Frontiers in Life Sciences and Related Technologies 5(2) (2024) 140-154

Contents lists available at Dergipark

Frontiers in Life Sciences and Related Technologies

Journal homepage: http://dergipark.org.tr/en/pub/flsrt

Research article

Novelties in the genus *Trifolium* in Türkiye

Mustafa Keskin*[1]

[1] *Marmara University, Institute of Pure and Applied Sciences, Biology Program, 34722, Goztepe, Istanbul, Türkiye*

Abstract

This article summarizes the information obtained during the revision of *Trifolium* of Türkiye. By the end of the revision, four new taxa (*T. leylae*, *T. konyaensis*, *T. tmoleum*, and *T. hybridum* subsp. *anatolicum* var. *minutum*) were introduced to the scientific world, and *T. dalmaticum* is reported as a new record for the Flora of Türkiye. Three new units of subgeneric classification of *Trifolium* (subsect. *Stipulia*, subsect. *Caudata*, and sect. *Anemopeta*) are offered. Therefore, two new combinations are made (*T. angustifolium* var. *infamia-ponertii* and *T. setiferum* var. *rumelicum*). Distribution information for all analyzed specimens is included in the article. New diagnostic keys for *T. hybridum* species and subgenus *Paramesus* had been constructed.

Keywords: *Keys; new record; new subgeneric units; new taxa; Trifolium*

1. Introduction

With over 255 species, *Trifolium* (Eng.: Clover) is one of the largest genera in the Fabaceae family (Zohary and Heller, 1984; Ellison et al., 2006; Ahmed et al., 2021; Keskin et al., 2023). *Trifolium* is a systematically challenging genus due to its high number of species and genetic diversity; moreover, clovers are one of the most commercially important genera in the family Fabaceae, with at least 16 species used as fodder and green manure (Gillett and Taylor, 2001; Nichols et al., 2023). Clovers are important natural components both in urban environments and in natural grasslands. The species present in this ecosystem play a vital role in maintaining its continuity, productivity, and ecological balance (Ozturk et al., 2012a). In addition, some species of this genus are among the herbaceous species that are often found in a variety of habitats under unfavorable conditions in urban environments (Severoglu et al., 2006; Eskin et al., 2012; Tarakci et al., 2012; Altay et al., 2015).

Trifolium is also an excellent source of pollen for honey production. The presence and diversity of *Trifolium* pollen in honey are a factor that improves the quality of honey. For this reason, it is important to recognize the pollen in honey. Studies for understanding the pollen characteristics of the species of the genus are important in this respect (Keskin 2007a; Ozturk et al 2012b; Kocyigit et al., 2013; Altay et al., 2018). The third volume of Davis' Flora of Turkey contains 94 species, some of which have doubtful or erroneous data (Zohary, 1970). According to the *Trifolium* monograph by Zohary and Heller (1984), the total number in Türkiye is 94, while the world total is 239. Many studies have been carried out on the genus *Trifolium* after the publication of the Flora of Turkey. During these studies, new taxa for the Flora of Türkiye and new species for science were described (Keskin, 2001a; 2001b; 2003; 2004a; 2004b; 2005; 2007a; 2007b; 2011a, 2011b; 2011c; 2012; Keskin et al., 2023). During the preparation of "*Trifolium* of Türkiye", extensive herbarium visits were conducted as part of the revision process. Detailed analyses of all herbaria yielded a wealth of new information. This evaluation led to the discovery of several new species and taxa, the identification of new records for Türkiye, refinements in species descriptions, and the acquisition of new data on some rare species. This study evaluates new data on the genus *Trifolium* and summarizes the results.

2. Materials and methods

During the revision of the *Trifolium* of Türkiye, field

* Corresponding author.
E-mail address: trifolium@hotmail.com (M. Keskin).
https://doi.org/10.51753/flsrt.1472552 Author contributions
Received 23 April 2024; Accepted 22 July 2024
Available online 30 August 2024

surveys were carried out from 1994 to 2024 and a large amount of data was gathered some of which were new taxa for science and Türkiye.

Despite the use of different floras, articles and collected plants, the new taxa offered in this article could not be recognized (Townsend, 1947; Hossain, 1961; Katznelson, 1965; Katznelson and Morley, 1965; Coombe, 1968; Katznelson and Zohary, 1970; Zohary, 1970; Bobrov, 1971; Meikle, 1977; Zohary and Heller, 1984; El-Macreq, 1986; Oster, 1995; Keskin, 2012; Keskin et al., 2023).

A large number of *Trifolium* samples from various herbaria (E, G, ANK, ANKO, EGE, ESSE, GAZI, HARRAN, ISTE, ISTF, ISTO, MARE, MUFE, NGBB, KNYA, OMUB and VANF) and from the author's clover collection since 1996 were analyzed (acronyms according to Thiers, 2024).

3. Result

3.1. New taxa

3.1.1. Trifolium leylae M.Keskin sp. nov. (Fig. 1, Table 1).

Diagnose: It is related to *Trifolium globosum* L. and *T. batmanicum* Katzn. ex Zohary & Heller. It differs from them in terms of the following characteristics: short length; longitudinally 2-row sparsely patulous hairy, small fruiting heads; fertile flowers 7-12 in a single row; creamish white corolla with violet veined and longer than calyx; seed 2-colored.

Holotypus: Türkiye: Malatya province, Pütürge, Sahilköy area, 27 iv 1999, Mustafa Keskin 2122 (holo. ISTE 78804!).

Paratypus: Türkiye: Malatya province, Pütürge, Sahilköy area, 24 iv 1999, Mustafa Keskin 2087 (ISTE 78769!).

Annuals. Stems 5-10 (-20) cm long and with a few branched; longitudinally 2-row sparsely patulous hairy or rarely subglabrous. Leaves petiolated, 10-40 mm long; leaflets obcordate to cuneate, 10-15 x 0.8-15 mm, pubescence, entire to dentate at the apex. Stipules are ovate to oblique lanceolate, green at apex, paler below, hairy. Heads on a thin or medium sparsely pubescent peduncle at length much longer than subtending petiole, 0.5-25 mm in flowering time, 50-90 mm in fruiting stage. Fertile flowers 7-12, in one (or sub two) lower whorls, deflexed to the peduncle after fertilization, deciduous. The calyx is hairy, 5 mm long, but the tube with 2-colored and sparsely hairy or glabrous in the colored area is nearly twice as long as the teeth. Corolla 8 mm long, creamish white with violet veined on standard, longer than calyx teeth. Sterile flowers as calyx, numerous, apetalous, occurring as a plumose, cylindrical 10-15 mm long body before anthesis, then developing into calyces with solid tube and 5 long deflexed teeth, longer than the tube; the sterile flowers bend over the fertile flowers forming together a discoid body, hairy. The fruiting head 10-20 mm diam. is shed to the soil at maturity, usually in two colors. Fruiting calyx enlarged and teeth slightly elongated. Pods are membranous and enclosed in calyx. Seeds 2-colored, blackish purple and dirty white.

Etymology: The specific epithet of the new species refers to Leyla who is the author's wife and his biggest supporter for sixteen years.

Vernacular name: Since no local name can be observed, the name “ece yoncası” is suggested as a new Turkish Scientific name (Menemen et al. 2021).

Ecology: The habitat of *T. leylae* M.Keskin is a moist area with rich soil. So, it is part of the field. The new species is associated with *Trifolium stellatum* L. var. *stellatum*, *T. cherleri* L., *T. pratense* L. var. *pratense*, *T. campestre* Schreber subsp. *campestre* var. *campestre*, *T. nigrescens* Viv. subsp. petrisavii (Clementi) Holmboe, *T. pauciflorum* d’Urv., *Lathyrus inconspicuus* L., *L. aphaca* L. var. *aphaca*, *L. annuus* L., *Trigonella monspeliaca* L., *Vicia sericocarpa* Fenzl, V. *articulata* Horn., *Cicer pinnatifidum* Jaub. & Spach, *Coronilla scorpioides* W.D.J. Koch, *Medicago orbicularis* (L.) Bartal., *Orchis collina* Banks & Sol., *Cephalanthera damasonium* Druce, *Papaver rhoeas* L., *Sherardia arvensis* L., *Valerianella* sp., *Asperula* sp., *Centaurea* sp..

3.1.2. Trifolium konyaensis M.Keskin sp. nov. (Fig. 2, 3, Table 2).

Diagnose: It is related to *Trifolium ochroleucon* Huds. but differs from it in terms of the following characteristics: different shapes and dimensions of stipules and leaves, small corolla, long peduncles, unique calyx teeth, open calyx throat, etc.

Holotypus: Türkiye: Konya province, Seydişehir-Susuz, Kızpınarı, Suğla lake, wetlands, 1150 m, 16 vii 1980, H. Ocakverdi (Holotype and Isotype KNYA 9897!).

Stems 30-35 cm long and 10-15 mm wide; more branched, woody at base, sparsely appressed or sub-patulous hairy. Leaves in three different shapes. Leaves at base oblong 20-30 x 6-10 mm, retuse at the tip, long adpressed or less patulous hairy, more with many forked veins. Petioles 20-30 mm long, patulous hairy. Stipules 20-25 mm long, tube 10-12 mm, greenish to purple-veined, glabrous; free parts 10-11 mm long, narrowly lanceolate to linear, acute at tips, long patulous hairy, no veins. Leaves at stem alternate except upper leaves, elliptic to lanceolate, obtuse at the tip, 20-30 x 5-8 mm, sparsely long appressed or less patulous hairy. Petioles 20-30 mm long, patulous hairy. Nods long. The upper leaves opposed, 20-35 x 3-5 mm, appressed hairy, narrowly elliptic to lanceolate, acutish at the tip. Petioles are short, at most 10 mm long. Stipules 13-16 mm long. Peduncles 25-75 mm long, appressed hairy. Inflorescences are more flowered, globular to ovoid when young, later ovoid, 18-30 x 15-18 mm. Corolla purple, 8 mm long when young, later 9-10 mm long, obtuse at the tip, longer than calyx. Calyx 6-8 mm, teeth in 3 different sizes; longer tooth 4.2-4.5 mm long, broad at the base, markedly narrowing towards the top, glabrous at the tip with short setae; middle teeth 3.2-3.5 mm; short teeth 2.8-3.0 mm; all teeth green with patulous hairy emerging from a tubercle; densely hairy almost recumbent just below the at base of calyx teeth; the tube straw-colored, 10-thick veined, glabrous at the base, sparsely hairy above, shorter and thinner than the upper hairs. Calyx throat open, ringed with fine hairs. Pods are ovoid, dehiscent with a leathery operculum, glabrous. Young seeds 0.5 mm, ovoid, straw-colored.

