

LICHENOSTIGMA COSMOPOLITES, A COMMON LICHENICOLOUS FUNGUS ON XANTHOPARMELIA SPECIES

JOSEF HAFELLNER (1) and VICENT CALATAYUD (2)

(1) Institut für Botanik, Karl-Franzens-Universität, Holteigasse 6, A-8010 Graz, Austria.

(2) Centro de Estudios Ambientales del Mediterráneo, Parc Tecnològic, C/ Charles R. Darwin 14, E-46980 Paterna (València), Spain.

ABSTRACT: The widely distributed *Lichenostigma cosmopolites* is described as new and its position in that genus is discussed. Earlier records of presumed *Echinothecium reticulatum* on *Xanthoparmelia* species mostly refer to this ascomycete. The fungus lives on a number of *Xanthoparmelia* species and is extremely widely distributed. It is known from all continents but Antarctica.

KEY WORDS: Ascomycotina, Arthoniales, *Lichenostigma cosmopolites*, *Xanthoparmelia*, lichenicolous fungi

Introduction

Lichenicolous ascomycetes whose ascomata are connected with conspicuous vegetative hyphae are known in several orders including Sordariales, Dothideales and Arthoniales. Well known are the superficial hyphal nets of *Echinothecium reticulatum* and several *Sphaerellothecium* species. Similar hyphal strands are also produced by a number of *Lichenostigma* subgen. *Lichenogramma* species. As fissitunicate asci and mostly one-septate ascospores are typical for all these taxa, misinterpretations of species and false determinations of specimens frequently occur.

One of these species, known for a long time but commonly misunderstood, is treated below in detail. Vouaux (1912) was as far as we know the first to report what he supposed to be *Echinothecium reticulatum* Zopf on *Xanthoparmelia conspersa* (Ehrh. ex Ach.) Hale referring to collections made by Arnold and Rieber in northern Italy. This fungus proved to be widespread and was continuously determined as *Echinothecium reticulatum* (see below). More thorough investigations performed by the authors showed that this species is hitherto undescribed and belongs to *Lichenostigma* subgen. *Lichenogramma*. Recently Girlanda et al. (1997) investigated the mycoflora on *Xanthoparmelia somloensis* (Gyeln.) Hale (sub *Parmelia taractica*) applying isolation techniques. The fungus treated here however has not been among the detected fungal taxa or is hidden among the undetermined sterile dematiaceous mycelia.

Material and methods

Dried herbarium specimens, cited together with the treatment of the species, were used. External morphology was studied with a dissecting microscope (WILD M3, 6,4x - 40x), anatomical studies of the thallus and the ascomata were carried out by use of light microscope (REICHERT POLYVAR, 40x - 1000x). Sectioning was performed with a freezing microtome (LEITZ, sections of 12 - 15 mm) but squash preparations were also used especially for ascus analysis. Preparations were mounted in water. When necessary, contrasting was performed by a pretreatment with lactic acid-cotton blue (MERCK 13741). Amyloid reactions in hymenia were observed both progressively and regressively by the use of Lugol's reagent (MERCK 9261). Sections and squash preparations were pretreated with KOH, when hemiamyloidy of hymenial elements was to be checked. Measurements refer to dimensions in ordinary water.

Results

Lichenostigma (subgen. ***Lichenogramma***) ***cosmopolites*** Hafellner & Calatayud spec. nov.

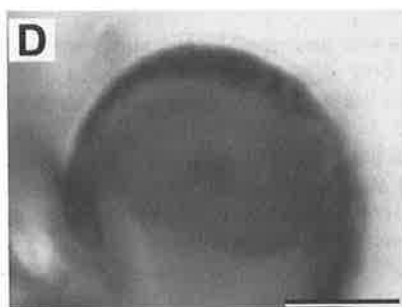
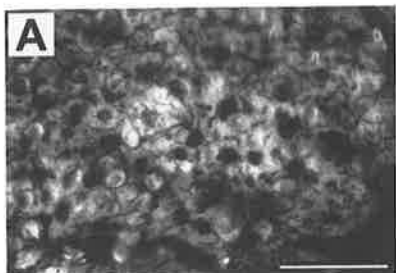
Fungus prima vista *Sphaerellothecium* quisquam valde similis, sed centrum ascomatis hemiamyloideum, asci latiores et ascosporae crassiores. Species differt a *L. maureri*, *L. rugosa* et *L. hyalospora* praesentia hypharum superficialium fuscarum et a *L. elongata* ascomatibus rotundatis et filis superficialibus haud compositis. Habitat supra thallum *Xanthoparmelium* diversarum.

