroups. The species cut of line drawn at c. 0.72 similarity level proves that the genus *Psathyrostachys* should be represented with three species in Turkey.

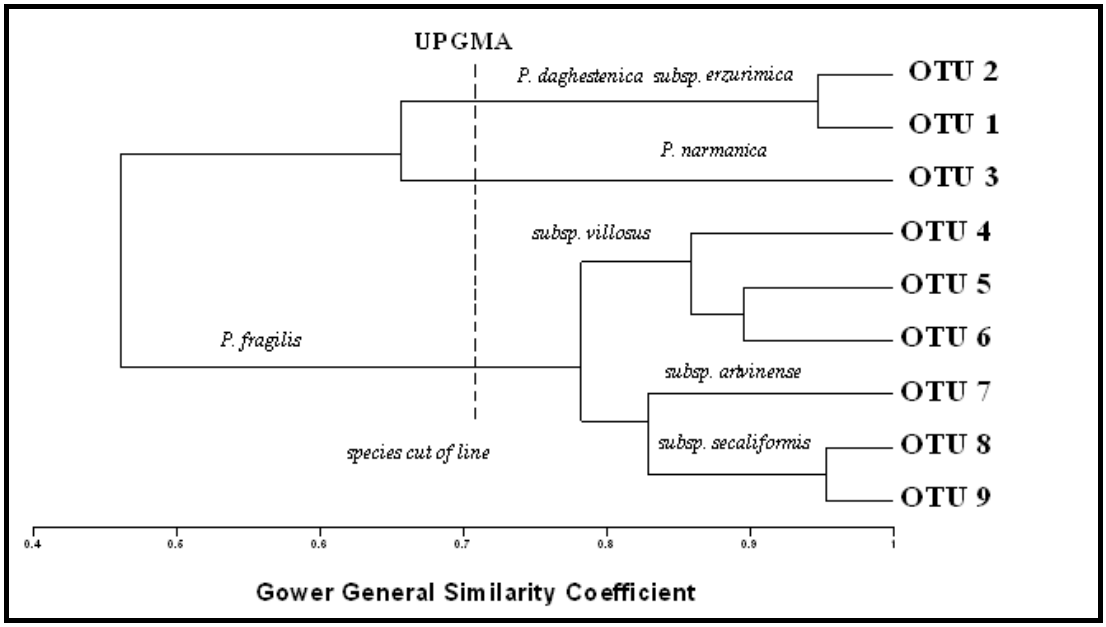

Figure 166. Obtained phenogram constructed by means of UPGMA algorithm and Gower General Similarity Coefiicient

OTUs: OTU 1,2 *P. daghestanica*; OTU 3 *P. narmanica;* OTU 4-6 *P. fragilis* subsp *villosus* OTU 7 *P. fragilis* subsp *artvinense* OTU 8-9 *P. fragilis* subsp secaliformis

***PSATHYROSTACHYS* Nevski** In Fl. URSS 2:716 (1934).- Nevski, Act. Inst. Bot. Acad. Sci. U.R.S.S., ser. 1, 1: 27 (1933), nom. Nud.

Type Species. *P. lanuginosa* (Trin.) Nevski. Ic: Baden (1991) Fig.10

Caespitose perennials, forming with short creeping rhizomes. Inflorescence an erect, dense spike with fragile rachis. Spikelets with 1 or 2-3 florets, arranged in groups of 2-3 at each rachis node, falling with next lower rachis segment; rachilla tough. Glumes subulate, erect or recurved, scabrid or pilose. Lemma coriaceous, lanceolate, glabrous or ± pilose, with scabrid or pilose awn.

Key to Species and Subspecies

1. Awn of lemma and glumes more than 30 mm long……**1. *P.fragilis***
    2. Glumes densely pilose; hairs patent. 0,5-1 mm……**1a. *P.fragilis* subsp. *villosus***
    2. Glumes scabrous to puberulent; hairs not patent, up to 0,4 mm; lemmas glabrous to pilose
        3. Lemmas scabrous to puberulent ……..**1b. *P.fragilis* subsp. *secaliformis***
        3. Lemmas densely pilose……**1c. *P.fragilis* subsp. *artvinense***
1. Awn of lemma and glumes up to 15 mm long,
    4. Spikelets usually two at each node, each spikelet contain one floret, glumes and lemmas densely pilose with patent hairs up to 1.2 mm long, giving plumose appearance……..……**2. *P. narmanica***
    4. Spikelets usually three at each node, contain two florets; glumes pilose at lower half, scabrous towards apex; lemmas scabrous to pilose; awn of lemmas scabrous……..**3. *P. daghestanica* subsp *erzurumica***

3.4.15.1. *Psathyrostachys fragilis* (Boiss.) Nevski in Kom., Fl. URSS 2: 716 (1934).
Syn. *Hordeum fragile* Boiss., Diagn. Ser. 1(7):128 (1846)! *Elymus fragilis* (Boiss.) Griseb. apud Ledeb., Fl. Ross. 4: 330 (1852)! **Ic**: Fl. Iraq 9: t. 89, Baden (1991)

Densely caespitose; with a curved base; older basal sheats glabrous. Nonflowering shoots 7,5-35 cm, convolute, scabrid at abaxial side. Stem 32-60 cm long, glaucous, glabrous, pubescent below spike or throughout; nodes 2-3, glabrous. Leaf sheats covering 3/4 of stem; uppermost internode 10-15 cm. Uppermost leaves 4-20 x 0.5-2.5 cm, adaxially scabrous to shortly pubescent, abaxialy glabrous. Auricles lacking. Ligule 0.1-0.3 mm, ciliate Spikes 41-

67x7-20 mm, with 3 spikelets at each node; rachis fragile, pubescent and hirsute on margins. Spikelets 2 flowered, often with a rudimentary second floret with a 4 mm long pedicel; central spikelets elliptic. Glumes 30-45.2 mm, unequal, straight or spreading and recurved, scabrous to patently pilose. Lemma 32.6-42.8 mm (including awn), glabrous, scabrous to patently pilose; awns 21.5-33.8 mm, erect to spreading. Palea 10-13 mm, equaling to lemma, bifid. Lateral spikelets narrowly elliptic. Glumes 33.5-45 mm, densely scabrous to hirsute, hairs 0.2-1 mm; lemma 37-51 mm (including awn); abaxially glabrous to scabrous, or sparsely to densely pilose, lemma awns 28.5-35 mm, scabrous or pilose. Palea 9.8-13.2 mm, slightly longer than lemma; anthers 5.4-6.8 mm long, yellow; caryopsis 5-5.5 mm.

Type: [S. Iran] in monte Sabst- Buschom prope Schiraz, Kotschy 375 (holo G! iso BM!, CAL, G, GOET, HEL, JE, K!, LE, M, MO, S, W)

subsp. *villosus* Baden in Nordic J. Bot. 11: 10 (1991). Ic: Baden op. Cit.: f. 2K-S (1991).

Type: [Turkey] A7 Gümüşhane, Argyridagh, 20 vi 1894, Sintenis 5947 (holo. K!, iso. B!).

Flowering and Habitat: June-July. Calcareous and gypsum slopes, 1450- 2100 m.

Endemic. Only known from localities distributed in B6 and B7 grid squares.

