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Revision of *Collema* Weber Ex. F.H. Wigg. Genus of Turkiye

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Abstract
Many lichens flora studies have been carried out within the borders of Türkiye, and as a result of these studies, a total of 35 taxa, including 25 species, 9 varieties and 1 subspecies, belonging to the genus *Collema*, have been identified. As a result of the studies, the categories of 28 taxa have been changed and they have been transferred to other genera. As a result of our work, samples were collected from 200 stations. *Collema* taxa were found in 54 of these stations. Taxa belonging to the genus *Collema* are *C. nigrescens, C. furfuraceum* from 12 locations, *C. subnigrescens* from 10 locations, *C. subflaccidum* from 7 locations, *C. flaccidum* from 5 locations, *C. ryssoleum* from 3 locations, and *C. texanum* var. *texanum* from 1 location collected. When taxa transferred from *Collema* to other genera are taken into consideration, the 4 most common taxa are *Lathagrium cristatum* (90), *Enchlium tenax* (75), *Blantholla crispa* (72) and *L. auriforme* (50).

Keywords: *Collema, Lichen, Revision, Turkiye*

Introduction

Lichens are represented on earth with approximately 25,000 species (Nash III 2008). Lichens are also known to be sensitive to environmental pollutants. Especially pollutant gases such as SO_2, NO_2, as well as sulfuric acid (H_2SO_4) and nitric acid (HNO_3) from acid rain, and heavy metals, trace metals, microplastic and radyoactivity are known to cause air pollution. Lichens are used as bioindicators due to their sensitivity to these atmospheric pollutants in the air. The first studies on Turkiye lichens were carried out by foreign researchers (Riegler 1852 Pisut 1970, 1971, Steiner 1905, 1909, 1916, Szatal 1927, 1940, 1941, 1960, Verseghy 1982). The first floristic studies of Turkish researchers started after the 1980s (Aslan et al. 1994, Çiçek et al. 1995, 1998, Özdemir-Türk 1990, 1997, 1998, Öztürk 1999, Yazıcı 1999). More detailed information about the lichen flora of Turkiye with a large number of studies in recent years have been obtained. 86% of the lichen studies were conducted in our country until 2007 cover floristic studies (John, 2007). It is seen that this rate is almost preserved in the studies up to the present day. To date, there is no specific study of the genus *Collema*. With this study, the species and categories of *Collema* species identified in our country were determined and presented. This study contributes to Turkiye's known lichen diversity and Turkiye has been carried out to make additions to the database in preparation for writing the lichen flora.

Materials and methods

Materials

The main material of our study was determined from locations across Turkiye, between the years 2016-2017 constitute collected 480 samples of lichen. Our research was carried out in two stages as field and laboratory work.

Field work and collection method

The materials we used in field work; digging tools such as knives, anchors or diggers for collecting lichens, GPS to determine the altitude and coordinates,

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or a phone with this feature, bags to carry the collected samples, blotter papers, camera to take samples, and paper and pencil to take notes. Between 2016 and 2017, lichen samples were collected by going to the land in a two-year period. Particular attention was paid to protecting the edges and central parts of the crustacean and some leafy specimens so that the morphological structures of the samples could collect together with a piece of lichens from their substrates such as rock, soil, bark, black moss. Sharp blade and chisels were used during the collection of samples on the bark. Care was taken to take samples in a complete and undamaged manner, as well as not to damage the tree from which the sample was collected. While collecting lichen samples on the rock, care was taken to remove the lichen tallus with the rock piece if possible. The collected materials were wrapped in soft papers and placed in bags made of plush paper. Subsequently, the substrate type, station coordinate and height, collection date, address of the known locality were written on these bags. Also, most of the studied areas were photographed and some of the samples collected were photographed while in their natural area.

Determination method and laboratory study

Various lichen flora books and determination keys were used for the determination of lichen collected from the land (Wirth 1995, Purvis et al. 1992, Brodo et al 2001). The materials brought to the herbarium were left to dry for a certain time (48-72 hours) at room temperature. All of the morphological examina- tions were made under the stereo microscope. Spores, which are an important factor in the determination of *Collema* species, were examined under a light micro- scope. Chemical reaction steps were not used for the determination of this type. Identified samples were labeled by placing them in lichen envelopes. The labeled samples are stored in Ankara University Lichen Herbarium (ANK).

Results

The recorded geographical locations of the samples were scanned from publications and the researched articles and publications were checked from the sources John and Türk, 2017 and John at al., 2020.

General characteristics of the species

Collema tyssoleum (Tuck.) A. Schneid.
Sin: *Collema meridionale* Hue. İsidia absent. Ascospors; elipsoid, 5 septum, 25-45 x 5-8 µm fusiform.

Table 1. *Location information of Collema tyssoleum*

Localities	Coordinates	Altitudes	Date	Substrates
Adana-Ceyhan Yılankale	N: 37° 00' 55" E: 35° 44' 48"	140 m	20.07.2017	on limestone rock
Çanakkale-Ezine road Mahmudiye village olive grove field	N: 39° 54' 36" E: 26° 18' 19"	43 m	31.07.2017	
Artvin-Kafkasör plateau in the forest after 500 m from the Koliva Hotel	N: 41° 10' 30" E: 41° 47' 32"	1208 m	28.08.2017	on *Picea orientalis*

Geographical Records:
Adana (Nimis and John, 1998): 44 - Çanakkale (Nimis and John, 1998): 44 - Muğla (Özdemir Türk and Candan, 2008): 4 - Trabzon (John and Breuss,2004): 147 - Steiner, (1909):114 (*Collema meridionale*).

