Cladonia uncialis subsp. *biuncialis*, *Scythioria phlogina* and *Sticta limbata* – three new lichen records for Turkey and Asia

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Zusammenfassung: Drei Flechten – *Cladonia uncialis* subsp. *biuncialis*, *Scythioria phlogina* und *Sticta limbata*, die in den Provinzen Trabzon und Bingöl (Türkei) gesammelt wurden – werden als neu für die Türkei gemeldet. *Cladonia uncialis* subsp. *biuncialis* ist auch neu für Asien. Die Beschreibungen werden durch Anmerkungen zu geographischer Verbreitung und Chemie sowie durch Vergleiche mit morphologisch ähnlichen Taxa ergänzt.

Abstract: Three lichens – *Cladonia uncialis* subsp. *biuncialis*, *Scythioria phlogina* and *Sticta limbata*, collected from Trabzon and Bingöl provinces (Turkey) – are reported as new to Turkey. *Cladonia uncialis* subsp. *biuncialis* is also new to Asia. Descriptions are supplemented by notes on geographic distribution and chemistry and comparisons with morphologically similar taxa.

In the last five years some new lichens or new lichen distribution records have been added to the lichen funga of Turkey (APTROOT & YAZICI 2012, 2017; YAZICI & AP-TROOT 2017; YAZICI & ASLAN 2016a,b). However, there are still many unexplored parts of Turkey although studies on lichen flora of Turkey have recently been increasing (CANDAN 2017, KINALIOĞLU 2017, KINALIOĞLU & APTROOT 2017, KOÇ ŞEREF & al. 2017, YAZICI & al. 2017). Thus extensive explorations are urgently needed for more regions of Turkey. Approximately 1700 lichen taxa are known from Turkey but only 25 lichen species had previously been reported from Bingöl region of Turkey (JOHN & TÜRK 2017).

Within our projects "Lichen flora of Tunceli and Bingöl Provinces" and lichenological survey for Trabzon we found some interesting lichen taxa. Sixty-eight species of *Cladonia* and two *Sticta* spp. have been reported from Turkey but no *Scythioria* species (JOHN & TÜRK 2017). The present contribution results from fieldwork in the region of Bingöl and Trabzon (eastern Turkey) and reports three new records of lichens for Turkey and one for Asia.



Fig. 1. *Cladonia uncialis* subsp. *biuncialis*. *a* Secondary thallus with podetia. *b* Podetia with white powdery surface, irregular dichotomously and trichotomously branching. *c* Podetia with pointed and dichotomously forked branch tips. *d* Breakable, swollen and hollow podetia with perforated axil. *e* Branch tips terminally pointed and dichotomously forked. *f* Main branches (hole) surrounded by small branches. Bars: a-c, e, f 1 cm, d 5 mm.

Materials and methods

Material: KENAN YAZICI and DILARA KARAHAN collected lichen samples in July and August 2018 during a lichenological survey of the Bingöl and Trabzon regions (Turkey).



Fig. 2. *Scythioria phlogina.* a-c Thallus with soralia, habitus. *d* Soredium. *e* Apothecium with proper margin, the disc and thalline margin. *f* Ascospores. Bars: *a*, *b*, *c* 5 mm, *d* 30 μ m, *e* 1 mm, *f* 20 μ m.

The descriptions are based on Turkish specimens and vouchers are stored in the Herbarium of the Biology Department, Karadeniz Technical University, Trabzon, Turkey (KTUB).

Samples were examined using a Nikon Zeiss Stemi 2000-c stereomicroscope and a Zeiss Axio Imager A2 light microscope. Macro- and microphotographs were taken with the digital camera Zeiss AxioCam ERc5s. The lichens were idetified by consulting the relevant keys (NASH & al. 2004, SMITH & al. 2009, VONDRÁK & al. 2010).

Study area: The Sis Mountain (Trabzon region, the Şalpazarı district) is mountainous and mainly covered by deciduous and coniferous trees and has also alpine and subalpine zones with rocks and grasslands (BAYTOP & DENIZCI 1963). Forest tree species are predominatly *Alnus glutinosa*, *Buxus*

sempervirens, Castanea sativa, Carpinus betulus, Fagus orientalis, Juglans regia, and Picea orientalis. The flora is very species-rich and abundant, although some parts of the mountains are covered with rocks. The region has oceanic climate characterized by warm winters, cool summers and rain all seasons. Temperatures range from -7.4 to 38.2 °C, with a mean annual temperature of 14.6 °C, and the mean annual rainfall ranges from 730 to 1680 mm with an average humidity of 80 % (AKMAN 1999).

