A new generic record of lichenized ascomycetes for Central America: *Thelocarpon laureri*

Josef HAFELLNER*

HAFELLNER Josef 2017: A new generic record of lichenized ascomycetes for Central America: *Thelocarpon laureri*. - Fritschiana (Graz) 87: 41–46. - ISSN 1024-0306.

Abstract: Based on a sample of *Thelocarpon laureri* from a high elevation locality in Costa Rica the genus *Thelocarpon* is recorded for the first time from Central America. The specimen is compared with material from Europe.

*Institut für Pflanzenwissenschaften, NAWI Graz, Karl-Franzens-Universität, Holteigasse 6, A-8010 Graz, AUSTRIA.
e-mail: josef.hafellner@uni-graz.at

Introduction

Despite the small size of its fruiting bodies *Thelocarpon* is a relatively well-known genus. There are not many genera of microlichens monographed several times either regionally (REHM 1891, MAGNUSSON 1935, MOTYKA 1964, KOCOURKOVÁ-HORÁKOVÁ 1998) or on a worldwide scale (SALISBURY 1966).

Traditionally the genus *Thelocarpon* was placed in the Acarosporales (resp. Lecanorales - Acarosporineae) (e.g., POELT 1974). But REEB et al. (2004) as well as LUMBSCH et al. (2009) demonstrated in phylogenetic reconstructions based on sequence data of various polyspored ascomycetes that *Thelocarpon* is not a member of Lecanoromycetes. However, its precise position in a system of Pezizomycotina is still not established.

Some of the *Thelocarpon* species are widely distributed, such as *T. epibolum* Nyl. (see e.g. MAGNUSSON 1935, SALISBURY 1966, AHTI 1973, KOCOURKOVÁ-HORÁKOVÁ 1998, SPRIBILLE et al. 2010, HARADA 2015) or *T. laureri* (Flot.) Nyl. (see this publication further below), others are known so far only from relatively small areas (e.g. *T. coccosporum* Lettau, *T. robustum* Eitn.). Most records are from European countries, relatively few from other continents. On the American double continent the majority of records refer to findings in Northern America, very few are from South America, none so far from Central America.

Central America as circumscribed by BRUMMITT (2001) includes the countries south of Mexico and north of Colombia: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama and some islands in the Pacific Ocean not too far away from the continental coast. Of these countries lichen checklists exist for Costa Rica (UMAÑA TENORIO et al. 2002, FEUERER 2016), Panama (PIEPENBRING 2006, FEUERER 2015), and El Salvador

(SIPMAN 2001), whereas the species lists of lichens recorded for the remaining countries are still only stubs. A search for *Thelocarpon* was negative in all these cited sources. Therefore a gathering of *Thelocarpon laureri* from Costa Rica is reported here as the first record of the genus in Central America.

Material and methods

Dried herbarium specimens have been examined. External morphology was studied with a dissecting microscope (WILD M3, 6.4–40x). Anatomical studies of the thallus and the ascomata were carried out under the light microscope (LEICA DMRE, 100–1000x). 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 by the use of Lugol's reagent (I) (MERCK 9261). Sections and squash preparations were not pretreated with KOH (K) unless otherwise stated. Measurements refer to dimensions in tap water.

Abbreviations for institutional herbaria follow HOLMGREN et al. (1990). Abbreviations of author names are those proposed by BRUMMITT & POWELL (1992). Geographic units are defined and named according to HOLLIS & BRUMMITT (1992) or BRUMMITT (2001).

Results

Thelocarpon laureri (Flot.) Nyl., Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg 3: 191 (1855).

≡ *Sphaeropsis laureri* Flot., Botanische Zeitung 5: 65 (1847). – *Thelomphale laureri* (Flot.) Körb., Parerga Lichenologica: 321 (1863).