Typus: Spain: Prov. Valencia: Serra Calderona, Puçol, El Picaio, U.T.M. 30SYJ3091, 350 m, sobre arenisca, on *Xanthoparmelia tinctoria*; 26. II. 1992, V. Calatayud 7982 (VAB - Holotypus).

Vegetative hyphae partly superficial, spreading over the host thallus and rarely also on the apothecial discs, single stranded, dark brown, septate, ramified to net-like, hyphae connecting also the ascomata, slightly constricted at the septa, hyphal cells 6 - 8 (- 10) x (4 -) 5 - 7 μm , upper surface sculptured, sculptural elements punctiform, less than 1 μm in diam., sometimes in short longitudinal rows, additional deeper cracks sometime present (Fig. 1B).

Ascomata superficial, scattered, subglobose to ellipsoid, dark brown to black, rough but without setae (Fig. 1C), 60 - 100 μm wide and 30 - 45 μm tall, opening apically with roundish to irregular ruptures; in longitudinal section outermost cells brown, subglobose, 5 - 7 μm in diam., covered by a granular brown pigment (from the outside cells of ascoma wall with punctiform sculpture), internal cells hyaline, subglobose, 3 - 6 μm in diam., filling up the ascoma. **Interascal filaments** absent.

Fig. 1: *Lichenostigma cosmopolites* A Surface view of a portion of *Xanthoparmelia conspersa* (scale = 0.5 mm). B Superficial hypha (scale = 10 μm). C Ascus (scale = 20 μm). D Ascus apex showing the reaction of the ascus wall after treatment with KJ and the presence of a ring structure in the endoascus (scale = 5 μm). E Ascospores (scale = 5 μm). (VAB no. 7983).



Asci about 4 – 8 per ascoma, broadly clavate to subglobose, 15 - 20 x 12 - 15 μm , fissitunicate of *Arthonia*-type, ascial wall apically thickened, with large apical dome, 8-spored (Fig. 1D). **Ascospores** hyaline, later brownish with age, 1-septate, lower cell slightly narrower than upper cell, often guttulate, 8 - 10 (- 11) x 3 - 4 (- 5) μm (Fig. 1E), young spores with prominent perispore forming a halo, perispore sheath later condensing and forming a fine punctiform sculpture on the surface of the spore wall. **Reactions:** Gel of the centrum hemiamyloid, I+ orange-red, K/I+ blue, ascus wall K/I+ bluish around the apex of the ocular chamber but this reaction difficult to see in mature asci, ascial periplasma I+ orange, dextrinoid. All parts K-.

Observed hosts: *Xanthoparmelia conspersa* (1), *X. somloensis* (2), *X. tinctina* (3), *X. chlorochroa* (4), *X. coloradoensis* (5), *X. coreana* (6), *X. cumberlandia* (7), *X. dichotoma* (8), *X. filarszkyana* (9), *X. isidiigera* (10), *X. leonora* (11), *X. tasmanica* (12), *X. mexicana* (13), *X. microspora* (14), *X. multipartita* (15), *X. notata* (16), *X. protomatrae* (17), *X. pseudohypoleia* (18), *X. cf. standaertii* (19), *X. subdistorta* (20), *X. substrigosa* (21), *X. succedans* (22), *X. tuberculiformis* (23), *X. ulcerosa* (24), *X. weberi* (25), *X. wildae* (26), *X. wyomingica* (27), *X. maricopensis* (28), *X. spec. indet.* (29).

Discussion: Although it cannot be excluded with certainty that a further species inhabits thalli of the same host genus, we assume that it was *L. cosmopolites*, rather than '*Echinothecium reticulatum*', that was recorded on *Xanthoparmelia* from various European countries (e.g. Diederich et al. 1992, Etayo 1997, Grube 1993, Hafellner 1993, 1994, Keissler 1930, Lettau 1919, 1958, Navarro-Rosines et al. 1994, Nimis & Poelt 1987, Santesson 1993, Vouaux 1912). The true *E. reticulatum*, the ascomata of which are provided with septate seta-like hyphae (see the drawings in Zopf 1898: 246 as well as Navarro-Rosinés & Gomez-Bolea 1989: 64), grows as far as we know exclusively on species of *Parmelia* s. str. (i.e. the *Parmelia saxatilis* group).