Bingöl has a hard continental climate with plenty of rain and snow, hot and dry summers, and long snowy winters. The mean annual temperature is 8.7 °C and the temperature ranges from –9°C to 39°C. The mean annual rainfall is about 900 mm (AKMAN 1999).

Bingöl has many valleys with streams, a poor plant cover, 15 % of it covered by forests and 75 % by meadows and grasslands. Tree communities are formed mostly by *Quercus* but some areas are completely treeless; sometimes deciduous trees are seen such as *Populus* or *Salix* in some villages and roadsides (BAYTOP & DENIZCI 1963).

Species records

Cladonia uncialis (L.) WEBER ex F. H. WIGG. subsp. *biuncialis* (HOFFM.) M. CHOISY, Bull. Mens. Soc. Bot. Lyon 20: 9 (1951). (Fig. 1)

Primary thallus: squamulose.

S e c o n d a r y t h a l l u s : fruticose, mature p o d e t i a up to 6 cm tall, without s c y p h i and basal s q u a m u l e s (Fig. 1a), whitish, pale yellow-green or grey-green, branchlets breakable hollow, like swollen, most of the axils perforate; inner surface powdery; branching mostly irregular, dichotomous and trichotomous (Fig. 1a,b,d); terminal branch tips pointed, \pm dichotomously forked and purple-brown (Fig. 1c,d,e); main branches (hollow) surrounded by small branches (Fig. 1f). Thallus C–, KC+ yellowish, Pd–, UV+ white.

A detailed description is provided by SMITH & al. (2009).

Specimen examined: Turkey, Trabzon: Şalpazarı, Sis Mountain, Bakır Alan Plateau, 40° 52' 27" N, 39° 07' 02" E, 1889 m s. m., on mosses and soil, 1. May 2018, K. YAZICI, A. ASLAN & D. KARAHAN (KTUB-2467). Associated species *Cladonia pyxidata* and *Cladonia coniocraea*.

Notes: *Cladonia uncialis* subsp. *biuncialis* mainly occurs on damp or dry acid soils, particularly on moorlands, mosses, maritime, also coastal aerohaline heathlands at all altitudes (SMITH & al. 2009). This species was previously known from Europe (Belarus, Denmark, England, Finland, Germany, Ireland, Latvia, Norway, Spain, Sweden), Azores, North America and is new to Turkey and Asia (SMITH & al. 2009).

Cladonia uncialis subsp. biuncialis is similar to C. uncialis subsp. uncialis. But the surface of the central canal is not powdery in C. uncialis subsp. uncialis, while it is powdery in C. uncialis subsp. biuncialis. Cladonia uncialis subsp. biuncialis has podetia \pm irregularly dichotomously branched but podetia of C. uncialis subsp. uncialis show terminal tri- to polychotomously branching in star form (SMITH & al. 2009).

Scythioria phlogina (ACH.) S. Y. KONDR., KARNEFELT, ELİX, A. THELL & HUR, in KONDRATYUK, KARNEFELT, THELL, ELIX, KIM, JEONG, YU & HUR, Acta Bot. Hung. 56(1–2): 164 (2014). (Fig. 2)

T h a l l u s : corticolous, smooth, greenish yellow, lemon yellow or yellow, discontinuous to continuous, 1.5-3.5 cm in diam., $100-250 \mu$ m thick (Fig. 2a,b,c); s o r a l i a circular, greenish yellow or lemon-yellow (Fig. 2c); convex, punctiform,

erumpent from areoles (Fig. 2c); s o r e d i a $40-70 \mu m$, yellow-grey, greenish yellow or yellow (Fig. 2d);

A p o t h e c i a : present, 0.25 mm in diam., sessile, \pm regular; d i s c orangeyellow, \pm white p r u i n a; p r o p e r m a r g i n paler than the disc; t h a l l i n e m a r g i n concolorous with the thallus (Fig. 2e); a s c o s p o r e s polaribilocular, 10– 12.5 × 3–4 µm, ellipsoid, hyaline, without e p i s p o r e (Fig. 2f). Thallus and soredia K–, apothecia K+ red.

A detailed description is provided by VONDRÁK & al. (2010).