East Anatolia B6 Sivas, 18 km from Kangal to Gürün, near crossroad of Kuşyakası village, open slopes of hills, sandy calcerous soils, 1564 m, 39°07'45.1" N 37°14'32.8"E; E. Cabi 2424. Sivas: Kangal to Zara 5 km before Karabel pass, gypsum slopes, 1700 m, 39°37'00.8" N 37°43'19.5" E, E. Cabi 2454 **B7 Erzincan** Keşiş Dağı above Cimin, 1900-2100 m D 31769!; Erzincan: Erzincan to Sivas, before 29 km from Refahiye, 2023m 39° 52' 180" N 39° 04' 209" E, E. Cabi 1510-1511.; Erzincan: Sivas to Refahiye, 49 km before Refahiye, 1522 m, 39°51'848" N 39°16'809" E, E. Cabi 1508; Erzincan: Refahiye to Erzincan, near Sakalsultan pass, gypsum rocks, slopes, 1932 m., 39°52'19,1"N 39° 04' 57.8" E, E. Cabi 2462. Erzincan: Refahiye to Erzincan, 24 km before Erzincan, 1592 m., scree, 39° 52' 31.2" N, 39° 14' 54.7" E, E Cabi 3407, Erzincan.2 km from Erzincan to Spikör Mount, calcareous slopes. 1465m., 39°47'34.9" N 39°28'25.8" E, E. Cabi 2469.

Figure 167. Habit of *P. fragilis* subsp. v*illosus* and its spike in close view.

subsp. *secaliformis* Tzelev in Novosti Sist. Vyssh. Rast. 9:58 (1972). Ic. Baden in Nordic J. Bot. 11: f. 3A-J (1991).

Syn. *Elymus secaliformis* Trin. ex Steud., Nomencl., ed. 2, 1: 551(1841) nom. nud.

Flowering and Habitat: June-September. Stony or rocky slopes or scree at altitudes between 1300-3100 m

Type: [Iran] Prov. Azerbaijan, distr. Khoi, in promotoris ad Seidkodzi locis lapidosis subhumidis, Szowitz 197 (LE-designated by Baden in Nordic J. Bot. 11: 10, 1991).

N& S. East Anatolia. A8 Erzurum: Tortum to Narman, near İncedere, slopes, 1946 m. 40° 21' 579" N. 41° 37' 259" E., E. Cabi 1481 (with *P. daghestenica* subsp. *erzurumica* E. Cabi 1480); Erzurum: Erzurum to Pazaryolu-İspir, 3 km before Toprakkale, 2152 m, rocky slopes and scree, 40° 13' 084" N, 40° 57' 616" E, E Cabi 3449 Erzurum: Erzurum to Pazaryolu-İspir, junction of Elmalı village, 1981 m 40° 08' 948" N, 41° 01' 866" E, slopes and scree, E. Cabi 3432 Gümüşhane: Aşkale to Bayburt Kop Geçidi, 2415-2450 m 40° 01' 569" N 40 31' 339" E E. Cabi 3758; Erzurum Aşkale to Bayburt Kop Mount, calcerous scree. 2039 m 40° 00' 12,2" N 40° 32' 06" E, E. Cabi 2543; Erzurum Aşkale to Bayburt, Kop Mount, Kop pass calcareous slopes. 2401m, 40° 01' 38,0"N 40° 31' 20,4" E., E. Cabi 2548; **B8 Muş**, Varto to

Erzurum, 80 km to Erzurum, 1 km before Kirişli pass, rocky mountains, slopes, scree. 2202 m, 39° 28' 190" N 41° 03' 202" E, E. Cabi 3714; **B9 Bitlis/Van**: mt. 10 km S. E. of Pelli, 2250 m D. 22521*!* ; Van İspiriz Mount., 2600 m D. 23630*!*; Van: 17 km from Özalp to Van 2100 m N slopes in steppe D 44357; **C9 Hakkari**: Elkiyayla Mount., above pass between Marunis and Beytuşşebap, CENTO road 2400-2550 m, D45297!; Hakkari: Mor Mount., 3100 m, Watson 3600.

External Distribution: Caucasia, Iraq, Iran Afghanistan

subsp. *artvinense* Cabi & Doğan subsp. nov.

Type: [TURKEY] **A9 Artvin**: Ardanuç to Arevet (Torbalı village), near Ekşiler village, slopes 560 m 41° 06'.142" N, 42° 03'.316" E, 25.vi.2008 E. Cabi 3529 (holotype GAZI) Artvin: İspir to Yusufeli, Alanbaşı village, 764 m. rocks 40° 43'.251' N, 41° 25'.813" E, 21.vi.2008 E Cabi 3478 (syntype GAZI)

Diagnosis: Subsp *secaliformis* smilis, ab ea diversa: lemmae patenter pilosae, pili 0.7-1.0 mm. longis.

Closely allied to subsp. s*ecaliformis,* from which it can be distinguished by having pilose lemmas. It also closely allied to subsp. *villosus*, from which it can be distinguished by having scabrid glumes.

Distribution. Endemic. Known only from Artvin province between 550 and 800m distribution range.

Flowering and Habitat: June. Rocky and stony slopes. 560-765m.

Figure 168. *Psathyrostachys fragilis* subsp. *artvinense* Cabi & Dogan subsp nov.
A. Spike **B.** Spikelet **C.** Indumentum of glume

3.4.15.2. *Psathyrostachys narmanica* Cabi & Doğan sp. nov.

Type: [TURKEY] **A8 Erzurum:** Narman to Pasinler, Fairy chimneys place, [40° 18' 050" N, 41° 52' 608" E], 1608 m, red soil slopes, 22.vi.2008, E.Cabi 3498 [holotype GAZI];

Diagnosis: *P. daghestenica* smilis, ab ea diversa: plerumque 2 spiculati et nodis, glumae and lemmae patenter pilosae confertim omnino, spica plumosus habitus.

Caespitose, with a curved base; older basal sheats yellowish brown, glabrous. Culms 50-70 cm long, glabrous; culm nodes 2, glabrous; leaf sheats covering 3/4 of the culm; uppermost internode 20-25 cm long; uppermost leaf sheath 9-12,5 cm long; uppermost leaf 10-30 cm x1-2 mm; basal leaves up to 20 cm long pale green, involute , culm leaves scarce two or three, flat to involute; leaf surface scabrous, with prominent veins, Spikes 60-85 x 6-9 mm; rachis brittle, rachis margin pilose; 2-3 spikelets per node, spikelets 1 flowered, central spikelets narrowly elliptic, glumes unequal 12,5-15,5 mm long both erect, densely hirsute,

hairs patently divergent 0,5-1,0 mm long; lemma including awn 15,5 mm long, densely pilose, 0,7-1 mm long, lemma awns 4,5 mm long; palea and body of lemma 9,5 mm; palea acute at apex; pilose; lateral spikelets narrowly eliptic, glumes 15-16,5 mm long; densely pilose, hairs patently divergent, 0,8-1 mm long; lemma including awn 18,5 mm long; lemma awns up to 7 mm long, densely pilose, palea and body of lemma 11 mm long, pilose, anther 4,5-6 mm long. Fl. 6-7

Flowering and Habitat: June-July, *Psathyrostachys narmanica* grows in dry mountain slopes, iron rich soils, and rocks. It was collected from 1690 m.

Distribution. Endemic. East Anatolia (A8 Erzurum). **Ir-Tur. Element**. It is known only from the type locality.

Etymology. This endemic species is named after Narman, a town in Erzurum, from where it was collected by the authors.

