

Syntaxonomical Synopsis of the Steppe Vegetation of Turkey

Türkiye'nin Step Vegetasyonunun Sintaksonomik Özeti

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Abstract: Floristic, ecological and genetic diversity is extremely important in terms of the Anatolian steppe (Turkey) that is located in the western border of Irano-Turanian floristic region. Syntaxonomy of Anatolian steppe have been studied over 40 years but there were many invalid published names and a disorder among syntaxonomical units. In this paper it was aimed to overview the phytosociological studies and the sum of syntaxa of steppe vegetation of Turkey. In the study, all syntaxa described so far from steppe vegetation of Turkey were gathered together to clear their ranks and last status. Steppe vegetation in Turkey is evaluated in 7 class, 13 order, 6 suborder, 52 alliance and 5 suballiance.

Key words: steppe vegetation, syntaxonomy, Turkey.

Özet: İran-Turan floristik bölgesinin batı sınırında yer alan Anadolu stepi (Türkiye), floristik, ekolojik ve genetik çeşitlilik açısından son derece önemlidir. Anadolu stebinin sintaksonomisi 40 yıldır çalışılmaktadır ancak sintaksonomik birimler arasında bir düzensizlik ve birçok geçersiz yayınlanmış isim bulunmaktadır. Bu makalede, Türkiye'nin step vegetasyonuna ait sintaksonlar özetlenmeye ve bu konudaki fitososyolojik çalışmaların kısaca gözden geçirilmesi amaçlanmıştır. Bu çalışmada bugüne kadar tanımlanan Türkiye'nin step vegetasyonuna ait bütün sintaksonlar kademeleri ve son statülerini saptamak üzere biraraya toplanmıştır. Türkiye'deki step vegetasyonu 7 sınıf, 13 ordo, 6 alt ordo, 52 alyans ve 5 alt alyans ile temsil edilmektedir.

Anahtar sözcükler: step vegetasyonu, sintaksonomi, Türkiye.

1. Introduction

Steppe is a xeric plant formation drying out in summer and dormant in winter, dominated by the cushion forming chamephytes, annual and perennial grasses. The steppe vegetation covering the vast areas in Central Asia extends towards to Inner Anatolia in the west.

Anatolian steppes differs from the Asian steppes by their anthropogenic origin due to the destruction of pine (*Pinus*) and oak (*Quercus*) forests in Anatolia (Akman, 1974). While the grasses (*Gramineae*) are dominated in Asian steppes where a continental climate prevails, broad and fleshy leaved (malacophyllous) plants are dominant in Anatolia, under the effects of Mediterranean climate (Takhtajan, 1986).

The steppe vegetation shows an altitudinal variation. Therefore, those occupying flat and slightly sloped lands between 800-1200 meters are called as 'plain steppe' and above this elevations those spreading on the steeper slopes are called 'montane steppes'.

On the other hand, steppe formations in Turkey can be grouped into four clusters according to their aspects;

- i. Malacophyllous steppes: It is believed to be derived from grass steppe dominated by fleshy leaved plants as a result by overgrazing on more humid and deeper soils.*
- ii. Gramineae steppes: This type of steppe dominated by grasses are no longer common today.*
- iii. Tragaganthic steppes: These are the steppes mostly dominated by cushion forming spiny species such as *Astragalus* and *Acantholimon*.*

iv. *Salty steppes*: In addition to those above, this is a type formed by halophytic plants occupying saline areas. The widespread species here belong to the families *Amaranthaceae* (syn: *Chenopodiaceae*) and *Plumbaginaceae* (Kurt et al, 2006).

Steppe vegetation in Turkey occupies large areas of Central, Eastern and South-Eastern Anatolia. These regions are the utmost western extension of Irano-Turanian floristic region phytosociologically.

Except for the Irano-Turanian parts of Turkey, highland steppes are dominated above the timberline of Taurus in the South and North Anatolian mountain range.

The first attempts for classification of syntaxonomic units of steppe vegetation in Turkey date back to 1960s. Many studies of Birand, Çetik, Akman, Quézel, Ketenoğlu, Kurt are focused on the steppe vegetation in Anatolia. After the 1990s, syntaxonomical studies on steppe vegetation of Anatolia has accelerated and many syntaxa were published. However, this situation has created a confusion in terms of compliance with the international code of phytosociological nomenclature.

In this article, the syntaxa described so far are complied and the upper units are rearranged.

2. Results and Discussion

Phytosociological steppe units of Turkey following list with class, order, alliance and associations was prepared and gathered together to clear their ranks and last status. Syntaxonomic units of steppe vegetation of Turkey is evaluated in 7 class, 13 order, 6 suborder, 52 alliance and 5 suballiance. Class, order and alliance are illustrated schematically.

1. Class: *DAPHNO OLEOIDIS-FESTUCETEA VARIAE* Quézel 1964

This class occupies high mountainous areas in the north and north-western Anatolia.

Characteristic species; *Festuca cyllenica* Boiss. & Heldr. [Syn: *Festuca varia* subsp. *cyllenica* (Boiss. & Heldr.) Acht.], *Festuca valesiaca* Schleich. ex Gaudin [Syn: *Festuca ovina* L.], *Festuca rubra* L., [Syn: *Festuca ovina* var. *duruiscula* (L.) W.D.J.Koch], *Rostraria cristata* (L.) Tzelev [Syn: *Koeleria cristata* (L.) Bertol.], *Stipa pulcherrima* K. Koch., *Daphne oleoides* Schreb., *Aubrieta deltoidea* L. (DC.), *Iberis sempervirens* L., *Berberis cretica* L., *Paronychia chionaea* Boiss., *Telephium imperati* subsp. *orientale* (Boiss.) Nyman. [Syn: *Telephium orientale* Boiss.], *Prunus prostrata* Labill., *Astragalus angustifolius* Lam., *Acantholimon ulicinum* (Willd. ex Schult.) Boiss. [Syn: *Acantholimon echinus* (L.) Boiss., *Acantholimon androsaceum* (Jaub. & Spach) Boiss.], *Cruciata taurica* subsp. *persica* (DC.) Ehrend., *Scutellaria orientalis* L., *Asyneuma limonifolium* (L.) Janch., *Thymus roegneri* K. Koch. [Syn: *Thymus hirsutus* M. Bieb.]

1.0.1. Alliance: *Hyperico-Verbascion* Akman & Ketenoğlu 1978

Locality; Koroğlu Mountain, Kös Mountain, Halkoluk Plateau/Between Devrez Stream and Kızılırmak River/Transition zone of Western Black Sea Region and Central Anatolia (Kılınç, 1985)

Bedrock; Andesite

Altitude; 1500-2350 m

Characteristic & Diagnostic species; *Verbascum armenum* Boiss. & Kotschy subsp. *occidentale* Hub-Mor., *Astragalus amoenus* subsp. *squalidus* (Boiss.) Ponert [Syn: *Astragalus squalidus* Boiss.], *Jasione supina* Sieber ex Spreng. subsp. *akmanii* Dambolt, *Hypericum orientale* L., *Sideritis germanicopolitana* Bornm., *Cerastium purpurascens* Adams, *Genista tinctoria* L., *Hypericum linarioides* Bosse, *Marrubium astracanicum* Jacq., *Stachys iberica* M. Bieb., *Stachys germanica* subsp. *bithynica* (Boiss.) R. Bhattacharjee, *Astragalus aquilonius* (Barneby) Barneby, *Pilosella pilisquama* (Nägeli & Peter) Dostál [Syn: *Pilosella hopeana* subsp. *troica* (Zahn) P.D.Sell & C.West]

1.1. Order: *DAPHNO OLEOIDIS-FESTUCETALIA VARIAE* Quézel 1964

This order that is located in Greece and in the west of Anatolia characterizes mesogeenes floristically and Mediterranean mountains climatically (Barbero et al. 1975). It spreads Akdağ/Afyon-Denizli environs Ayaş Mountains and Bozdağ/İzmir (Akman and Ketenoğlu 1976; Gemici, 1988; Bekat and Oflas, 1990).

Characteristic & Diagnostic species: *Acantholimon puberulum* Boiss. & Balansa subsp. *puberulum*, *Helichrysum pallasii* (Spreng.) Ledeb., *Marrubium astracanicum* Jacq., *Euphorbia herniariifolia* Willd. subsp. *herniariifolia*, *Minuartia globulosa* (Labill.) Schinz & Thell., *Eremogone ledebouriana* (Fenzl) Ikonn. [Syn: *Arenaria ledebouriana* Fenzl.], *Saponaria pumilio* Boiss., *Eryngium bourgatii* subsp. *heldreichii* (Boiss.) P.H. Davis, *Dianthus erinaceus* Boiss. var. *alpinus*, *Juniperus communis* var. *saxatilis* Pall. [Syn: *Juniperus communis* subsp. *nana* (Willd.) Baumg.], *Sideritis condensata* Boiss. & Heldr., *Draba brunifolia* Steven, *Silene caryophylloides* Otth, *Erysimum kotschyianum* J. Gay [Syn: *Erysimum pallidum* Boiss.], *Muscari bourgaei* Baker, *Merendera trigyna* Woronow, *Ranunculus demissus* DC. var. *major* Boiss.

1.1.1. Alliance: *Stipa pulcherrimae-Morinion persicae* Quézel 1964

Locality; Gavur Mountains/Erzurum (Tatlı 1985)

Bedrock; Calcareous

Altitude; 2250-2360 m

Characteristic & Diagnostic species: *Stipa pulcherrima* K.Koch [Syn: *Stipa pennata* var. *pulcherrima* (K. Koch) Asch. & Graebn.], *Scutellaria altissima* L. [Syn: *Scutellaria peregrina* Waldst.&Kit.], *Melica ciliata* L., *Pterocephalus perennis* Coult., *Asphodeline lutea* (L.) Reichb. [Syn: *Asphodelus luteus* L.], *Anthemis cretica* L. [Syn: *Anthemis montana* L.], *Ononis pusilla* L., *Echinops sphaerocephalus* subsp. *taygeteus* (Boiss. & Heldr.) Kožuharov, *Morina persica* L.

1.1.2. Alliance: *Festucion chalcophaeae* Tatlı 1982

Locality; Dumlu and Gavur Mountains/Erzurum, Tahir Mountain and Güzeldere Valley/Ağrı (Behçet & Tatlı 1989; Gümüş 1992)

Bedrock; Andesite, basalt, calcareous, schist, marn

Altitude; 2000-2250 m

Characteristic & Diagnostic species: *Festuca chalcophaea* Krecz. & Bobrov, *Draba bruniifolia* Steven, *Tripleurospermum oreades* (Boiss.) Rech. f. var. *oreades*, *Minuartia recurva* (All.) Schinz & Thell. subsp. *oreina* (Mattf.) McNeill, *Erigeron caucasicus* Steven, *Plantago atrata* Hoppe

2. Class: *ASTRAGALO-BROMETEA* Quézel 1973

This class containing thorny cushion-like chamaephytes and perennial *Gramineae* plants extends across the Taurus mountains and the Aegean Anatolian plateau. It envelops all mountainous areas of Anatolia. The characteristic species of the class belong to are essentially oro-Mediterranean zone (Akman et al, 1987). It is represented in Turkey by six orders.