Lichenostigma subgen. *Lichenogramma* was described by Navarro-Rosinés and Hafellner (1996), comprising originally only *L. elongata* Nav.-Ros. & Hafellner. The key characters of this subgenus are the oval to elongate ascomata that are connected with superficial pigmented hyphae. *L. elongata* differs from *L. cosmopolites* e.g. by having plurihyphal superficial strands and more elongated ascomata and it is restricted to *Aspicilia* and *Lobothallia* species. The other three known *Lichenostigma* species, *L. usneae* Hafellner, *L. rugosa* Thor, and *L. hyalospora* Kalb & Hafellner lack conspicuous brown superficial vegetative hyphae (Hafellner 1982, Thor 1985, Kalb et al. 1995). *L. usneae* is found on a number of macrolichens, *L. rugosa* grows exclusively on *Diploschistes* species, and *L. hyalospora* is known only from the few Australian collections, with *Haematomma eremaeum* being the host. A few further species of *Lichenostigma* may be hidden among the bunch of *Lichenothelia* species described by Henssen (1987), as some are said to grow on lichens (*Lichenothelia convexa* Henssen pro parte, *L. patagonica* Henssen pro parte, *L. tenuissima* Henssen pro parte), however for none of them a *Xanthoparmelia* is mentioned as host.

Regarding the correct position of *Lichenostigma* in the system of Ascomycotina there is some confusion in the literature. In the most recent edition of the "Dictionary of the Fungi" (Hawksworth et al. 1995: 246) and the "Outline of the Ascomycetes" (Eriksson & Hawksworth 1998) the genus is placed in the Dothideales (Lichenotheliaceae). However the presence of polysaccarides in the ascus wall reactive with Lugol's reagent, that are present in at least some species, support its inclusion in the order Arthoniales.

Distribution: widespread in extratropical regions of both hemispheres (Europe, Asia, Africa, North America, South America, Australia), in temperate regions mainly in the lowlands, in tropical regions only from mid elevations upwards.

Further specimens seen (The numbers in brackets before the date refer to the corresponding numbers in the list of the hosts given above. Collections preserved under the name of the host lichen are indicated by an asterisk* after the number which refers to the host. The names of the authors are abbreviated by their initials):

Europe: Norway: Oppland: Vågå, N-Ufer des Sees Vågávavn ca. 2 km W von Vågåmo, ca. 450 m; S-exponierte Schieferschrofen in einer Triftweide, (2); 29. VIII. 1984, J. H. 11427 & A. Ochsenhofer (GZU). - Oppland: Vågå, ca. 1 km W von Vågåmo; Schieferabbrüche ober der Straße am Nordufer des Sees Vågávavn, ca. 400 m, (2); 29. VIII. 1984, J. H. 11348 & A. Ochsenhofer (herb. Hafellner).

