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Author: Christensen, Steen N.

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STEEN N. CHRISTENSEN[1]

The epiphytic lichen flora of *Platanus orientalis* stands in Greece

Abstract

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The epiphytic lichen flora of 37 stands of *Platanus orientalis* L. (plane) on the Greek mainland from Makedonia in the north to Peloponnisos in the south and in the W half of Kriti has been investigated. It is shown that a rich flora, including several members of the *Collemataceae* (12 taxa of *Collema* and 16 taxa of *Leptogium*), *Gyalectaceae*, *Opegraphaceae* and *Pannariaceae*, is more or less restricted to areas with high precipitation or sites with a humid mesoclimate, while under drier conditions *P. orientalis* supports mainly taxa of the families *Lecanoraceae*, *Physciaceae* and *Teloschistaceae*. However, elements of both species groups are present in most of the stands. Such a species combination may lend support to the S European *Lobaria-Anaptychia* nodum of the *Lobarion* proposed by Rose (1988). Riparian plane forests are discussed in relation to conservation of biodiversity. Among the 152 lichen taxa encountered, 13 taxa are new to Greece, viz.: *Arthonia* aff. *stellaris*, *Bacidia absistens*, *Collema fragrans*, *C. ligerinum*, *Lecidella laureri*, *Lemmopsis* cf. *pelodes*, *Lepraria* cf. *imposibilis*, *Leptogium aragonii*, *L. microphylloides*, *L. pulvinatum* var. *quercicola*, *Opegrapha rufescens*, *Phaeophyscia chloantha* and *Rinodina anomala*. A further ten taxa are new to the Greek mainland.

Additional key words: azonal vegetation, conservation, *Lobarion*, plane, riparian forests, *Xanthorion*

Introduction

The lichen flora of Greece is at present insufficiently known (Abbott 2009; Christensen & Svane 2009), and even less is known about its lichen vegetation. Neither the lichen flora nor the lichen vegetation of the zonal vegetation types in Greece, such as the lichen communities of the major forest types, is known to any satisfactory degree. When it comes to azonal vegetation types or special biotopes within the zonal vegetation units, knowledge of the lichen flora and vegetation is virtually unknown.

Azonal riparian forests constitute a special environment different from the surrounding zonal vegetation. Higher humidity is a common feature and in many cases reduced human influence due to difficult topography results in the presence of large old trees. As a consequence the epiphytic flora of riparian forests often deviates substantially from that of the surrounding forests.

Though often small in area, riparian forests of *Platanus orientalis* L. (plane) constitute a characteristic and important element in the Greek landscape. The plane forests occur naturally from the lowlands to the mountains (Mayer 1984: 529). The distribution of larger riparian forest complexes in Greece, including *P. orientalis* stands, was mapped by Bohn & al. (2003: vol. 1, map 20). The vascular plant flora and vegetation of riparian *P. orientalis* forests in Greece have been studied by Gradstein & Smittenberg (1977), Bergmeier (1990) and Moeschhauser & Papp (1994), who also studied the bryophytes of this habitat. Schuler (2000) briefly mentioned the soil conditions and the ground flora of a riparian *Platanus* forest in N Greece and Bohn & al.

1 Natural History Museum of Denmark, Botanical Garden & Museum, University of Copenhagen, Sølvgade 83, Entr. S, DK-1307 Copenhagen K, Denmark; e-mail: steenc@snm.ku.dk

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(2003) give a general picture of the floristic composition of E Mediterranean riparian plane forests. Outside their natural habitat plane trees are widely planted to provide shade. Based on herbarium specimens the occurrence of *P. orientalis* in Greece was mapped by Strid & Tan (2002: map 1333).

Platanus orientalis is distributed from the Balkan Peninsula to the W Himalayas (Strid & Tan 2002). The European distribution is mapped by Horvat & al. (1974: fig. 66). Although widespread in Greece, it first appears in pollen records as late as c. 3000 BP, together with *Castanea* and *Juglans* (Willis 1992).