Characteristic species: *Bromus tomentellus* Boiss., *Anthyllis variegata* Grossh. [Syn: *Anthyllis vulneraria* subsp. *variegata* (Boiss.) Cullen], *Rostraria cristata* (L.) Tzelev [Syn: *Koeleria cristata* (L.) Bertol.], *Daphne oleoides* Schreb., *Leontodon asperrimus* (Willd.) Endl., *Scutellaria orientalis* L., *Draba bruniifolia* Steven, *Asyneuma virgatum* (Labill.) Bornm., *Senecio pseudo-orientalis* Schischk., *Helianthemum nummularium* (L.) Mill., *Androsace villosa* L., *Poa alpina* L. [Syn: *Poa alpina* subsp. *fallax* F.Hermann], *Helichrysum plicatum* DC., *Globularia trichosantha* Fisch. & C.A.Mey., *Astragalus* (*plural sp.*), *Campanula stricta* L., *Veronica multifida* L., *Sideritis libanotica* Labill., *Cyanus triumfettii* subsp. *axillaris* (Čelak.) Štěpánek [Syn: *Centaurea triumfettii* var. *cana* (Sibth. & Sm.) Dostál], *Podospermum canum* C.A.Mey. [Syn: *Scorzonera jacquiniana* (W.D.J.Koch) Boiss.], *Linum tenuifolium* L., *Acantholimon ulicinum* (Willd. ex Schult.) Boiss. [Syn: *Acantholimon echinus* (L.) Boiss., *Acantholimon androsaceum* (Jaub. & Spach) Boiss.], *Ononis adenotricha* Boiss., *Helianthemum oelandicum* subsp. *incanum* (Willk.) G.López [Syn: *Helianthemum canum* (L.) Baumg.], *Teucrium chamaedrys* L., *Minuartia anatolica* (Boiss.) Woronow, *Hypericum organifolium* Willd., *Cruciata taurica* subsp. *taurica* [Syn: *Cruciata coronata* (Sm.) Ehrend.], *Ziziphora clinopodioides* Lam., *Papaver apokrinomenon* Fedde, *Teucrium polium* L., *Iberis simplex* DC. [Syn: *Iberis taurica* DC.], *Melica ciliata* L., *Onobrychis cornuta* (L.) Desv., *Phlomis armeniaca* Willd., *Silene spergulifolia* (Willd.) M.Bieb., *Minuartia juniperina* (L.) Maire & Petitm., *Astragalus angustifolius* Lam., *Euphorbia myrsinites* L., *Anthemis cretica* L. [Syn: *Anthemis montana* L.]

The two alliances below (*Astragalo erythrotaeni-Gundelion armatae* and *Tanaceto orientali-Astragalion gummiferi*) are attached directly to the class *Astragalo-Brometea*.

2.0.1. Alliance: *Astragalo erythrotaeni-Gundelion armatae* Kaya & Ketenoglu 2010

Locality; Karacadağ Mountain/Şanlıurfa-Diyarbakır (Kaya & Ketenoglu 2010)

Bedrock; Volcanic, Basalt

Altitude; 1000-1500 m

Characteristic & Diagnostic species; *Alcea striata* (DC.) Alef subsp. *striata*, *Astragalus amblolepis*, *Astragalus erythrotaeni* Boiss., *Astragalus plumosus* subsp. *akardaghicus* (Eig) Ponert [Syn: *Astragalus plumosus* Willd. var. *akardaghicus* (Eig) D.F. Chamb. & Matthews], *Cerasus microcarpa* (C.A. Mey.) Boiss. subsp. *tortuosa* (Boiss. & Hausskn.) Browicz, *Cicer echinospermum* P.H. Davis, *Crucianella exasperata* Fisch. & C.A. Mey., *Dianthus hymenolepis* Boiss., *Dianthus strictus* Banks & Sol. var. *gracilior* (Boiss.) Reeve, *Grammosciadium macrodon* Boiss., *Gundelia tournefortii* L. var. *armata* Freyn & Sint., *Lathyrus inconspicuus* L. var. *stenophyllus* (Boiss.) Rech., *Lens montbretii* (Fisch. & C.A. Mey.) P.H. Davis & Plitmann, *Lotus gebelia* Vent. var. *hirsutissimus* (Ledeb.) Dinsm., *Medicago shepardii* Post ex Boiss., *Onobrychis megataphros* Boiss., *Onosmo rascheyanum* Boiss., *Paracaryum cristatum* (Schreb.) Boiss. subsp. *cristatum*, *Scrophularia libanotica* Boiss. subsp. *armena* R.R. Mill, *Torilis leptocarpa* (Hochst.) C.C. Towns., *Trifolium hausknechtii* Boiss. var. *candollei* (Post) Hossain.

2.0.2. Alliance: *Tanaceto orientali-Astragalion gummiferi* Kaya & Ketenoglu 2010

Locality; Karacadağ Mountain/Şanlıurfa-Diyarbakır (Kaya & Ketenoglu 2010)

Bedrock; Volcanic, Basalt

Altitude; 1500-1950 m

Characteristic & Diagnostic species; *Alcea calvertii* (Boiss.) Boiss., *Astragalus gummifer* Labill., *Astragalus lagopoides* Lam. [Syn: *Astragalus lagurus* Willd.], *Delphinium macrostachyum* Boiss. ex Huht, *Echinops heterophyllus* P.H. Davis, *Fibigia macrocarpa* (Boiss.) Boiss., *Linaria kurdica* Boiss. & Hohen. subsp. *araratica* (Tzvelev) P.H. Davis, *Paracaryum kurdistanicum* (Brand) R.R. Mill, *Phlomis armeniaca* Willd., *Phlomis kurdica* Rech.f., *Ranunculus macrorhynchus* Boiss. subsp. *trigonocarpus* (Boiss.) P.H. Davis, *Rosa vanheurckiana* Crép. var. *vanheurckiana* [Syn: *Rosa heckeliana* Tratt. subsp. *vanheurckiana* (Crép.) O. Nilsson], *Symphytum aintabicum* Hub.- & Wickens, *Tanacetum cadmeum* (Boiss.) Heywood subsp. *orientale* Grierson, *Telephium oligospermum* Steud. ex Boiss., *Thymus kotschyanus* Boiss. & Hohen. [Syn: *Thymus kotschyanus* Boiss. & Hohen. var. *glabrescens* Boiss.], *Viola modesta* Fenzl. Mor.

2.1. Order: *ASTRAGALO-BROMETALIA* Quézel 1973

The order extends in the central Taurus, western part of eastern Taurus range, and a mountain range in northwest Anatolia (Quézel, 1973; Akman et al, 1983; Ocakverdi and Çetik, 1982).

Characteristic & Diagnostic species; *Bromus tomentellus* Boiss., *Onobrychis cornuta* (L.) Desv., *Rumex angustifolius* Campd. subsp. *macranthus* (Boiss.) Rech.f., *Ononis adenotricha* Boiss., *Polygonum setosum* Jacq., *Cynoglossum montanum* L., *Aethionema iberideum* (Boiss.) Boiss., *Paracaryum lithospermifolium* (Lam.) Grande, *Silene cappadocica* Boiss. & Heldr., *Campanula stricta* L., *Silene spergulifolia* (Willd.) M.Bieb., *Scorzonera cana* (C.A. Mey.) Griseb. var. *jacquiniana* (W. Koch) D.f. Chamb., *Minuartia juniperina* (L.) Maire & Petitm., *Phlomis armeniaca* Willd., *Minuartia anatolica* (Boiss.) Woronow, *Senecio pseudo-orientalis* Schischk., *Astragalus species*.

2.1.1. Alliance: *Tanacion praeteriti* Quézel 1973

Locality; Akdağ, Tekedağ, Sandras Mountain, West of Antalya/Western Taurus (Quézel, 1973)

Bedrock; Serpentine, Calcareous

Altitude; 1700-2700 m

Characteristic & Diagnostic species; *Dianthus eretmopetalus* Stapf., *Astragalus paecilanthus* Boiss. & Heldr., *Bornmuellerantha aucheri* (Boiss.) Rothm. [Syn: *Odontites aucheri* Boiss.], *Tanacetum praeteritum* (Horw.) Heywood, *Anthemis rosaea* Sm., *Elymus reflexiarristatus* (Nevski) Melderis [Syn: *Agropyron strigosum* (Schult.) Boiss.]

2.1.2. Alliance: *Thurion capitatae* Quézel 1973

Locality; Mazmılı Mountain, Acıman Plateau (Quézel, 1973)

Bedrock; Calcareous

Altitude; 2000-2500 m

Characteristic & Diagnostic species; *Alyssum callichroum* Boiss., *Cochlearia sempervivum* Boiss. & Balansa, *Thlaspi rosulare* Boiss. & Balansa, *Thurya capitata* Boiss. & Balansa, *Fumana oligosperma* Boiss. & Kotschy, *Sideritis phlomoides* Boiss. & Balansa, *Scutellaria diffusa* Benth., *Leontodon asperrimus* (Willd.) Endl. [Syn: *Leontodon masmenaesus* Boiss. & Balansa], *Lactuca mulgedioides* (Vis. & Pančić) Boiss. & Kotschy ex Boiss. & Kotschy [Syn: *Lactuca seticuspis* Boiss.]

2.1.3. Alliance: *Paronychion lycicae* Quézel 1973

Locality; Akdağ/Western Taurus (Quézel, 1973)

Bedrock; Calcareous

Altitude; 2200-2600 m

Characteristic & Diagnostic species; *Alopecurus lanatus* Sm., *Paronychia lycica* Chaudhri, *Dianthus brevicaulis* Fenzl. subsp. *setaceus* Reeve, *Veronica cuneifolia* D. Don, *Asperula lycia* Stapf.

2.1.4. Alliance: *Silenion oreades* Quézel 1973

Locality; Akseki, Yaylacık Hill, Cırlavık Hill, Ermenek and Oyuklu Mountain/Central Taurus, Bolkar mountains (Quézel, 1973)

Bedrock; Calcareous

Altitude; 2200-2600 m

Characteristic & Diagnostic species; *Fritillaria crassifolia* Boiss. & A.Huet, *Aethionema subulatum* (Boiss. & Heldr.) Boiss., *Erysimum kotschyanum* J.Gay, *Arenaria isaurica* Boiss., *Silene oreades* Boiss. & Heldr., *Veronica cuneifolia* D.Don subsp. *isaurica* P.H. Davis, *Achillea formosa* (Boiss.) Sch. Bip. [Syn: *Leucocyclus formosus* Boiss.]