- Czech Republic: Bohemia merid., Lomnice n./L., Hráze rybníku, (2*); 24. III. 1886, A. Weidman (GZU). - Austria: Niederösterreich: Waldviertel, Ritterkamp 2,5 km N von Rappottenstein, 750 - 800 m, MTB 7456, 7. IV. 1994, J. Poelt & R. Türk (GZU). - Steiermark: [Gurktaler Alpen], bei Murau, Gestüthofbrücke, (17); 29. IV. 1906, B. Fest (GZU). - Steiermark: [Gurktaler Alpen], 2 km NW von Neumarkt, beim Gasthof Vetterl, 900 m, MTB 8952/1, auf niederen phyllitischen Felsblöcken in einer Viehweide, (2*), 13. IX. 1987, W. Obermayer 1874 (GZU). - Steiermark: bei Teufenbach, auf Felsen, (17); 23. VII. 1906, Weisbach (GZU). - Steiermark: Seetaler Alpen, W-Abhang, 1 km E von Perchau, beim Gehöft Pacher, ca. 1140 m, MTB 8852/4, in einer Viehweide, auf Bodensteinen (1*); 20. III. 1987, W. Obermayer 1863 (GZU). - Steiermark: [Seetaler Alpen], bei Neumarkt, auf Felsen, (2); 30. VII. ?, herb. Weisbach (GZU). - Steiermark: [Seetaler Alpen], 4 km E von Scheifling, Feßnach, beim Gehöft Ertl, ca. 1000 m, MTB 8852/4, auf einem Feldblock am Waldrand, (2*); 20. III. 1987, W. Obermayer 1872 (GZU). - Steiermark: Oststeirisches Hügelland, Klösch, S-Hänge N ober der Kirche, ca. 350 m, MTB 9261/2, auf niederen Basaltschrofen, (1); 24. III. 1994, J. H. 41068 & B. Wieser (GZU). - Steiermark: E-exponierte felsige Abbrüche W über der Kirche von Klösch, 330 - 350 m, (1), 20. XI. 1988, leg. J. Poelt (GZU). - Kärnten: zwischen Mühlndorf und Möllbrücke, auf einem Gneisblock, (2); 15. II. 1953, W. Kuhnelt (GZU). - Tirol: Osttirol, Hohe Tauern, Virgental, am Eingang ins Dorfertal, S-exponierte Hänge über Hinterbichl, 1350 - 1400 m, (2); 2. VIII. 1986, M. Mayrhofer & H. Mayrhofer (GZU). - Tirol: Osttirol, Hohe Tauern, Virgental, SE- und S-exponierte Kalkschieferfelsen der Burg ca. 500 m W des Ortes Obermauern, 1350 - 1400 m, (2*); 6. IX. 1978, M. Mayrhofer & H. Mayrhofer (GZU). - Tirol: Osttirol, Hohe Tauern, Venediger-Gruppe, Prosegglamm N von Matrei, ca. 1000 m, 47°01'15"N / 15°32'E, MTB 8941/3; Kalkschiefer, auf besonnten Schieferschrofen, (2), 2. IX. 1998, leg. J. Hafellner no. 46794 (GZU). - Switzerland: Kanton Wallis: Saas-Fee, Kapelle zur Hohen Steige, ca. 1750 m, (2*); 7. IX. 1975, P. B. Topham & A. M. Burnet 50 (GZU). - Canton Valais, Gueuroz, along the road between Martigny and Salvan, close to the bridge over Les Gorges du Trient, on gently sloping rock surface, southeastern exposure, ca. 700 m, (2), 16. VII. 1972, leg. M. S. Christiansen no. 72.384 (herb. Hafellner, as an admixture of a specimen of *Stigidium xanthoparmeliarum*). - Kanton Graubünden: Engadin, Chaschlin bei Susch, um 1440 m, an Gneisfelsen, (17); 31. VIII. 1980, J. Poelt (GZU). - Italy: Südtirol: Ötztaler Alpen, Vinschgau, ca. 1 km E von Latsch, 700 - 850 m; S-exponierte Trockenhänge, über Glimmerschiefer, (2); 18. X. 1975, J. H. 41073 (herb. Hafellner). - Ibid., (2), R. Stipacek (GZU). - Südtirol: [Ötztaler Alpen], Vinschgau, Laaser Leiten NW von Laas und Eyrs, ca. 900 m; S-exponierte Trockenrasen mit kleinen Silikatschrofen, auf Blöcken und Schrofen, (1), 5. IX. 1992, J. H. 30593 (GZU). - Südtirol: Ortler Gruppe, am Eingang in das Martelltal bei Morter, ca. 800 m; auf einem Gneisblock, (1); 15. VII. 1962, J. Poelt (GZU). - Südtirol: auf dem Ritten, Unterinn, (2*); 18. VII. 1974, W. Möschl & H. Pittoni (GZU). - Toskanischer Archipel, Insel Elba: Ost-Elba, Fluchtburg Volterraio SE von Bagnai, Radiolaritfelsen um die Burg,