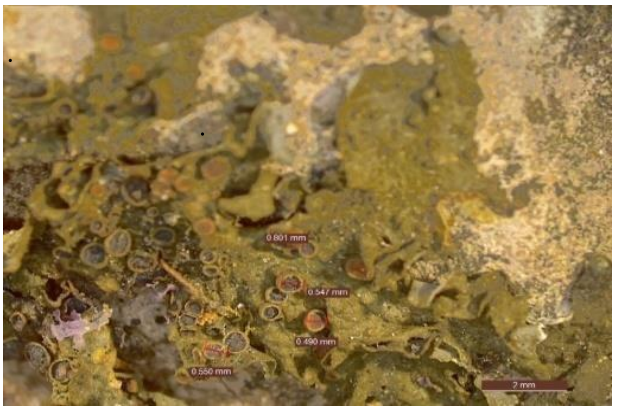

Figure 1. *Collema tyssoleum upper surface imags*

Collema texanum Tuck.
Sin: *Collema laciniatum* Nyl., Sin: *Collema nylanderianum* Zahlbr.
Tallus has very deep lobes, while re-branching at the ends. 1.5 cm wide. 130-350 µm thick. With a lobe width of up to 4 mm, Apotesium is available in dark red 1-1.5 mm width. Ascospores are characteristic with 2 compartments. rarely with 4 compartments. Septats do not contract. 12-22 x 4-7 µm.

Table 2. *Location Information of Collema texanum*

Localities	Coordinates	Altitude	Date	Substrates
Çorum, Tokat and Sivas Gokce village 10 km road turnoff to the left of the road	N: 40° 14' 56" E: 36° 32' 48"	807 m	01.12.2017	on limestone rock

Geographical Records:

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Figure 2 *Collema texanum* general view

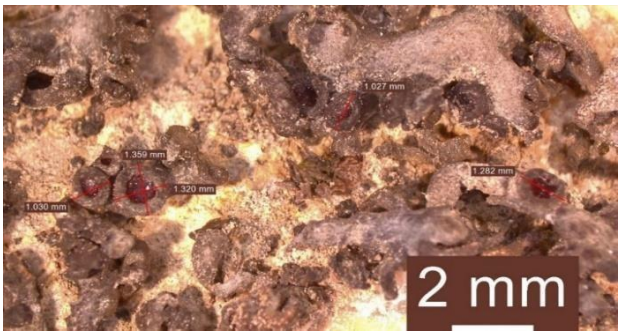

Figure 3 *Collema texanum* apotesium measurements

Collema flaccidum (Ach.) Ach.

They are 3-6 cm in diameter, foliose, pale, smooth or striped, usually colony; lobes 0.5-1.5 cm in diameter, loosely attached. As the Izids grow, they show a tile-like arrangement. Apotesium is rare; 1.5-2.5 mm in diameter. Ascospores; 26-34 x 6-6.5 µm ellipsoidal fusiform, 3-5 compartments. It can be grown on calcareous, siliceous rocks or on the tree trunk.

Table 3. *Location information of Collema flaccidum*

Localities	Coordinates	Altitudes	Date	Substrates
Antalya- Seydişehir road Yavpuz located	N: 37° 07' 30" E: 31° 50' 34"	1314 m	06.08.2017	on *Quercus* sp.
Artvin-Kafkasör plateau in the forest after 500 m from the Koliva hotel	N: 41° 10' 30" E: 41° 47' 32"	1208 m	28.08.2017	
Rize-Zilkale New road into the forest	N: 40° 57' 38" E: 40° 57' 39"	757 m	28.08.2017	on *Fagus orientalis*
Rize-Ayder road 19.4 km after the separation of Çamlıhemşin, the road is to the left of the rocks.	N: 41° 03' 40" E: 41° 00' 25"	238 m	28.08.2017	on the stump
Bartın-Muratbey village entrance	N: 41° 55' 34" E: 32° 22' 30"	20 m	03.12.2017	on limestone rock

Geographical records:

AdaHalıcı and Güvenç, 2008. Adıyaman; Candan and Özdemir Türk, 2008. Antalya; Tufan Çetin, 2010. Ardahan; Yazıcı et all., 2011na;. Artvin; Pisut and Guttova, 2008. Balıkesir; Öztürk and Oran, 2011. Bayburt; Yazıcı and Aslan, 2007. Bolu; Öztürk at al., 1998. Burdur; Yazıcı et al., 2015. Bursa; Güvenç and Öztürk, 2004; Öztürk, 1989; Yazıcı 1999. Çanakkale; Oran and Öztürk, 2011; Oran and Öztürk, 2012. Giresun; Kınalıoğlu, 2006; 2009. Hatay; John and Nimis, 1998; Yazıcı et al., 2010. Iğdır; Yazıcı et al., 2013. Isparta; Akgül, 2013. İstanbul; Çobanoğlu and Akdemir, 1997; Oran and Öztürk, 2011. Karabük; Öztürk and Güvenç, 2010. Kayseri; Halıcı, 2007. Malatya; Candan and Özdemir Türk, 2008. Mersin; Dinçer and Özdemir Türk, 2001. Ordu; Kınalıoğlu, 2010; Yazıcı et al., 2010. Osmaniye; Yazıcı at al., 2008. Rize; John and Breuss, 2004; Pisut and Guttova, 2008; Yazıcı and Aslan, 2002. Sakarya; Çiçek and Türk, 1998. Samsun; Kınalıoğlu, 2007. Sivas; Akgül et al., 2012. Trabzon; John and Breuss, 2004; Pisut and Guttova, 2008; Steiner, 1909 (Collema rupestre); Yazıcı, 1999; Szatala, 1960; Yazıcı et al., 2007. Trabzon; Yazıcı, 1993. Uşak; Kınalıoğlu, 2008.

Figure 4 *Collema flaccidum* general view

Figure 5 Image of *Collema flaccidum* isidia

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Collema subflaccidum Degel.

Tallus up to 6 cm in diameter. The lobes, which are attached to the ground with the petals, are curved and slightly rising from the ground, the lobes are close to the 0.5-1 cm wide circle. Isidia are generally globular and cylindrical. Apotesium is very rare, superficial, Disc 1.5-2.5 mm Ascospores; 42-65 x 4.5-6.5 µm generally straight or curved fusiform, 5-7 compartments. It develops on the crust, especially on aged *Fraxinus sp.* in damp and shady areas, rarely on rocks (Smith et al. 2009).

Geographical Records

Adıyaman; Candan and Schultz, 2015. Afyon; Kınalıoğlu, 2008. Antalya; Çetin, 2015; Çetin and Sümbül, 2008; John and Seaward, 2000; Kocakaya et al., 2014. Balıkesir; Özdemir, 2004. Bilecik; Hezarfen et al., 2001. Burdur; Yazıcı et al., 2015; Öztürk et al., 2005. Bursa; Uludağ, 2005; Töre, 2006; Oran and Öztürk, 2006. Çanakkale; Oran and Öztürk, 2011. Giresun; Kınalıoğlu, 2009; Selvi, 2011; Uzun, 2016. Hatay; John and Nimis, 1998. Iğdır; Yazıcı et al., 2012.Isparta; Koç, 2012. Karabük; İğci, 2013, İğci and Aytaç, 2016, Rize; Türüt, 2012. Sakarya; Öztürk and Güvenç, 2010, Tunceli; Çobanoğlu and Doğan, 2010. Uşak; Kınalıoğlu, 2008. Van; Aslan and Yazıcı, 2011. Zonguldak; Güvenç et al., 2009.

Table 4. *Location information of Collema subflaccidum*

Localities	Coordinates	Altitudes	Date	Substrates
Malatya-Adıyaman road Tunnel exit	N: 37° 55' 30" E: 37° 52' 27"	1220 m	22.07.2017	on limestone rock
Sinop-Gerze Dilemen road 6 km. right of the road in the forest	N: 41° 45' 15" E: 35° 13' 10"	145 m	22.08.2017	on the sand silica rock with moss
Artvin-Kafkasör plateau in the forest after 500 m from the Koliva hotel	N: 41° 10' 30" E: 41° 47' 32"	1208 m	28.08.2017	on the stump
Rize Ç.hemsin-Zilkale road 11. km. Right of road	N: 40° 57' 57" E: 40° 57' 56"	726 m	28.08.2017	on the wall (sand-silica)
Trabzon-Maçka Çatak 2 bridge 2.5 km after the center of Maçka. Forest road separation right of the road	N: 40° 48' 16" E: 39° 35' 39"	400 m	25.08.2017	on silica rock
Sinop-Erfelek Tatlıca Waterfall 34 km from Gerze-Sinop road separation.	N: 41° 50' 26" E: 34° 46' 47"	554 m	29.08.2017	on *Quercus* sp.
Sinop Erfelek 41 km from Tatlıca waterfall to Ayancık, on the right rock of the road	N: 41° 51' 56" E: 34° 45' 17"	610 m	29.08.2017	
Bartın-Muratbey village entrance	N: 41° 55' 34" E: 32° 22' 30"	20 m	03.12.2017	on *Fagus orientalis*

Figure 6. *Collema subflaccidum isidia image*

Figure 7. *Collema subflaccidum general view*

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Collema nigrescens (Hudson) DC.

Sin: *Liche nigrescens* Huds.

Tallus 2-6 (10) cm in diameter, folded, looks like frog-back skin. The lobes are 1 cm wide. Especially there are granular isidia with a diameter of 0.2 mm towards the center of the upper surface. dice-like, like a bat wing, when the edge is smooth or the striped lobes are wet, Lobes overlaps. Apotesium up to 0.4-1 mm diameter; Ascospores; 50-90 x 3-4.5 µm needle-shaped, elongated, 5-12 septate.