The lichen flora of *Platanus orientalis* has been little studied. This may be due to the loose scaly bark of trunks and branches of young trees, which make a poor substrate for epiphytes. However, old trees develop a rough and stable bark on the trunks, which provide a suitable habitat for many bryophytes and lichens (Fig. 5). Due to the overall moss cover of the trunks resulting from the humid environment on the island of Evvia, Krause & Klement (1962) considered *P. orientalis* as a less important phorophyte for lichens. They included only seven species from *Platanus* in their species list from Evvia: *Collema nigrescens*, *Crocynia membranacea* (Dicks.) Zahlbr., *Leptogium lichenoides*, *Lobaria pulmonaria*, *Nephroma lusitanicum* Schaer. (= *N. laevigatum*), *Peltigera degenii* Gyeln. and *P. praetextata*. Christensen (1994b) studied the lichen flora of plane trees at two Greek localities with different humidity. In the locality with a more dry town environment, among the nine taxa found, species of *Lecanoraceae* and *Teloschistaceae* dominated while in the more humid locality in a ravine a large number of cyanophilic lichens were encountered among the 20 species collected. No taxa were in common. These finds motivated the study of a larger number of localities in order to provide an overview of the variation in species composition of different environments. The present study documents the epiphytic lichen flora of 37 stands of *P. orientalis* on the Greek mainland and on the island of Kriti, the majority being riparian plane forests.

Material and methods

Material for this paper was collected during trips to Greece in 1989 (Christensen 1994b), 1994, 1997, 2002, 2006, 2009 and 2011. The sampling procedure was as follows: at each site all species were collected from a single tree from the base to c. 2 m in height. From the closest neighbouring tree all new species from the same section of the tree were collected. More trees in the close surroundings were examined until no further species were found. More distant trees were examined only if they had niches that were not already studied or if they grew under different conditions (higher up the bank, more shaded, etc.). Thus, the time spent on each site was dependant on the diversity of the biotope. The specimens are deposited in the Botanical Museum of Copenhagen (C) and in the private herbarium of the author. A minor part of the material is deposited in the Botanical Museum in Berlin-Dahlem (B) and a few specimens are deposited elsewhere (BG).

In the list of taxa the specimens are referred to by their collection numbers. Specimens co-occurring in the herbarium packets of numbered specimens are referred to by the numbers (placed in brackets) of the specimens with which they occur. All co-occurrences are listed, since the number of co-occurrences for the smaller species to a certain extent reflects their abundance on the different localities. Unless otherwise stated the specimens grew directly on the bark on the middle part of the trunks of plane trees. With few exceptions the nomenclature is in accordance with Abbott (2009). When other synonyms are used on the labels these are mentioned in the list of taxa. Based on Abbott (2009), Christensen & Svane (2009) and Christensen & Alstrup (2013), *** denotes taxa new to Greece, ** denotes taxa new to the Greek mainland, and * denotes taxa new to one or more provinces of Greece (i.e. the traditional geographic regions, of which Makedonia, Ipiros, Thessalia, Sterea Ellas, Peloponnisos and Kriti are covered in this paper).

Names of provinces and larger landscapes follow The Times Atlas of the World (1990). Geographical names for N Makedonia and Sterea Ellas follow "Greece. Mainland (without Thrace) with Crete and Rhodes, 1: 500 000". Kümmerly + Frey, Bern Edition 1988. Names for southernmost Makedonia, Ipiros and Thessalia follow "Epiros/Thessaly, 1: 250 000". ROAD Editions, Athens 1995. Names for Peloponnisos follow "Hildebrand's TravelMap Greece: Peloponnese and southern mainland, 1: 400 000". KARTO+GRAFIK Verlagsgesellschaft, Germany 1988/1989. Names for Kriti follow "Anavasi 93: Iraklio and Rethimno. 1: 100 000. 2010." and "Anavasi 94: Chania. 1: 100 000. 2007". Both published by Anavasi Maps & Guides, Athens.