Typus: [Germany, Mecklenburg-Vorpommern] Greifswald, « habitat ad aggeres turfosos », 1846, leg. Laurer et [Poland, Lower Silesia] Grafschaft Glatz [Ziemia Kłodzka], « in ericetis humidis », 1824, leg. Flotow no. 285 (herbarium ? - syntypes) not examined. Locality data from protologue.

For heterotypic synonyms including *Thelocarpon epilithellum* Nyl., *Thelocarpon interceptum* Nyl., *Thelocarpon prasinellum* Nyl., and others see MAGNUSSON 1935: 310 ff. or SALISBURY 1966: 189!

Full descriptions: MAGNUSSON 1935: 310 ff.; SALISBURY 1966: 189 f.; MCCARTHY & KANTVILAS 2009: 566 f.

Icon.: MAGNUSSON 1935: 313 Fig. 64 (drawings of a fertile verruca in vertical section, ascus, interascal filament); SALISBURY 1966: 189 Figure 12 (drawings of a fertile verruca in vertical section, asospores); KOCOURKOVÁ-HORÁKOVÁ 1998: Fig. 12–14 (colour photographs of a fertile verruca in vertical section, squash preparation of hymenium and habit); MCCARTHY &

KANTVILAS 2009: 569 Fig. 177 D–G (drawings of habit, a fertile verruca in vertical section, ascus tip, ascospores).

Key characters for identification: Verrucae yellow-greenish, hemispherical, with thalline outer layer and containing a single perithecioid ascoma. Asci flask-shaped, polysporous, lacking an apical apparatus. Interascal filaments branched, as long as or shorter than the asci. Ascospores non-septate, hyaline, broadly ellipsoid.

Character expression on specimen from Costa Rica: Thalline verrucae scattered, hemispherical to broadly conical, intensely yellow-greenish. Ascomata perithecioid, 1 per verruca, entirely immersed in the thalline verrucae and practically invisible under the dissecting microscope, only occasionally a punctiform ostiolar region is poorly visible. Asci polysporous, (containing more than 100 ascospores), flask-shaped with subcylindrical upper third and ventricose lower half, exceeding 100 µm in length and 20–25 µm wide. Interascal filaments filiform, branched, 1–1.5 µm wide, apical cells neither enlarged nor pigmented. Ascospores broadly ellipsoid, liberated spores 3.5–4.5 × 2–2.5 µm.

Notes: 1. SALISBURY (1966) erroneously indicated the type locality as being located in Austria and the collecting year given with 1865. However, the species is based on two syntypes (see above). No lectotype has been chosen so far.

2. As demonstrated by POELT & HAFELLNER (1975) the development of entirely closed and therefore perithecioid ascomata as typical for *Thelocarpon laureri* goes along with a complete reduction of the euamyloid apical apparatus that other species with apothecial ascomata still have. These observations of specific phenotypic character expressions led the authors to the hypothesis that hymenial features of *Thelocarpon* species are influenced by ascoma shape and function. However, LUMBSCH et al. (2009) were not able to either confirm or reject this hypothesis on the basis or the molecular data at their disposal.

Ecology: *Thelocarpon laureri* is found on a wide range of acidic substrates, such as siliceous rocks or wood, occasionally also on bark, plant remnants and humous soil. Unusual for a *Thelocarpon*, the species is often found on more exposed and sunny sites in pioneer communities of cryptogams. KOCOURKOVÁ-HORÁKOVÁ (1998) has listed the accompanying species including e.g. taxa of *Trapelia*, *Trapeliopsis*, *Placynthiella*, and *Micarea*. Species of *Amandinea* and *Candelariella* occasionally growing nearby indicate a certain tolerance of eutrophication.

At the locality in Costa Rica, it was found on low volcanic outcrops in open shrub-vegetation (subpáramo). Apart from the *Thelocarpon*, only fragmentary thalli of *Placopsis lambii* Hertel & V.Wirth have been detected on the rock pieces. GALLOWAY & ARVIDSSON (2002) have already recorded this pioneer species from a locality nearby.

Confused species: None. Saxicolous populations have been treated as a distinguishable taxon on species or infraspecific level by some lichenologists. However, various monographers disagree with this.