2.2. Order: DRABO-ANDROSACETALIA Quézel 1973

This order extends on calcareous bedrock of alpine and subalpine zones of Taurus Mountains, Davras Mountain/Isparta, Anti-Taurus Mountains /Adana (Sağlam 2007; Yurdakuol 1973). It is hard to draw the farthest boundaries of the order, but there is a possibility of presence of the order in high elevations of Lebanon Mountains (Akman et al, 2014).

Bedrock; Calcareous

Altitude; 2100-2300 m

Characteristic & Diagnostic species; *Alopecurus vaginatus* (Willd.) Kunth, *Aethionema cordatum* (Desf.) Boiss., *Festuca pinifolia* (Hack. ex Boiss.) Bornm., *Astragalus angustifolius* Lam. subsp. *pungens* (Willd.) Hayek, *Minuartia leucocephala* Mattf., *Saponaria pumilio* (L.) Fenzl ex A.Braun, *Alyssum pateri* Nyár., *Androsace villosa* L., *Alyssum oxycarpum* Boiss. & Balansa, *Pedicularis cadmea* Boiss., *Alyssum lepidotum* Boiss., *Veronica caespitosa* Boiss. var. *caespitosa*, *Alyssum condensatum* Boiss. & Hausskn., *Ziziphora clinopodioides* Lam., *Alyssum condensatum* subsp. *flexibile* (Nyár.) Dudley, *Asperula setosa* Jaub. & Spach, *Alyssum erosulum* Gennari & Pestal. ex Clem., *Psephellus mucronifer* (DC.) Wagenitz [Syn: *Centaurea mucronifera* DC.], *Hesperis kotschyi* Boiss., *Centaurea kotschyi* (Boiss. & Heldr.) Hayek, *Draba brunifolia* subsp. *heterocoma* (Fenzl) Coode & Cullen, *Centaurea drabifolia* subsp. *cappadocica* (DC.) Wagenitz, *Draba brunifolia* Steven subsp. *brunifolia*, *Centaurea drabifolia* Sibth.&Sm. subsp. *austro-occidentalis* Wagenitz, *Aethionema oppositifolium* (Pers.) Hedge

2.1.1. Alliance: *Agropyro-Stachion* Quézel 1973

Locality; Akseki, Ermenek, Oyuklu Mountain, Bolkar Mountains/West of Antalya

Bedrock; Calcareous

Altitude; 1700-2300 m

Characteristic & Diagnostic species; *Elymus tauri* (Boiss. & Bal.) Melderis [Syn: *Agropyron tauri* Boiss. & Balansa], *Hypericum scabrum* L., *Asphodeline taurica* (Pall.) Endl., *Onosma stellulatum*

Waldst. & Kit., *Papaver polychaetum* Schott & Kotschy ex Boiss., *Pterocephalus pinardi* Boiss., *Arenaria rotundifolia* M.Bieb. [Syn: *Arenaria pauciflora* (Boiss.) Prodan], *Galium cilicicum* Boiss., *Eremogone acerosa* (Boiss.) Ikonn. [Syn: *Arenaria acerosa* Boiss. & Heldr.], *Asyneuma lobelioides* (Willd.) Hand.-Mazz., *Silene spergulifolia* (Willd.) M.Bieb. [Syn: *Silene supina* M.Bieb.], *Asyneuma virgatum* (Labill.) Bornm., *Aethionema coridifolium* DC., *Senecio pseudo-orientalis* Schischk., *Hypericum kotschyanum* Boiss., *Stachys lavandulifolia* Vahl

2.3. Order: *ONOBRYCHIDO ARMENI-THYMETALIA LEUCOSTOMI* Akman, Ketenoğlu, Quézel 1985

This order includes all steppe associations developed under the xeric climatical conditions are in the central and peripheral zone of Anatolia. The altitudinal ranges of the order vary between 600 - 1300 meters. The floristic composition of steppe vegetation of Central Anatolia does not match up with the floristic composition of Taurus and Anti-Taurus Mountains. Main reasons of the variation are height difference, precipitation, bedrock and endemism rate.

Characteristic & Diagnostic species: *Onobrychis arenaria* subsp. *cana* (Boiss.) Hayek [Syn: *Onobrychis armena* Boiss. & A.Huet], *Alyssum pateri* Nyár., *Minuartia hamata* (Hausskn.) Mattf., *Stachys cretica* L., *Alyssum sibiricum* Willd., *Marrubium parviflorum* Fisch. & C.A.Mey., *Moltkia caerulea* Lehm., *Paronychia kurdica* Boiss., *Dianthus anatolicus* Boiss., *Polygala anatolica* Boiss. & Heldr., *Polygala pruinosa* Boiss., *Globularia orientalis* L., *Anthemis tinctoria* L., *Centaurea virgata* Lam., *Astragalus condensatus* Ledeb., *Achillea santolinoides* subsp. *wilhelmsii* (K.Koch) Greuter [Syn: *Achillea wilhelmsii* K.Koch], *Achillea phrygia* Boiss. & Balansa, *Ajuga salicifolia* (L.) Schreb., *Astragalus lycius* Boiss., *Astragalus mesogitanus* Boiss. [Syn: *Astragalus lydius* Boiss.], *Bungea trifida* (Vahl) C.A.Mey., *Convolvulus holosericeus* M. Bieb., *Cousinia birandiana* Hub.-Mor., *Genista aucheri* Boiss., *Genista sessilifolia* DC., *Hedysarum varium* Willd., *Hypericum aviculariifolium* Jaub. & Spach, *Jurinea consanguinea* DC., *Lappula barbata* (M.Bieb.) Gürke, *Linum flavum* L., *Noaea mucronata* (Forssk.) Asch. & Schweinf., *Onobrychis hypargyrea* Boiss., *Onosma aucherana* DC., *Onosma isaurica* Boiss. & Heldr., *Phlomis pungens* Willd., *Salvia cryptantha* Montbret & Aucher ex Benth., *Salvia hypargeia* Fisch. & C.A.Mey., *Bromus cappadocicus* Boiss. & Balansa subsp. *cappadocicus*, *Silene supina* M.Bieb. subsp. *pruinosa* (Boiss.) Chowdhuri, *Astragalus brachypterus* Fisch., *Fumana aciphylla* Boiss., *Thymus leucostomus* Hausskn. & Velen., *Saponaria prostrata* Willd., *Astragalus anthylloides* Lam., *A. campylosema* Boiss., *A. vulnerariae* DC., *Leontodon asperrimus* (Willd.) Endl.

2.3.0.1. Alliance: *Cousinia iconici-Artemision santonici* Geven, Adıgüzel and Vural 2010

Locality; Ereğli-Karaman (Geven et al, 2010)

Bedrock; Calcareous

Altitude; 1000-1180 m

Characteristic & Diagnostic species: *Artemisia santonicum* L., *Cousinia iconica* Hub.-Mor., *Androsace maxima* L., *Lolium subulatum* (Banks & Sol.) Eig, *Alyssum linifolium* Stephan ex Willd., *Consolida stenocarpa* (P.H.Davis & M.Hossain) P.H.Davis, *Minuartia sclerantha* Thell., *Allium macrochaetum* Boiss. & Hausskn., *Ceratocephalus falcatus* (L.) Pers.

2.3.0.2. Alliance: *Euphorbio armeni-Oligochaetion divaricatae* Tatlı 1991

Locality; Karahacı, Gödekli villages/Iğdır/East Anatolia (Tatlı, 1991)

Bedrock; Volcanic

Altitude; 800-1000 m

Characteristic & Diagnostic species: *Oligochaeta divaricata* (Fisch. & C.A.Mey.) K.Koch, *Stipa hohenackeriana* Trin. & Rupr., *Euphorbia marschalliana* subsp. *armena* (Prokh.) Oudejans [Syn: *Euphorbia armena* Prokh.], *Trinia scabra* Boiss. & Noë, *Erysimum huber-morathii* Polatschek [Syn: *Erysimum torulosum* Hub.-Mor.], *Stipagrostis plumosa* Munro ex T.Anderson, *Lepidium vesicarium* L.

2.3.1. Suborder: *ONOBRYCHIDO ARMENIAE-THYMETALIA LEUCOSTOMI* Akman, Quézel, Barbéro, Ketenoğlu and Aydoğdu 1991

This suborder extends on lower elevations (1200-1300 m) of central and south-west Anatolia.

Characteristic & Diagnostic species: *Artemisia scoparia* Waldst. & Kitam., *Cousinia birandiana* Hub.-Mor., *Thymus leucostomus* Hausskn. & Velen., *Artemisia santonicum* L., *Bungea trifida* (Vahl) C.A.Mey., *Astragalus mesogitanus* Boiss. [Syn: *Astragalus lydius* Boiss.], *Stipa holosericea* Trin., *Salvia absconditiflora* Greuter & Burdet [Syn: *Salvia cryptantha* Montbret & Aucher ex Benth.], *Stipa lessingiana* Trin. & Rupr.

1.3.1.1. Alliance: *Alyso lepidoto-stellati-Astragalion condensati* Aydoğdu, Ketenoğlu and Hamzaoğlu 1999

Locality; Baran and Kervansaray Mountain/Kırşehir (Aydoğdu, 1999)

Bedrock; Calcareous

Altitude; 1380-1670 m

Characteristic & Diagnostic species: *Astragalus condensatus* Ledeb., *Astragalus micropterus* Fischer, *Astragalus densifolius* Lam., *Alyssum lepidoto-stellatum* (Hausskn. & Bornm.) Dudley, *Euphorbia anacampseros* Boiss., *Salvia modesta* Boiss., *Verbascum vulcanicum* Boiss. & Heldr. var. *vulcanicum*, *Minuartia anatolica* (Boiss.) Woron. var. *arachnoidea* McNeill, *Anchonium elichrysofolium* (DC.) Boiss. subsp. *canescens* (Hausskn. ex Bornm) Jacquemoud, *Sideritis galatica* Bornm., *Salvia blepharochlaena* Hedge & Hub.-Mor., *Centaurea paphlagonica* (Bornm.) Wagenitz.