Geographical Records

Ankara; Yıldız et al., 2007.Antalya; Pisut, 1970; Nimis and John, 1998; Tufan et al., 2005; Tufan Çetin, 2010. Aydın; Samsun Dağı, 750 m, Quercus sp. üzerinden 29.8.1988, leg. M.R.D. Seaward (herb. Seaward 105801). Balıkesir; Öztürk and Oran, 2011. Bolu; Çobanoğlu and Akdemir, 2004. Burdur; Yazıcı et al., 2015. Bursa; Oran and Öztürk, 2011. Çanakkale; Oran and Öztürk, 2011. Giresun; Kınalıoğlu, 2006. Karabük; İğci, 2013; İğci and Aytaç, 2016. Hatay; John and Nimis, 1998. Isparta; Oran et al., 2007. İstanbul; Özdemir Türk and Güner, 1998; Rigler, 1852; Steiner, 1899 (Synechoblasturs nigrescens). Kütahya; Hezarfen et al., 2001. Mersin; Öz, 2013. Muğla; John, 2003; Halıcı and Aksoy, 2006. Niğde; Halıcı and Aksoy, 2009. Sinop; Özdemir Türk, 1997. Sivas; Yazıcı et al., 2008. Şanlıurfa; Candan and Özdemir-Türk, 2008. Trabzon; Yazıcı, 1999.

Table 5. *Location information of Collema nigrescens*

Localities	Coordinates	Altitudes	Date	Substrates
Ankara/Çubuk Karagöl promenade area	N: 40° 24' 42" E: 32° 54' 40"	1527 m	14.07.2017	on *Carpinus* sp. *Quercus* sp.
Adana-Ceyhan Yılankale	N: 37° 00' 55" E: 35° 44' 48"	140 m	20.07.2017	on limestone rock
Osmaniye-Toprakkale	N: 37° 02' 59" E: 36° 08' 10"	130 m	20.07.2017	on volkanic rock
Orhaneli-Bursa road. Than Erenler village 1 km. left of the road.	N: 40° 02' 54" E: 28° 54' 21"	634 m	27.07.2017	on sand-silica rock
İstanbul-Çatalca Karamandere village exit	N: 41° 22' 45" E: 28° 17' 45"	47 m	29.07.2017	on stump
Balıkesir-Edremit Kardağı Süteğen waterfall	N: 39° 38' 29" E: 26° 55' 18"	211 m	01.08.2017	on limestone rock, on *Olea europaea*
Manisa-Salihli Salihli Bozdağ road of National park	N: 38° 25' 04" E: 28° 05' 06"	895 m	02.08.2017	on limestone rock
Sinop-Gerze Dilemen road 6 km. right of the road. In the forest	N: 41° 45' 15" E: 35° 13' 10"	145 m	22.08.2017	on sand-silica rock, on moss
Samsun-Salıpazarı Karacaören road	N: 41° 03' 55" E: 36° 47' 50"	220 m	22.08.2017	on limestone wall
Samsun-Terme Gölardı-Çobanyatağı	N: 41° 16' 08" E: 36° 59' 17"	5 m	23.08.2017	on stump
Giresun-Keşap Karaishak village	N: 40° 53' 55" E: 38° 34' 16"	345 m	24.08.2017	on *Malus domestica*
Trabzon-Maçka, 19 km after Maçka. The road to the forest than 200 m.	N: 40° 42' 00" E: 39° 28' 51"	1200 m	25.08.2017	on *Carpinus* sp.
Kastamonu Devrekani	N: 41° 46' 15" E: 34° 04' 17"	1313 m	28.08.2017	on silica rock
Düzce-Ceneviz castle	N: 41° 05' 08" E: 31° 05' 36"	61 m	03.12.2017	on sand
Sakarya-Karasu	N: 41° 00' 24" E: 30° 46' 56"	20 m	03.12.2017	on limestone rock
Karabük-Gerede road. Yazıkavak village road separation 800 m inside the road, right side in-oak rocks	N: 40° 56' 32" E: 32° 34' 15"	835 m	02.12.2017	on sand silica rock, limestone rock

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Figure 8. *Collema nigrescens General image and apotesium image*

Figure 9. *Collema nigrescens Images from terrain.*

Figure 10. *Other Collema nigrescens wet images like frog skin.*

Collema subnigrescens Degel.

Tallus looks like frog skin, folded 2-6 (-20) cm in diameter. Folios to. the edge is smooth or striped, the lobes are 0.5-1.5 cm wide, the membrane is like a bat. wing when the upper surface is dark green to wet, from apotesium 0.8-2 mm; Ascospores; 40-75 x 4,5-7 µm needle-shaped, thin long tip resembles thicker fussuits, usually slightly curved, 5-12 compartments.