Notes on the taxon. The proposed new species *P. narmanica* has thought to be close to *P. lanuginosa* at first glance because of its extremely brittle spikes with distinct patent pilose hairs giving a plumose appearance to the spike. After a close examination of the specimens and cross-checking it with the description given in Baden's account. We realized that the two taxa are strictly different from each other. Then we determined that closest species of our specimen is *P. daghestanica.* Our new specimen differs from the *P. daghestenica* by having usually two spikelets per node and indumentum of glume and lemma features.

Figure 169. *P. narmanica* Cabi&Dogan sp. nov.

3.4.15.3. *Psathyrostachys daghestanica* (Alex.) Nevski subsp. *erzurumica* Cabi & Doğan subsp.nov.

Type: [TURKEY] **A8 Erzurum:** Oltu, Çamlıdere (Borahan), [40° 31.037' N, 41° 59.603' E], 1401 m, slopes, 22.06.2008, E.Cabi 3486 (GAZI) ; **A8 Erzurum** Tortum to Narman, calcerous soils and slopes, 1804 m, 40° 20' 263" N 41° 35' 031" E, 05.07.2006, E. Cabi 1480 (GAZI)

Diagnosis: Subsp *daghestenica* smilis, ab ea diversa: palea obtusus et apex

Caespitose perennial. Older basal sheats brown, glabrous. Culms 40-65 cm long, sparsely hairy just below the spike, remaining part is glabrous; nodes 2, glabrous; leaf sheats covering 3/4 of the culm, uppermost internode 13-20 cm long; uppermost leaf sheath up to 15 cm long; uppermost leaf 6-8x 0,2-0,5 cm, basal leaves up to 25 cm long pale green, involute , culm leaves scarce one or two, flat to involute; leaf surface glabrous, with prominent veins, Spikes 40-70x 6-12 mm; rachis brittle, rachis margins pilose; three spikelet per node, spikelets usually with 2 flowered, one fertile, the other one is rudimentary or sterile with a 3 mm long pedicel; central spikelets narrowly elliptic, glumes unequal 10.5-13.5 mm, long both erect; or recurved, densely hirsute, hairs patently divergent 0,5-1,0 mm long; lemma including awn 13-15 mm long, pilose, mostly so at the apex of the body, lemma awns 4.0-5.0 mm long; palea and body of lemma 10 mm; palea obtuse at apex; sparsely pilose on keels; lateral spikelets narrowly eliptic, glumes 11-18 mm long; densely hirsute, hairs patently divergent, 0,8-1 mm long; lemma including awn 15-20 mm long; lemma awns 4.0-8.5 mm long, scabrid, palea and body of lemma 10-11 mm long, sparsely pilose. Caryopsis 6-7 mm long, anthers yellow 5.5-6 mm long.

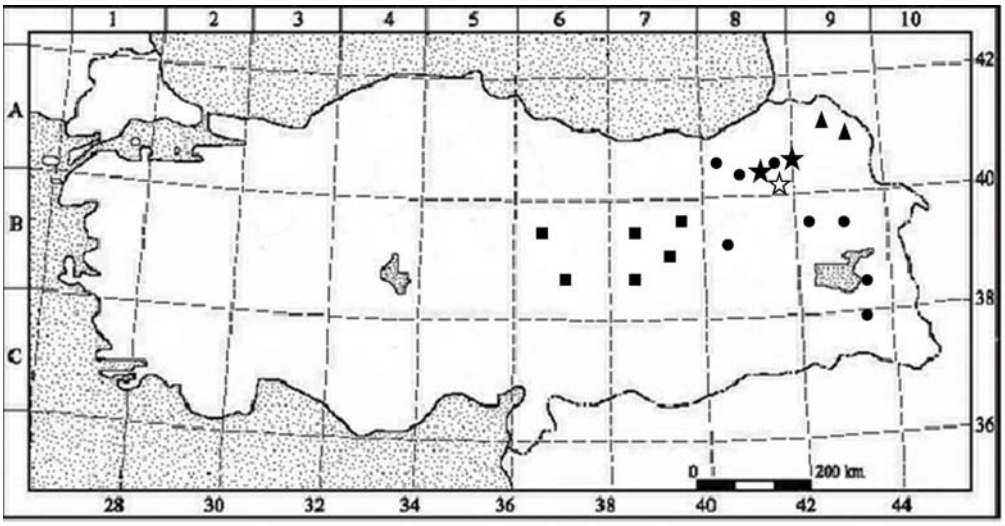

Figure 170. Distribution of the genus *Psathyrostachys* in Turkey.

Legend. *Psathyrostachys fragilis* (■) subsp. *villosus*, (●) subsp secaliformis, (▲) subsp *artvinense; P. narmanica* (★); *P. daghestanica* (Alex.) Nevski subsp. *erzurumica* (☆)

3.4.16. *Hordelymus* (Jess.) Harz

***Hordelymus* (Jess.) Harz** In Landwirthschatfliche Samenkunde 2: 1147. 1885.
Basionym: *Hordeum* subgen. *Hordelymus* Jess. Deutsch. Graser 202. 1863.

Caespitose perennial. Inflorescence an erect or nodding dense spike-like raceme with tough rachis. Spikelets usually in groups of 3 at each rachis node, all pedicellate, central hermaphrodite or male, lateral ones hermaphrodite, with 1-2 florets, disarticulating above glumes at maturity. Glumes linear-subulate, connate at base, gradually tapering into an erect, scabrid awn. Lemma lanceolate, coriaceous, scabrid towards apex, gradually tapering into a scabrid awn. Monotypic. **2n=28** Haploid genome symbol **Ns**

Syn: Cuviera Koeler, nom. rejic., non Cuviera A. DC., nom. cons.; Hordeum L. subgen. *Hordelymus* Jessen, non x *Hordelymus* Bachtj. & Darevsk.

3.4.16.1. *Hordelymus europaeus* (L.) Jessen in Harz, Samenkunde 2:1148, f. 135 (1885).

Syn: *Elymus europaeus* L., Mant. 35 (1767); *Hordeum europaeum* (L.) All.., Fl.. Pedem. 2:260 (1785); *Cuviera europaea* (L.) Koeler, Descr. Gram. Gall & Germ. 328 (1802). Ic: Host, Gram. 1: t. 28 (1801), as *Elymus europaeus*.

Lectotype: *Elymus europaeus* L., Syst. Nat., ed. 12, 2: 101; Mant. PI.: 35. 15-31 Oct 1767. [-Hordelymus europaeus (L.) Harz]. - Lectotype (designated by Cope): Herb. Linn. No. 100.13 (LINN).

Stems 50-100 cm, scabridulous below spikes, pubescent at nodes. Leaf sheaths pilose; blades 4-12 mm broad, flat, usually scabridulous. Raceme 4-12 cm. Glumes 14-17 mm (incl. awns). Lemma 8-10 mm, scabridulous towards apex, with awn 1.5-2.5 mm.

Flowering and Habitat: May-July. Picea forest, deciduous and mixed woods and thickets, to 2100 m. Described from Germany (Hb. Linn. 100/13 & 14).