The 37 localities below are arranged geographically from NE to SW on the Greek mainland and from W to E on Kriti (Fig. 1). The latitudes and longitudes given are map readings. Vascular plant taxa in the habitat descriptions are listed in descending order of abundance.

List of localities

Makedonia

1. Nomos and eparchia Kavalas, Mt Pangeon, E slope, Ikosifinissis monastery, 40°59'N, 24°06'E, c. 350 m. – On trunk of a single free-standing *Platanus* tree in a grazed area near the monastery, N slope, inclination 15°. Substrate limestone. – 16 Sep 1997.

2. Nomos Kavalas, along coastal road, c. 2 km E of Loutra Eleftheron village, 40°45'N, 24°06'E, c. 20 m. – On *Platanus* trees c. 1 m d.b.h. (diameter at breast height)

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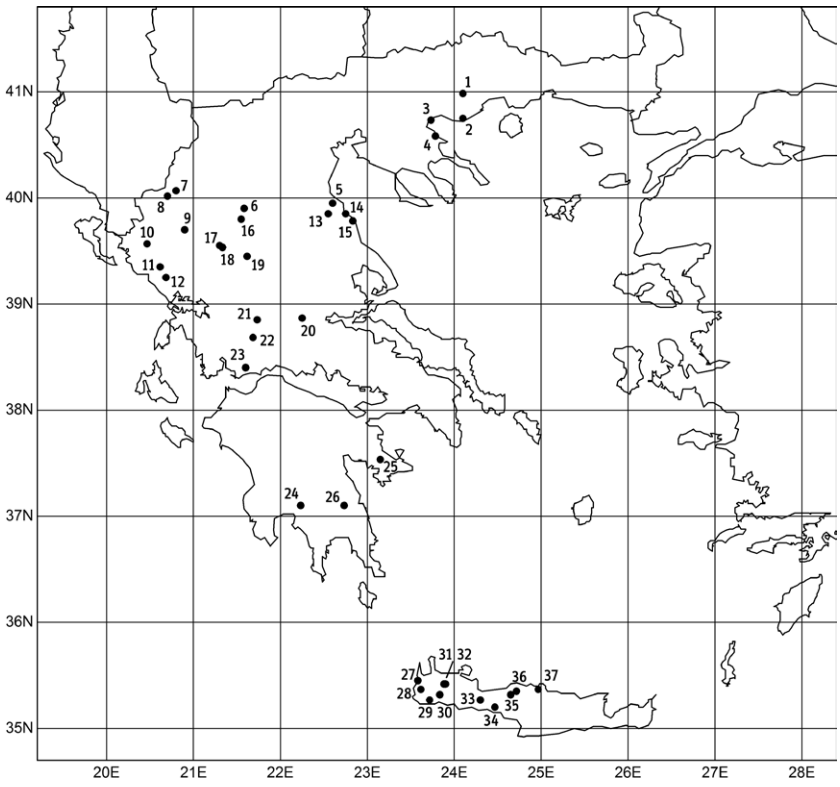


Fig. 1. The geographical distribution of the 37 localities.

in a natural riparian plane forest of relatively small trees in a summer-dry river bed in a S-sloping ravine, inclination c. 8°, surrounded by maquis with *Quercus coccifera* L., *Pistacia terebinthus* L., *Arbutus unedo* L., *Asparagus* and *Olea europaea* L. Substrate partly quartzite, partly lime-rich conglomerate. – 17 Sep 1997.

3. Nomos Thessalonikis, along coastal road, c. 1 km NE of Asprovalta, 40°44'N, 23°44'E, c. 2 m. – Old *Platanus* trees 1–1.25 m d.b.h. on S-facing littoral, used as picnic site (tables and benches between the trees). Substrate quartzite. – 17 Sep 1997.

4. Nomos Chalkidikis, E coast, just S of Olymbias village, 40°35'N, 23°47'E, c. 50 m. – NNE-running, summer-dry river bed, inclination c. 8°, with a highly modified riparian plane forest. A small group of scattered trees surrounded by open grazing land is the only remnant of a former riparian plane forest. On *Platanus* trees c. 1 m d.b.h. Substrate quartzite. Dirt road along riverside. Much sheep dung and road dust. – 17 Sep 1997.