Etymology: The specific epithet of the new species refers to Konya province, where the type specimen was collected.

Vernacular name: Since no local name can be observed, the name “Mevlana yoncası” is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Ecology: The nature of the area has been visited and examined in July 2021. The natural habitat of *T. konyaensis* M. Keskin is a moist and fertile ground area. It is a characteristic of the damp meadow.

The new species is associated with *Trifolium pratense* L. var. *pratense*, *T. fragiferum* L. var. *pulchellum*, *T. hybridum* L. subsp. *hybridum* var. *elegans* (Savi) Boiss., *T. hybridum* L.

Table 1
The differences among *T. globosum*, *T. batmanicum*, and *T. leylae*.

	***T. globosum* L.**	***T. batmanicum* Katz. ex Zohary & Heller**	***T. leylae* M.Keskin**
Stem surface	patulous hairy	glabrous	longitudinally 2-row sparsely patulous hairy or subglabrous
Stem length	10-40 cm	20-50 cm	5-10 (-20) cm
Fruiting heads	15-25 mm	20-30 mm	10-20 mm
Fertile flowers	10-16, in two ring	10-14, in two ring	7-12, in single (or sub two) ring
Corolla	white or pale pink, 6-11 mm, slightly longer than calyx	cream color but later becoming rose pink-cream, 5-8 mm, slightly longer than calyx	creamish white and standard violet veined, 8 mm, net longer than calyx
Calyx tube	tube=teeth	tube twice as long as the teeth	tube nearly twice as long as the teeth
Calyx surface	hairy	hairy	hairy, but the tube with 2-colored and sparsely hairy in the colored area
Sterile calyx	only teeth, 8-15 mm	empty calyx and teeth, 10-15 mm	empty calyx and teeth, 10-15 mm
Seeds	yellowish brown	black, ovoid–oblong, rarely white in the hilum area	seed 2-colored, blackish purple, and dirty-white

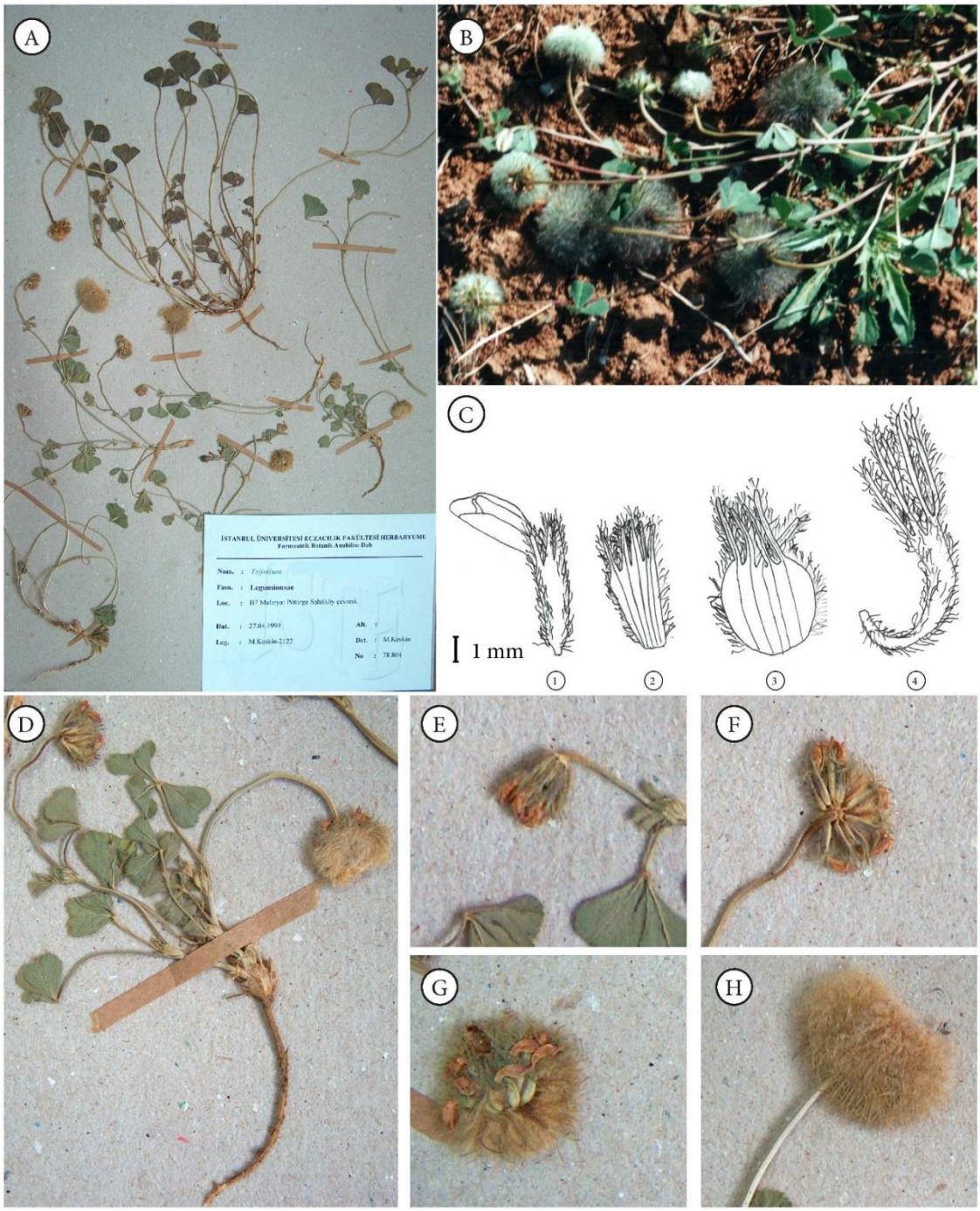

Fig. 1. *Trifolium leylae* M. Keskin (A) Holotype specimen, (B) Habitus (C) Drawing -1: Calyx and corolla -2: Opened flowering calyx -3: Opened fruiting calyx -4: Sterile calyx (D) Single plant (E) Inflorescence (F) Inflorescence with sterile calyx (G) Subinfrutescence (H) Infrutescence.

Table 2
The differences between *T. ochroleucon* and *T. konyaensis*.

	***Trifolium ochroleucon* Huds.**	***Trifolium konyaensis* M. Keskin**
Stem length	20-70 cm	30-35 cm
Stem surface	Appressed or antrorse hairy	Sparsely appressed or sub patulous hairy
Stipules	20-50 mm, free parts subulate	20-25 mm, free parts narrowly lanceolate to linear
Petioles	Lower and middle leaves very long-petioled, upper ones almost sessile	All leaves at least 1.0 cm petioled, absent sessile or almost sessile leaves
Leaves		
at base	Obovate to oblong, cuneate, retuse at apex, 8-16 x 5-10 mm	Oblong, retuse at the apex, 20-30 x 6-10 mm
at middle and upper	Oblong-elliptical to lanceolate, 20-55 x 12-18 mm	Elliptic to lanceolate, obtuse at tip, 20-30 x 5-8 mm and 20-35 x 3-5 mm, sub-appressed hairy, narrowly elliptic to lanceolate
at top	Opposed, narrowly oblong elliptical to lanceolate, shorter than restings, 10-22 x 5-7 mm	Opposed, 20-35 x 3-5 mm, appressed hairy, narrowly elliptic to lanceolate
Heads	Globular to ovoid, later elongating, 10-30 mm across, sessile or on short peduncle subtended by opposite leaves	Globular to ovoid when young, later ovoid, 18-30 x 15-18 mm, 25-75 mm long pedunculate, no subtended by leaves
Flowers	15-18 mm; cream, white, yellowish, pink or purplish	8-10 mm; purple
Standard	Oblong-lanceolate, much longer than keel and wings, acute	Oblong-lanceolate, much longer than keel and wings, obtuse
Calyx	(8-) 10-12 mm	6-8 mm
Teeth of calyx	Lanceolate-subulate with 3-nerved, no setae at the tip	Lanceolate-subulate with 1-nerved and setae present
Throat of calyx	Closed by bilabiate callosity	Open but present a hairy ring
Seeds	Ovoid, brownish	Ovoid, straw color

Fig. 2. *Trifolium konyaensis* M. Keskin: (A) Holotype specimen, (B) Isotype specimen.

subsp. *anatolicum* (Boiss.) Hossain var. *anatolicum*, *Glycyrrhiza echinata* L., *Althea officinalis* L., *Dipsacus laciniatus* L., *Eleocharis quinqueflora* (Hartmann) O.Schwarz, *Galega officinalis* L., *Melilotus albus* Medik., *Lycopus europaeus* L., *Hibiscus trionum* L., *Convolvulus* sp., kindly Poaceae and Cyperaceae species.