1.3.1.2. Alliance: *Convolvulo assyrici-Helianthemion cani* Ketenoğlu, Aydoğdu, Kurt, Hamzaoğlu, Tuğ & Aslantürk 2008

Locality; Şarkışla, Kangal and Gürün/Sivas (Ketenoğlu et al, 2008)

Bedrock; Calcareous

Altitude; 1300-1700 m

Characteristic & Diagnostic species: *Helianthemum oelandicum* subsp. *incanum* (Willk.) G.López [Syn: *Helianthemum canum* (L.) Baumg.], *Ebenus laguroides* Boiss., *Hypericum thymopsis* Boiss., *Convolvulus assyricus* Griseb., *Convolvulus compactus* Boiss., *Linum flavum* L. subsp. *scabrinerve* (Davis) Davis, *Galium incanum* Sm. subsp. *pseudocornigerum* Ehrend., *Stipa capillata* L., *Minuartia anatolica* (Boiss.) Woronow subsp. *scleranthoides* (Boiss. & Noë) McNeill, *Asphodeline tenuior* (Fisch.) Ledeb. subsp. *tenuiflora* (K.Koch) E.Tuzlacı

1.3.1.3. Alliance: *Convolvulo holosericeae-Ajugion salicifoliae* Akman, Ketenoğlu, Quézel & Demirörs 1984

Locality; West of Ankara, Ayaş, Temelli, Polatlı and Beypazarı, Acıkır, Polatlı/Ankara (Akman, 1984)

Bedrock; Marly and marly-gypsaceous

Altitude; 650-1150 m

Characteristic & Diagnostic species: *Convolvulus holosericeus* Bieb. subsp. *holosericeus*, *Ajuga salicifolia* (L.) Schreber, *Euphorbia macroclada* Boiss., *Linum flavum* L. subsp. *scabrinerve* (Davis) Davis, *Galium verum* L.

2.3.1.3.1. Suballiance: *Ebeno hirsutae-Thymenion leucostomi* Hamzaoğlu, Aydoğdu, Kurt and Cansaran 2004

Locality; Cihanbeyli/Konya, Çifteler/Eskişehir (Hamzaoğlu et al, 2004)

Bedrock; Calcareous

Altitude; 850-1150 m

Characteristic & Diagnostic species: *Thymus leucostomus* Hausskn & Velen, *Ebenus hirsuta* Jaub. & Spach, *Minuartia anatolica* (Boiss.) Woron. var. *arachnoidea* McNeill, *Astragalus vulnerariae* DC., *Cousinia iconica* Hub.-Mor., *Astragalus tmoleus* Boiss. var. *bounacanthus* (Boiss.) Ponert., *Alyssum niveum* Dudley, *Achillea phrygia* Boiss. & Bal.

1.3.1.4. Alliance: *Salvio tchihatcheffii-Hedysarion varii* Akman, Ketenoğlu, Quézel & Demirörs 1984

Locality; South-west of Ankara, Haymana (Akman et al, 1984)

Bedrock; Marly

Altitude; 800-1250 m

Characteristic & Diagnostic species: *Salvia tchihatcheffi* (Fisch. & Meyr.) Boiss., *Hedysarum varium* Willd., *Linum hirsutum* L. subsp. *anatolicum* (Boiss.) Hayek var. *anatolicum*, *Helianthemum nummularium* (L.) Mill., *Asyneuma limonifolium* (L.) Janch.

2.3.1.5. Alliance *Phlomido armeniacae-Astragalion microcephali* Akman, Ketenoğlu, Quézel & Demirörs 1984

Locality; South-west of Ankara, Beynam-Bala, Ayaş Mountains west of Ankara, Kırıkkale, Kalecik, Kırşehir, Davras Mountain, Çiçek Mountain, Kızıldağ/Isparta, Karadağ/Karaman, Ermenek, Tahir Mountain and Güzeldere Valley/Erzurum, Emirdağ/Afyon, Beykavağı Kestel Mountain/Burdur, Kızılören-Çal-Loras, Akdağ, Ilgın, Kadınhanı, Hadim, Ermenek, Bucakkışla/Konya, Kütahya, Karaömer Mountain/Amasya, Pirreşit Mountain/Muradiye-Van, Baskil/Elazığ (Akman and Ketenoğlu 1976; Akman et al, 1996; Gümüş, 1992; Tatlı et al, 1994; Akman et al, 1996; Behçet and Ünal, 1999; Kurt, 2002; Sağlam, 2004; Sağlam, 2007).

Bedrock; Radiolarite, flysch, marly, serpentine

Altitude; 750-1300 m

Characteristic & Diagnostic species: *Phlomis armeniaca* Willd., *Astragalus microcephalus* subsp. *microcephalus*, *Teucrium chamaedrys* L., *Marrubium parviflorum* Fisch. & Meyr. subsp. *oligodon* Boiss.

2.3.1.5.1. Suballiance: *Astragalenion lycii* Akman, Ketenoğlu, Quézel & Demirörs 1984

Locality; Karayavşan, Şerefliköy, Yenice, Haymana/Ankara (Akman et al, 1984)

Bedrock; Flysch

Altitude; 1000 m

Characteristic & Diagnostic species: *Astragalus lycius* Boiss., *Helianthemum oelandicum* subsp. *incanum* (Willk.) G.López [Syn: *Helianthemum canum* (L.) Baumg.], *Astragalus lycius* Boiss., *Acantholimon acerorum* (Willd.) Boiss. subsp. *acerorum*

2.3.1.6. Alliance: *Phlomido nissolii-Onobrychidion tournefortii* Kurt 2002

Locality; South-west of Afyon, Emirdağ, Bolvadin, Çay, Senirkent, Uluborlu (Kurt, 2002)

Bedrock; Volcanic (agglomerates), chalk, marly chalks

Altitude; 900-1000 m

Characteristic & Diagnostic species: *Hypericum origanifolium* var. *depilatum* (Freyn & Bornm.) N.Robson [Syn: *Hypericum avicularifolium* Jaub. & Spach. subsp. *depilatum* Freyn & Bornm.], *Phlomis nissolii* L., *Onobrychis tournefortii* (Wild) Desv., *Eryngium bithynicum* Boiss.

2.3.1.7. Alliance: *Astragalo karamasici-Gypsophylion eriocalycis* Ketenoğlu, Quézel, Akman & Aydoğdu 1984

Locality; Polatlı-Acıkır, Beypazarı, Nallıhan, Haymana, north-west of Ankara, Çankırı, Kızılırmak Valley, Yapraklı Mountains/north-east of Çankırı, Şereflikoçhisar-Aksaray,-Nevşehir, Kırıkkale, Kalecik, Kırşehir (Akman, 1990b; Ketenoğlu et al, 1984)

Bedrock; Gypsaceous, calcareous

Altitude; 350-900 m

Characteristic & Diagnostic species: *Astragalus karamasicus* Boiss. & Ball., *Thymus leucostomus* Jalas, *Linum mucronatum* Bertol subsp. *gypsicola* Davis var. *gypsicola*, *Centaurea patula* DC., *Allium flavum* L. subsp. *tauricum* (Besser ex Reichb.) Stearn var. *tauricum*, *Gypsophila eriocalyx* Boiss., *Gypsophila parva* Brak, *Bupleurum boissieri* Post.

2.3.1.7.1. Suballiance: *Asperulenion bornmuelleri* Ketenoğlu, Quézel, Akman & Aydoğdu 1983

Locality; North-east part of the Central Anatolia (Ketenoğlu et al, 1983)

Bedrock; Gypaceous

Altitude; 700-900 m

Characteristic & Diagnostic species: *Asperula bornmuelleri* Velen, *Acantholimon acerorum* (Willd.) Boiss., *Minuartia micrantha* Schischk., *Linaria corifolia* Desf., *Scorzonera cana* var. *radicosa* (C.A. Meyer) Hoffm.

2.3.1.7.2. Suballiance: *Helichryso-Thymenion cappadoci* Ketenoglu, Aydoğdu, Kurt, Akman & Hamzaoglu 2000

Locality; North-east part of the Central Anatolia (Ketenoglu et al, 2000)

Bedrock; Gypaceous

Altitude; 700-900 m

Characteristic & Diagnostic species: *Thymus cappadocicus* Boiss., *Helichrysum noeanum* Boiss., *Achillea sintenisii* Hub.-Mor., *Chrysothesium stelleroides* (Jaub. & Spach) Hendrych [Syn: *Thesium stellerioides* Jaub. & Spach.], *Scorzonera aucheriana* DC., *Chrysochamela neona* (Boiss.) Boiss., *Allium sivasicum* Özhatay & Kollman.

2.3.1.8. Alliance: *Achilleo wilhelmsii-Artemision santonici* Aydoğdu, Kurt, Hamzaoglu, Ketenoglu & Cansaran 2004

Locality; Tuz Lake and Seyfe Lake (Aydoğdu et al, 2004)

Bedrock; Salty soils, salty steppes

Altitude; 960-1000 m

Characteristic & Diagnostic species: *Artemisia santonicum* L., *Achillea santolinoides* subsp. *wilhelmsii*, (K.Koch) Greuter [Syn: *Achillea wilhelmsii* K.Koch], *Allium pseudoflavum* Vved., *Reaumuria alternifolia* (Lab.) Britten, *Alyssum blepharocarpum* Dudley and Hub.-Mor., *Allium scabriflorum* Boiss., *Acantholimon halophilum* Bokhari, *Anthemis fumariifolia* Boiss., *Verbascum helianthemoides* Hub.-Mor.

2.3.1.8.1. Suballiance: *Artemisenion santonicii* Ketenoglu, Quézel, Akman & Aydoğdu 1983

Locality; North-east part of the Central Anatolia (Ketenoglu et al, 1983)

Bedrock; Gypaceous, calcareous

Altitude; 7600-800 m

Characteristic & Diagnostic species: *Artemisia santonicum* L., *Scabiosa argentea* L., *Taeniatherum caput-medusae* (L.) Nevski

2.3.1.9. Alliance: *Arenario ledebouriani-Astragalion plumosi* Akman 1990

Locality; Aydos Mountain/Ankara, Eldivan Mountain/Çankırı, Dinek Mountain/Kırıkkale (Akman, 1990a; Kurt et al, 1999; Hamzaoglu and Duran, 2004)

Bedrock; Volcanic, calcareous, marly

Altitude; 1300-1800 m

Characteristic & Diagnostic species: *Eremogone ledebouriana* (Fenzl) Ikonn. [Syn: *Arenaria ledebouriana* Fenzl.], *Thymus sipyleus* Boiss., *Astragalus plumosus* Willd., *Thymus longicaulis* subsp. *chaubardii* (Rechb.f.) Jalas [Syn: *Thymus longicaulis* subsp. *subisophyllus* (Borbás) Jalas], *Stachys iberica* subsp. *stenostachya* (Boiss.) Rech. f., *Galium verum* L. subsp. *glabrescens* Ehrend., *Sideritis germanicopolitana* Bornm.