Table 6. *Location information of Collema subnigrescens*

Localities	Coordinates	Altitudes	Date	Substrates
Eskişehir- Sundiken dağı Çayköy mh. Köyün girişi yolun sol tarafı	N: 40° 02' 33" E: 30° 27' 03"	208 m	26.07.2017	on sand silica rock
Tekirdağ-Evrenbey village Karademir Dam side. Hilly area	N: 40° 57' 03" E: 27° 00' 03"	120 m	29.07.2017	on limestone rock
Balıkesir-Edremit Kardağı Süteğen waterfall	N: 39° 38' 29" E: 26° 55' 18"	211 m	01.08.2017	on *Olea europaea*
Kastamonu Ilgaz dağı national park	N: 41° 03' 43" E: 33° 43' 26"	1982 m	21.08.2017	on stump of *Abies normandionma* subsp. *bornmulleriana*
Samsun-Bafra Bafra'dan 10 km sonra yolun sağında kalan ormanlık alan	N: 41° 30' 37" E: 35° 58' 01"	86 m	22.08.2017	on *Quercus* sp.
Giresun-Doğankent Güdül village	N: 40° 47' 49" E: 38° 55' 52"	465 m	24.08.2017	on *Ostrya carpinifolia,* silica rock
Giresun-Keşap Karaishak village	N: 40° 53' 55" E: 38° 34' 16"	345 m	24.08.2017	on *Quercus* sp.
Gümüşhane-Zigana Torul-Trabzon road 15 km	N: 40° 39' 27" E: 39° 21' 30"	1465 m	25.08.2017	on limestone rock
Artvin-Karagöl Parking side, in the forest	N: 41° 23' 22" E: 41° 51' 27"	1516 m	28.08.2017	on moss
Artvin-Kafkasör plateau in the forest after 500 m from the Koliva hotel	N: 41° 10' 30" E: 41° 47' 32"	1208 m	28.08.2017	on stump of *Pinus nigra*
Artvin-Karagöl Bardnala waterfall Karagöl-Artvin road. 5. km right of the road	N: 41° 24' 33" E: 41° 50' 00"	1245 m	28.08.2017	on limestone rock

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Geographical records

Antalya; Nimis and John, 1998. Aydın; Nimis and John, 1998. Balıkesir; Oran et al., 2018. Bursa: Doğru and Güvenç, 2018. Denizli; Yavuz and Çobanoğlu, 2007. Eskişehir; Yavuz and Türk, 2017. Gaziantep; Halıcı et al., 2007. Giresun; Kınalıoğlu, 2005; 2006; 2009. Muğla; Nimis and John, 1998. Ordu; Kınalıoğlu, 2010. Trabzon; Yazıcı et al., 1999. Tunceli; Çobanoğlu and Doğan, 2010.

Figure 11. *Collema subnigrescens image from terrain*

Collema furfuraceum Du Rietz 1929

Sin: *Collemis rupestris* (Sw.) Clem.

Tallus 3-6 (-10) cm in diameter, upper surface from dark olive green to black, pale, transparent when wet, protruding, pale, thick, opened rosette shaped; Lobes are 0.5-1 cm wide, izids are present in the protruding parts. Hymenium hyalin 85-110 µm. Apotesium is very rare; 0,5-1,5 mm diameter, Askosporlar; 40-80 x 3-7 µm curved fusiform, 4-5 septate. It is a species that develops on the crust and sometimes on moist rocks. (Wirth 1995, Smith et al. 2009).

Geographical records

Afyon; Candan 2016; Sezer 2016. Antalya; Tufan et al., 2005; Tufan-Çetin and Sümbül, 2008.

Aydın; Nimis and John, 1998. Ardahan; Yazıcı et al., 2011. Balıkesir; John, 1999. Burdur; Yazıcı et al., 2015. Bursa; Oran, 2008. Aydın, 2002; Oran and Öztürk, 2006; Oran and Öztürk, 2011.Çanakkale; Oran, 2008. Oran and Öztürk, 2012. Erzincan; Karagöz and Aslan, 2012; Yazıcı and Aslan, 2003. Erzurum; Aslan, 2000. Eskişehir; Yavuz et al., 2015 Giresun; Kınalıoğlu, 2005. Gümüşhane; Yazıcı and Aslan, 2003. Hatay; John, 1996; John and Nimis, 1998. İstanbul; Oran, 2008; Oran and Öztürk 2011; Pisut, 1970. İzmir; John, 2000. Isparta; Oran et al., 2007. Kocaeli; PiGút, 1970. Konya; Kocakaya et al. 2014. Mersin; Öz, 2013. Rize; John and Breuss, 2004.

Trabzon; Yazıcı, 1999.

Table 7. *Location information of Collema furfuraceum*

Localities	Coordinates	Altitudes	Date	Substrates
Çanakkale-Ezine road Mahmudiye village olive grove field	N: 39° 54' 36" E: 26° 18' 19"	43 m	31.07.2017	on limestone rock
Entry to Balıkesir-Ayvalık Çakmak village	N: 39° 14' 49" E: 26° 48' 39"	113 m	01.08.2017	on limestone rock
İzmir Bozdağ Gölcük Land Ödemiş road Woodland Area	N: 38° 18' 21" E: 28° 03' 07"	1178 m	02.08.2017	on *Carpinus* sp.
Antalya-Alıneli-Seydisehir road Yavpuz location	N: 37° 07' 30" E: 31° 50' 34"	1314 m	06.08.2017	on limestone rock
Ordu-Fatsa Dolunay district	N: 41° 04' 04" E: 37° 26' 35"	58 m	23.08.2017	on sand-silica rock
Giresun-Gümüşhane road 15 km. roadside	N: 40° 54' 43" E: 38° 50' 43"	39 m	24.08.2017	on sand-silica rock
Artvin-Karagöl Parking side, in the forest	N: 41° 23' 22" E: 41° 51' 27"	1516 m	28.08.2017	on moss
Artvin-Kafkasör plateau in the forest after 500 m from the Koliva hotel	N: 41° 10' 30" E: 41° 47' 32"	1208 m	28.08.2017	on stump of *Pinus nigra*
Artvin-Karagöl Bardnala Waterfall Karagöl-Artvin road 5 km right of the road	N: 41° 24' 33" E: 41° 50' 00"	1245 m	28.08.2017	on limestone rock
Trabzon-Maçka 19 km after Maçka, the road going into the forest is 200 m. then left side	N: 40° 42' 00" E: 39° 28' 51"	1200 m	25.08.2017	on *Carpinus* sp.
Karabük- Safranbolu - Bartın road Aşağıdana village road junction left slopes	N: 41° 19' 07" E: 32° 41' 43"	957 m	02.12.2017	on limestone rock
Bartın-Muratbey village entrance	N: 41° 55' 34" E: 32° 22' 30"	20 m	03.12.2017	on *Quercus* sp.