3.1.3. A note for Trifolium tmoleum and identification key of subgenus Paramesus

Trifolium tmoleum is accepted as a synonym name in Flora of Turkey (Zohary, 1970) and Genus *Trifolium* (Zohary and Heller, 1984) under *T. glanduliferum* var. *glanduliferum*. However, when the type specimens of both *T. glanduliferum* and *T. tmoleum* taxa were analyzed, significant differences were found to distinguish between the two species. *T. tmoleum* Boiss. is not a valid published name. Firstly, for a species to be valid, its author must also stand behind the name given. Boissier named this species after the name written by Balansa on the herbarium plate: *Trifolium tmoleum* Boiss. but this name has never been validly published anywhere by Balansa. In using this name, Boissier made it clear that he recognized it as a variety (beta) and not as a species: *Trifolium glanduliferum* var. *tmoleum* (Boissier, 1872). If this name had been published as an alternative to the name written by Balansa, it would have been a valid name. In other words, Boissier did not indicate in any way that it was published as an alternative name for "*Trifolium glanduliferum* var. *tmoleum*".

3.1.3.1. Trifolium tmoleum (Boiss.) M. Keskin comb. et stat. nov. (Fig. 4, Table 3).

Syn.: *Trifolium glanduliferum* var. *tmoleum* Boiss., Fl. Orient 2: 141 (1872). *Trifolium tmoleum* Boiss. in Balansa pl. exs.

Lectotypus: Türkiye, İzmir: Yaila de Bozdagh (Tmolus occidental), dans les prairies. 21 Juillet 1854, B. Balansa 175 (as 175. *Trifolium tmoleum*, sp. nov. (Boiss.) (G-Boiss 00783508!). The lectotype is designated here.

Isolectotype: ibid, barcode no "a" !. (Isolectotypus designated here).

ibid: E 00296064 !. (Isolectotypus designated here).

ibid: E 00342454 !. (Isolectotypus designated here).

Examined specimens (Paratypus): Türkiye, İzmir: Yaila de Bozdagh, 21 Juillet 1854, Balansa 414 (G-Boiss 00783511!).

Table 3
The differences between *T. glanduliferum* and *T. tmoleum* according to type specimens.

	***Trifolium glanduliferum* Boiss.**	***Trifolium tmoleum* (Boiss.) M. Keskin**
Habit	Spreading and ascending or sometimes prostrate, branched from base	Strict and dichotomously branched at upper, simple at base
Stem length	7-25 cm	30-45 cm
Leaflets	5-8 x 1-2.5 mm	8-15 x 1-2 mm
Peduncles	15-25 mm	12-40 mm
Pedicels	About 1 mm	Absent
Corolla	8-12 mm, two (or three) times as long as calyx	8-10 mm, somewhat longer than calyx or equal
Calyx	4-7 mm	6-8 mm
Teeth at the base	1-nerved	3-nerved

Vernacular name: Since no local name can be observed, the name "Bozdağ üçgülü" is suggested as a new Turkish Scientific name (Menemen et al., 2021).

3.1.3.2. Identification key

1. Involucral bracts absent or very rudiment; leaflets and stipules sparingly or not glandular *T. nervulosum*

1. Involucral bracts present; leaflets and stipules always long glandular

2. Calyx 3-5 mm; corolla 5-8 mm *T. strictum*

2. Calyx 4-8 mm; corolla 8-12 mm

3. Stems branched from the base; calyx 4-7 mm; teeth 1-nerved; corolla 2-3 times longer than calyx *T. glanduliferum*

3. Stems dichotomously branched at upper part; calyx 6-8 mm; teeth 3-nerved; corolla at most slightly longer than calyx *T. tmoleum*

3.1.4. A revision of Trifolium hybridum

Trifolium hybridum is a widely distributed species with highly variable characteristics. It is an important fodder crop and is widely cultivated for grazing and cutting (Zohary and Heller, 1982). The current classification is no longer adequate for this species. Considering the data obtained to date, the following classification of *T. hybridum* is proposed.

3.1.4.1. Trifolium hybridum L., Sp. Pl. 2: 766 (1753).

Perennials. Stem 1-60 cm, usually almost glabrous or sparsely hairy; erect, creeping, or almost stemless and more branched. Stipules ovate or ovate-lanceolate, lower part adjacent to the petiole, free part long, slender, and narrow. Leaflets elliptic, ovate-elliptic, obovate or more or less rounded, 1-35 x 1-20 mm, the side veins are abundant and prominent; edges whole or finely toothed; the tip is blunt or sometimes slightly recessed. Flowers are usually numerous, usually in globose umbels at the apex, 5-25 mm; peduncles longer than the leaf. Bracts lanceolate, 0.5-1 mm, white, membranous. Pedicel 3-5 mm, fruiting time net curled back. Calyx 5-veined, with 5-faint veins; teeth longer than tube or sometimes equal. Corolla pink or whitish, 7-10 mm; standard elliptic, longer than wings and keels. Ovary with 2 ovules. Pod elliptic. Seed 2, brownish, tuberculate.

3.1.4.2. Identification key

1. Stem long, erect or decumbent, branching few; base not woody …..…..subsp. *hybridum*

2. Stem hollow with prominent veins; usually more than 25 cm long; inflorescence 2 cm or wider var. *hybridum*

2. Stem solid, veins absent or less prominent; usually shorter than 25 cm; inflorescence 1-1.5 cm in diameter var. *elegans*

Fig. 3. *Trifolium konyaensis* M. Keskin: (A) Flowering branch, (B) A stipule, (C) The basal leaf, (D) The median leaf, (E) The upper leaf, (F) Calyces and corollas, (G) Close-up of the inflorescence.

Fig. 4. *Trifolium tmoleum* (Boiss.) M. Keskin (A) Lectotype specimen, (B) The close up of inflorescences.

1. Stem short, woody, and abundantly emerging from the base …..…..subsp. *anatolicum*

3. Stems 5–10 cm, prominent on woody stems as well as on flowering branches; leaflets 5–10 mm; leaves overcrowded at the base and not hiding the stem var. *anatolicum*

3. Stems almost absent or sometimes with a few flowering branches prominent; woody stems prominent below the leaves; leaflets 1-3 mm, densely clustered at the base, covering the base like a dome var. *minutum*

3.1.4.3. Trifolium hybridum L. subsp. hybridum var. hybridum

Syn.: *Trifolium fistulosum* Gilib., Fl. Lit. Inch. ii. 86 (1782). *T. bicolor* Moench, Methodus 111 (1794). T. *intermedium* Lapeyr., Hist. Pl. Pyrenées Suppl. 115 (1818). *T. michelianum* Gaudin, Fl. Helv. iv. 573 (1829) non Savi (1798). *T. caespitosum* Eichw., Skizze 166 (1830). Amoria hybrida C. Presl, Symb. Bot. (Presl) i. 47 (1830).

Lectotypus: Habitat in Europae Cultis., Herb. Linn. No. 930.15 (LINN)!. (designated by Zohary & Heller, Genus Trifol.: 145, 1984).

Vernacular name: Melez yonca

Description: The stem is generally hollow; strict, 25-70 cm long; striate; peduncles 2-5 cm, hairy or glabrous; flowering heads 15-20 x 15-20 mm; pedicel hairless sometimes loosely hairy; corolla white or pink, 5-10 mm; calyx 3-4 mm.

Examined samples: Amasya: Akdağ, Ziyaretkar, Saracakağı area, 28 vi 1977, K. Alpınar (ISTE 38034!). **Ankara:** Çubuk, Ovacık-Saraycık village, Hallayık pınarı area, bushes, fountain edge, 1250-1380 m, 11 ix 1992, E. Dündar (GAZI 1484!). **Antalya:** Manavgat, Seydişehir, Irmasan the breach, 1810 m, 04 vii 1976, M. Nydegger 10840 (G!). **Artvin:** Hopa, Sarp, rocky areas across the tunnel, 01 viii 2003, M. Keskin 2994 (ISTE!). **Aydın:** Kuşadası, 5 kilometers north, sea level, 01 vi 1967, A. Huber-Morath 17540 (G!). **Bingöl:** Merkez, 1100 m, 20 viii 1859, T. Kotschy 818 (G 00783573!). **Bolu:** Kale, Kırık plateau, forest clearings, 1550 m, 24 vi 1990, İ. Kılınç (ANKO 1145!). **Eskişehir:** Mahmudiye, vii 1943, H. Demiriz (ISTF 2525!); Oluklu, 03 vii 1963, A. Pamukçuoğlu (EGE 14495!). **İstanbul:** Maltepe, 28 iv 1989, A. Baytop (ISTE 60234!); Sarıyer, Belgrad forest, Büyükbent, 03 vi 1894, G.V. Aznavour (G!); Sultançiftliği, 11 vi 1893, G.V. Aznavour (G!); Şile, Ömerli willage, 06 iv 2004, M. Keskin 3078 (ISTE!); **Kastamonu:** Çatalzeytin, Malafören village, road side, 41° 56′ 205″ K and 034° 13′ 996″ D, 133 m, 17 vi 2008, A.A. Dönmez 14591 (HUB!).

3.1.4.4. Trifolium hybridum L. subsp. hybridum var. elegans (Savi) Boiss., Fl. Orient. 2: 146 (1872).

Syn.: *Trifolium elegans* Savi, Fl. Pis. ii. 161. t. 1. f. 2 (1798). *T. vaillantii* Poir., Encycl. 8: 4 (1808). *T. hybridum* L. var. *pratense* Babenh., Fl. Lusit. 1: 198 (1839). *Amoria elegans* (Savi) C.Presl, Symb. Bot. (Presl) i. 47 (1830).

Lectotypus: [illustration] "*Trifolium elegans*" in Savi, Fl. Pis. 2: t. 1, fig. 2, 1978 (designated by Roma-Marzio & al., *Trifolium* names described by Gaetano Savi, TAXON 67 (2): 413, 2018).