2.3.1.10. Alliance: *Minuartion juniperino-pestalozzae* Ketenoglu, Serin, Kurt & Akman 1996

Locality; Hacibaba Mountain/Konya (Serin et al, 1996)

Bedrock; Calcareous

Altitude; 2000-2350 m

Characteristic & Diagnostic species: *Minuartia juniperrina* (L.) Marie & Petitm., *Minuartia pestalozzae* (Boiss.) Bornm., *Astragalus angustifolius* Lam, *Marrubium globosum* Montbret & Aucher ex Bentham subsp. *micranthum* (Boiss. & Heldr.) P. H. Davis, *Silene pharnaceifolia* Fenzl., *Dianthus zederbaueri* Vierh., *Poa alpina* L. [Syn: *Poa alpina* subsp. *fallax* F.Hermann], *Psephellus mucronifer* (DC.) Wagenitz [Syn: *Centaurea mucronifera* DC.], *Veronica cuneifolia* D. Don subsp. *isaurica* P.H. Davis, *Paronychia davisii* Chaudhri.

2.3.1.11. Alliance: *Thymo subisophyllii-Alyssion virgatii* Akman, Quézel, Aydoğdu, Ketenoglu, Kurt & Evren 1994

Locality; Yapraklı Mountain/Çankırı (Akman et al, 1994)

Bedrock; Calcareous, serpentine

Altitude; 1400-1850 m

Characteristic & Diagnostic species: *Thymus longicaulis* subsp. *chaubardii* (Rechb.f.) Jalas [Syn: *Thymus longicaulis* C. Presl subsp. *subisophyllus* (Borbás) Jalas], *Alyssum virgatum* Nyár., *Astragalus leucotrix* Freyn. & Bornm., *Helichrysum arenarium* L. Moench. subsp. *aucheri* (Boiss.) Davis & Kupicha, *Erysimum thyrsoides* Boiss., *Paronychia beauverdii* Czecz., *Silene olympica* Boiss., *Astragalus plumosus* DC. ex Bunge subsp. *nitens* (Freyn & Bornm.) Ponert

2.3.2. Order: *ASPERULO PHRYGIAE-THYMENETALIA CHAUBARDII* Akman, Quézel, Barbéro, Ketenöglü & Aydoğdu 1991

This suborder extends supramediterranean/temperate zone/Mediterranean orobiome between 1300 and 2000 m on siliceous and partly calcareous bedrock in south-west of Anatolia.

Characteristic & Diagnostic species: *Acantholimon acerosum* (Willd.) Boiss. subsp. *brachystachyum* (Boiss.) Doğan & Akaydın, *Astragalus tmoleus* Boiss. var. *bounacanthus* (Boiss.) D.F.Chamb., *Acantholimon ulicinum* (Willd. ex Schult.) Boiss. subsp. *ulicinum*, *Asyneuma compactum* Damboldt, *Achillea wilhelmsii* K.Koch, *Cyanus pichleri* (Boiss.) Holub. [Syn: *Centaurea pichleri* subsp. *pichleri*], *Eremogone acerosa* (Boiss.) Ikonn. [Syn: *Arenaria acerosa* Boiss. & Heldr.], *Cerasus prostrata* (Labill.) Ser. var. *prostrata* (Moris) Browicz, *Asperula lilaciflora* subsp. *Phrygia* (Bornm.) Schönb.-Tem., *Dianthus zonatus* Fenzl. subsp. *zonatus*, *Euphorbia kotschyana* Fenzl., *Erysimum smyrnaeum* Boiss. & Balansa, *Paronychia dudleyi* Chaudhri, *Festuca paphlagonica* (St.-Yves) Markgr.-Dann. subsp. *paphlagonica*, *Thymus longicaulis* C.Presl subsp. *chaubardii* (Rechb.f.) Jalas *Hypericum organifolium* Willd., *Saponaria prostrata* Willd. subsp. *prostrata*, *Plantago holosteum* Scop.

2.3.2.1. Alliance: *Siderito phrygiae-Centaurion maculicipis* Akman, Quézel, Barbéro, Ketenöglü & Aydoğdu 1991

Locality; Sultan Mountains/Akşehir (Akman et al, 1991)

Bedrock; Phyllite, calcareous

Altitude; 1200-2200 m

Characteristic & Diagnostic species: *Asperula nitida* subsp. *hirtella*, *Astragalus strictispinis* Boiss., *A. wiedemannianus* Fischer, *Aubrieta anamasica*, *Bolanthus frankenioides* var. *fasciculatus*, *Centaurea cariensis* Boiss. var. *maculiceps* (O.Schwarz) Wagenitz, *Helictotrichon pubescens* subsp. *longipes*, *Minuartia anatolica* (Boiss.) Woron. subsp. *anatolica*, *Minuartia leucocephala* (Boiss.) Mattf., *Sideritis phrygia* Bornm., *Verbascum cherianthifolium* Boiss. subsp. *heldreichii*.

2.3.2.2. Alliance: *Verbasco phrygiae-Astragalion flavescens* Akman, Quézel, Barbéro, Ketenöglü&Aydoğdu 1991

Locality; Kumalar Mountain/Afyon (Akman et al, 1991)

Bedrock; Desite, Andesite

Altitude; 1200-2300 m

Characteristic & Diagnostic species: *Astragalus flavescens* Boiss., *Euphorbia anacampseros* Boiss. subsp. *anacampseros*, *Sideritis condensata* Boiss. & Heldr. Apud Bentham, *Verbascum cryserium* Schrad., *Verbascum phryginum* Bornm.

2.3.2.3. Alliance: *Astragalo akscheriensis-Onobrychidion pisidici* Akman, Quézel, Barbéro, Ketenöglü&Aydoğdu 1991

Locality; Karadağ/Isparta (Akman et al, 1991)

Bedrock; Volcanic

Altitude; 1300-2300 m

Characteristic & Diagnostic species: *Astragalus akscheherensis* Freyn. & Bornm., *Chamaecytisus drepanolobus* (Boiss.) Rothm., *Hieracium patentissimum* Freyn & Sint. ex Freyn & Sint., *Onobrychis pisidica* Boiss., *Sideritis pisidica* Boiss. & Heldr. Apud Bentham, *Saponaria chlorifolia* (Poir.) Kunze

2.3.2.4. Alliance: *Micromerio phrygiae-Olymposiadion caespitosi* Akman, Quézel, Barbéro, Ketenöglü & Aydoğdu 1991

Locality; Kapı Mountain, Barla Mountain/Isparta (Akman et al, 1991)

Bedrock; Calcareous

Altitude; 1950-2250 m

Characteristic & Diagnostic species: *Cyclotrium origanifolium* (Labill.) Manden. & Scheng., *Festuca jeanpertii* (St. Yves) F. Markgraff Apud Hayek subsp. *jeanpertii*, *Micromeria cristata* (Hampe) Griseb. subsp. *phrygia* P.H. Davis, *Olymposciadium caespitosum* (SM.) Wolff., *Silene caryophylloides* (Poiret) Oth. subsp. *eglandulosa* (Chowdh.) Coode & Cullen

2.3.2.5. Alliance: *Genisto involucratae-Marrubion micranthi* Akman, Vural, Quézel, Kurt, Ketenoğlu, Serin & Barbéro 1996

Locality; Karaman-Ermenek (Akman et al, 1996)

Bedrock; Calcareous, calcareous marl

Altitude; 1450-1650 m

Characteristic & Diagnostic species: *Marrubium globosum* subsp. *micranthum* Montbret & Aucher ex Benth., *Genista involucrata* Spach., *Cousinia ermenekensis* Hub.-Mor., *Arenaria ledebouriana* var. *parviflora* Boiss., *Astragalus acicularis* (Bunge) Podl., *Paronychia argyroloba* Stapf.

2.4. Order: *HYPERICO-THYMETALIA SKORPILII* Akman, Quézel, Yurdakulol, Ketenoğlu & Demirörs 1987

This order spreads in the western part of Ilgaz Mountains, encloses the highest peaks of the Bolu region (Abant, Aladağ and Çaltepe) in the northwest of the Anatolia and also is seen on Kısır Mountains (Kars) in the northeastern part of Anatolia.

Characteristic & Diagnostic species: *Thymus praecox* subsp. *skorpilii* (Velen.) Jalas, *Hypericum linarioides* Bosse, *Veronica gentianoides* Vahl, *Campanula olympica* Boiss., *Potentilla crantzii* (Crantz) Beck ex Fritsch. var. *crantzii*, *Bupleurum falcatum* subsp. *persicum* (Boiss.) H.Wolff, *Pilosella hoppeana* subsp. *troica* (Zahn) P.D.Sell & C.West, *Bunium microcarpum* subsp. *bourgaei* (Boiss.) Hedge & Lamond, *Scabiosa columbaria* L. subsp. *pahlagonica*, *Asperula capitellata* Hausskn. & Bornm., *Allium olympicum* Boiss., *Dianthus balansae* Boiss, *Anthemis melanoma* Trautv. subsp. *melanoma*, *Sesleria pontica* Deyl, *Pilosella macrotricha* (Boiss.) F.W.Schultz & Sch.Bip., *Stachys germanica* subsp. *bithynica* (Boiss.) R.Bhattacharjee, *Scorzonera pygmaea* subsp. *nutans* (Czeczott) D. F.Chamb.

2.4.1. Alliance: *Sileno-Astragalion densifolii* Akman, Quézel, Yurdakulol, Ketenoğlu & Demirörs 1987

Locality; Northern slopes of Ilgaz Mountains/Kastamonu, Akyaka, Arpaçay, Melikköy and Değirmenköprüküy Plateaus/Kars (Akman et al, 1983; Ocakverdi, 1994)

Bedrock; Siliceous

Altitude; 1850-2200 m

Characteristic & Diagnostic species: *Silene olympica* Boiss., *Erysimum pulchellum* (Willd.) J.Gay, *Astragalus densifolius* Lam., *Stachys byzantina* K.Koch, *Onobrychis montana* subsp. *cadmea* (Boiss.) P.W.Ball, *Muscari aucheri* (Boiss.) Baker, *Anthemis tinctoria* subsp. *pallida* DC., *Minuartia hirsuta* subsp. *falcata* (Griseb.) Mattf., *Ranunculus dissectus* M. Bieb. subsp. *sibthorpii* Davis, *Nepeta nuda* subsp. *albiflora* (Boiss.) Gams, *Achillea coarctata* Poir.

2.4.1.1. Suballiance: *Globulario cordifoliae-Dianthenion leucophae* Akman, Quézel, Barbéro, Aydoğdu, Demirörs & Ekim 1988

Locality; Keltepe/Karabük (Akman et al, 1988)

Bedrock; Calcareous

Altitude; 1600-2000 m

Characteristic & Diagnostic species: *Globularia cordifolia* L., *Alchemilla sericata* Rchb. ex Buser, *Sideritis dichotoma* Huter, *Dianthus leucophaeus* Sm., *Valeriana phu* L.