Turkey-Europe, N. Anatolia . **A1(E)** Kırklareli: Mahyadağ, Hermann. **A2**(A) Bursa: Ulu Mount., Elma Çukuru, Pabot ST 483(!). **A3** Bolu: above Abant G., 15 vii 1940, B. Post! Bolu Yedigöller Milli Parkı , 900 m 12.06.1977, R. İlarslan. **A4** Kastamonu: Kastamonu to Ilgaz Mountain, Ilgaz geçidi, Abies forest, 1854m, 41°04' 0.08" N 33°45' 01.4" E, 11.07.2007 E. Cabi 2558 **A7** Trabzon: d. Maçka, Meryemana, 1540 m, Anşin 1567(!). **A8** Rize: above Khabackar (Kabakçur), 1750 m, 1866, Bal. **A9** Çoruh: 20 km E. of Şavşat, 2100 m, Sorger 81-75-37!

External Distribution: Europe (except extreme N.), N.W. Africa, Caucasia. **Euro-Sib. element**. Threat category: **VU**

Figure 171. Spike of *Hordelymus europaeus*

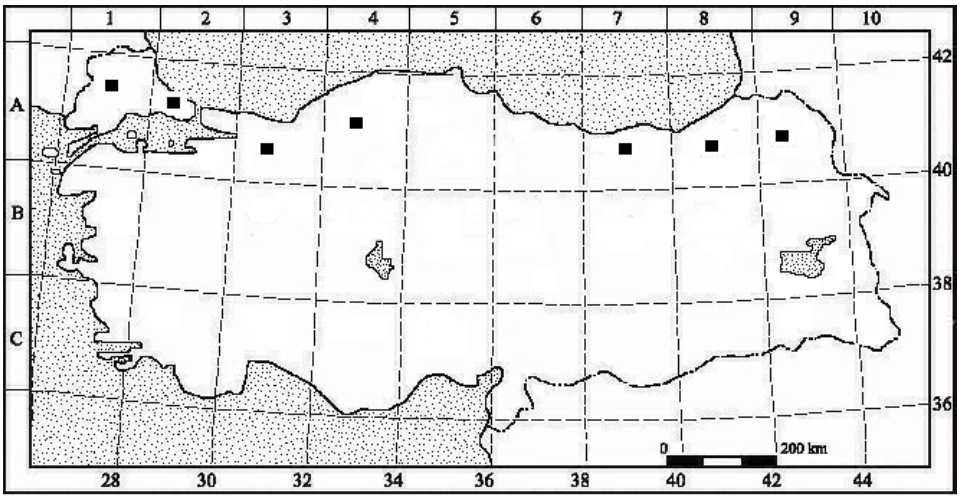

Figure 172**.** Distribution of *Hordelymus europaeus* in Turkey.

3.4.17. *Taeniatherum* Nevski

Taeniatherum Nevski Trudy Sredne-Aziatskogo Gosudarstvennogo Universiteta. Seriya 8b, Botanika 17: 38. 1934.

Type species: *Taeniatherum crinitum* (Schreb.) Nevski. *Trudy Sredne-Aziatskogo Gosudarstvennogo Universiteta. Seriya 8b, Botanika* 17: 38-39. 1934.

Annuals. Leaves evenly distributed; sheaths open, usually glabrous; auricles 0.1–0.5 mm, rarely absent; ligules membranous, truncate; blades flat to involute. Inflorescense dense, broad spike with tough rachis. Spikelets in pairs at rachis nodes, each with 2 florets, lower hermaphrodite, upper rudimentary; rachilla disarticulating above glumes. Glumes linear subulate, coriaceous, dilated at the base Caryopses narrowly elliptic, with an adaxial groove, apices pubescent. $x = 7$. Haplome **Ta.**

3.4.17.1. *Taeniatherum caput-medusae* (L.) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.), 17:38 (1934).

Syn: *Elymus caput-medusae* L., Sp. Pl. 1 :84 (1753); *Hordeum caput-medusae* (L.) Cosson & Durieu, Expl. Sci.Alg. 2:198 (1856).

Culms to 5-50 cm with 2-4 nodes, glabrous, erect. Leaf blades 2-5 mm broad, flat, convolute when dry, glabrous or scabrid, sparsely pilose on veins above and on margins, glabrous beneath. Spike 2.5-5 cm (excl. awns). Glumes 2-3.5 cm (incl. awns), erect, ascending from near base, or ± spreading or reflexed. Lemma glabrous or scabrid. 2n = 2x = 14 (Linde Laursen ve Frederiksen 2008). Haploid genome symbol: **Ta**

1. Glumes ± spreading at maturity, slender; lemma 6-8 mm, awn 4-7 cm, slender, 0.3-0.5 mm broad at base, flexuous or arcuate. ……..subsp. ***asper***

1. Glumes erect or slightly ascending near base at maturity, rather robust; lemma 8.5-12 m, awn 7-11 cm, robust, 0.6-1.2 mm broad at base, sometimes recurved…..…….subsp. ***crinitum***

subsp. *asper* (Simonkai) Melderis in Notes R.B.G. Edinb. 42:81 (1984).

Syn: *Cuviera caput-medusae* (L.) Koeler var. *aspera* Simonkai in Term. Füz. 29:230 (1897); *Hordeum asperum* (Simonkai) Degen in Aschers. & Graebn., Syn. Mitteleur. Fl. 2: 744

(1902); *Taeniatherum asperum* (Simonkai) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.), 17:39 (Apr. 1934) et in FI. URSS 2:719, t. 50 f. 4 (Sept. 1934).

Flowering and Habitat: May-August. Steppe, fallow fields, waste ground, roadsides, 450-1200 m.

Described from Hungary.

Widespread **A1(E)** Edirne: Keşan to Enez, 17.05.1970, A. Baytop 17823 (ISTE!) **A2(E) Istanbul**: Istanbul, viii 1850, Clement! **A2(A) Istanbul**: Maltepe, Kuyular düzü, 30.08.1995, M. Keskin 292 (ISTE!). İstanbul: Kayış Mount., 30.05.1958, A. Baytop 5178 (ISTE!) **A5 Amasya**: Amasya, Maniss. 605. **B1** Izmir: Izmir, iv 1827, Fleischer! **B2 Kütahya**: Murat Mount. above Gediz, between Hamam and Kesik Söğüt, 1200 m, D. 36717! **B4 Ankara**: Dikmen, vi 1936, Kuntay. **B6** Sivas, N. Çelik 2199 (ISTE!) **B7 Elaziğ**: Göldschik (Gölcük) nr Harput, Hand.-Mazz. **B8** Diyarbakır: Mermer, 670 m, E.S. Brown 2550! Diyarbakır: Silvan, fallow fields, Regel (ISTE 18993!). **B9 Bitlis**: Nemrut Mount., Peşmen. **C2 Denizli** 19 km S. of Acıpayam, on Denızli road, 925m, RMN 575. **C3/4** Antalya/Içel: Pisidia and Cilicia Trachea, Heldr. **C4 Konya**: Küçükköy, roadsides, 1015 m, 37°40.285'N 32 49.390' E 14.05.2006, E. Cabi 645. **C7 Adiyaman**: Adiyaman textile factory, Alava 6982! **Ş. Urfa**: Urfa to Viransehir, 40 km before Karakeçi, 476m, 37°08.863' N 39°07.490' E, 22.04.2007, E. Cabi 1817. **C9 Siirt**: Fündik above Dschesiret (Cizre), 1400 m, Hand.-Mazz.

External Distribution: C. & S.E. Europe, N. Africa, Caucasia, Iran, Iraq, Afghanistan, C. Asia.

Figure 173**.** Spikes of *Taeniatherum caput-medusae* subsp. *asper*

subsp. *crinitum* (Schreber) Melderis in Notes R.B.G. Edinb. 42:81 (1984).