Epitypus: "Monte Pisano sul Monte Aspro (Buti, Pisa), sentiero al margine di un rimboschimento a conifere con sottobosco a prevalenza di eriche, 290 m s.l.m. [WGS84: 43.73702, 10.58162], 29 Jun 2016, F. Roma-Marzio" (PI No. 004813!; Isoepitypus FI!). designated by Roma-Marzio & al., *Trifolium* names described by Gaetano Savi, TAXON 67 (2): 413, (2018).

Vernacular name: Since no local name can be observed, the name "Şirin üçgül" is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Description: Stem is solid, prostrating-ascending, 10-40 cm long; smooth, no vein or obscurely veined but no striate; peduncles 2-10 cm, hairy. Flowering head 15-17 x 15-17 mm; pedicel hairy; corolla pink, red or white-pink, 6-7 mm; calyx 2-3 mm.

Examined samples: Afyonkarahisar: Sandıklı, Akdağ-Sığırkuyruğu around the plateau, 1500 m, 22 vii 1983, M. Nydegger 2390 (EGE 25685!). **Ankara:** Beypazarı, 30 vi 1971, Y. Akman (ANK 884! and G!); Merkez, İstanbul road side, Kargakesmez village, 1120 m, 05 ix 1974, I. Kukkonen 8220 (G!). **Ardahan:** Çıldır on the coast north-west of the lake, near the village of Gölbelen -damp Gladiolus, *Trifolium*, *Polygonum* meadow-, 1960 m, 29 v 1995, A.J. Byfield 1740 (ISTE 69090!). **Artvin:** Hopa, Başköy, mosque relatives, 40° 57′ 16,4″ K and 29° 08′ 43,7″ D, 213 m, 30 vii 2017, M. Keskin 7528 (ISTE!); Hopa, Bucak district, 01 viii 2003, M. Keskin 2952 (ISTE!); Hopa, Bucak district, 1 viii 2003, M. Keskin 2952 (ISTE!); Tiryal dağı, southern slopes, Hatila region, rocky, stream, 1850 m, 28 v 1963, A. Düzenli (ANK 573!). **Aydın:** Çine, Madrandağı, Kavşıt village, 750 m, 2 viii 1978, Ö. Seçmen (1580), G. Görk and all. (EGE 1020!). **Balıkesir:** Kazdağı, Sarıkız tepesi, zirve, 21 vii 2012, M. Keskin 5831 (ISTE!). **Bartın:** Kurucaşile Göçgün seaside, creekside, 24 x 2006, M. Keskin 5297 (ISTE!). **Bilecik:** Pazaryeri, 30 vi 1983, toplayıcısız (ESSE 5947!). **Bolu:** Abant lake around, 02 vii 2009, M. Keskin 5754 (ISTE!); Aladağ plateau, meadow, 1350 m, 11 viii 1985, M. Vural (GAZI 2666!); Karacasu, 700 m, tarihsiz, O. Alpay (ANKO!); Koru motel, mixed *Fagus* and *Abies* forest, 860 m, 30 viii 1972, I. Kukkonen 8237 (G!); Uludağ, experimental pasture, 1300 m, 12 vi 1954, O. Alpay and Gezgürel (G!); Yedigöller national park, fish breeding ground, 900 m, 14 vi 1977, R. İlarslan (HUB 13215! and KNYA 9832!); Yedigöllller Milli parkı, Tombullar area, 1500 m, 14 vi 1977, R. İlarslan (KNYA 9930!). Bursa: Uludağ, Arpalı district, 10 km east of Termalin, 140 m, R. Çetik (KNYA 9830!); Uludağ, Çekirge-Uludağ, 31 km, 13 viii 1969, H. Demiriz (ISTF 24558!); Uludağ, Diktekir, 5 vii 1944, M. Başarman (ISTF 4146!); Uludağ, Elmaçukuru, 13 v 1944, M. Başarman (ISTF 2823!); Uludağ, Gökdere, Kestanelik, 28 vi 1944, M. Başarman (ISTF 3492!); Uludağ, Sarıalan plateau, Pala Cemal mangal near, 2 vii 2004, Y. Belge and A. Sarı (ISTE 81879!); Uludağ, Teleferik around, 30 vi 2007, M. Keskin 5706 (ISTE!); Uludağ, Teleferik around, 30 vii 2007, M. Keskin 5706 (ISTE!); Uludağ, summit, 20 viii 1994, S. Alan (ESSE 13314!). Çankırı: Merkez, Research forest, regional 1, 1435 m, 21 vi 1961, İ. Bozakman (ANKO!). **Eskişehir:** Kırka, Türkmen mountain promenade, 28 vi 2007, M. Keskin 5558 (ISTE!); Kırka, Türkmen mountain, Kurugöl, 39° 28′ 08.1″ K and 30° 21′ 24,5″ D, 29 vi 2007, M. Keskin 5637 (ISTE!); Kırka, Türkmen mountain, Kurugöl, 39° 28′ 08.1″ K and 30° 21′ 24,5″ D, 29 vi 2007, M. Keskin 5668 (ISTE!); Kirka, Türkmendağı Kurugöl, 29 vi 2007, M. Keskin 5667 (ISTE!); Kirka, Türkmendağı promenade, 28 vi 2007, M. Keskin 5558 (ISTE!); Sündiken mountain, Güzelce village aroud, Aralık, areas with high ground water, 6 vi 1971, 800 m, T. Ekim (ANK!). **Isparta:** Atabey, Gelincik main hill, alpine

zone, 2200-2700 m, 22 vii 1983, L. Bekat (EGE 35559!). **İstanbul:** Alemdar-Kurtköy, South slopes of Omerli dam, 11 v 1995, A.J. Byfield 2273 and R. Fitzgerald (ISTE 69627!); Akfırat Opposite Formula 1 area, 19 v 2005, M. Keskin 3959 (ISTE!); Alemdağ, 29 v 1898, G.V. Aznavour (G!); Alemdağ, in forest, 17 v 2000, M. Keskin 2404 (ISTE 79232!); Alemdağ, in forest, 25 v 2003, M. Keskin 2857 (ISTE!); Arnavutköy, Durusu, Ormanlı road, 41° 22′ 42,8″ K and 28° 33′ 28,8″ D, 8 m, 19 v 2017, M. Keskin 7148 (ISTE!); Belgrad forest, 29 x 1964, A. Baytop (ISTE 7797!); Beykoz Anadolu Hisarı, 29 v 2005, M. Keskin 4084 (ISTE!); Beykoz, 8 km east, roadside, flowers pink, 29° 10′ D and 41° 10! K, 350 m, 23 vi 1971, J.R. Edmondson (ISTF 25607!); Beykoz, Anadolu hisarı, 29 v 2005, M. Keskin 4084 (ISTE!); Kağıthane-Şişli, 20 vi 1893, G.V. Aznavour (G!); Maltepe, Başıbüyük Mahallesi Süreyyapaşa hospital forest, 04 vi 2006, M. Keskin 5087 (ISTE!); Maltepe, Başıbüyük Mahallesi Süreyyapaşa hospital forest, 01 vii 2000, M. Keskin 2440 (ISTE 79268!); Maltepe, Başıbüyük mahallesi, hill slopes behind the school, 04 vi 2006, M. Keskin 5087 (ISTE!); Paşabahçe-Polenezköy, 02 vi 1940, B.V.D. Post (G!); Pendik, Green fields on the way to Formula One, 41° 02′ 17,9″ K and 29° 18′ 57,5″ D, 206 m, 10 viii 2017, M. Keskin 7583 (ISTE!); Sarıyer, Kale distict, 05 xii 2006, M. Keskin 5229 (ISTE!); Şile, Ömerli village, 6 iv 2004, M. Keskin 3078 (ISTE!); Tarabya, 01 vi 1888, G.V. Aznavour (G!); Tuzla, Akfırat district, Formula 1 area, lake area, 06 v 2005, M. Keskin 3850 (ISTE!); Tuzla, Akfırat beldesi Opposite Formula 1 area, 06 v 2005, M. Keskin 3822 (ISTE!); Tuzla, Akfırat district, Formula door, meadow, 04 vi 2005, M. Keskin 4130 (ISTE!); Tuzla, Akfırat beldesi, Formula One field entrance, meadow, 4 vi 2005, M. Keskin 4130 (ISTE!); Tuzla, Akfırat beldesi, Formula-1, across the runway, 6 v 2005, M. Keskin 3822 (ISTE!); Tuzla, Akfırat beldesi, Formula-1 field entrance, meadow, 19 v 2005, M. Keskin 3959 (ISTE!); Tuzla, Akfırat district, lake area, 6 v 2005, M. Keskin 3850 (ISTE!); Tuzla, Göçbeyli village, 19 v 2005, M. Keskin 3991 (ISTE!); Tuzla, Göçbeyli village, 19 v 2005, M. Keskin 3991(ISTE!); Ümraniye, Alemdağ, 17 v 2000, M. Keskin 2404 (ISTE 79232!); Ümraniye, Alemdağ, 25 v 2003, M. Keskin 2857 (ISTE!). **İzmir:** Bozdağ, 20 vi 1854, B. Balansa 170 (G 00783581!). **Kars:** Ardahan-Kars arası, 30 km before Kars, right of the road, deep valley, inside the waterfall, 1900 m, 20 viii 1984, R.İlarslan (ANK!); Sarıkamış, between Acısu-Sarıkamış, 22 vii 1947, A. Heilbronn, M. Başarman (ISTF 7978!). **Kastamonu:** Hanönü, around Kayabaşı village, 41° 43′ 227″ K and 034° 20′ 566″ D, *Fagus* fores cleanig, A.A. Dönmez 16140 - Z. Uğurlu (HUB!); İnebolu, 2 vii 1947, A. Heillbronn and M. Başarman (ISTF 6986!). **Kırklareli:** Demirköy, 18 vii 1959, A. Baytop and T. Baytop (ISTE 5486a!); Demirköy, 18 vii 1959, A. Baytop and T. Baytop (ISTE 5486a!). **Konya:** Beyşehir, 12 km to Kurucuova, Musalla top, KB slope, 1500-1700 m, 17 vi 1980, M. Serin (KNYA 9831!); Hadim, Bademli village, Kandemir area, çayırlık içleri, 1500 m, 18 viii 1988, M. Serin (KNYA 9833!). **Kütahya:** Gediz, Murat dağı, Karapınar, in forest, on rock, 1650 m, 12 vii 1980, A. Çırpıcı (ISTF 34453!); Simav, 8 km from Simav, from the forest road towards Mount Simav, *Pinus nigra* forest, 1700 m, 17 vii 1965, M.J.E. Coode and B.M.G. Jones 2635 (ISTF 20874!). **Samsun:** Kavak, Azaklı village, 10 vi 2000, M. Keskin 2430 (ISTE 79258!). **Sivas:** Zara, 5 km S of Şerefiye plateau, 1600 m, 19 vi 1958, A. Huber-Morath 15023 (G!).