Fig. 3. *Sticta limbata. a, b* Thallus with soredia. *c* Soredia on the thallus and margins. *d* Lower surface of the thallus. *e* Tomentose lower surface with cyphellae. *f* Tomentose lower surface. Bars: *a, b, d*–*f* 1 cm, *c* 2 mm, *d* 1 cm, *e* 1 cm, *f* 1 cm.

Specimen examined: Turkey: Bingöl: Adaklı, 3 km to Çatma, mainroad side, 39° 14' 29.22" N, 40° 33' 10.12" E, 1580 m s. m., on *Juglans*, 28. August 2018, K.YAZICI & D. KARAHAN (KTUB-2470). Associated species *Caloplaca cerina, Myriolecis hageni* and *Physcia aipolia*.

Notes: *Scythioria phlogina* grows mostly on trunks and twigs of deciduous trees (VONDRÁK & al. 2010). It was previously known from England, Germany, Montenegro (Karadağ), India and Azores, and is new to Turkey (SMITH & al. 2009).

Scythioria phlogina resembles Solitaria chrysophthalma, Flavoplaca citrina and F. flavocitrina, but the thin thallus and pale yellow soralia in S. phlogina help to differentiate from Solitaria chrysophthalma. On the other hand soredia in Flavoplaca citrina, growing on rock, are larger than those of Scythioria phlogina and apothecial discs are orange and with crenulate-sorediate exciple. Flavoplaca flavocitrina has yellow soredia at the tips of squamules (SMITH & al. 2009).

Sticta limbata (SM.) ACH., Methodus, Sectio post. (Stockholmiæ): 280 (1803). (Fig. 3)

T h a l l u s : foliose, slightly palmate, up to 4.5(-5) cm in diam., loosely adnate, gray, pale gray, pale gray brown or brown, *c*. 0.20 mm thick, surface shiny, smooth, some parts uneven and slightly wavy, lobate; lobes 1-1.5(-2 cm) wide, rounded, mostly into 3-4 mm inwards divided into smaller lobes, these 2-4 mm wide, or sometimes 1.5-2.5 cm inwards deeply divided into lobes, some parts of lobe margins wavy, ascending, concave or palmate concave; lobe tips slightly recurved down (Fig. 3a,b). I s i d i a absent; s o r e d i a blue gray or slightly gray brown, coralloid-isidia like, mostly along the lobe margins and also on the surface, pustulate or forming convex groups 1-1.5 mm wide at first, expanding and spreading in pustulate clusters 4-5 mm wide mostly towards the surface of the lobe tips, later breaking off and excavate when old (Fig. 3c), sometimes linear, 0.5-2 mm wide and covering almost all lobe margins; 1 o w e r s u r f a c e uniformly creamy brown, creamy yellow, \pm yellow brown or brown, entirely white creamy felted-tomentose, with c y p h e 11 a e (Fig. 3d,e,f) 0.5-1 mm in diam., round or angular, larger towards the center; m e d u 11 a white (Fig. 3e). A p o t h e c i a not seen. Thallus and medulla K-, C-, KC-, P-; soredia K + rust red, C-, P-, KC-.

A detailed description is provided by NASH et al. (2004).

Specimen examined: Turkey: Trabzon: Şalpazarı, Sis Mountain, Kireçhane Plateau, 40° 51′ 25″ N, 39° 09′ 48″ E, 1598 m s. M., on mosses, 9. April 2018, K. YAZICI A. ASLAN & D. KARAHAN (KTUB-2471); - Trabzon: Şalpazarı, Sis Mountain, Kireçhane Plateau, 40° 51′ 28″ N, 39° 09′ 50″ E, 1602 m s. m., on mosses and decayed branch of cf. *Fagus orientalis*, 9. April 2018, K. YAZICI, A. ASLAN & D. KARAHAN (KTUB-2472).

Notes: *Sticta limbata* mainly grows on somewhat exposed mosses, rocks and parklands (SMITH & al. 2009). It was previously known from Africa, Asia (China, India, New Zealand, South Korea), Australia, Canada, Europe (Cape Verde, Germany, Ireland, Italy, Norway, Portugal, Spain, Sweden), Macaronesia, North and South America (SMITH & al. 2009), and is new to Turkey.

Sticta limbata is confused with *Nephroma parile*, but *N. parile* has a smooth lower surface without cyphellae. Species associated with our specimens were *Nephroma parile*, *Peltigera collina* and *P. membranacea* (SMITH & al. 2009).

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