2.4.2. Alliance: *Pedicularo-Asterion alpinii* Akman, Quézel, Yurdakulol, Ketenoğlu and Demirörs 1987

Locality; Ilgaz Mountains, Akyaka, Arpaçay, Melikköy and Değirmenköprüküy Plateaus, Kısır Mountains/Kars (Ocakverdi 1994; Ocakverdi et al, 2009)

Bedrock; Calcareous, volcanic

Altitude; 2500-3000 m

Characteristic & Diagnostic species: *Pedicularis comosa* L. subsp. *sibthorpii* (Boiss.) Boiss., *Gentiana verna* subsp. *balkanica* N.M. Pritch., *Aster alpinus* L., *Myosotis alpestris* F.W. Schmidt, *Jasione supina* subsp. *pontica* (Boiss.) Damboldt, *Gentiana septemfida* Pall., *Galium album* Mill. subsp. *prusense* (K.Koch) Ehrend.&Krendl.

2.5. Order: FESTUCO OREOPHILAE-VERONICETALIA ORIENTALIS Hamzaoglu 2006

This order extends to the mountains in the west of Anatolian Diagonal, Eastern Pontic Mountains and southeast Taurus Mountains. The associations included in the order are found between 1500 and 3200 m. The order spreads on volcanic bedrocks limestone and marl sediments.

Characteristic & Diagnostic species: *Arenaria dianthoides* Sm., *Astragalus lagurus* Willd., *Astragalus onobrychis* L., *Coronilla orientalis* Mill. var. *orientalis*, *Festuca brunnescens* (Tzvelev) Galushko, *Medicago papillosa* Boiss., *Onobrychis transcaucasica* Grossh., *Rosa pimpinellifolia* L., *Scutellaria orientalis* L. subsp. *orientalis*, *Thymus transcausicus* Ronniger, *Veronica orientalis* Mill. subsp. *orientalis*, *Acantholimon caryophyllaceum* Boiss. subsp. *caryophyllaceum*, *Alyssum pateri* Nyár. subsp. *prostratum* (Nyár.) T.R. Dudley, *Anemone albana* Steven subsp. *armena* (Boiss.) Smirn., *Artemisia spicigera* K.Koch, *Asperula laxiflora* Boiss., *Astragalus cinereus* Willd., *Centaurea rhizantha* C.A.Mey, *Coluteocarpus vesicaria* (L.) Holmboe subsp. *vesicaria*, *Cephalaria sparsipilosa* V.A.Matthews, *Daphne oleoides* Schreb. subsp. *kurdica* (Bornm.) Bornm., *Erysimum leptocarpum* Gay, *Festuca oreophila* Markgr.- Dann., *Gypsophila bitlisensis* W.F.Barker, *Helichrysum arenarium* (L.) Moench subsp. *rubicundum* (K.Koch) P.H.Davis & Kupicha, *Malabaila dasyantha* (K.Koch) Grossh., *Pimpinella peucedanifolia* Fisch. ex Ledeb., *Silene montbretiana* Boiss., *Thymus pubescens* Boiss. & Kotschy var. *cratericola* Jalas.

2.5.1 Alliance: Festuco oreophilae-Veronicion orientalis Hamzaoglu 2006

Locality; Nemrut Mountains/Bitlis, Allahuekber Mountains/Kars-Erzurum, Dumlu Mountain /Erzurum, Ağrı and Tahir Mounatins/Ağrı, Hizan, Varik Plateau/Bitlis, Akyaka, Arpaçay, Melikköy and Değirmenköprüküy Plateaus/Kars (Tatlı 1987; Behçet & Tatlı 1989; Gümüş 1992; Behçet 1994a; Ocakverdi 1994)

Bedrock; Volcanic, limestone

Altitude; 1650-2650 m

Characteristic and differential species are counted in the order *Festuco oreophilae-Veronicetalia orientalis*.

2.5.2 Alliance: Tanaceto aucherani-Thymion pubescentis Hamzaoglu 2006

Locality; Çoruh and Kelkit Valleys/Gümüşhane-Bayburt (Hamzaoglu, 2006)

Bedrock; Limestone, volcanic and marl

Altitude; 1500-2200 m

Characteristic & Diagnostic species: *Achillea schischkinii* Sosn., *Astragalus lagopodioides* Vahl, *Centaurea carduiiformis* DC. subsp. *orientalis* Wagenitz, *Isatis candolleana* Boiss., *Tanacetum aucheranum* (DC.) Sch.Bip., *Thymus pubescens* Boiss. & Kotschy var. *pubescens*, *Arenaria armeniaca* Boiss., *Erysimum pycnophyllum* Gay subsp. *ponticum* (Hauskn. & Bornm.) Cullen, *Onobrychis hajastana* Grossh., *Salvia rosifolia* Sm., *Senecio lorentii* Hochst.

2.5.3. Alliance: Astragalo aurei-Festucion caucasicae Hamzaoglu 2006

Locality; Dumlu, Gavur and Palandöken Mountains/Erzurum, Pirreşit Mountain/Van, Süphan and Nemrut Mountains/Bitlis (Behçet and Tatlı, 1989; Tatlı, 1985; Behçet and Ünal, 1999)

Bedrock; Andesite, basalt (volcanic)

Altitude; 2400-3200 m

Characteristic & Diagnostic species: *Astragalus aureus* Willd., *Cephalaria procera* Fisch. & Avé-Lall., *Festuca woronowii* Hack. subsp. *caucasica* (St.-Yves) Markgr.- Dann., *Nepeta transcaucasica* Grossh., *Silene arguta* Fenzl, *Vicia alpestris* Steven subsp. *alpestris*, *Erigeron caucasicus* Stev. subsp. *venustus* (Botsch.) Grierson, *Poa longifolia* Trin., *Senecio pseudo-orientalis* Schischk.

2.6. Order TRIFOLIO ANATOLICI-POLYGONETALIA ARENASTRI Quézel 1973

This order includes meadows in Taurus Mountains.

Characteristic & Diagnostic species: *Crypsis acuminata* Trin., *Astragalus acmonotrichus* Fenzl, *Agrostis stolonifera* L., *Astragalus tauricolus* Boiss., *Eremopoa persica* (Trin.) Roshev. [Syn: *Poa persica* Trin.], *Astragalus pinetorum* Boiss., *Polygonum cognatum* Meisn., *Plantago lanceolata* L., *Polygonum arenastrum* Boreau, *Plantago media* L., *Ranunculus demissus* DC. var. *major* Boiss., *Helichrysum plicatum* DC., *Paronychia polygonifolia* (Vill.) DC., *Pilosella macrotricha* (Boiss.) F.W.Schultz & Sch.Bip., *Lotus corniculatus* var. *alpinus* Ser., *Taraxacum officinale* (L.) Weber ex F.H.Wigg., *Potentilla hirta* L., *Astragalus gymolobus* Fisch., *Trifolium hybridum* var. *anatolicum* (Boiss.) Hossain, *Astragalus caudiclosus* Boiss., *Taraxacum bithynicum* DC., *Myosotis alpesteris* F.W.Schmidt

2.6.1. Alliance *Thlaspion papilloso* Kürschner, Parolly & Raab-Straube 1998

Locality; Bey Mountains, Akdağ, Bakırlı Mountain/Western Taurus, Geyik Mountains/West of Central Taurus (Kürschner et al, 1998)

Bedrock; Calcareous

Altitude; 2180-2720 m

Characteristic & Diagnostic species: *Corydalis erdelii* Zucc., *Gagea villosa* (M. Bieb.) Sweet var. *hermonis* Dafn & Heyn, *Marrubium bourgaei* Boiss., *Ornithogalum oligophyllum* E.D. Clarke [Syn: *Ornithogalum brevipedicellatum* Boiss. ex Baker], *Scilla bifolia* L. [Syn: *Scilla pleiophylla* Speta], *Noccaea papillosa* (Boiss.) F.K. Mey. [Syn: *Thlaspi papillosum* Boiss.], *Tragopogon olympicus* Boiss., *Veronica cuneifolia* D.Don subsp. *cuneifolia*, *Veronica cuneifolia* subsp. *isaurica* P.H.Davis

2.6.2. Alliance: *Bolanthion frankenioidis* Quézel em. Kürschner, Parolly & Raab-Straube 1998

Locality; Bey Mountains, Akdağ/Western Taurus Mountains (Kürschner et al, 1998)

Bedrock; Calcareous

Altitude; 1900-2700 m

Characteristic & Diagnostic species: *Bolanthus frankenioides* (Boiss.) Barkoudah, *Tanacetum densum* (Labill.) Sch.Bip., *Astragalus angustifolius* Lam., *Veronica cuneifolia* D.Don, *Spergularia lycia* P.Monnier & Quézel

2.6.3. Alliance: *Trifolio-Polygonion* Quézel 1973

Locality; Akseki, Oyuklu Mountain, Bolkar Mountains, Acıman Plateau/Central and Eastern Taurus Mountains (Quézel, 1973)

Bedrock; Serpentine

Altitude; 2000-2400 m

Characteristic & Diagnostic species: *Helichrysum plicatum* DC., *Lotus corniculatus* var. *alpinus* Ser., *Polygonum arenastrum* Boreau, *Marrubium lutescens* Boiss. & Heldr. *micranthum* (Boiss. & Heldr.) P.H. Davis [Syn: *Marrubium micranthum* Boiss. & Heldr.], *Trifolium hybridum* subsp. *anatolicum* (Boiss.) Hossain, *Polygonum cognatum* Meisn., *Astragalus gymolobus* Fisch., *Ranunculus demissus* DC. var. *major* Boiss., *Taraxacum officinale* (L.) Weber ex F.H.Wigg., *Eremopoa persica* (Trin.) Roshev. [Syn: *Poa persica* Trin.], *Potentilla hirta* L., *Paronychia polygonifolia* (Vill.) DC., *Astragalus angustifolius* Lam., *Astragalus acmonotrichus* Fenzl

3. Class: *ALCHEMILLO-CAMPANULETEA TRIDENTATA* (Quezel & Düzenli 1979)

3.1. Order: *ALCHEMILLO-CAMPANULETALIA TRIDENTATAE* (Quezel & Düzenli 1979)

This order includes alpine meadows that have Euxin and Hyrcano-Euxin elements of North-eastern Anatolia and Caucasus and it is also present in two types of environment: wet, substantially fixed stony ground and the dry, surface (shallow), very mobile and stony ground (Düzenli, 1988; Korotkov and Belonovskaya, 2004).

Locality; Tiryal Mountain, Artvin

Bedrock; Spilite, dacite

Altitude; 2100-2844 m

Characteristic & Diagnostic species: *Alchemilla caucasica* Buser, *Minuartia recurva* (All.) Schinz & Thell. subsp. *oreina* (Mattf.) McNeill, *Campanula tridentata* Schreb., *Carum caasicum* (M.Bieb.) Boiss., *Ranunculus brachylobus* Boiss. & Hohen. subsp. *brachylobus*, *Poa alpina* L. [Syn:

Poa alpina subsp. *fallax* F.Hermann], *Thymus nummularius* M.Bieb., *Primula algida* Adams, *Erigeron caucasicus* Steven subsp. *venustus* (Botsch.) Grierson, *Carex cilicica* Boiss., *Trifolium polyphyllum* (C.A.Mey.) Latsch., *Tripleurospermum oreades* (Boiss.) Rech.f., *Pedicularis pontica* Boiss., *Viola altaica* Ker Gawl. subsp. *oreades* (M. Bieb.) W.Becker, *Heracleum apifolium* Boiss.