Syn: *Elymus crinitus* Schreber, Beschr. Gras. 2:15, t. 24 f. 1 (1772); *Hordeum crinitum* (Schreber) Desf., Fl. Atl. 1:113 (1798); *Elymus intermedius* Bieb., Fl. Taur.-Cauc. 1:82 (1808); *Taeniatherum crinitum* (Schreber) Nevski in Acta Univ. Asiae Med. ser. 8b (Bot.), 17:38 (1934); *T. caput-medusae* (L.) Nevski var. *crinitum* (Schreber) C.J. Humphries in Bot. J. Linn. Soc. 76:343 (1978). Ic: Fl. URSS 2: t. 50 f. 3 (1934), as *T. crinitum*; Fl. Iraq 9:t. 91 (1968), as *T. crinitum*.

Flowering and Habitat: May-July. Steppe, grassy mountain slopes, story hillsides, mountain scrub, sandy plains, 400-2050 m.

Type: [Turkey] **B1** İzmir W. Sherard (holo. OXF).

Widespread **A1(E)** Tekirdağ: Muratlı, Arzulu village, 19.06.1991, T. Cerit 40 (ISTE!). Kırklareli: 8 km from Kırklareli to Kofçaz, 16.06.1975, A. Baytop 31972 (ISTE) **A2(E)** Istanbul: Tschilingos (Çilingoz), Hermann. **A2(A)** Bursa: Mudanya, Bornm. 1899:5685! **A3** Bilecik: 7 km from Osmaneli to Pamukova, 21.05.1966, A. Baytop 9298 (ISTE!) **A4** Ankara: Gerede to Ankara, nr Kizilcahamam, 1200 m, McNeill 270! **A5** Çorum: 40 km E. of Çorum, on Samsun to Çorum road, Jardine 410! **A6** Tokat: Ferince to Niksar, 400-600 m, Tchihatcheff. **A7** **Trabzon**: Trabzon, Hand.-Mazz. **B1** İzmir: d. Kemalpaşa, upper slopes of Nif Mount., Alava 4877! **B2** Manisa: Salihli, 15 km to Kula, 800 m, Coode & Jones 2807! B3 Konya: Sultan Mount. above Akşehir, 1000-1100 m, Bornn. 1899:5684! **B4** **Ankara**: Elma Mount., Price 953! **B5** **Nevşehir**: Göreme, 10 km W. of Ürgüp, 1000 m, McNeill 415! **B6** **Maraş**: Yalak, 1400 m, D. 19916! Sivas: Güneşli village to Yılanlı Mount., Step, 1500 m, B. Yıldız 4261 (ISTE) **B7** Tunceli: Balan, 700 m, C.E. Brown 238! **B8** **Erzurum**: Erzurum, vii 1853, Huet! **B9** **Van**: 7 km from Van to Erçek, 1850m, D. 44252! **B10** **Kars**: 3 km S.W. of Iğdir D.Ü.Ç., Aras valley, 800 m, D. 43783! C4 lçel: 10 km from Silifke to Mut, 100 m, Coode &Jones 743! **C5** **Adana**: d. Feke, Sencan De. between Süphandere and Belanköy, 1000 m, D. 19577! **C6** **Maraş**: 10 km S. of Maraş 550 m, 27350! Hatay: Hassa to Dörtyol, mountain road, E. of main mountain ridge, dry Quercus scrub and road verge, 28.5.1996, A.J. Byfield & Pearman 2611 (ISTE!) **C7** **Urfa**: 5 km from Akçakale to Urfa, 450 m, D. 28120! C8 Diyarbakir: Cinar to Diyarbakir, 700 m, D. 28688! Urfa: 50 km from Diyarbakır to Urfa, 07.06.1971, A. Baytop 20109 (ISTE!) **C9** **Siirt**: 14 km from Şirnak to Cizre, 610 m, D. 42683! Is: Lesvos, Rech. 5770.

External Distribution: Balkans, N Africa, Transcucasia, Crimea, Iran, Iraq, Cyprus, W. Syria, Afghanistan, Central Asia, W. Pakistan. **Multi regional.** Threat category **LC**

Figure 174. Spike of *Taeniatherum caput-medusae* subsp. *crinitum*

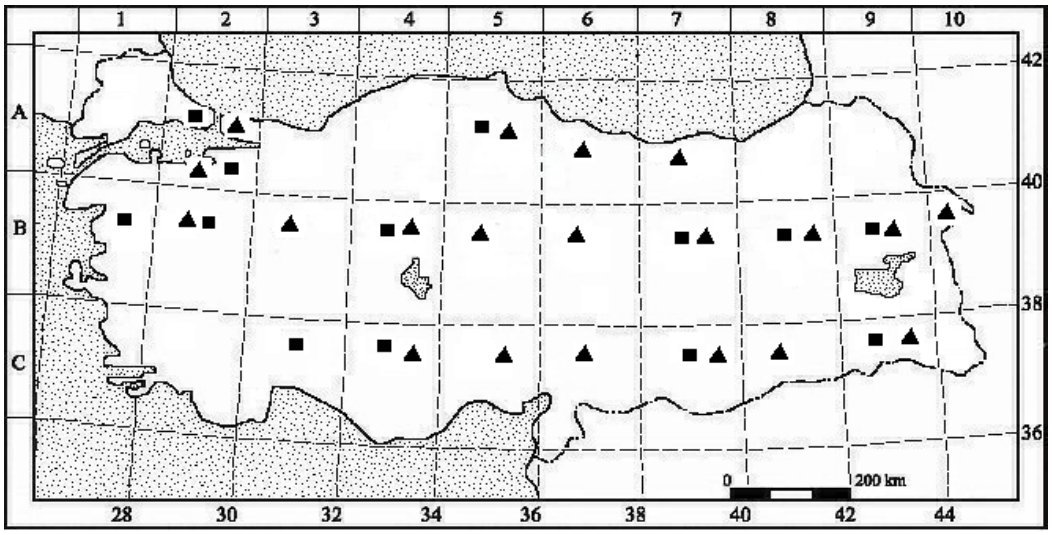

Figure 175. Distribution of *Taeniatherum caput-medusae* in Turkey.

Legend. *Taeniatherum caput-medusae* (▲) subsp. *crinitum* and (■) subsp *asper*.

3.4.18. *Henrardia* C. E. Hubbard

Henrardia C. E. Hubbard In Blumea, Supplement 3: 15. 1946.

Syn: *Rottboellia* L. f. Supplementum Plantarum 13, 114. 1781[1782].

Type Species: *Henrardia persica* (Boiss.) C.E. Hubb. - *Blumea, Supplement* 3: 17 1946

Annuals. Inflorescence a cylindrical, rigid spike with fragile rachis, transversely disarticulating at nodes below spikelets at maturity. Spikelets solitary, alternately arranged, closely adpressed to cavities in rachis, spikelets oblong-lanceolate, unawned, 1-2 hermaphrodite florets; rachilla continous, produced beyond terminal fertile floret and bearing a rudimentary floret at tip. Glumes placed side by side, covering florets, coriaceous, becoming undurated except for narrow margins, pubescent or glabrous. Lemmas nearly as long as glumes, membranous, 3-5 veined. **2*n* = 14**. Diploid. Haploid genom symbol **O.**

3.4.18.1. *Henrardia persica* (Boiss.) C.E. Hubbard in Blumea Suppl. 3:17 (1946).

Basionym: *Lepturus persicus* Boiss. Diagnoses plantarum orientalium novarum 13: 71. 1853 (G!).