3.1.4.5. Trifolium hybridum L. subsp. anatolicum (Boiss.) Hossain, Notes Roy. Bot. Gard. Edinburgh 23: 466 (1961) var. anatolicum

Syn.: *Trifolium anatolicum* Boiss., Diagn. Pl. Orient. ser. 1, 2: 31 (1843), non Katznelson (1965). *T. parvulum* Beck ex Stapf, Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 51(2): 379 (1886).

Lectotypus: Türkiye, Tmoli cacumini supra Philadelphiam (Alaşehir), June 1842, Boissier (G-Boiss 00783575!). designated by Hossain, A Revision of *Trifolium* in The Nearer East, Notes Roy. Bot. Gard. Edinburgh 23: 466 (1961).

Vernacular name: Since no local name can be observed, the name "Güdük üçgül" is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Description: Plants branching from the base; stem more or less distinct, creeping or ascending, up to 15 cm; veins on the stem absent or indistinct; peduncles 3-8 cm, hairy or glabrous; flowering heads 10-17 x 10-17 mm; pedicel usually hairy; corolla pink, reddish or purple, 6-10 mm; calyx 3-4 mm.

Examined samples: Afyonkarahisar: Büyükkalecik, Kocatepe, Gölcük district, in water, 1650 m, 14 vi 1982, T. Ekim and H. Malyer (ESSE 2508!). **Amasya:** Akdağ, Alıç plateau, 02 x 1976, K. Alpınar (ISTE 36183!); Akdağ, Ormanözü village, Mezarlık district, Kavacık hill, Zirand road, 01 x 1976, K. Alpınar (ISTE 36164!). **Ankara:** Beypazarı, 30 vi 1971, Y. Akman (ANK 884! and G!); Çamlıdere, Çamkoru research forest, trial area 1435 m, 21 vi 1961, İ.H. Bozakman (ANKO!); Çamlıdere, Çamkoru research forest, trial area 1740 m, 20 vii 1963, İ.H. Bozakman (ANKO!); Çamlıdere, Peçenek, Tatar field, black pine, 1400 m, 2 vi 1978, M. Aydoğdu (ANK!); Çubuk, slopes North East of Karagöl, step, 23 v 1973, S. Erik 23 (HUB 13310!); Karagöl, 64 km south of Ankara, *Pinus nigra* forest,1600 m, 10 vii 1965, M.J.E. Coode and B.M.G. Jones (ISTF 20604!); Kızılcahamam, Çamkoru, cleanig and in forest, roadside, B. Kasaplıgil (ANKO 72!); Kızılcahamam, Soğuksu National Park, Göklü district, 1400 m, 9 vi 1983, A. Güner 4992, K. Sorkun (AEF 12888! and HUB 13308!); Kızılcahamam, Soğuksu National Park, İncegeliş area, cleaning forest, 1550-1600 m, 9 viii 1990, Ö. Eyüpoğlu (GAZI 2040!); between Lalahan-Çiftlik, meadow, 2 vii 1954, R. Çetik (KNYA 16553!). **Antalya:** Gazipaşa, Çobanlar village plateau, Akçamağar district, korunmuş arazi, 1800-2000 m, 20 vii 1981, H. Sümbül 1149 (HUB 13318!); Gazipaşa, Çobanlar village plateau, Dereyurt district, protected area, 1850 m, 12 vii 1983, H. Sümbül 2266 (HUB 13314!); Gazipaşa, Çobanlar village, Oyuklu plateau, 1900-2000 m, 11 vii 1983, H. Sümbül 2230 (HUB 13316!); Gazipaşa, Sugözü village to Ekinçalı plateau, 2000 m, 12 vii 1982, H. Sümbül 1250 (HUB 133171). **Bartın:** Kurucaşile, 24 viii 2006, M. Keskin 5138 (ISTE!). **Bilecik:** Bozöyük, 2 km west of the centre, 21 vi 1990, R. Lampinen 7642 (ISTE 63685!). **Bolu:** Abant lake, 1350 m, 03 viii 1984, Ö. Ödemiş, M. Nydegger, H. Tabaka and Yasuda (EGE 17794!); Aladağ plateau, meadow, 1350 m, 11 viii 1985, M. Vural (GAZI 2622!); Gerede, 5 km west of Yeniçağa, 1040 m, 03 vii 1984, M. Nydegger 19004 (G 386879!); Koru motel, meadow, 850 m, 30 viii 1972, P. Uotilla 20129 (EGE 23466!); Merkez, Aladağ, Değirmenözü experience pasture, 22 vii 1954, O. Alpay (ANKO 193!); Merkez, around hotel, meadow, 10 m, 15 vi 1986, B. Tutel (ISTF 35776!); Mudurnu, Abant lake, 1300 m, 06 vii 1977, M. Nydegger 12013 (G!). **Bursa:** Keşiş mountain, 200 m, 26 v 1899, J. Bornmüller 4352 (G !); Kirazlı, Sarıalan, Elmaçukuru, 28 vi 1944, M. Başarman (ISTF 3573!); Uludağ Teleferik area, 30 vi 2007, M. Keskin 5709 (ISTE!); Uludağ, 09 vii 1978, A.

Baytop (ISTE 40740!); Uludağ, 09 viii 1978, A. Baytop (ISTE 40740!); Uludağ, 7 vii 1963, C. Regel (EGE 1455!); Uludağ, Aras, viii 1945, M. Başarman (ISTF 56331); Uludağ, Bakacık on road, 03 viii 1957, N. Gülen (ISTE 5107!); Uludağ, Bakacıkaltı, 6 ix 1944, M. Başarman (ISTF 4733!); Uludağ, Diktekir, 4 vii 1944, M. Başarman (ISTF 4029!); Uludağ, Elmaçukuru, 28 vi 1944, M. Başarman (ISTF 3524!); Uludağ, Elmaçukuru, around otel, 28 vi 1944, M. Başarman (ISTF 3577!); Uludağ, Karabelen, Dolubaba, 19 v 1944, M. Başarman (ISTF 3074!); Uludağ, Karatepe, Karçukuru, 2 viii 1944, M. Başarman (ISTF 4618!); Uludağ, Kirazlı, Sarıalan, 29 vi 1944, M. Başarman (ISTF 3635!); Uludağ, Kurt rock, viii1945 M. Başarman (ISTF 5687!); Uludağ, Paşaçayırı, 31 vii 1944, M. Başarman (ISTF 4450!); Uludağ, on stream, viii 1945, M. Başarman (ISTF 5654!); Uludağ, around Teleferik, 30 vii 2007, M. Keskin 5709 (ISTE!); Uludağ, peak road, viii 1945, M. Başarman (ISTF 5751!); Uludağ, peak, 13 vi 1953, M. Heilbronn (ISTF 12936!); Uludağ, Zobrandere, 1820 m, 10 viii 1951, H. Demiriz (ISTF 11535!). **Çankırı:** Atkaracalar, Dumanlı mountain, Ulupınar village, erenler district, rocky step, 1200-1400 m, 10 vii 1992, A. Duran (GAZI 1595!). **Düzce:** Akçakoca, between Çiçekpınar-Doğancılar village, along the brooke, 41º 04′ 26″ K and 31º 09′ 39″ D, 20 m, 10 vi 2001, A. Doğru-Koca 1437A (HUB!). **Eskişehir:** Kirka Türkmendağı promenade, 28 vi 2007, M. Keskin 5559 (ISTE!); Merkez Anadolu Üniversitesi Yunus Emre Kampüsü, 29 vi 2007, M. Keskin 5696 (ISTE!). **Isparta:** Senirkent, Garip köy exit, Kapıdağ area, *Cedrus* forest, 1250 m, 9 vi 1983, L. Bekat (EGE 35560!). **İstanbul:** Alemdağ, around Nişantepe, 18 vii 1998, M. Keskin 1915 (ISTE 78609!); Ataşehir, Turkuaz Su Fabrikası-Maltepe Ün. Arası, meadow-maquis, 40º 57′ 28,9″ K and 29º 11′ 32,5″ D, 9 iv 2006, M. Keskin 5947 (ISTE!); Beykoz, Riva area, meadow-maquis, 41º 12′ 15″ K and 29º 15′ 28,5″ D, 17 iv 2016, M. Keskin 6012 ISTE!); Çınarcık, Üçreisler area, 10 viii 1983, E. Tuzlacı (ISTE 52184!); Silivri, Danamandıra Tabiat park road, Sinekli road junction, rejuvenated oak forest, 19 v 2006, M. Keskin 6223, N. Özhatay and E. Özhatay (Sarıyer Orm Müd. !); Silivri, Danamandıra Tabiat park road, Sinekli road, 41º 04′ 24,7″ K and 28º 44′ 27,1″ D, 165 m, 19 v 2016, M. Keskin 6222, N. Özhatay and E. Özhatay (Sarıyer Orm Müd.!); Şile, İmam Hatip Lisesi near, meadow-maquis, 41º 02′ 55,7″ K and 29º 18′ 03,1″ D, 130 m, 23 iv 2016, M. Keskin 6057, N. Özhatay and E. Özhatay (Sarıyer Orm. Müd.!). **Kahramanmaraş:** Engizek mountain, Kavurmaçukuru area, high mountain meadows, 2200-2300 m, 20 vii 1987, H. Duman (GAZI 3636!). **Kastamonu:** Taşköprü, Kayabaşı village area, climb the fire tower, 41º 33′ 110″ K, 034º 12′ 183″ D, mountain steppe, *Pinus nigra-Pinus sylvestris* açıklığı, 1710 m, 04 viii 2010, A.A. Dönmez 17571, Z. Uğurlu (HUB!). **Kayseri:** Akkışla, Ganişeyh, Hınzır mountain, Göğkuyu area, 1900 m, N. Çelik (HUB 13311!). **Konya:** Akşehir, Sultandağları, Tekke around, North of the coal hills, 2080 m, 28 vii 1976, G. Dökmeci (ISTE 35556!); Bozkır, Ardıç spring, 1800 m, 15 vi 1967, R. Çetik, T. Ekim and E. Yurdakul (KNYA 9829!); Ereğli, Aydos mountain, Berendi, Meydan plateau, alpinic step, 2500 m, 23 vi 1977, S. Erik 2302 (G!); Ereğli, Aydos mountain, Berendi, Meydan plateau, alpinik step, limestone bedrock, 2500 m, 23 vi 1977, S. Erik (HUB 13299!); Tavşan hill, *Quercus* forest, 1350 m, 26 v 1989, A. Tatlı, B. Eyce and M. Serin (KNYA 9828!). **Kütahya:** Tahtalı mountain, 1600 m, 9 vi 1981, G. Görk and M. Nydegger (EGE 38026!). **Malatya:** İnönü Üniversitesi campus, 15 vii 2006, M. Keskin 4992 (ISTE!). **Mersin:** Aslanköy, Dümbelek pass, 37º 06′ 24,6 K and 34º 15′ 47,2 ″ D, 1891 m, 1 viii 2008, M. Keskin 4565 (ISTE 83286!). **Muğla:** Sandras mountain, Çiçekbaba 2100 m, 14 vii 1978, N. Özhatay and E. Özhatay (MUFE 4229!). **Niğde:** Bulgar mountain, 2100-2500 m, 04 vi 1853, T. Kotschy 361a (G 00783580!). **Rize:** İkizdere, below the Haya village, Spruce-Fir clearing, 1650 m, 6 viii 1986, A. Güner 7084 (HUB 13214!). **Sivas:** Şarkışla, Diğnendim hill, 39º 32 ′ 49″ K and 36º 08′ 21″ D, alpinic meadow, 1900-2000 m, 25 x 2007, B. Özüdoğru 1572 (HUB!). **Tokat:** Artova, Çamlıbel, Yıldızeli, 1700 m, 14 vi 1939, H. Reese (G!); Reşadiye, Karlı plateau, 27 vii 1972, Ş. Şahin (ISTE 23343!). **Trabzon:** Meryemana area, Gırlav plateau, slope, 17 viii 1980, A. Okatan (ISTE 48344!). **Yozgat:** Milli park, under *Pinus nigra,* 1500 m, 26 vi 1979, B. Saygın (ANK 54!).