5. Nomos and eparchia Pierias, Mt Kato Olymbos, E slope, E of Pori village, just W of Agia Paraskevi church, 39°57'N, 22°36'E, 340 m. – SSW-sloping ravine with rivulet riparian *Platanus* forest. Substrate limestone. Ground cover of *Equisetum*, *Pteridium aquilinium* (L.) Kuhn and *Rubus*. On trunks of *Platanus* trees 1–1.5 m d.b.h. on W-facing slope, inclination 10°. – 27 Jul 1994. – See the phytosociological description of the riparian *Platanus* forests of this mountain by Bergmeier (1990) and the habitat photograph in Bohn & al. (2003: Bild 146).

6. Nomos and eparchia Grevenon, Grevena-Kalambaka road, at the tributary to the Aliakmon river, which constitutes the border between the nomi Grevenon and Trikalon, c. 5 km S of Anixis village, 39°54'N, 21°35'E, c. 550 m. – Riparian *Platanus* forest lining the banks of a very broad, almost level, summer-dry shingle bed of the NE-running river. Substrate acidic shingle. Sheep-grazed, but only a little dung in proximity of the sampled trees. *Quercus* cf. *frainetto* Ten. woodland around the river. On *Platanus* trees c. 1 m d.b.h. at the N bank. – 18 Sep 1997.

Ipiros

7. Nomos Ioanninon, eparchia Konitsas, N Pindos, W-facing valley of Aoös river, at the old Konitsa-bridge, 40°04'N, 20°48'E, 475 m. – Substrate limestone. Riparian *Platanus* forest with uniform, relatively old trees, used as a recreational site, on N-facing slope, inclination 40°. On trunks of *Platanus* trees 0.5–1 m d.b.h. at margin of river bed. – 25 Jul 1994.

8. Nomos Ioanninon, eparchia Dodonis, N Pindos, at mouth of Vikos gorge of Voïdomatis river, E of Ioannina-Konitsa road, near Geroplatanos village, 40°01'N, 20°42'E, 425 m. – Riparian *Platanus* forest in W-facing gorge. Substrate limestone. On trunks of old *Platanus* trees c. 1.5 m d.b.h. on shingle of the margin of the river bed. Recreational area for local inhabitants. – 23 Jun 1994.

9. Nomos Ioanninon, Ioannina town, between old town wall and Pamvotis lake, 39°42'N, 20°54'E, 475 m. – On trunks of wayside *Platanus* trees. Recreational area for local inhabitants. – 23 Apr 1989. – Included in Christensen (1994b).

10. Nomos Thesprotias, c. 16 km E of Igoumenitsa town, c. 2 km E of Neraïda village, Thiamis (Kalamas) river valley between the old and new bridges from the Igoumenitsa-Ioannina road to the villages of Kokkinia and Kiparisos, 39°34'N, 20°28'E, 25 m. – Riparian mixed *Platanus* forest with *Alnus glutinosa* (L.) Gaertn., *Populus tremula* L. and *Salix* sp. on level river bed on NW-facing bank. Ground flora includes *Rubus fruticosus* s.l., *Dactylis glomerata* L., *Smilax*, *Hedera helix* L., *Cy-*

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clamen cf. *hederifolium* Aiton, *Orobanche* sp. Substrate limestone. On trunks of tall and slender *Platanus* trees 20–40 cm d.b.h. – 20 Sep 2002.

11. Nomos Thesprotias, c. 18 km E of Parga town, just E of Gliki village, valley of Acheron river, 39°21'N, 20°37'E, 25 m. – Riparian *Platanus* forest in E–W-running river gorge with steep to almost vertical rock walls and mountain slopes. Substrate limestone conglomerate. On trunks of *Platanus* trees 0.4–1.5 m d.b.h. on S-facing river-bank, on level ground to 20° slope. – 18 Sep 2002.