- 370 - 394 m, (3*); 29. VIII. 1982, H. Mayrhofer 3889 (GZU). - **France:** Korsika: Dept. Haute-Corse: Umgebung von Corte, Gorges de la Restonica, Forêt de la Restonica, ca. 5 km WSW von Corte, ca. 650 m; Schwarzföhrenwald mit Granitblockwerk, auf Neigungsflächen von Granitblöcken im Halbschatten, (2); 4. IX. 1993, J. H. 31684 (GZU). - Korsika: Dept. Haute-Corse: Golo Tal, ca. 5 km E von Ponte Leccia, S der Eisenbahnbrücke über den Golo Fluß, ca. 170 m; Grünschieferschrofen in einer Macchie, auf SW-exponierten, geneigten Felsplatten, (3); 6. IX. 1993, J. H. 31811 (GZU). - **Spain:** Zaragoza: Tal des Río Jalón, ca. 3 km NE von Calatayud an der Straße nach Embid de la Riviera, ca. 430 m, SE-exponierte Silikatblockschulthalde mit kleine Schrofen, auf Neigungsflächen von Silikatblöcken, (2); 24. V. 1983, J. H. 17786 (GZU), adest: *Stigmatidium xanthoparmellarum*). - Prov. Tarragona: Sierra de Prades, an der Straße vom Monasterio de Poblet nach Prades kurz ober der Abzweigung nach Vilanova de Prades, ca. 900 m, Quercetum pyrenaicae mit Silikatblöcken, (2); 23. V. 1983, J. H. 17484 (GZU). - Ibid., (2*), J. H. 17510 (GZU). - Prov. Valencia: Castelló, Azuébar, Bnc. Mosquera, U.T.M. 30SYK2417, sobre arenisca, 620 m, (1), 25. X. 1997, V.C. 7983. (VAB).- Prov. Madrid, E von San Martín de Valdeiglesias, kurz W vom Río Alberche, ca. 500 m, S-exponierte Silikatfelsen, (3*); 11. IX. 1980, J. H. 8638 (GZU). - See also under Canary Islands! - **Macedonia:** Babuna, Paß Pletvar E von Prilep, S-exponierte Hänge mit einzelnen großen Silikatblöcken und Schutt, um 1150 - 1200 m, (2), 11. VII. 1977, J. H. 3910 (GZU, adest: *Nesolechia oxyspora*).
- Asia:** **Georgia:** Caucasus, distr. Dusheti, in vicinitate pagi Pasanauri, in valle fluminis Belaia Arava, 1200 - 1500 m, (2); 31. VII. 1982, V. Vasák (GZU). - **Nepal:** Central Himalaya, Langtang area, Palpa SE of Langtang, S of Langtang Khola, ca. 3500 m, low rocks in pasture, (10*); 6. IX. 1986, J. Poelt (GZU). - **Japan:** Honshu: Prov. Hitachi, Ohgata, Tsukuba city, elev. 40 m; on roof tile, (6); 15 II. 1994, H. Kashiwadani & M. Takashiba (separated from Kashiwadani, Lichenes minus cogniti exsiccati 25)(GZU). - Honshu: Prov. Shinano, Kawahake, Minami-Saku-gun, elev. c. 1300 m, on rock, (13); 23. VII. 1972, H. Shibuichi & K. Yoshida (separated from Kurokawa, Lichenes rariores et critici exsiccati 235)(GZU). - Honshu: Prov. Echigo, Pref. Niigata, Takase, Sekikawamura, Iwafune-gun, on rocks, (23); 3. X. 1959, M. Togashi (separated from Kashiwadani, Lichenes minus cogniti exsiccati 100)(GZU).
- Africa:** **Canary Islands:** Tenerife: Macizo de Teno, ca. 1 km W des Ortes Teno Alto, ca. 760 m, 28°20'30"N/16°52'30"W; niedere Lavabreckzienblöcke in einer Weide, (2); 15. II. 1989, J. H. 35895 & A. Hafellner (GZU). - Tenerife: Macizo de Teno, Montana de la Venta ca. 1 km E von Las Casas, ca. 150 m, NE-exponierte Basaltrippe, an Basaltschrofen, (3*); 7. II. 1989, J. H. 35011 & A. Hafellner (GZU). - Tenerife: SW-Abhänge des Teide-Massivs, kurz N oberhalb von Chirche, NE ober Guia de Isora, 28°14'20"N/16°46'W, ca. 1160 m; lockerer Pinus canariensis-Wald über Lavaströmen, (3), 15. XII. 1998, J. H. 46411 (GZU). - Tenerife: Teno-Gebirge, an der Forststraße zwischen Erjos und Las Portelas, 28°20'N/16°49'30"W, ca. 850 m; auf niederen Vulkanitschrofen auf einer Geländerippe im Fayal-Brezal, 17. XII. 1998, (2), J. H. 46406 (GZU). - Tenerife: Teno-Gebirge, Paß zwischen Masca und Carrizal Alto, am Kamm in Richtung Westen, 28°18'30"N/16°51'20"W, 780 - 830 m; Sukkulentenbusch, NW-exponiert auf Blöcken und Schrofen am Grat, (2); 17. XII. 1998, J. H. 46401 (GZU). - El Hierro: Bergrücken S ober dem Mirador de la Peña SW ober dem Ort Guarazoca, ca. 740 m, 27°48'N/17°58'40"W; Weide, auf W-exponierten Abbrüchen der obersten Basaltbänke, (2), 9. II. 1995, J. H. 45589 (GZU). - El Hierro: Punta de Tigrote NE unter dem Ort San Andrés, ca. 840 m, 27°47'10"N/17°55'40"W; markante Felsrippe umgeben von Weideland, auf großen Basaltblöcken am Grat, (2), 10. II. 1995, J. H. 45590 (GZU). - **South Africa:** Transvaal: Pietersburg District, western end of Soutpansberg Mountain above Farm Llewellyn, 23°00'S / 29°17'E, 1400 - 1650 m, on acid rock, (11); 13. I. 1986, T.H. Nash (GZU). - Cape Province: about 46 km SW of Swelendam, near the road R316, 34°21'S / 20°9'E, (29), 25. IX. 1987, W. Wetschnig & U. Wetschnig (GZU).
- North America:** **Canada:** British Columbia: Wells Gray Park, Wells Gray Education and Research Centre, 51°52'N / 120°01'W, ca. 700 m; partly forested farm land, (5); 26. VIII. 1994, T. Goward & J. Poelt (GZU). - Ontario: Cochrane District, Thuderhouse Falls, Scovil Tp., elev. 700 ft.; Jack pine area at top of gorge, (2); VIII. 1976, G.A. Shea (GZU). - **U.S.A.:** Virginia: Shenandoah/Hardy Counties, George Washington National Forest, Wolf Gap campground, oak-hickory woods, (1); 3./6. VI. 1966, R.C. Harris (GZU). - Colorado: Jefferson Co., lower slopes of spurs of The Castle, Bancroft property NW of Wellington Lake, on tors of Pikes Peak granite, (27), 22. VI. 1976, W.A. Weber & M. Klockenbrink (separated from Weber, Lichenes exsiccati 513)(GZU).- Arizona: Coconino Co., Kaibab National Forest, 3.5 km E of Red Butte in mature pinyon-juniper woodland, 35°48'30"N / 112°01'57"W, 1950 m; on soil, (4), 28. VI. 1992, M. Thomas (separated from Nash, Lichenes exsiccati ASU 147)(GZU). - Arizona: Santa Cruz Co., Coronado National Forest, hills just