Distribution: *Thelocarpon laureri* is widely distributed in the temperate zone of the Holarctic region. Most records are from Central and Western Europe (see e.g. MAGNUSSON 1935: 310 ff., LETTAU 1955: 76, KOCOURKOVÁ-HORÁKOVÁ, J. 1998: 288 ff.). In the Czech Republic KOCOURKOVÁ-HORÁKOVÁ (l. c.) regards it as the most common species of the genus. But *T. laureri* is also known from more remote localities in Central Russia (Zhdanov & Volosnova 2008), the Canary Islands (HERNÁNDEZ PADRÓN & SANCHEZ PINTO 1987) and a number of localities in various states in the United States of America (e.g. MAGNUSSON 1935, SPRIBILLE et al. 2010, RAJAKARUNA et al. 2012). On the southern hemisphere, it has been recorded from Tasmania (MCCARTHY & KANTVILAS 2009), Chile (GALLOWAY & QUILHOT 1998, uncertain record), and Bolivia (FLAKUS et al. 2016). The locality in Bolivia is also a high altitude site with fragmentary shrub vegetation.

As already noted by Magnusson (1935), in temperate regions *Thelocarpon laureri* is a species of sites at lower elevation. Therefore, it is not surprising that in the tropics the species appears to be confined to the upper altitudinal belts (FLAKUS et al. 2016, this publication). Similar patterns have been discussed by HERTEL (1971) who was able to record a number of "holarctic" species (including e.g., *Arthrorhaphis citrinella*, *Carbonea vorticosa*, *Lecanora polytropa*, *Lecidea lapicida*, *Lecidella carpathica*, *Protoparmelia badia*, and *Trapelia coarctata*) at high elevation (above 3000 m) in the Venezuelan Andes.

Specimens seen:

CENTRAL AMERICA: **Costa Rica**: Prov. Cartago, Cordillera de Talamanca, Monte Asunción, 7,5 km NW von Villa Mills, N der Car. Nac. 2, 9°34'N / 83°46'W, 3300–3396 m, Subpáramo mit Felsblöcken, auf einem Block vulkanitischen Gesteins, 29. XII. 1978, leg. J. Hafellner no. 7009 (GZU).

Material studied for comparison:

Exsiccata: Arnold, Lichenes exsiccati 522b (GZU). – Arnold, Lichenes exsiccati no. 866, sub *Thelocarpon interceptum* (GZU). – Nowak, Lichenes Poloniae Meridionalis exsiccati 45 (GZU). – Nowak, Lichenes Poloniae Meridionalis exsiccati 122 (GZU). – Obermayer, Dupla Graecensia Lichenum 1187 (CANB, GZU, M, NY, UPS). – Reliquiae Suzaianae 69 (GZU). – Suza, Lichenes Bohemoslovakiae 164, sub *Thelocarpon prasinellum* (GZU). – Triebel, Microfungi exsiccati 394 (GZU). – Vězda, Lichenes selecti exsiccati 1028 (GZU). – Vězda, Lichenes selecti exsiccati 1640 (GZU).

EUROPE: **Austria**: Steiermark: Steirisches Randgebirge, Gleinalpe, Gamsgraben, ca. 4,5 km NW von Rothleiten, kurz hinter der Einmündung des Lehmbachgrabens, 47°18'05''N / 15°15'10''E, ca. 700 m, GF [grid ref.] 8657/4, Gneisschrofen auf steilen Südhängen, auf Lesesteinen auf einer Felskanzel, 10. XII. 2000, leg. J. Hafellner no. 58087 (GZU). – Steiermark: Steirisches Randgebirge, Koralpe, Stoffkogel ca. 14 km NW von Deutschlandsberg, untere E Abhänge, unterhalb des Gehöftes Weberbauer, 46°52'40''N / 15°03' 25''E, ca. 1040 m, GF 9156/1, Blockhaufen und niedere Ausbisse auf einer Weide, Eklogitamphibolit, auf Neigungsflächen, 22. IX. 2012, leg. J. Hafellner no. 81197, L. Muggia & & A. Hafellner (GZU) (duplicates distributed in Obermayer, Dupla Graecensia Lichenum no. 1187]. – **Germany**: Bayern, Niederbayern, Bayerisch-Böhmischer Wald, Kreis Wolfstein, kurz S Grainet, ca. 700 m alt., auf Lesesteinen an einem Feldrain, VIII. 1971, leg. J. Poelt (GZU).