3.1.4.6. Trifolium hybridum L. subsp. anatolicum (Boiss). Hossain var. minutum M.Keskin var. nov. (Fig. 5)

Holotypus: Türkiye, Muğla: Sandras Dağ, W side of the summit area, 2100-2200 m, Snowbed meadows and rocky slopes, Serpentine. Prostrate in snowbed meadow. Flowers pink. 37º 04′ N and 28º 50′ E, P. Hartvig, Ö. Seçmen, A. Strid 23352 (holo. EGE 27963!).

Vernacular name: Since no local name can be observed, the name “doruk üçgül” is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Diagnose: It is closed to *T. hybridum* L. subsp. *anatolicum* (Boiss.) Hossain var. *anatolicum* but stems obscure and very rich branched; the flowering branch is short and a few. The leaves come out in dense bunches and cover the body like a dome. Leaflets 1-3 mm, usually orbicular. Peduncles 1-5 cm, hairy.

Description: The stems are indistinct, thick woody, 1-4 cm, but not visible due to dense leaves. Flowering branch 1-5 (-10) cm. Leaves come out in bundles. Leaflets almost orbiculate or slightly obovate–obcordate, 1-3 mm diam.; minutely serrate at the margin, veins little obvious and a few. Petiols are loose hairy. Stipules mebranous at base, up to 1 cm; upper ones green, 0.5 mm. Pedicel hairy, 5 mm. Calyx 5-veined, almost membranous, other 5-veins obscured; tube hairy at base. Calyx teeth are as long as tube, obtuse at the tip. Calyx 3 mm. Bracts membranous 1 mm. Corolla 5-6 mm, pink-light purple. Seeds 2, 1.5 mm, almost orbiculate and depressed not spheroidal. Legumes are thick veins and slightly longer than tubes, shortly hairy. Peduncles 1-5 cm, hairy.

Examined samples: Antalya: Akdağ, 1700-2000 m, 8 vii 1993, M. Nydegger, N. Özel, G. Görk (EGE 26643!); **Isparta:** Atabey, Gelincik main hill, alpine zone, 2200-2700 m, 22 vii 1983, L. Bekat (EGE 35559)!. **Muğla:** Sandras mountain, west slope, serpentine land, 2100-2200 m, 07 vii 1984, P. Hartwig, Ö. Seçmen & A. Strid 23352 (G 284827!); Sandras mountain, Dikmecik plateau, 1710 m, 3 viii 1978, Ö. Seçmen (EGE 17110!); Sandras mountain, south west, *Pinus nigra* forest, 37º 04′ K, 28º 49′ D, 1750 m, 6 vii 1984, P. Hartvig, Ö. Seçmen, A. Strid 23324 (EGE 27959!).

3.2. Two New Combinations

3.2.1. Trifolium infamia-ponertii Greuter

Trifolium angustifolium L. is a common species worldwide. It exhibits various different morphological characters. Therefore, different conceptions have been put forward from time to time to determine the limits of this species.

Fig. 5. Holotypus of *Trifolium hybridum* L. subsp. *anatolicum* (Boiss). Hossain var. *minutum* M.Keskin (EGE 27963).

For this historical process, it is sometimes encountered with name confusion during the naming of this species. *T. angustifolium* L. var. *intermedium* Gib. & Belli and *T. intermedium* Guss. have been described as a variety of this species. Later, a researcher discovered this nomenclatural confusion and proposed a new name for this plant: *Trifolium infamia-ponertii* Greuter (Greuter, 1976).

Although Greuter accepted it as a separate species, it has become clear over the years that this plant does not normally have sufficient morphological differences to be clearly distinguished from *Trifolium angustifolium* L. For this reason, it was concluded that it would be better to consider this name at the varietal level of *Trifolium angustifolium* L..

***Trifolium angustifolium* L. var. *infamia-ponertii* (Greuter) M. Keskin, comb. et stat. nov.**

Syn.: *Trifolium intermedium* Guss., Cat. Pl. Hort. Reg. Bocc.: 82 (1821), nom. illeg. non Lapeyr (1818). *Trifolium angustifolium* L. var. *intermedium* Gibelli & Belli, Mem. Reale Accad. Sci. Torino, ser. 2, 39: 420 (1889). *Trifolium angustifolium* L. subsp. *intermedium* (Gibelli & Belli) Arcang., Comp. Fl. Ital., ed. 2: 495 (1894). *Trifolium angustifolium* L. var. *acrogymnum* Maire, Pl. Marocc. Nov. 1: 3 (1929). *Trifolium angustifolium* L. var. *acrolophum* Maire, Pl. Marocc. Nov. 1: 3 (1929). *Trifolium angustifolium* L. subsp. *gibellianum* Pignatti, Giorn. Bot. Ital. 107: 217 (1973). *Trifolium angustifolium* L. subsp. *intermedium* (Guss.) Ponert, Feddes Repert. 83, 9/10: 637 (1973). nom. illeg. *Trifolium infamia-ponertii* Greuter, Candollea 31: 215 (1976).

3.2.2. Trifolium rumelicum Griseb.

Trifolium rumelicum was analysed as a variety of *T. vesiculosum* in the Flora of Turkey. (Zohary, 1970; Ovalle et al, 2010). However, as a result of the studies on the types of this species, it was concluded that it is close to *T. setiferum*. For this reason, it was concluded that *T. rumelicum* species should be related to *T. setiferum* species.

***Trifolium setiferum* Boiss. var. *rumelicum* (Griseb.)M. Keskin comb. et stat. nov.**

Syn.: *Trifolium vesiculosum* var. *rumelicum* Griseb.; Spic. Fl. Rumel. 1: 35 (1843). *Trifolium rumelicum* (Griseb.) Halácsy; Consp. Fl. Graec. 1: 399 (1900).

3.3. Some notes about the infrageneric classification of Trifolium subgen. Trifolium sect. Trifolium

3.3.1. Correction of subsection Stipulia

Subsection *Stipulia* was previously published by Keskin et al. (2023) but is not valid because the type information was not written. It is redefined here by giving the correct type of information.

Subsect. *Stipulia* M. Keskin, subsect. nov.

Diagnose: It differs from the other subsections of sect. *Trifolium* in terms of the following characters: free part of stipules ovate-lanceolate to lanceolate, green, foliaceous; longest tooth of calyx 3-5 nerved.