S of Pena Blanca Lake along state route 289, 3800 ft., on rock, (3*); 30. XII. 1972, T.H. Nash 6102 (GZU). - Arizona: Pima Co., Tucson Mountains, east base of Contzen Pass, 4.8 km SW of Cortaro, on rhyolite boulders, (25); 12. I. 1973, W.A. Weber & G. Kunkel (separated from Weber, Lichenes exsiccati 415)(GZU). - Arizona: Pima Co., west side of Tucson Mountains, NW facing slopes, elev. 3000 ft., on volcanic rock, (25*); 29. XII. 1972, leg. T.H. Nash 6197 (GZU). - Arizona: Pinal Co., between Boyce Thompson Arboretum and Picket Post Mountain, 33°16'N / 111°10'W, 700 m, on andesite and rhyolite tuff, (28); 29. XII. 1988, leg. R.S. Egan 13613 (GZU). - California: San Mateo Co., San Bruno Mountains, just SE of San Francisco, 37°41'N / 122°25'30"W, elev. ca. 250 m, (7*); 5. I. 1988, leg. B.D. Ryan 21984 (GZU). - Mexico: Estado de Baja California Norte: 10 km N of El Rosario in Cañón del Rosario, 30°08'N / 115°46'W, elev. 90 m, on soil in coastal scrub community, (19); 28. XII. 1990, leg. T.H. Nash (separated from Nash, Lichenes exsiccati ASU 149)(GZU).