Acknowledgements

The author gratefully acknowledges a critical reading of the manuscript by Walter OBERMAYER and Christian SCHEUER.

References

AHTI T. 1973: Notes on the lichens of Newfoundland. 2. *Thelocarpon epibolum* Nyl. - Annales Botanici Fennici 10: 66–67.

BRUMMITT R.K. [with assistance from F. Pando, S. Hollis, N. A. Brummitt and others] 2001: World geographical scheme for recording plant distributions. Edition 2. Plant Taxonomic Database Standards No. 2 Edition 2, August 2001. - Published for the International Working Group on Taxonomic Databases For Plant Sciences (TDWG) by the Hunt Institute for Botanical Documentation Carnegie Mellon University (Pittsburgh). XV+137 pp.

BRUMMITT R.K. & POWELL C.E. 1992: Authors of plant names. - Royal Botanic Gardens (Kew) 732 pp.

FEUERER T. 2015: Checklist of lichens of Panama supervised by O. Breuss, Naturhistorisches Museum, Wien, Austria. Preliminary version 1 June 2015. - URL: http://www.lichens.uni-hamburg.de/lichens/middle-america/panama_l.htm [last accessed December 2017].

FEUERER T. 2016: Checklist of lichens of Costa Rica. Preliminary version 1 December 2016. - URL: http://www.lichens.uni-hamburg.de/lichens/middle-america/costa-rica_l.htm [last accesed 10 December 2017].

FLAKUS A., OSET M., RYKACZEWSKI M., SCHIEFELBEIN U. & KUKWA M. 2016: Contribution to the knowledge of the lichen biota of Bolivia. 8. - Polish Botanical Journal 61(1): 107–126.

GALLOWAY D.J. & ARVIDSSON L. 2007: Notes on *Placopsis* (Ascomycota: Trapeliaceae) in Ecuador. - In: FRISCH A., LANGE U. & STAIGER B. (editors). Lichenologische Nebenstunden. Contributions to lichen taxonomy and ecology in honour of Klaus Kalb. - Bibliotheca Lichenologica 96: 87–102.

GALLOWAY D.J. & QUILHOT W. 1998: Checklist of Chilean lichen-forming and lichenicolous fungi [Lista patron de los líquenes y hongos liquenícolas de Chile]. - Gayana Botanica 55(2): 111–185.

HARADA H. 2015: *Thelocarpon epibolum* (Ascomycota, Thelocarpaceae) newly found in Japan. - Lichenology 13(2): 53–57.

HERNÁNDEZ PADRÓN C. & SANCHEZ PINTO L. 1987: Notas corológicas sobre la flora liquénica de las Islas Canarias. III. - Vieraea 17: 323–332.

HERTEL H. 1971: Über holarktische Krustenflechten aus den venezuelanischen Anden. - Willdenowia 6: 225–272.

HOLLIS S. & BRUMMITT R.K. 1992: World geographic scheme for recording plant distributions. - Hunt Institute for Botanical Documentation, Carnegie Mellon University (Pittsburgh) IX +104 pp.

HOLMGREN P.K., HOLMGREN N.H. & BARNETT L.C. (editors) 1990: Index herbariorum. Part I. The herbaria of the world. 8th edition. - New York Botanical Garden for the International Association for Plant Taxonomy (Bronx, New York). Regnum Vegetabile 120: 693 pp.