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Figure 12. *Collema furfuraceum image from terrain*

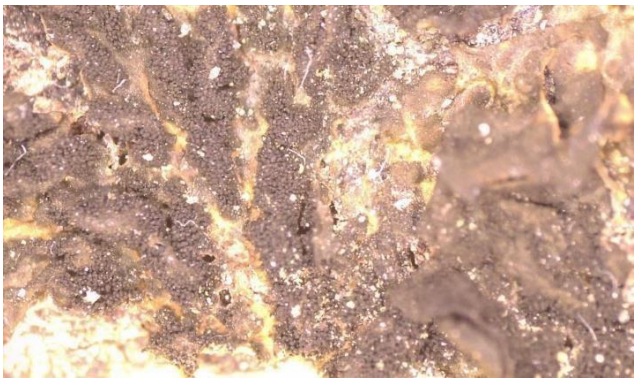

Figure 13. *Collema furfuraceum image thallus with numerous isidia*

Diagnostic Key

1 Tallus loosely attached to the surface, no apotecia 3
Tallus has more or less apotecia attached to the surface.....2 3 (1) Tallus surface is covered with isidia, these isidia are lined with tiles..... *flaccidum*
The surface of the tallus is covered with cylindrical isidia ..... *subflaccidum*
2 Wet tallus look like frog skin 4
Wet tallus is not like frog skin, lobes are branched like palm, includes fingerlike appendage .....*texanum* 4 (2) Tallus ridges contain abundant izid, apotesium few ..... *furfuraceum*
Apotecia is numerous 5
5 (4) Up to 1-2 mm diameter.....*subnigrescens*
Apotecia up to 1 mm diameter..... 6
6 (5) Askosporlar ellipsoid 5 septat, up to 45 µm long.....*ryssoleum*
Ascospores ellipsoid 5-12 septat, up to 50-90 µm in length .....*nigrescens*

Morphological and anatomical comparison of species. Comparison of the morphological and anatomical structures of *Collema* taxa is given in Table 8 below.

Table 8. *Morphological and anatomical comparison of species*

	Species	Thallus	Lob dimension	Apotesyum Dimension (mm)	Ascospore Dimension (µm)
1	*nigrescens*	1-5 (-10) cm diameter (60-) 90-150 µm thickness	05-1 cm	05-1 mm	50-90 x 3-4,5 µm
2	*subnigrescens*	2-6 (-20) cm	0,5-1,5 cm	1,5-2 mm	40-75 x 4,5-7 µm
3	*ryssoleum*	2-6 (-10) cm	0,5-1 cm	0,5-1 µm	25-45 x 5-8µm
4	*texanum*	Palm-like 1,5- 3 cm	0,5 cm 130- 350 µm	Frequent red 1-1,5 mm	12-22 x 4-7 µm
5	*furfuraceum*	Rosetta shaped (1-)3-6 (-10) cm	(0,2-) 0,5-1 cm 60-105 µm thickness	Rare 0,5-1,5 mm	40-80 x 3-7 µm
6	*flaccidum*	2,5-6 cm 70-170 µm thickness. Tile-like arrayed isidia	0,5- 1,5 cm	Rare 1,5- 2,5 mm	20-40 x 6-6,5 µm
7	*subflaccidum*	3-6 cm	0,5-1 cm	Rare 1,5-2 mm	42-55 x 4,5-6,5 µm

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Numerical distribution of the identified *Collema* species

After the examination and diagnosis of 480 lichen samples collected, 18 *C. nigrescens*, 12 *C. furfuraceum*, 10 *C. subnigrescens*, 7 *C. subflaccidum*, 5 *C. flaccidum*, 2 *C. ryssoleum* and 1 *C. texanum*. The *Collema* taxons has been found and is shown in detail in Figure 14.