12. Nomos Prevezas, c. 27 km WNW of Arta town, c. 10 km NNW of Louros village, between the villages Ano Kotsanopoulo and Ano Rachi, 39°15'N, 20°41'E, 225 m. – Riparian *Platanus* forest on NE slope, inclination 10° in river bed. Substrate quartzite. On trunks of *Platanus* trees 1.5–1.75 m d.b.h. – 21 Sep 2002.

Thessalia

13. Nomos Larisas, eparchia Tirnavou, Pinios river, vale of Tembi, between Tembi village and the Agia Paraskevi cave church, 39°51'N, 22°33'E, 25 m. – EW-running ravine with riparian *Platanus* forest. A highly modified natural stand where human constructions (buildings, car parks etc.) have reduced humidity considerably. Used as a picnic site. Substrate limestone? On trunks of *Platanus* trees 0.5–1 m d.b.h. on N-facing slope, outside the church on N bank. – 26 Jul 1994 and 22 Sep 1997.

14. Nomos Larisas, eparchia Agias, E coast, Stomion village, mouth of Pinios river, 39°51'N, 22°45'E, 1.5 m. – *Platanus orientalis-Alnus glutinosa* summer-dry swamp located within the village. The crown-cover is rather dense, leaving the trunks rather dark. Ground flora includes *Polygonum persicaria* L., *Juncus effusus* L., *Mentha aquatica* L., *Lycopus europaeus* L., *Carex*. On trunks of *Platanus* trees 0.8–1 m d.b.h. – 24 Sep 1997.

15. Nomos Larisas, eparchia Agias, E coast, just W of Paliouria village, 39°47'N, 22°50'E, 25 m. – Riparian *Platanus* forest along NE-running, summer-dry river with c. 8° slopes, surrounded by arable land. Dirt road alongside the river. Substrate arkose (a coarse-grained sandstone containing feldspar). Ground flora includes *Cyclamen hederifolium*, *Hedera helix*, *Arbutus unedo*, *Ruscus aculeatus* L., *Pteridium aquilinum*, *Galium*. On trunks of *Platanus* trees 0.3–1.5 m d.b.h. – 24 Sep 1997.

16. Nomos Trikalon, eparchia Kalambakas, Grevena-Kalambaka road where it crosses Ion (Mourgani) River, 39°48'N, 21°33'E, c. 300 m. – Riparian *Platanus* forest in a rather narrow and steep river bed, inclination 40° to level (bottom). The crowns of the plane trees heavily shade the trunks, which are also shaded by dense growth of *Rubus fruticosus* s.l. and *Clematis vitalba* L. Substrate acidic unconsolidated conglomerate. On *Platanus* trees 0.5–1 m d.b.h. on W slope of river. – 18 Sep 1997.

17. Nomos and eparchia Trikalon, S Pindos, valley of Acheloös river, at bridge to the mountain village Gardikio, 39°33'N, 21°18'E, c. 700 m. – This humid riparian *Platanus* forest on S slope, inclination 30° to level (in river bed), with a permanent water-bearing river is natural except for a road above the slope of the river bed. Substrate quartzite. On *Platanus* trees 0.4–1.5 m d.b.h. Ground flora of *Rubus fruticosus* s.l., *Hedera helix*, *Cyclamen hederifolium*, *Helleborus*, *Primula*, *Geranium*. On trunk of *Platanus orientalis*. – 21 Sep 1997.

18. Nomos and eparchia Trikalon, S Pindos, valley of Acheloös river, c. 5.5 km W of Agios Nikolados village, 10.5 km NW of Mt Avgo, SW slope of Mt 1930 m (no name on map), in N-facing bend in road, 39°32'N, 21°20'E, c. 800 m. – Riparian *Platanus* forest remnant consisting of a few plane trees in S-sloping ravine with summer-dry rivulet, inclination 20°. A house is under construction in the remainder of the ravine. Substrate quartzite. On trunks of *Platanus* trees 0.5–1 m d.b.h. Ground flora sparse, dominated by *Rubus fruticosus* s.l. – 21 Sep 1997.