Stems to 25 cm, decumbent at base, erect, minutely pubescent below spikes and usually on lower internodes. Leaf blades to 3.5 mm broad, densely and shortly pubescent on upper surface, glabrous beneath. Auricles falcate. Spike erect or slightly curved, 6-15 cm. Spikelets oblong, distinctly compressed, 6-10 mm long. Glumes with membranous margins, rigid, covered lower florets or exceeding, obscurely 7-9 veined. Lemmas 6-7 mm long, paleas nearly equal to lemma, membranous. Caryopsis adherent to pericarp, 5-7 mm long.

Flowering and Habitat. April-July. Step, shaddy and stony places, sandy and calcerous soils, field margins, 800-2070 m.

1. Spike minutely pubescent, with retrorsely adpressed hairs…… var. ***persica***

1. Spike glabrous ……var. ***glaberrima***

var. ***persica***.

Syn: *Lepturus incurvatus* (L.) Trin. var. *erectus* Griseb. in Ledeb., Fl. Ross. 4:325 (1852); *L. persicus* Boiss., Diagn.ser. 1(13):71 (1854)! *Pholiurus persicus* (Boiss.) A. Camus in Ann. Soc., Linn. Lyon 69:90 (1923)! *Lepturus erectus* (Griseb.) Szov. in Consp. Gram. Turkest. 81. 1923. *Lepturus hirtulus* Regel in Trudy Imperatorskago S.-Peterburgskago Botaničeskago Sada 7: 576. 1881.

Type: [Iran] in Persia Australi, Aucher 2914 (holo. G!).

Inner Anatolia B3 Eskişehir: 29 km from Polatlı to Sivrihisar, 800 m, Coode & Jones 2276(!). **B4 Ankara**:32 km from Ankara to Polatlı, 900 m, Coode & Jones 2230b! **B5 Kayseri**: Sultanhan to Kayseri, 1200m, Bornm. 1890:1642 (with var. *glaberrima*)! **Niğde**: 5 km N.W. of Ulukişla, 1450 m, Ehrend. 62-1/65-6 p.p.(!). **B6 Sivas**: Ulaş to Kangal, 2 km to Kangal-Gürün junction, 1534 m, 39°12.111' N 37°14.537' E, 20.07.2008, E. Cabi 3633. **B7 Erzincan**: Egin (Kemaliye), Kota, Sint. 1889:2830! Elazığ: Elazığ to Hazar L., 850 m, D. 28970! **B9 Van**: 24 km from Gürpınar to Hoşap, 2000 m, D. 44698a! **B10** Kars: 3 km S.W. of Iğdır D.Ü.Ç. 800 m, D. 45184!

Notes on the taxon. A specimen from A8 Rize [Ardeşen to Fındıklı, 5 m., 23.05.1981, A. Güner 3598!] does not belong to the genus *Henrardia***.** This specimen is probably early form of species of *Lolium* sp.

External Distribution. Armenia, Transcaucasia, Russia, Iran, Iraq, Afghanistan, Central Asia. **Ir.-Tur. element**.

var. ***glaberrima*** (Hausskn. ex Bomm.) C.E. Hubbard in Blumea Suppl. 3: 19 (1946). Syn: *Lepturus persicus* Boiss. var. *glaberrimus* Hausskn. ex Bornm. in Mitt. Thür. Bot. Ver. N.F. 20:51 (1904-1905). Ic: Fl. Iraq 9: t. 83 (1968)!.

Syntype. [Turkey] **B5** Kayseri in planitie prope Caesaream (Kaisarie) [= Kayseri], 1200 m, 14.06.1890, Bornmüller 1642; **B7** Erzincan; Armenia Turcica, Egin (ad Euphratem) in collibus prope Salachlü, 25.06.1890, P. Sintenis 2737 (JE).

Inner Anatolia. A4 Ankara: 22 km N.W. of Ankara, 900 m, Sorger 71-6-33! **B3 Eskişehir**: Polatlı to Sivrihisar, 32 km to Sivrihisar, 870 m, 39°33.843' N 31°48.627' E, 16.07.08, E.Cabi 3579 **B5 Niğde**: 5 km N.W. of Ulukişla, 1450 m, Ehrend. 62-1/65-6 p.p.(!). **B6 Sivas**: Ulaş to Kangal, 2km to Kangal-Gürün ayrımı, 1534 m, 39°12.111' N 37°14.537' E 20.07.2008, E. Cabi 3633 **B7 Elaziğ**: Elazığ to Kale (on Euphrates), 1150 m, D. 28900! **Malatya** Beydağı, around Eskiçamurlu village, 1500 m, sandy soil, 14.06.1995, B.Yıldız 12800!, **B9 Van**: 7 km from Van to Erçek, 1850 m, D. 44392!.

External Distribution: Transcaucasian, Iran, Afghanistan, W. Pakistan. **Ir.-Tur. element.**

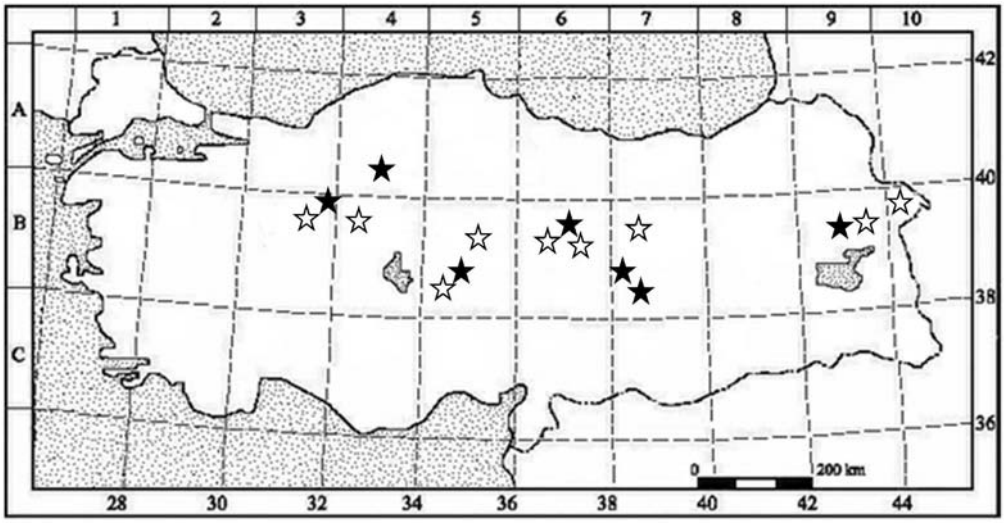

Figure 176. Distribution of *Henrardia persica* in Turkey

Legend. *Henrardia persica* (★) var. *persica* and (☆) var. *glaberrima*

Figure 177. Habit of *Henrardia persica* in its native habitat

CHAPTER 4

4. CONCLUSION

Towards achieving taxonomic revision of the tribe Triticeae, extensive field studies were conducted throughout Turkey for a period of four years and approximatelly 3500 grass specimens most of which belong to the tribe have been collected during the excursions. GPS coordinates for the specimens are given and the specimens are stored at the Plant Systematic s and Taxonomy Laboratory in the Department of Biological Sciences. New revisions of the genera included in the tribe Triticeaee are made by consulting these specimens by means of using morphological, ecological, numerical taxonomic and phytogeographical methods.