South America: **Venezuela:** Estado Merida: Anden, an der Straße Merida - Valera, zwischen San Rafael und Mucuchies, ca. 2950 m, über verbackener Erde an steiler, ca. 2 m hoher Straßenböschung, S- und E-exponiert, (26); 16. IV. 1969, leg. H. Hertel, B. Oberwinkler & F. Oberwinkler (GZU). - **Brazil:** Paraíba, lower 100 m of Pico do Jabre SSW of Patos, 07°16'S / 37°23'W, ca. 850 m, on granite, (22); 18. VI. 1990, leg. T.H. Nash (GZU). - **Uruguay:** Departamento de Lavalleja, 13 km E of Mina and 6 km from route 8 along secondary road to Casadas de Agua del Penitente, 34°21'S / 55°10'W, c. 150 m, on acidic rock, (14); 13. VI. 1989, leg. T.H. Nash (GZU). - **Chile:** without locality data, (24); 1836, leg. Barchay (GZU).

Australia: Australian Capital Territory (A.C.T.): Gudgenby River Gorge, 4.5 km S of Tharwa, 35°34'S / 149°04'E, elev. 620 m, growing on granite rocks in open woodland, (15); 12. IV. 1982, leg. J.A. Elix (separated from Elix, Lichenes australasici exsiccati 19) (GZU). - A.C.T.: Glendale Crossing, 15 km W of Michelago, 35°44'S / 149°00'E, elev. 900 m, growing on granite rocks in open Eucalyptus woodland, (12), 15. III. 1982, leg. J. A. Elix (separated from Elix, Lichenes australasici exsiccati 24)(GZU). - A.C.T.: 8 km W of Canberra, 0.8 km W of Coppins Crossing, 35°15'S/149°03'E, 520 m; over porphyry rocks and onto soil in open grassland, (2); 28. III. 1982, leg. J.A. Elix (GZU). - A.C.T.: Booroomba Rocks, on granite (21); 28. IX. 1983, leg. M. Seaward & J.A. Elix (GZU). - New South Wales: Black Flat, Currowan State Forest, 6 km NW of Nelligen, 35°36'S / 150°05'E, elev. 120 m; growing on mossy granite rocks in wet sclerophyll forest, (8); 2. X. 1982, leg. J.A. Elix (separated from Elix, Lichenes australasici exsiccati 32) (GZU). - New South Wales: Googong Dam Foreshore Reserve, Londonbridge 18 km S of Queanbean, 35°31'S / 149°16'E, on schist, (9*); 26. VII. 1992, leg. H. Mayrhofer 11302 & J.A. Elix (GZU). - New South Wales: Gurrangoramba Range between Coleman Plain and Tangatara Reservoir, west side of Brindabella Range, ca. 4500 ft., on summit rock outcrops, (21); 17. X. 1967, leg. W.A. Weber (separated from Weber, Lichenes exsiccati 338)(GZU). - Victoria: Bullock Creek, 16 km S of Bendigo along the Calder Highway, 37°52'S / 144°13'E, growing on large granite boulders with a southerly aspect, on creek bank in light shade, in remnant eucalypt woodland, (18); 12. XII. 1983, leg. J. Johnston (separated from Elix, Lichenes australasici exsiccati 63) (GZU). - South Australia: hillside in Torrens Gorge near Castanbul, 16 km NE of Adelaide, 34°52'S / 136°46'E, 160 - 180 m, (12); 12. VIII. 1981, leg. M. Mayrhofer & H. Mayrhofer (GZU). - South Australia: Guthries Steep Gully, 9 km E of Springton, 34°02'S / 139°04'E, 400 m, (16); 12. VIII. 1981, leg. M. Mayrhofer & H. Mayrhofer (GZU). - Western Australia: Lower South West, Meelup NW of Dunsborough, coastal rocks, granite, (10*); 20. VIII. 1988, leg. M., D. & H. Mayrhofer 8533 (GZU).

Acknowledgements

Dr. J. Elix and Dr. T.H. Nash are thanked for sending specimens of *Xanthoparmelia* species in exchange to the herbarium GZU and for determining most of the mentioned hosts. The critical reading of the manuscript by Dr. B. Coppins is gratefully acknowledged.