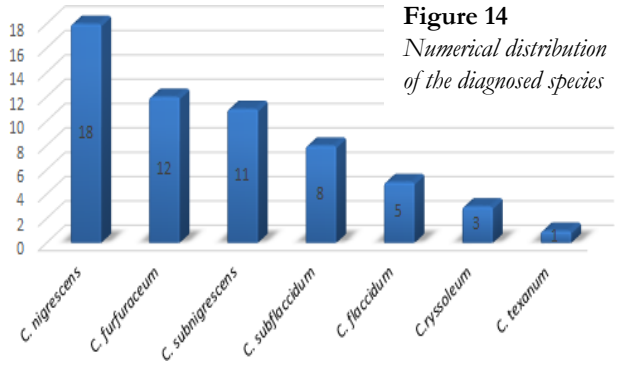
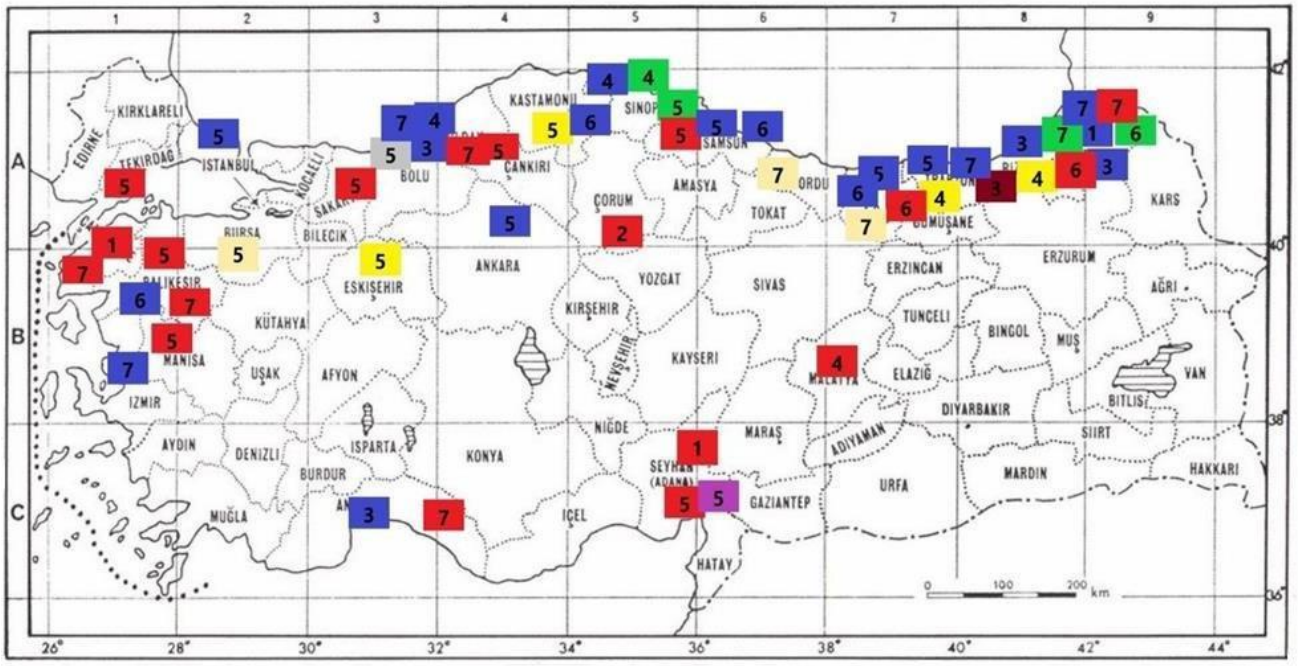


Figure 14
Numerical distribution of the diagnosed species

Distribution of substrates with *Collema* species

When the surfaces where *Collema* taxa are located are examined in detail, it is seen that they select the top of the tree trunk with 37%, then 26% on limestone rock, 22% on silica sand rock, 9% on moss as substrate, Soil and Limestone rock It has been determined that the taxon ratios that choose as substrate are 3% each. These data are shown in Figure 15 below.

Considering the climatic conditions and substrates of the places where the species samples were taken, it is understood that the *Collema* species is a species that develops better in places with high humidity, abundant rainfall or close to water sources. This situation is also understood from the distribution on the map of Türkiye. The samples are more common in the Aegean region, Marmara and Black Sea coasts.



Number for taxa
1. *C. ryssoleum* - 2. *C. texanum* - 3. *C. flaccidum* - 4. *C. subflaccidum*
5. *C. nigrescens* - 6. *C. subnigrescens* - 7. *C. furfuraceum*

Color for substrate
Red: tree trunk – Blue: limestone rock – Yellow: silica sand
Green: on moss – Purple: chalk stone – Grey: soil

Figure 15. *Substrate types with taxa (Davis, 1965)*

Most encountered of the transmitted species

Considering the taxa transferred from *Collema* to other genera, the 4 most common taxa are *Lathagrium cristatum* (90), *Enchlium tenax* (75), *Blantholla crispa* (72) and *L. auriforme* (50), respectively. This information is given as a graphic in Figure 16.

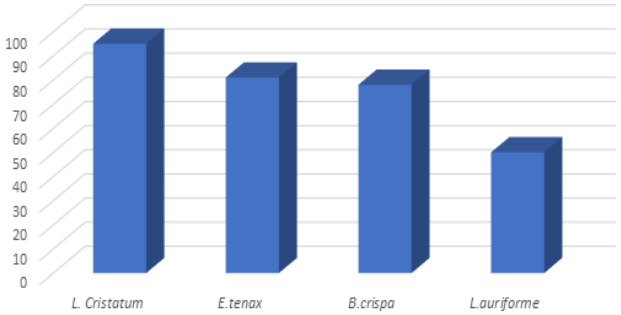


Figure 16. *Most common types of transferred species*

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Old and new status of taxa with change in name

As a result of the studies carried out by Otalora and his friends, the transfer, name and status changes made in some *Collema* taxon names that were found in our country were made and the status of 28 taxa was changed from our country. The taxa that have been modified are shown in Table 9. According to the table above, the distribution of *Collema* taxa according to the Figure 17 below.