In Triticeae, 18 genera, 79 species, 27 subspecies and 37 varieties are recognized including **1** new species (***Psathyrostachys narmanica*** Cabi & Doğan sp. nov.), **3** new subspecies (***Psathyrostachys fragilis*** (Boiss.) Nevski **subsp. *artvinense*** Cabi & Doğan subsp. nov. ; ***P. daghestanica*** (Alex.) Nevski **subsp *erzurumica*** Cabi & Dogan subsp. nov.; ***Aegilops triuncialis*** L. **subsp *bozdagensis*** Cabi & Doğan subsp nov**.)** and **4** new varieties (***Agropyron cristatum*** (L.) subsp. ***pectinatum*** (Bieb.) Tzvelev var. ***mucranatum*** var. nov.; ***Eremopyrum bonaepartis*** (Sprengel) Nevski. **var. *aristatum*** Cabi & Doğan **(Cabi & Doğan 2010); *Thinopyrum pycnanthum*** (Godr.) Barkworth **var. *aristatum*** Cabi & Dogan var. nov.; ***Hordeum spontaneum*** C. Koch **var. *anatolicum*** Cabi & Dogan var. nov. As well as the description of new taxa, first records of ***Aegilops juvenalis*** (Thell.) Eig. (Cabi & Doğan 2009) and ***H. spontaneum* var. *proskowetzii*** Nábělek are also made for the Flora of Turkey.

Diagnostic morphological characters commonly used in the keys of the tribe and their possible variations are evaluated. Among a variety of characters, the ones such as habit, number of spikelets per rachis nodes, rachis fragility, shape of spikelets in size and sexuality, shape of florets, length of glumes and lemmas, number of florets per spikelet, and indumentum of glumes and lemmas are found to have diagnostic values.

Synonymy, updated descriptions, flowering time, habitat, type citation, general distribution inside Turkey, phytogeographical elements, specimen citations on a grid basis and general distribution outside Turkey are given for each species. Keys to species and the intraspecific categories are given along with general decriptions.

The study showed that micromorphological features of the florets are very important for systematic purposes and can be used to unravel relationships in the tribe. On the bases of SEM studies, three types of pointed structures, hooks, prickles, and macrohairs are found on the glume and lemma epidermises of the taxa. Glume and lemma epidermises are found to be more or less homogenous with the pointed structures as well as silica bodies and and epicuticular waxes. The epidermises of glumes and lemmas are evaluated separately, as the surfaces of glume and lemma on the same taxa may includes different features as far as above mentioned charecters are concerned. Macrohairs are always unicellular and differ from each other in length and direction. *Henrardia persica* var. *persica* is the only taxon in the tribe which have pubescent glumes covered with retrorsely adpressed hairs. All the other taxa have pubescent glumes with antrorsely adpressed hairs. Although hooks (crown cells) are commonly observed among the investigated taxa, it is realized that some taxa belonging the genera such as *Hordeum*, *Thinopyrum*, *Psathyrostachys*, *Henrardia* and *Leymus* do not have hooks on their glume epidermises. Long cells are notably varied in length among the taxa. Basically two types of cells can be recognized. The first type consists of rather elongated cells with straight cell walls (i.e. *Pseudoroegneria sosnovskyi*, *Thinopyrum pycnanthum, Psathyrostachys fragilis* subsp. *villosus* etc.). In the second type, cells might be short or long but cell walls are more or less sinuous (i.e. *Eremopyrum bonaepartis, Elymus repens, Hordeum spontaneum, Taeniatherum caput medusae, H. bulbosum*, *Crithopsis delileana*, *E. distans* and *Henrardia persica* var. *persica* etc.). The degree of cell wall indulations are the most prominent in the *Henrardia persica* var. *persica*. An outline for each genus is drawn on the basis of the micromorphological characters such as macrohairs, prickles, hooks (crown cells), silica bodies and long cells.

IUCN threat categories of the taxa are re-evaluated on the basis of their updated geographical and ecological distributions in Turkey. The categories such as Data Deficient (DD), Extinct (E), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Least Concern (LC) are recognized at national level. The distribution is DD for 5 taxa, E for 1 taxon, CR for 1 taxon, EN for 12 taxa, VU for 9 taxa and LC for the remaining taxa. It is

obvious that additional ecogeographical surveys are required especially for the taxa which were evaluated as Data Deficient in the thesis.

The results of soil analysis of the samples gathered from suitable habitats of the species showed that the members of this tribe show high ecological tolerance and grow in a variety of soils such as clayish (C), clay-loam (CL), loam (L), sandy (S), sandy-clay-loam (SCL), sandy-loam (SL), silt-clay (SiC) and silt-clay-loam (SiCL).

The generic delimitation in the genus *Elymus* is made more natural and it is decided that the genera *Thinopyrum* and *Pseudoroegneria* should be recognized as distinct genera differing greatly from the *Elymus* s.s. on the basis of their genomic and morphological features. Cytologically all the taxa with **StH, StY** genomes (i.e. *Roegneria*) are retained in the genus *Elymus* s.str. Since *Thinopyrum* and *Lophopyrum* have the same basic genome in different modified foms as $\mathbf{E}^{b}$ and $\mathbf{E}^{e}$, respectively, these two genera are combined and **E** genome containing species and their morphologically similar species are placed in *Thinopyrum.* The St genome seems to be the donor genome of the species in the polyploid genera of the tribe. Therefore, the species containing St (i.e. ***Pseudoroegneria libonotica***) and **StP** (i.e. ***P. tauri***) genomes as well as the other morpholgically closely similar species are placed in *Pseudoroegneria. Elytrigia repens* (L.) Nevski (the type species of the genus *Elytrigia*) is found to have the StStH genome combination (Assadi & Runemark 1995), and thus the genus *Elytrigia* is included in the genus *Elymus*.

This revision of the tribe in Turkey led to the following nomenclatural novelties such as;

- *Elymus divaricatus* subsp. *lomatolepis* (Melderis) Cabi and Doğan comb. nov.
- *Eremopyrum bonaepartis* (Sprengel) Nevski. var. *sinaicum* (Steudel) Cabi & Dogan comb nov.
- *Eremopyrum confusum* Melderis var. *sublanuginosum* (Drob.) Cabi & Dogan comb nov.
- *Thinopyrum caespitosum* (K. Koch) Cabi & Doğan comb. nov
- *Thinopyrum caespitosum* (K. Koch) Cabi & Dogan subsp. *sinuatum* (Nevski) Cabi & Doğan comb. nov
- *Thinopyrum caespitosum* (K. Koch) Cabi & Dogan subsp. *gypsicolus* Cabi and Doğan comb nov.
- *Thinopyrum caespitosum* (K. Koch) Cabi & Dogan subsp. *platphyllus* Cabi and Doğan comb nov
- *Thinopyrum erosiglumis* **(**Melderis) Cabi & Dogan comb. nov

- *Thinopyrum farctum* (Viv) Cabi & Doğan comb. nov
- *Thinopyrum elongatum* (Host) D.R. Dewey subsp. *ponticum* (Podp.) Cabi & Dogan comb nov
- *Thinopyrum elongatum* (Host) D.R. Dewey subsp. *turcicum* (McGuire) Cabi & Dogan comb. nov.
- *Thinopyrum elongatum* (Host) D.R. Dewey subsp. *salsum* (Melderis) Cabi & Doğan comb. nov.
- *Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey subsp *intermedium* var. *podperae* (Nabelek) Cabi & Doğan comb et stat. nov.
- *Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey subsp *intermedium* subsp**.** *intermedium* var. *barbulatum* (Schur) Cabi & Doğan comb. et stat. nov.
- *Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey subsp. *pulcherrimum* (Grossh.) Cabi&Doğan comb nov.