KOCOURKOVÁ-HORÁKOVÁ J. 1998: Distribution and ecology of the genus *Thelocarpon* (Lecanorales, Thelocarpaceae) in the Czech Republic. - Czech Mycology 50(4): 271–302, tab.

LETTAU G. 1955: Flechten aus Mitteleuropa X. - Feddes Repertorium Specierum Novarum Regni Vegetabilis 57(1–2): 1–94.

LUMBSCH H.T., ZIMMERMANN D.G. & SCHMITT I. 2009: Phylogenetic position of ephemeral lichens in Thelocarpaceae and Vezdaeaceae (Ascomycota). - In: THELL A., SEAWARD M.R.D. & FEUERER T. (editors). Diversity of lichenology – anniversary volume. - Bibliotheca Lichenologica 100: 389–398.

MAGNUSSON A.H. 1935–1936: Acarosporaceae und Thelocarpaceae. - In: Dr. L. Rabenhorst's Kryptogamen-Flora von Deutschland, Österreich und der Schweiz, 2. Aufl. Bd. 9, Abt. 5, Teil 1: I–VII, 1–318. Akademische Verlagsgesellschaft (Leipzig) [p. 1–285, 286–318, 1935; Vorwort 1936].

MCCARTHY P.M. & KANTVILAS G. 2009: Thelocarpaceae. - In: MCCARTHY P.M. (editor). Flora of Australia, Volume 57, Lichens 5: 563–569. ABRS and CSIRO Publishing (Canberra and Melbourne).

PIEPENBRING M. 2006: Checklist of fungi in Panama. Preliminary version. - Puente Biológico 1: 1–190, [5] tab.

POELT J. 1974 ('1973'): Classification. - In: AHMADJIAN V. & HALE M.E. (editors), The Lichens. p. 599–632. - Academic Press (New York & London).

POELT J. & HAFELLNER J. 1975: Schlauchpforten bei der Flechtengattung *Thelocarpon*. - Phyton (Horn) 17(1–2): 67–77.

RAJAKARUNA N., KNUDSEN K., FRYDAY A.M., O'DELL R.E., POPE N., OLDAY F.C. & WOOLHOUSE S. 2012: Investigation of the importance of rock chemistry for saxicolous lichen communities of the New Idria serpentinite mass, San Benito County, California, USA. - The Lichenologist 44(5): 695–714.

REEB V., LUTZONI F. & ROUX C. 2004: Contribution of RPB2 to multilocus phylogenetic studies of the euascomycetes (Pezizomycotina, Fungi) with special emphasis on the lichen-forming Acarosporaceae and evolution of polyspory. - Molecular Phylogenetics and Evolution 32: 1036–1060.

REHM H. 1891: Die Discomyceten-Gattung *Ahlesia* Fuckel und die Pyrenomyceten-Gattung *Thelocarpon* Nyl. - Hedwigia 30(1): 1–12.

SALISBURY G. 1966: A monograph of the lichen genus *Thelocarpon* Nyl. - The Lichenologist 3: 175–196.

SIPMAN H.J.M. 2001: Listado básico de la Flora Salvadorensis. Lichenes. - Cuscatlania 1(11): 1–34.

SPRIBILLE T., PÉREZ-ORTEGA S., TØNSBERG T. & SCHIROKAUER D. 2010: Lichens and lichenicolous fungi of the Klondike Gold Rush National Historic Park, Alaska, in a global biodiversity context. - The Bryologist 113(3): 439–515.

UMAÑA TENORIO L., SIPMAN H.J.M. & LÜCKING R. 2002: Preliminary checklist of lichens from Costa Rica. Version 1.2 (June 2002). - URL: http://archive.fieldmuseum.org/ticolichen/checklist.html [last accesed 10 December 2017]

ZHDANOV I.S. & VOLOSNOVA L.F. 2008: Preliminary list of lichens of Oksky Biosphere Reserve (Ryazan Region). - Novitates Systematicae Plantarum non Vascularium 42: 178–188.