Vernacular name: The name “Taraküçgülü altseksiyonu” is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Typus: *Trifolium longidentatum* Nábělek

The members of subsection *Stipulia* M. Keskin are as follows:

1) *Trifolium longidentatum* Nábělek, Spisy Přír. Fak. Masarykovy Univ. 35: 69 (1923).
2) *Trifolium kurdistanicum* S.Yousefi, Assadi & Ghaderi, Phytotaxa 297(2): 217 (2017).
3) *Trifolium elazizense* M.Keskin, Sonay & Balos, Phytotaxa 583(2): 202 (2023).

3.*3.2. A new subsection of Trifolium*

Two *Trifolium* species endemic to Türkiye should be combined under a new sub-section due to their common characteristics.

Subsect. *Caudata* M.Keskin, subsect. nov.

Diagnose: Perennials. The leaf crowded at the base. The calyx is 10-nerved; the mouth closed by two-lipped callosity; teeth are 1-nerved, different lengths. Corolla longer than calyx.

Vernacular name: The name “Anaüçgül altseksiyonu” is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Typus: *Trifolium caudatum* Boiss.

The members of subsection *Caudata* M. Keskin are as follows:

1) *Trifolium caudatum* Boiss., Diagn. Pl. Orient. ser. 1, 9: 22 (1849).
2) *Trifolium davisii* Hossain, Notes Roy. Bot. Gard. Edinburgh 23: 403 (1961).

3.3.3. A new section and a short note for subgenus Calycomorphum

The subgenus *Calycomorphum* shows distinct characteristics within the genus *Trifolium* and even within the family. Some of its flowers are sterile, containing no petals, stamens or ovaries, only empty calyx tubes or long teeth. The seed heads either penetrate deep into the soil or are in the form of a hairy ball.

Subgenus *Calycomorphum* (C. Presl) Hossain, Not. Roy. Bot. Gard. Edinb. 23 : 438 (1961).

Syn.: *Calycomorphum* C. Presl, Symb. Bot. (Pragae) 1: 50 (1831). Sect. *Trichocephalum* Koch, Syn. Fl. Germ. Helv. 171 (1835). Sect. *Calycomorphe* (C. Presl) Griseb., Spicil. F. Rumel. 1 : 31 (1843). Sect. *Oliganthema* Bertol., Fl. Ital. 8 : 131 (1850), pro parte.

Diagnose: Annuals. Flowers sessile and without stalks; inner flowers in sterile, petalless calyx or long teeth; outer flowers fertile; legume 1-seeded.

Vernacular name: The name “Yeraltıüçgülü altcinsi” is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Typus: *Trifolium subterraneum* L.

Sect. *Calycomorphum*

Syn.: Strips *Subterranea* (Carpohypogea) Gib. et Belli in Mem. Accad. Sc. Tor. II, 43: 181 (1893). Strips (*Medusea*) Gib. et Belli subsect. *Geotropa* Gib. et Belli in Mem. Accad. Sc. Tor. II, 43: 205 (1893).

Diagnose: Short, decumbent plants; sterile flowers appear after flowering; fruiting heads touch the soil or penetrate completely into it and develop there, never forming a hairy ball.

Vernacular name: The name "Yeraltıüçgülü seksiyonu" is suggested as a new Turkish Scientific name (Menemen et al., 2021).

Typus: *Trifolium subterraneum* L.

The members of section *Calycomorphum* are as follows:

1) *Trifolium suberraneum* L., Sp. Pl. 2: 767 (1753).
2) *Trifolium israeliticum* D. Zohary & Katznelson, Austral. J. Bot. 6: 179 (1958).

Sect. *Anemopeta* (Gib. et Belli) M. Keskin stat. nov.

Syn.: Sect. *Calycomorphum* gruppo *Carpoepigea* (Medusea) subsect. *Anemopeta* Gib. et Belli in Mem. Accad. Sc. Tor. II, 43: 207 (1893). Sect. *Calycomorphum* subsect. *Anemopeta* Katznelson & Morley in Israel J. Botany 14, 112, 171 (1965).

Diagnose: Plants usually grow more or less erect, fertile and sterile flowers develop almost simultaneously; the fruit is like a hairy ball and never penetrates below the ground.

Vernacular name: The name "Yumakyonca seksiyonu" is suggested as a new Turkish Scientific name (Menemen et al., 2021).

The members of section *Anemopeta* (Gib. et Belli) M. Keskin are as follows:

1) *Trifolium batmanicum* Katznelson ex Zohary & Heller, Genus Trifolium 520 (1984).
2) *Trifolium chlorotrichum* Boiss. & Balansa, Diagn. Pl. Orient. ser. 2, 6: 48 (1859).
3) *Trifolium eriosphaerum* Boiss., Diagn. Pl. Orient. ser. 1, 9: 25 (1849).
4) *Trifolium globosum* L., Sp. Pl. 2: 767 (1753).
5) *Trifolium leylae* M. Keskin, sp. nov., in this article.
6) *Trifolium meduseum* C.I. Blanche ex Boiss., Fl. Orient. 2: 134 (1872).
7) *Trifolium pauciflorum* d'Urv., Mém. Soc. Linn. Paris 1: 350 (1822).
8) *Trifolium pilulare* Boiss., Diagn. Pl. Orient. ser. 1, 2: 29 (1843).

3.4. A new record for Türkiye

***Trifolium dalmaticum* Vis., Flora 12 (1, Ergänzungsbl.): 21 (1829).**

Annuals. Stems 10-25 cm, patulous in the lower part and adpressed hairy in the upper part; more or less striate. Lower leaves are long-petioled, and those at the middle and apex of the stem are sessile or sometimes subsessile. Stipules oblong-linear, membranous with obviously nerved; free parts long patulous hairy. Leaflets 10-15 x 6-10 mm, cuneate, orbicular, denticulate, nerves recurved near margin; those of lower leaves obovate or spherical, those of upper ones obovate-oblong. Flowering heads terminal, 10-30 x 8-10 mm, involucrate by upper leaves and its stipules. Flowers many 10-12 mm long. Calyx tube 10-nerved, generally hairy; teeth sparsely hirsute, lanceolate-subulate to narrow-linear, rigid, unequal; fruiting calyx somewhat large, teeth indurating, stellately spreading; throat narrowed by a callous ring. Corolla pink is 1.5-2 times longer than calyx. Legume ellipsoid and somewhat compressed, membranous. Seed 1-1.5 mm, obovoid.

Examined specimens: İstanbul: Erenköy, 07 v 1891, *G.V. Aznavour* (G!) and Kağıthane, 19 vi 1978, *G.V. Aznavour* (G!).

Vernacular name: Since no local name can be observed, the name "Kaba yonca" is suggested as a new Turkish Scientific name (Menemen et al., 2021).

4. Discussion

Türkiye is a rich country in terms of *Trifolium* species and is home to almost half of the world's species. Especially recent studies have shown that this genus is definitely monophyletic (Ellison et al. 2006, Watson et al. 2000).

In this paper, three new taxa are described for science in the light of specimens collected from Türkiye: *T. leylae* M. Keskin (Subgenus *Calycomorphum*), *T. konyaensis* M. Keskin (Subgenus *Trifolium*), and *T. hybridum* L. subsp. *anatolicum* (Boiss.) Hossain var. *minutum* M. Keskin (Subgenus *Lotoidea*). The taxonomic status of the species *T. tmoleum* was also clarified. Since it was realized that it could not be a synonym of *T. glanduliferum* and that it has unique characteristics, this species was reinstated: *T. tmoleum* (Boiss.) M. Keskin (Subgenus *Paramesus*). The subgeneric classification of the genus *Trifolium* was investigated. As a result, three new classification units were proposed to science: subsect. *Stipulia* M. Keskin, subsect. *Caudata* M. Keskin, and sect. *Anemopeta* (Gib. et Belli) M. Keskin. In addition, two new taxonomic arrangements were made: *T. angustifolium* var. *infamia-ponertii* (Greuter) M. Keskin and *T. setiferum* Boiss. var. *rumelicum* (Griseb.) M. Keskin. Finally, the presence of a new *Trifolium* species not previously reported in Türkiye is reported: *T. dalmaticum* Vis.

Keskin (2012) previously reported 106 *Trifolium* species in the flora of Türkiye. Since it was concluded that *T. bithynicum* Boiss. is actually a synonym of *T. medium* L., and since there was no evidence for the presence of *T. isthmocarpum* Brot., *T. mutabile* Port., *T. plebium* Boiss., and *T. rubens* L., whose presence in Türkiye was already doubtful, they were removed from the list of Turkish flora.

It is concluded that the number of species belonging to the genus *Trifolium* in Türkiye, together with the species reported in this study, is 104.

Acknowledgments: I would like to thank the curators of the various herbaria for granting access to *Trifolium* specimens for this study and the ANG Foundation for funding the herbarium visits. Also, Thanks to Eyal Ben-Hur from Scientific Manager of HUJ herbarium for sending me the type specimen photographs of *Trifolium batmanicum* and some specific information about it. I would like to thank Prof. Dr. Yusuf Menemen for his valuable contributions and Prof. Dr. Osman Tugay for the trip to the type area of *Trifolium konyaensis*.

Conflict of interest: The author declares that he has no conflict of interests.

Informed consent: The author declares that this manuscript did not involve human or animal participants and informed consent was not collected.

References

Ahmed, H. I. S., Badr, A., El-Shazly, H. H., Watson, L., Fouad, A. S., & Ellmouni, F. Y. (2021). Molecular phylogeny of *Trifolium* L. section *Trifolium* with reference to chromosome number and subsections delimitation. *Plants*, *10*(10), 1985.

Altay, V., Karahan, P., Karahan, F., & Ozturk, M. (2018). Pollen analysis of honeys from Hatay/Turkey. *Biological Diversity and Conservation*, *11*(3), 209-222.