3.1.1. Alliance: *Stachydion macranthae* (Quezel&Düzenli 1979)

Locality; Tiryal Mountain/Artvin (Düzenli 1976)

Bedrock; Flysch

Altitude; 2100-2844 m

Characteristic & Diagnostic species: *Stachys macrantha* (K.Koch) Stearn, *Polygonum bistorta* L., *Geranium subacutum* (Boiss.) Aedo [Syn: *Geranium cinereum* subsp. *subcaulescens* (Boiss.) P.H.Davis & J.Roberts], *Anthyllis vulneraria* subsp. *boissieri* (Sagorski) Bornm., *Astragalus viridissimus* Freyn & Sint., *Pedicularis pontica* Boiss., *Trifolium ambiguum* M.Bieb., *Draba hispida* Willd.

3.1.2. Alliance: *Oxytropion albanae* (Quezel&Düzenli 1979)

Locality; Tiryal Mountain/Artvin (Düzenli, 1976)

Bedrock; Flysch

Altitude; 2100-2844 m

Characteristic & Diagnostic species: *Oxytropis albana* Steven, *Cerastium gnaphalodes* Fenzl, *Androsace villosa* L., *Anthemis marschalliana* subsp. *pectinata* (Boiss.) Grierson

4. Class: *ASPLENIETEA TRICHOMANIS* (Br.-Bl. in Meier and Br.-Bl. 1934) Oberd. 1977 This class as known chasmophytic vegetation on calcareous bedrocks is rich in endemic species and spreads on Taurus Mountains.

Characteristic & Diagnostic species: *Asplenium trichomanes* L., *Ceterach officinarum* Willd., *Asplenium ruta-muraria* L., *Cheilanthes peridioides* C. Chr. [Syn: *Cheilanthes fragrans* (L. f.) Sw.], *Cystopteris fragilis* (L.) Bernh., *Parietaria judaica* L., *Arabis caucasica* Willd. [Syn: *Arabis alpina* subsp. *caucasica* (Willd.) Briq.]

4.0.1. Subclass: *POTENTILLENIA SPECIOSAE* Hein, Kürschner & Parolly 1998

Rock surfaces and crevices mountain ranges in Anatolia covered by chasmophytic plant communities are included in this subclass.

4.1. SILENETALIA ODONTHOPETALEA Quézel 1973

This order mostly extends on calcareous slopes of high mountains in Antalya province and environs and also central and eastern Taurus Mountains. The order comprises five alliances that are in the xero-to mesophytic montane to subalpine and hygro-to mesophytic orcal to alpine zone in the South Anatolia and one alliance in Northwest Anatolia (Hein et al. 1998). Characteristic species determined so far of the order is not enough, thus, exhaustive studies in the future will be allowed to increase the number of species belonging to alliances and associations (Akman et al, 2014).

Characteristic & Diagnostic species: *Asplenium haussknechtii* Godet & Reut., *Rosularia sempervivum* (M.Bieb.) A. Berger subsp. *pestalozzae* (Boiss.) Eggli [Syn: *Rosularia pestalozzae* (Boiss.) Samuelsson & Froderstrom], *Arenaria tmolea* Boiss., *Potentilla kotschyana* Fenzl, *Arenaria deflexa* Decne., *Salvia caespitosa* Montbret & Aucher ex Benth., *Silene odontopetala* Fenzl, *Macrotomia densiflora* (Ledeb. ex Nordm.) J.F.Macbr. [Syn: *Macrotomia cephalotes* Boiss.], *Dianthus elegans* d'Urv. subsp. *actinopetalus* (Fenzl) Reeve, *Hypericum origanifolium* Willd., *Campanula cymbalaria* Sm., *Ranunculus libanoticus* Freyn, *Tanacetum nivale* Sch.Bip., *Asyneuma compactum* Damboldt, *Hieracium pannosum* Boiss.

4.1.1. Alliance: *Aubretion olympicae* Quézel & Pamukçuoğlu 1970

Locality; Uludağ and environs

Characteristic & Diagnostic species: *Aubrieta olympica* Boiss., *Scrophularia olympica* Boiss., *Lamium garganicum* subsp. *striatum* (Sm.) Hayek, *Saxifraga rotundifolia* L.

4.1.2. Alliance: *Silenion odontopetalae* Quézel 1973

Locality; Bakırlı Mountain/Western Taurus Mountains, Çiçek and Davras Mountains/Isparta (Quézel, 1973; Sağlam, 2007; Sağlam, 2014)

Bedrock; Calcareous
Altitude; 1940-2500 m

Characteristic & Diagnostic species; *Silene odontopetala* Fenzl, *Asyneuma linifolium* (Boiss. & Heldr.) Bornm. subsp. *linifolium*, *Laserpitium petrophilum* Boiss. & Heldr., *Hypericum origanifolium* var. *depilatum* (Freyn & Bornm.) N. Robson [Syn: *Hypericum avicularifolium* Jaub. & Spach. subsp. *depilatum* Freyn & Bornm.]

4.1.3. Alliance: *Onosmion mutabilis* Quézel 1973

Locality; Bolkar Mountains and Aladağlar/East of Central Taurus Mountains, Engizek Mountain/Kahramanmaraş (Quézel, 1973; Duman, 1995)

Bedrock; Calcareous
Altitude; 1500-2700 m

Characteristic & Diagnostic species; *Arabis aubrietoides* Boiss., *Scrophularia variegata* M. Bieb., *Aethionema capitatum* Boiss. & Balansa, *Veronica macrostachya* Vahl subsp. *sorgerae* M. A. Fisch., *Potentilla speciosa* Willd., *Tanacetum argenteum* subsp. *flabellifolium* (Boiss. & Heldr.) Grierson, *Tanacetum armenum* (DC.) Sch. Bip., *Onosma mutabile* Boiss. & Hausskn.

4.1.4. Alliance: *Campanulion isauricae* Hein, Kürschner and Parolly 1998

Locality; Geyik Mountains, Oyuklu Mountain/Western Central Taurus Mountains (Hein et al, 1998)

Bedrock; Limestone
Altitude; 1850-2550 m

Characteristic & Diagnostic species; *Arenaria tmolea* Boiss., *Hypericum origanifolium* Willd., *Prometheum chrysanthum* (Boiss.) 't Hart subsp. *chrysanthum*, *Valeriana speluncaria* Boiss., *Nepeta concolor* Boiss. & Heldr. ex Benth., *Onosma isaurica* Boiss. & Heldr., *Asyneuma compactum* Damboldt, *Campanula isaurica* Contandr., Quézel & Pamukç., *Campanula leucosiphon* Boiss. & Heldr., *Erodium pelargoniflorum* Boiss. & Heldr., *Euphorbia isaurica* M. L. S. Khan, *Geranium glaberrimum* Boiss. & Heldr., *Senecio castagneanus* DC.

4.1.5. Alliance: *Drabion acaulis* Hein, Kürschner and Parolly 1998

Locality; Bolkar Mountains/Eastern Central Taurus Mountains (Hein et al, 1998)

Bedrock; Limestone
Altitude; 2600-3720 m

Characteristic & Diagnostic species; *Potentilla pulvinaris* Fenzl, *Draba acaulis* Boiss., *Veronica kotschyana* Benth., *Minuartia rimarum* Mattf., *Thymus leucotrichus* Halácsy

4.1.6. Alliance: *Campanulion cymbalariae* Hein, Kürschner and Parolly 1998

Locality; Bakır Mountains, Elmalı Village/ Western Central Taurus Mountains, Aladağlar, Bolkar Mountains/Eastern Central Taurus Mountains (Hein et al, 1998)

Bedrock; Limestone
Altitude; 2000-2900 m

Characteristic & Diagnostic species; *Campanula cymbalaria* Sm., *Saxifraga luteoviridis* Schott & Kotschy, *Pedicularis cadmea* Boiss., *Myosotis speluncicola* (Boiss.) Rouy, *Ranunculus demissus* DC. var. *major* Boiss., *Cystopteris fragilis* (L.) Bernh., *Arenaria deflexa* Decne., *Sedum magellense* Ten., *Umbilicus luteus* (Huds.) Webb & Berthel., *Scrophularia cryptophila* Boiss., *Asplenium ramosum* L., *Alchemilla ellenbergiana* Rothm., *Oxyria digyna* (L.) Hill, *Poa cenisia* All., *Poa bulbosa* L., *Lactuca muralis* (L.) Fresen., *Anthriscus kotschyi* Fenzl ex Boiss.

5. Class: *HELDREICHITEA* Quézel ex Parolly 1995

This class includes plant communities on calcareous and serpentine moving rocks mountain ranges in South Anatolia (Quézel, 1973; Parolly, 1995). Besides, Parolly (1998) is stated that Düzenli (1976) identified two plant communities included in *Heldreichietea* in Hasandağ/Central Anatolia and there is a high possibility of occurrence of scree communities within *Heldreichietea* in North Anatolian Mountain ranges.

Characteristic & Diagnostic species: *Ajuga chamaepitys* (L.) Schreb. subsp. *glareosa* P.H.Davis, *Alyssum argyrophyllum* Schott & Kotschy, *Androsace villosa* L., *Arabis alpina* subsp. *brevifolia* (DC.) Greuter & Burdet, *Bunium microcarpum* (Boiss.) Freyn & Bornm., *Bupleurum falcatum* L., *Cicer incisum* (Willd.) K.Maly, *Euphorbia herniariifolia* Willd. var. *glaberrima* Halácsy, *Galium cilicicum* Boiss., *Galium incanum* Sm., *Heldreichia* subsp., *Lamium garganicum* subsp. *striatum* (Sm.) Hayek [Syn: *Lamium garganicum* subsp. *reniforme* (Montbret & Aucher ex Benth.) R.R.Mill], *Laserpitium petrophilum* Boiss. & Heldr., *Oxyria digyna* (L.) Hill, *Ranunculus brevifolius* Ten., *Rumex scutatus* L., *Noccaea sintenisii* (Bornm.) F.K. Mey. [Syn: *Thlaspi sintenisii* Bornm.], *Vavilovia formosa* (Steven) Al.Fed., *Veronica caespitosa* Boiss. var. *caespitosa*, *Viola crassifolia* Fenzl

5.1. Order: LAMIETALIA CYMBALARIIFOLII Parolly 1995

This order includes plant communities on moving rocks in the western Taurus.