The morphological variation in *Agropyron* Gaertner within Turkey was examined by using numerical analyses. The results indicate that there are five morphologically distinct entities in Turkey, representing three species, *A. imbricatum* Roem. & Schult., *A. cristatum* (L.) Gaertn., and *A. incanum* (Nábělek) Tzvelev. *Agropyron cristatum* is represented by three entities that we recognize as varieties of *A. cristatum* subsp. *pectinatum* (M. Bieb.) Tzvelev: var. *pectinatum,* var. *mucronatum* Cabi & Doğan var. nov., and var. *puberulum* Boiss.

In Turkey, the genus *Elymus s. str.* is represented with 9 species containing St, H, Y basic genomes and combinations of them. *Elymus elongatiformis* (Drobow) Assadi and *E. divaricatus* Drobow were earlier treated as subspecies under *E. repens* (L.) Gould and *E. lazicus* (Boiss.) Melderis but these taxa are recognized as valid species. Since close morphological similarities between the taxa *E. divaricatus* and *E. lazicus* subsp. *lomatolepis* Melderis, subspecies *lomatolepis* are transferred to *E. divaricatus* and a new name combination (*E. divaricatus* subsp. *lomatolepis* (Melderis) Cabi and Doğan comb. nov.) is proposed for this taxa.

After transferring the **E** genome carrying species into the genus *Thinopyrum*, the genus is represented by 8 species including *Thinopyrum flaccidifolium* (Boiss. & Heldr.) M. Moustakas, *Thinopyrum elongatum* (Host) D.R. Dewey**,** *Thinopyrum caespitosum* (C. Koch) Cabi & Doğan comb. nov, *Thinopyrum gentryi* (Melderis) D.R. Dewey**,** *Thinopyrum erosiglumis* (Melderis) Cabi & Doğan comb. nov, *Thinopyrum pycnanthum* (Godr.) Barkworth**,** *Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey and *Thinopyrom*

farctum (Viv) Cabi & Dogan comb. nov. in Turkey. The infraspecific delimitation of the *Thinopyrum intermedium* (*Elymus hispidus*) complex is re-evaluated and taxonomic status of the taxa *Elymus hispidus* subsp. *podpyerae* (Nâb.) Melderis and *Elymus hispidus* subsp. *barbulatus* (Schur) Melderis are recognized as varieties of *Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey subsp *intermedium*.

The species containing St (i.e. *Pseudoroegneria libonotica* (Hack.) D.R. Dewey) and StP (i.e. *P. tauri* (Boiss. & Bal.) A. Löve) genomes as well as the other morpholgically closely similar species (i.e *Pseudoroegneria sosnovskyi* (Hack.) Á. Löve and *Pseudoroegneria kosaninii* (Náběl) Á. Löve) are placed in *Pseudoroegneria.* Therefore the genus is represented by 4 species in Turkey. *Pseudoroegneria sosnovskyi* (Hack.) Á. Löve (Syn=*Elymus sosnowskyi* (Hackel) Melderis), a rare endemic species was recollected during the field excursions in the timeline of the thesis and diagnostic characters including its morphological, anatomical and palynological features of this rare taxa are determined.

The revisional study is carried out with the help of numerical taxonomic methods on the genus *Eremopyrum* in Turkey (Cabi and Doğan 2010). In contrast to Frederiksen (1991), the results of this study suggest that there are basically five species, namely *E. triticeum* (Gaertner) Nevski, *E. orientale* (L.) Jaub. & Spach, *E. distans* (K. Koch) Nevski, *E. bonaepartis* (Sprengel) Nevski, and *E. confusum* Melderis. For the first time a new variety, *E. bonaepartis* (Sprengel) Nevski. var. *aristatum* Cabi&Doğan, is proposed along with two new combinations: *E. bonaepartis* (Sprengel) Nevski. var. *sinaicum* (Steudel) Cabi & Doğan and *E. confusum* Melderis var. *sublanuginosum* (Drob.) Cabi & Dogan.

The number of *Aegilops* species naturally distributed in Turkey is reached to 17. In the Flora of Turkey, Davis (1985) recognized only fifteen species among which *Ae. juvenalis* (Thell.) Eig and *Ae. vavilovii* (Zhuk.) Chennav. were not encountered. The first vouchered records of *Aegilops juvenalis* (Thell.) Eig. are made within the Flora of Turkey during the timeline of the thesis and *Ae. vavilovii* previously evaluated as an infraspecific taxon under the species *Ae. crassa* is recognized as valid species.

The results of the revision of *Psathyrostachys* Nevski showed that . It is decided that the the genus is represented by 3 species (*Psathyrostachys fragilis* (Boiss.) Nevski**,** *Psathyrostachys narmanica* Cabi & Doğan sp. nov. and *Psathyrostachys daghestanica* (Alex.) Nevski subsp. *erzurumica* Cabi & Doğan subsp.nov.) one of which is new for Turkey.

As a conclusion, the actual biodiversity of tribe Triticeae in Turkey is provided with this thesis. The tribe is represented by 18 genera namely *Agropyron, Elymus, Thinopyrum, Pseudoroegneria, Eremopyrum, Heteranthelium, Crithopsis, Amblyopyrum, Aegilops, Triticum, Dasypyrum, Secale, Leymus, Psathyrostachys, Hordeum, Hordelymus, Taeniatherrium and Henrardia.*

During the timeline of the thesis, more than 10 papers were prepared, submitted or published including new taxa, records and revision. The relevant published papers were given at the end of the thesis as appendixes.

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PUBLICATIONS

1. Cabi E, Özler H (2008). Pollen morphology of some Sunflower (*Helianthus annuus* L.-Heliantheae) Cultivars. *World Applied Sciences Journal* 4 (1): 18-23.

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1. Cabi E, Pehlivan S & Özler H (2006). An examination of pollen morphology of some species belonging to Gramineae family, Turkey. Bulgaria – Sofia: 20–26 June 2006 IV Balkan Botanical Congress Scientific Area A, p. 16 **(Oral Presentation).**

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5. Cabi E., Doğan M. (2008) Biodiversity of the tribe Triticeae Dum.(Gramineae) in Turkey. Aqaba Jordan 20-23 October (2008), First International Congress Documenting, Analysing and Managing Biodiversity in the Middle East **(Oral Presentation)**

6. Mavi, Ö., **Cabi, E**., Doğan 2008. Anatomy of *Leymus* Hochst. (Gramineae: Triticeae) Aqaba Jordan 20-23 October (2008), First International Congress Documenting, Analysing and Managing Biodiversity in the Middle East **(Poster Presentation)**

7. Dizkırıcı A, Kaya Z, Güren HE, **Cabi E**, and Musa Dogan, "Sequence diversity in the nuclear ribosomal internal transcribed spacer of Elymus and related genera (Poaceae: Triticeae) and its implication in speciation 4th International Symposium on Health Informatics and Bioinformatics, April 16-17 2009 Turkey'09. **(Poster Presentation)**

8. Cabi E., Doğan M., Akaydın G. Systematical Studies and generic delimitation on the genus Elymus L. (Poaceae) in Turkey. XII OPTIMA Meeting. March 22-26 2010 Antalya TÜRKİYE **(Invited paper) Oral presentation**

HOBBIES

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