19. Nomos and eparchia Trikalon, S Pindos, S part of Mt Kerketio, c. 1 km W of Pili village, 39°27'N, 21°37'E, c. 210 m. – A rather open riparian *Platanus* forest on N slope, inclination 12°, facing Pinias river (or tributary). Substrate limestone. On trunks of *Platanus* trees 0.75–1 m d.b.h. Ground flora dominated by *Rubus fruticosus* s.l., *Urtica dioica* L., *Brachypodium sylvaticum* (Huds.) P. Beauv., *Calamintha nepeta* (L.) Savi. Moderately sheep-grazed. Picnic site (benches and tables between the trees). – 20 Sep 1997.

Sterea Ellas

20. Nomos Fthiotidas, c. 17 km W of Lamia town, N slope of Mt Iti, E outskirts of Ipati town. 38°52'N, 22°15'E, 380 m. – Riparian *Platanus* forest in a small ravine, with small waterfall on NW slope, inclination 55°. Used for recreational purposes, and due to its proximity of the town, heavily influenced by trampling, etc. Substrate crystalline acidic rock (probably metamorphic sandstone). On trunks of *Platanus* trees 0.6–1.25 m d.b.h. – 1 Aug 1994.

21. Nomos and eparchia Evritanias, c. 11 km SSW of Karpenisi town, just S of Mikron Chorion village, Karpenisiotis river, 38°51'N, 21°44'E, 590 m. – Situated in a narrow valley, this natural riparian *Platanus* forest borders a S-running river. A short stretch of dirt road alongside the river (old road?) functions as a lay-by. Substrate arkose. Ground flora includes *Rubus fruticosus* s.l., *Dactylis glomerata*, *Equisetum telmateia* Ehrh., *Convolvulus cantabrica* L., *Teucrium flavum* subsp. *hellenicum*

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Fig. 2. Plane trees in the square of the mountain village Kosmas (loc. 26) in SE Peloponnisos. The dark patches of the tree trunks are due to *Collema furfuraceum* and *Leptogium pulvinatum* var. *quercicola* in particular. Also present are *L. microphylloides* and *L. teretiusculum*.

Rech. f., *Agrimonia eupatoria* L. subsp. *eupatoria*, *Berteroa mutabilis* (Vent.) DC., *Calamintha nepeta*, *Verbascum glandulosum* Delile, *Brachypodium sylvaticum*, *Helleborus*, *Plantago major* L. On trunks of *Platanus* trees 30–80 cm d.b.h. – 28 Sep 1997.

22. Nomos Etoloakarnanias: S slope of Panetolikon Mts., along Karpenisi-Thermon road, c. 1 km N of Ladikon village, 38°41'N, 21°41'E, 980 m. – Riparian *Platanus* forest in small, S-facing ravine with summer-dry rivulet, in a bend of dirt road, slopes c. 50° on both sides. *Abies* forests surround the ravine. Substrate limestone. Ground cover sparse. On trunks of *Platanus* trees 0.8–1 m d.b.h. – 28 Sep 1997.

23. Nomos Etoloakarnanias: Evinos river along the small (old?) road which runs more or less parallel to the modern Nafpaktos-Mesolongion road, 38°24'N, 21°36'E, c. 75 m. – Modified natural riparian *Platanus* forest on level ground c. 50 m from river bed. Substrate acidic shingle. Ground cover sparse, including *Rubus fruticosus* s.l., *Nerium oleander* L., *Asparagus*. Recreational area for local inhabitants. On trunks of *Platanus* trees 1.5–2 m d.b.h. – 29 Sep 1997.

Peloponnisos

24. Nomos Messinias, Mt Taïgetos, along Kalamata (Kalamai)-Sparti road, in S outskirts of Artemisio village, 37°06'N, 22°14'E, 800 m. – On old *Platanus* trees at a kafenion (coffee-house) in N-facing bend in road in a damp ravine. – 17 Apr 1989. – Included in Christensen (1994b).