Altay, V., Ozyigit, I. I., Osma, E., Bakir, Y., Demir, G., Severoglu, Z., & Yarci, C. (2015). Environmental relationships of the vascular flora alongside the railway tracks between Haydarpaşa and Gebze (Istanbul-Kocaeli/Turkey). *Journal of Environmental Biology*, *36*(1), 153-162.

Bobrov, E. G. (1971). *Trifolium* L. In: Shishkin B. K. (ed) *Flora of The U.S.S.R.* (pp. 145-197). Moscova-Leningrad 1945, (English Translations, Jerusalem).

Boissier, E. (1849). *Diagnoses plantarum orientalium novarum* (Vol. 2). B. Hermann, 1-114.

Boissier, E. (1872). *Flora orientalis, sive enumeratio plantarum in Oriente a Graecia et Aegypto ad Indiae fines hucusque observatarum: 2: Calyciflorae polypetalae* (Vol. 2). Apud H. Georg, 1-1033.

Coombe, D. E. (1968). *Trifolium* L. *Flora Europaea*, *2*, 157-172.

Ellison, N. W., Liston, A., Steiner, J. J., Williams, W. M., & Taylor, N. L. (2006). Molecular phylogenetics of the clover genus (*Trifolium*—Leguminosae). *Molecular Phylogenetics and Evolution*, *39*(3), 688-705.

El-Macreq, R. (1986). *Trifolium* L. In: Mouterde, P. (ed). *Nouvelle Flore Du Liban et de la Syrie* (pp. 269-300). Ediscurs CIV-CXIII, Beyrouth.

Eskin, B., Altay, V., Ozyigit, I. I., & Serin, M. (2012). Urban vascular flora and ecologic characteristics of the Pendik District (Istanbul-Turkey). *African Journal of Agricultural Research*, *7*(4), 629-646.

Gillett, J. M., Taylor, N. L., & Collins, M. (2001). *World of clovers*. Iowa State University Press.

Greuter, W. (1976). The flora of Psara (E. Aegean Islands, Greece): an annotated catalogue. *Candollea: Journal International De Botanique Systématique*, *31*, 191-242.

Hossain, M. (1961). A revision of *Trifolium* in the Nearer East. *Notes from the Royal Botanic Garden Edinburgh*, *23*, 387-481.

Katznelson, J. (1966). A taxonomic revision of sect. *Calycomorphum* of the genus *Trifolium*. II. The anemochoric species. *Israel Journal of Botany*, *14*, 171-83.

Katznelson J. (1966). Corrigenda. *Israel Journal of Botany*, *15*(2), 80.

Katznelson, J., & Morley, F. H. W. (1965). A taxonomic revision of sect. *Calycomorphum* of the genus *Trifolium*. I. the geocarpic species. *Israel Journal of Botany*, *14*, 112-34.

Katznelson, J., & Zohary, D. (1970). Seed dispersal in *Trifolium* sect. *Calycomorphum*. *Israel Journal of Botany*, *19*(2-3), 114-120.

Keskin, M. (2001a). A contirbution to the genus *Trifolium* in Turkey. *Journal of Faculty of Pharmacy of Istanbul University*, *34*(2), 1-8.

Keskin, M. (2001b). The genus *Trifolium* L. Sect. *Chronosemium* Ser.(Fabaceae) in Turkey. *The Second Balkan Botanical Congress 1. Proceedings of The Second Balkan Botanical Congress Plants of Balkan Peninsula: into the Next Millennium.* İstanbul. 267-278.

Keskin M. (2011c). Türkiye florasına katkılar. *OT Sistematik Botanik Dergisi*, *18*, 1, 29-39.

Keskin, M., Sonay, V., & Balos, M. M. (2023). *Trifolium elazizense* (Fabaceae), a new species from Turkey. *Phytotaxa*, *583*(2), 199-206.

Keskin, M. E. (2003). Fabaceae familyasından yeni kare kayıtları. *OT Sistematik Botanik Dergisi*, *10*(2), 181-187.

Keskin, M. (2004a). İstanbul'un *Trifolium* L. (Fabaceae) türleri. *Kırsal Çevre Yıllığı*, 7-16.

Keskin, M. (2004b). Türkiye florasındaki *Trifolium* L. cinsi üzerinde incelemeler. *Article Present at the Meeting of the XVII. Ulusal Biyoloji Kongresi*, Adana, June, Turkey. 1-24.

Keskin, M. (2005). Türkiye de *Trifolium* L. cinsinden yeni bir takson kaydı ve bir türün varlığı. *Ot Sistematik Botanik Dergisi*, *12*(2), 21-24.

Keskin, M. (2007a). The genus *Trifolium* L. sect. *Micrantheum* (C.Presl) Gib. & Belli (Fabaceae) in Turkey. Poster session presented at the *International Symposium 7th Plant Life of South West Asia (7th PLosWA)*. June, Eskişehir, Turkey. 25-27.

Keskin, M. E. (2007b). Türkiye'de *Trifolium pratense* L.(Fabaceae) türü ve iki yeni varyete kaydı. *Ot Sistematik Botanik Dergisi*, *14*(2), 5-8.

Keskin, M. (2011a). Türkiye'de yayılış gösteren *Trifolium nigrescens* Viv. (Fabaceae) türünün taksonomik durumu. *OT Sistematik Botanik Dergisi*, *18*(2), 25-34.

Keskin, M. (2011b). Yoncalar (*Trifolium* spp.). *Bağbahçe*, *33*, 2-5.

Keskin, M. (2012). *Trifolium* L. In: Güner, A., Aslan, S., Ekim, T., Vural, M. & Babaç, M. T. (Eds) *Türkiye Bitkileri Listesi (Damarlı Bitkiler)* (pp. 488-498). Nezahat Gökyiğit Bahçesi and Flora Araştırmaları Derneği Yayını. İstanbul.

Keskin, M., Sonay, V., & Balos, M. M. (2023). *Trifolium elazizense* (Fabaceae), a new species from Turkey. *Phytotaxa*, *583*(2), 199-206.

Kocyigit, M., Dastan, M. K. T., Keskin, M., & Dastan, T. (2013). Pollen morphology of some *Trifolium* species which are favorite plants of honey bees in Istanbul. *Journal of Faculty of Pharmacy of Istanbul University*, *43*(2), 85-94.

Meikle, R. D. (1977). *Flora of Cyprus*. (pp. 437-471). Royal Botanic Garden, Kew.

Menemen, Y., Aytaç, Z., & Kandemir, A. (2021). Türkçe bilimsel bitki, mantar, suyosunu ve bakteri adları yönergesi. *Bağbahçe Bilim Dergisi*, *8*(3), 188-195.

Nichols, P. G. H., Smith, G. R., Moot, D. J., Ates, S., Porqueddu, C., Rios, E. F., ... & Ryan, M. H. (2023). Annual clovers around the world: current status and future prospects. *IGC Proceedings*, 1-4.

Oster, U. (1995). *Trifolium* L. In: Cullen J. (ed). *The European Garden Flora* (pp. 524-526). Cambridge Un. Press.

Ovalle, C., del Pozo, A., Fernandez, F., Charria, J., Arrendondo, S. (2010). Arrowleaf clover (*Trifolium vesiculosum* Savi): A new species of annual legumes for high rainfall areas of the Mediterranean climate zone of Chile. *Chilean Journal of Agricultural Research*, *70*(1), 170-177.

Ozturk, M., Altay, V., Gucel, S., & Aksoy, A. (2012). Aegean grasslands as endangered ecosystems in Turkey. *Pakistan Journal of Botany*, *44*, 7-18.

Ozturk, M., Dalgic, R., Guvensen, A., Altay, V., & Gucel, S. (2012). Honey-pollen-health: palinochemical analysis of honey from Turkey. *International Symposium on Medicinal Plants and Natural Products 1030*, Quito, (Ecuador). 83-92.

Roma-Marzio, F., D'Antraccoli, M., Astuti, G., Maccioni, S., Amadei, L., & Peruzzi, L. (2018). Typification of the names in *Trifolium* described by Gaetano Savi. *Taxon*, *67*(2), 411-421.

Severoglu, Z., Yasar, U., Keskin, M. & Serin, M. (2006). Contributions to the flora of Ballıkayalar National Park (Gebze, Kocaeli/Turkey). Plant, fungal and habitat diversity investigation and conservation,. *Proceedings of IV Balkan Botanical Congress*, 20-26 June 2006, *Sofia*, 427-429.

Tarakci, S., Altay, V., Keskin, M., & Sümer, S. (2012). Beykoz ve çevresi (İstanbul)'nin kent florası. *Karadeniz Fen Bilimleri Dergisi*, *3*(2), 47-66.

Thiers, B. (2024). Index Herbariorum: a global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium, http://sweetgum. nybg.org/ih/, Last accessed on April 23, 2024.

Townsend, C. C. (1947). *Trifolium* L. In: *Flora of Iraq*. Ministry of Agriculture and Agrarian, Reform of Republic of Iraq. 150-196.

Watson, L. E., Sayed-Ahmed, H., & Badr, A. (2000). Molecular phylogeny of Old-World *Trifolium* (Fabaceae), based on plastid and nuclear markers. *Plant Systematics and Evolution*, *224*, 153-171.

Zohary, M., & Heller, D. (1984). The genus *Trifolium*. The Israel Academy of sciences and humanities, Jerusalem, Israel. feed. *Biotechnology in Animal Husbandry*, *21*(3-4), 89-96.

Zohary, M., & Heller, D. (1970). *Trifolium* L. *Flora of Turkey and the East Aegean Islands*, *3*, 384-448.

Cite as: Keskin, M. (2024). Novelties in the genus *Trifolium* in Türkiye. *Front Life Sci RT*, *5*(2), 140-154.