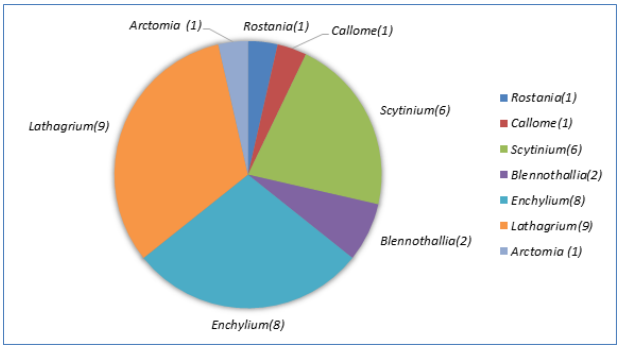

Figure 17. *Data on the genera including taxa transferred*

Table 9. *Changed taxa in the name*

Transfered Taxa Old Name	Transfered Taxa New Name
Collema latzelii Zahlbr.	***Lathagrium latzelii*** (Zahlbr.) Otálora, P. M. Jørg & Wedin
C. auriforme (With.) Coppins & J. R. Laundon	***L. auriforme*** (With.) Otálora P.M. Jorg. & Wedin
C. undulatum Flot.	***L. undulatum*** (Flot) Otálora P.M. Jorg. & Wedin
C. undulatum. var. ***undulatum*** Lourer ex Flot.	***L. undulatum*** var. ***undulatum*** (Lourer ex Flot.) Poetcsh
C. undulatum var. ***granulosum*** Degel.	***L. undulatum*** var. ***granulosum*** Degel.
C. cristatum (L.) Weber ex F.H. Wigg.	***L. cristatum*** (L.) Otálora P.M. Jorg. & Wedin
C. cristatum var. ***cristatum*** (L.) Weber ex F.H. Wigg.	***L. cristatum*** var. ***cristatum*** (L.) Flot.
C. cristatum var. ***marginale*** Huds. Degel.	***L. cristatum*** var. ***marginale*** (Huds.) Cl. Roux
C. fuscovirens (With.) Laundon	***L. fuscovirens*** (With.) Otálora, P. M. Jørg. & Wedin
C. dichotomum (With.) Coppins & J.R. Laundon	***L. dichotomum*** (With.) Otálora, P. M. Jørg. & Wedin
C. tenax (Sw.) Ach.	***Enchylium tenax*** (Sw.) Otálora, P. M. Jørg & Wedin
C. tenax var. ***tenax*** (Sw.) Ach	***E. tenax*** var. ***tenax*** (Sw.) Gray
C. polycarpon Hoffm.	***E. polycarpon*** (Hoffm.) Otálora P.M. Jorg. & Wedin
C. polycarpon var. ***corcyrense*** (Arnold) Degel.	***E. polycarpon*** var. ***corcyrense*** (Arnold) Degel.
C. coccophorum Tuck.	***E. coccophorum*** (Tuck.) Otálora, P. M. Jørg & Wedin
C. conglomeratum Hoffm.	***E. conglomeratum*** (Hoffm.) Otálora, P. M. Jørg & Wedin
C. limosum (Ach.) Ach.	***E. limosum*** (Ach.) Otálora P.M. Jorg. & Wedin
C. crispum (Huds.) F.H. Wigg.	***Blennothallia crispa*** (Huds.) Otálora, P. M. Jørg & Wedin
C. crispum var. ***crispum*** (Huds.) Weber ex F.H.Wigg.	***Blennothallia crispa*** var. ***crispum*** (Huds.) Otálora, P. M. Jørg & Wedin
C. callopismum A. Massal.	***Scytinium callopismum*** (A. Massal.) Otálora, P. M. Jørg & Wedin
C. callopismum var. ***callopismum*** A. Massal.	***S. callopismum*** var. ***callopismum*** (A. Massal.) Otálora, P. M. Jørg & Wedin
C. fragrans (Sm.) Ach.	***S. fragrans*** (Ach.) Otálora, P. M. Jørg & Wedin
C. parvum Degel.	***S. parvum*** (Degel.) Otálora, P. M. Jørg & Wedin
C. plicatile (Ach.) Ach.	***S. plicatile*** (Ach.) Otálora, P. M. Jørg & Wedin
C. leptogioides Anzi	***S. leptogioides*** (Anzi) Otálora, P. M. Jørg & Wedin
C. fasciculare (L.) F.H. Wigg.	***Arctomia fascicularis*** (L.) Otálora & Wedin
C. occultatum Bagl.	***Rostania occultata*** (Bagl.) Otálora, P. M. Jørg & Wedin
C. multipartitum Sm.	***Callome multipartita*** (Sm.) Otálora, P. M. Jørg & Wedin

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