References

- Diederich, P., Lambinon, J., Serusiaux, E. & Boom, P. van den 1992. Lichens et champignons lichénicoles nouveaux ou intéressants pour la flore de la Belgique et des régions voisines. VI. *Belg. J. Bot.* 125: 137 - 150.
- Eriksson, O. E. & Hawksworth, D. L. 1998. Outline of the ascomycetes - 1998. *Syst. Ascomycetum* 16: 83 - 296.

- Etayo, J. 1997. Líquenes de roquedos silíceos en los Pirineos occidentales. - *Naturzale* 12: 123 - 148.
- Girlanda, M., Isocrono, D., Bianco, C. & Luppi-Mosca, A. M. 1997. Two foliose lichens as microfungial ecological niches. *Mycologia* 89: 531 - 536.
- Grube, M. 1993. Über metachromatisches Färbeverhalten bei einigen Arten der Sammelgattung *Arthopyrenia*, mit weiteren Beispielen aus ähnlichen Gattungen (Ascomycetes, Arthopyreniaceae). *Nova Hedwigia* 57: 473 - 482.
- Hafellner, J. 1982. Studien über lichenicole Pilze und Flechten II. *Lichenostigma maureri* gen. et spec. nov., ein in den Ostalpen häufiger lichenicoler Pilz (Ascomycetes, Arthoniales). *Herzogia* 6: 299 - 308.
- Hafellner, J. 1993. Über Funde von lichenicolen Pilzen und Flechten im südlichen Norwegen. - *Herzogia* 9: 749 - 768.
- Hafellner, J. 1994. Über Funde lichenicoler Pilze und Flechten auf Korsika (Frankreich). *Bull. Soc. Linn. Provence* 45: 219 - 234.
- Hawksworth, D. L., Kirk, P. M., Sutton, B. C. & Pegler, D. N. 1995. *Ainsworth and Bisby's Dictionary of the Fungi*. 8. ed. Wallingford, Oxon: CAB International.
- Henssen, A. 1987. *Lichenothelia*, a genus of microfungi on rocks. *Biblioth. Lichenol.* 25: 257 - 293.
- Kalb, K., Hafellner, J. & Staiger, B. 1995. *Haematomma*-Studien II. Lichenicole Pilze auf Arten der Flechtengattung *Haematomma*. *Biblioth. Lichenol.* 59: 199 - 222, tab.
- Keissler, K. v. 1930. *Die Flechtenparasiten*. Rabenh. Krypt.-Fl., 2. ed., 8: I - XI, 1 - 712. Leipzig.
- Lettau, G. 1919. Schweizer Flechten. II. *Hedwigia* 60 (4): 267 - 312.
- Lettau, G. 1958. Flechten aus Mitteleuropa XIV. - *Feddes Repert.* 61: 105 - 171.
- Navarro-Rosinés, P., Boqueras, M. & Llimona, X. 1994. Primer catàleg dels fongs liquenícoles de Catalunya i zones pròximes (NE de la Península Ibèrica). *Butl. Soc. Catalana Micol.* 16-17: 165 - 204.
- Navarro-Rosinés, P. & Gómez-Bolea, A. 1989. *Rhagadostoma lichenicola* (D. Not.) Keissler i *Echinothecium reticulatum* Zopf, dos fongs liquenícoles nous per a la Península Ibèrica. *Folia Bot. Misc.* 6: 61 - 64.
- Navarro-Rosinés, P. & Hafellner, J. 1996. *Lichenostigma elongata* spec. nov. (Dothideales), a lichenicolous ascomycete on *Lobothallia* and *Aspicilia* species. *Mycotaxon* 57: 211 - 225.
- Nimis, P. L. & Poelt, J. 1987. The lichens and lichenicolous fungi of Sardinia (Italy). An annotated list. *Stud. Geobot.* 7, Suppl. 1: 1 - 269.
- Santesson, R. 1993. *The lichens and lichenicolous fungi of Sweden and Norway*. Lund: SBT-förlaget.
- Thor, G. 1985. A new species of *Lichenostigma*, a lichenicolous ascomycete. *Lichenologist* 17: 269 - 272.
- Vouaux, L. 1912. Synopsis des champignons parasites de lichens. *Bull. Soc. Mycol. France* 28: 177 - 256.
- Zopf, W. 1898. Untersuchungen über die durch parasitische Pilze hervorgerufenen Krankheiten der Flechten (Fortsetzung). *Nova Acta. Abh. K. Leop. Deutsch. Akad. Naturf.* 70(4): 242 - 288.