Characteristic & Diagnostic species: *Lamium garganicum* var. *microphyllum* (Boiss.) Mennema [Syn: *Lamium cymbalariifolium* Boiss.], *Scrophularia depauperata* Boiss., *Fritillaria crassifolia* Boiss. & A.Huet subsp. *crassifolia*, *Ranunculus cadmicus* Boiss., *Aethionema cordatum* (Desf.) Boiss., *Euphorbia pestalozzae* Boiss., *Festuca adanensis* Markgr.-Dann., *Galium incanum* subsp. *centrale* Ehrend., *Heldreichia bupleurifolia* Boiss. subsp. *bourgaei* (Boiss.) Parolly, Nordt & Mumm., *Ricotia davisiana* B.L. Burt, *Scrophularia candelabrum* Heywood, *Vavilovia formosa* (Steven) Al.Fed., *Euphorbia herniariifolia* Willd. var. *glaberrima* Halácsy, *Peucedanum alpinum* (Sieber ex Schult.) B.L.Burt & P.H.Davis

5.1.1. Suborder: LAMIENALIA CYMBALARIIFOLII Parolly 1995

5.1.1.1. Alliance: Scrophularion depauperetae Parolly 1995

Locality; Akdağ, Bey Mountains/Western Taurus Mountains (Parolly, 1995)

Bedrock; Limestone

Altitude; 2000-3000 m

Characteristic & Diagnostic species: *Alkanna attilae* P.H.Davis, *Heldreichia bupleurifolia* Boiss. subsp. *bourgaei* (Boiss.) Parolly, Nordt & Mumm, *Scrophularia depauperata* Boiss., *Cyanus bourgaei* (Boiss.) Wagenitz & Greuter, *Elymus lazicus* (Boiss.) Melderis, *Lamium garganicum* var. *microphyllum* (Boiss.) Mennema [Syn: *Lamium cymbalariifolium* Boiss.], *Euphorbia pestalozzae* Boiss., *Ormosolenia alpina* (Sieber ex Schult.) Pimenov

5.2. Order: HELDREICHIETALIA Quézel ex Parolly 1995

This order includes plant communities on moving rocks on mountain ranges in the central and southern Taurus.

Characteristic & Diagnostic species: *Cerastium cerastoides* (L.) Britton, *Cyclotrichium organifolium* (Labill.) Manden. & Scheng., *Galium incanum* subsp. *elatus* (Boiss.) Ehrend., *Heldreichia bupleurifolia* Boiss. subsp. *bourgaei* (Boiss.) Parolly, Nordt & Mumm, *Heracleum humile* Sm., *Lamium eriocephalum* Benth., *Linaria corifolia* Desf., *Melica ciliata* L., *Nepeta cilicica* Boiss. ex Benth., *Poa cenisia* All., *Scorzonera cana* (C.A.Mey.) Griseb.

5.2.1. Suborder: LAMIENALIA GLANDULOSIDENTIS Parolly 1995

This suborder extends west of Central Taurus.

5.2.1.1. Alliance: Scrophularion myriophyllae Parolly 1995

Locality; Bakırlı Mountain/Central Taurus Mountains (Parolly, 1995)

Bedrock; Limestone

Altitude; 2160-2300 m

Characteristic & Diagnostic species: *Scrophularia myriophylla* Boiss. & Heldr., *Lamium eriocephalum* Benth., *Heldreichia bupleurifolia* Boiss., *Ricotia varians* B.L. Burt

5.2.2. Suborder: LAMIENALIA ERIOCEPHALI Parolly 1995

This order spreads on west of eastern Taurus Mountains.

5.2.2.1. Alliance: Scrophularion rimarium Parolly 1995

Locality; Bolkar Mountains and Aladağlar/The upper orcal to subalpine zone of east of Central Taurus Mountains (Parolly, 1995)

Bedrock; Limestone
Altitude; 2200-2700 m

Characteristic & Diagnostic species; *Scrophularia rimarum* Bornm., *Anthriscus kotschy* Fenzl ex Boiss, *Heracleum humile* Sm., *Aurinia rupestris* subsp. *cyclocarpa* (Boiss.) Cullen & T.R.Dudley, *Arenaria kotschyana* Fenzl subsp. *kotschyana*, *Hypericum crenulatum* Boiss., *Aethionema stylosum* DC., *Aethionema speciosum* Boiss. & A.Huet

5.2.2.2. Alliance: *Jurinellion moschus* Parolly 1995

Locality; The upper alpine zone to subnival belt of the Eastern Central Taurus Mountains (Parolly, 1995)

Bedrock; Limestone
Altitude; 2750-3600 m

Characteristic & Diagnostic species; *Jurinella moschus* (Habl.) Bobrov subsp. *moschus*, *Silene pruinosa* Boiss. [Syn: *Silene supina* subsp. *pruinosa* Chowdhuri], *Hedysarum erythroleucum* Schott & Kotschy ex Boiss., *Thymus leucotrichus* Halácsy, *Astragalus pelliger* Fenzl, *Noccaea sintenisii* (Bornm.) F.K. Mey. [Syn: *Thlaspi sintenisii* Bornm. subsp. *crassum*], *Minuartia rimarum* Mattf., *Crepis frigida* (Boiss. & Balansa) Babc., *Scorzonera cana* var. *radicosa* (C.A. Meyer) Hoffm., *Scutellaria orientalis* L. subsp. *alpina* (Boiss.) O.Schwarz var. *glandulosissima* O.Schwarz, *Scutellaria orientalis* L. subsp. *pinnatifida* J.R. Edm., *Androsace multiscapa* Duby, *Tulipa humilis* Herb.

6. Class: *JUNCETEA MARITIMI* Braun-Blanq. in Braun-Blanq., Roussine and Nègre 1952

This class involves plant communities dominated by *Gramineae* on salt marshes. It has a wide distribution and spreads on the whole Mediterranean and Black Sea region in Anatolia.

Characteristic & Diagnostic species; *Juncus maritimus* Lam., *Juncus acutus* L., *Polypogon maritimus* Willd. subsp. *maritimus*, *Limonium angustifolium* (Tausch) Turritt, *Aeluropus littoralis* (Gouan) Parl., *Plantago maritima* L., *Tetragonolobus maritimus* (L.) Roth, *Carex extensa* Gooden.

6.1. Order: *JUNCETALIA MARITIMI* Braun-Blanq. ex Horvatić 1934

The order spreads across Mediterranean region and Black Sea region in Turkey and called the halophytic grasslands. The order has less salty and carbonate-rich soils and also due to exposing to floods in rainy seasons, the soils remain moist in the summers (Hamzaoğlu and Aksoy 2009).

Characteristic & Diagnostic species; *Juncus maritimus* Lam, *Triglochin maritima* L., *Lotus corniculatus* var. *tenuifolius* L., *Scorzonera parviflora* Jacq., *Juncus gerardii* Loisel. subsp. *gerardii*, *Orchis palustris* Jacq., *Taraxacum bessarabicum* (Hornem.) Hand.-Mazz.

6.1.1. Alliance: *Juncion maritimi* Braun-Blanq. ex Horvatić 1934

Locality; Cihanbeyli, Kırkışla, Bulak Lake/Konya, Erçek, Turna, Bostaniçi/Van (Yurdakulol and Ercoşkun, 1990; Behçet, 1994b)

Altitude; 1890 m

Characteristic & Diagnostic species; *Juncus maritimus* Lam, *Halimione portulacoides* (L.) Aellen, *Lotus corniculatus* var. *tenuifolius* L., *Polypogon maritimus* Willd. subsp. *maritimus*, *Puccinellia distans* (Jacq.) Parl. subsp. *distans*,

Cirsieto-Juncetum maritime Yurdakulol and Ercoşkun 1990. Cihanbeyli, Kırkışla, Bulak Lake, Aksaray

6.1.2. Alliance: *Inula aucheranae-Elymion salsi* Aydoğdu, Hamzaoğlu&Kurt 2002

Locality; Salt Lake/ Aksaray, Seyfe Lake/Konya, around Ufaktepe drainage channel/Yeşilhisar and Sultansazlığı Marsh/Kayseri (Aydoğdu et al, 2002; Hamzaoğlu and Aksoy 2009)

Bedrock; Salty soils

Altitude; 930-1076 m

Characteristic & Diagnostic species; *Inula aucherana* DC., *Verbascum pyroliforme* (Boiss. and Heldr.) O. Kuntze, *Gladiolus halophilus* Boiss. and Heldr., *Allium sieheanum* [Hauskn. ex] Kollmann, *Scorzonera hieraciifolia* Hayek, *Hypericum salsugineum* Robson and Hub.-Mor., *Gypsophila oblanceolata* Bark., *Onosma halophilum* Boiss. and Heldr., *Salvia halophila* Hedge., *Elymus elongatus* (Host) Runemark subsp. *salsus* Melderis

7. Class: MOLINIO-ARRHENATHERETEA Tüxen 1937

This class includes nutrient-rich hygrophilous meadow communities in the western Taurus, Hizan/Bitlis, Pirreşit Mountain/Van, Allahüekber Mountains/Erzurum.

Characteristic & Diagnostic species: *Lotus corniculatus* var. *tenuifolius* L., *Plantago lanceolata* L., *Dactylis glomerata* subsp. *hispanica* (Roth) Nyman, *Polygonum cognatum* Meisn., *Lotus corniculatus* L. subsp. *corniculatus*, *Rumex acetosella* L., *Achillea millefolium* L. subsp. *millefolium*, *Trifolium repens* L. subsp. *repens*, *Lathyrus pratensis* L., *Trifolium pratense* L. subsp. *pratense*, *Juncus persicus* subsp. *libanoticus* (J.Thiébaud) Novikov & Snogerup [Syn: *Juncus gerardii* subsp. *libanoticus* (J.Thiébaud) Snogerup]

7.1. Order: ARRHENATHERETALIA ELATIORIS Pawl. 1928

The order is present at Dumlu Mountains/Erzurum, between Akyaka, Arpaçay, Melikköy and Değirmenköprüküy Plateaus/Kars

Characteristic & Diagnostic species: *Festuca pratensis* Huds., *Phleum pratense* L., *Agrostis stolonifera* L., *Plantago major* L.

7.1.1. Alliance: Molinio-Holoschoenion Br. - Bl. 1947

Locality; Pirreşit Mountain, Muradiye/Van

Bedrock; Andesite

Altitude; 2400-2500 m

Characteristic & Diagnostic species: *Molinia caerulea* (L.) Moench, *Pulicaria dysenterica* (L.) Bernh. subsp. *dysenterica*, *Tetragonolobus maritimus* (L.) Roth, *Carex panicea* L., *Eupatorium cannabinum* L., *Hypericum tetrapterum* Fr. var. *tetrapterum*, *Prunella vulgaris* L.

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