25. Nomos Argolidas, c. 27 km E of Nafplio town, near Neochori village, 37°32'N, 23°09'E, 225 m. – Riparian *Platanus* forest along rivulet with stagnant water in deep, narrow ravine on S slope, inclination 35º, surrounded by dry agricultural land. Undergrowth of *Nerium oleander*, *Ficus carica* L. and *Rubus*. No ground flora. On trunks of *Platanus* trees c. 75 cm d.b.h. – 30 Sep 2006.

26. Nomos Arkadias, c. 18 km WSW of the coastal town Leonidi, Kosmas village, 37°06'N, 22°44'E, 1125 m. – On large old *Platanus* trees c. 1.8 m d.b.h. with heavily shaded trunks in the central square of a mountain village. – 26 Sep 2006. – Fig. 2.

Kriti

27. Nomos Chanion, W coast, c. 9 km SW of Kissamos town, about half way between the villages Platanos and Sfinari, 35°27'N, 23°35'E, 300 m. – Riparian *Platanus* forest in W-facing ravine, inclination 25°. Undergrowth of *Nerium oleander*. Forest floor dominated by dense *Urtica pilulifera* L. Substrate quartzite. On trunks of *Platanus* trees c. 75 cm d.b.h. – 26 Apr 2009.

28. Nomos Chanion, c. 15 km S of Kissamos town, few km W of Louchi village, at the side road to the south, 35°22'N, 23°37'E, 500 m. – Riparian *Platanus* forest in a S-facing ravine with stream in a bend in the road. Undergrowth of *Nerium oleander.* Picnic site. Substrate quartzite. On trunks of *Platanus* trees 50–75 cm d.b.h. – 29 Apr 2009. – Fig. 3 & 4.

29. Nomos Chanion, c. 5.5 km NE of Paleochora town, E outskirts of Azogires village, 35°16'N, 23°43'E, 400 m. – Riparian *Platanus* forest in ravine on SE slope. Undergrowth of *Nerium oleander*. On trunks of *Platanus* trees c. 40 cm d.b.h. – 30 Apr 2009.

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30. Nomos Chanion, c. 26 km SW of Chania town, just S of Agia Irini village, Agia Irini Gorge, 35°19'N, 23°50'E, 575–550 m. – Riparian *Platanus* forest in NW–SE-running gorge, inclination 10° to SE. Substrate limestone. On trunks of *Platanus* trees 0.4–1 m d.b.h. – 27 Apr 2009.

31. Nomos Chanion, c. 19 km SW of Chania town, just W of Langos village, 35°25'N, 23°53'E, 350 m. – Riparian *Platanus* forest along an E–W-running river valley with orchards (*Olea europaea*, *Castanea sativa* Mill., *Citrus*) in the valley bottom and on the lower slopes. Substrate quartzite. On trunks of *Platanus* trees 40–60 cm d.b.h. – 27 Apr 2009.

32. Nomos Chanion, c. 17 km SW of Chania town, just W of Langos village, 35°25'N, 23°54'E, 250 m. – Riparian *Platanus* forest along an E–W-running river valley with orchards (*Olea europaea*, *Castanea sativa*, *Citrus*) in the valley bottom and on the lower slopes. Substrate quartzite. On trunks of *Platanus* trees c. 40 cm d.b.h. – 27 Apr 2009.

33. Nomos Rethymnis, c. 19 km SW of Rethymno town, c. 3 km N of Myriokefala village, at the junction of the side road to Maroulou village with the Episkopi-Asi Gonia road, E bank of Mafselas river, 35°16'N, 24°18'E, 275 m. – Riparian *Platanus* forest along water-bearing river. Undergrowth of *Nerium oleander*, *Smilax aspera* L., *Quercus coccifera*. Ground flora with *Arisarum vulgare* Targ. Tozz., *Dracunculus vulgaris* Schott, *Cyclamen creticum* Hildebr. On *Platanus* trees 40–75 cm d.b.h. – 1 Apr 2011.



Fig. 3. A riparian plane forest in a small ravine in an area with maquis on the W slope of the westernmost mountains of Kriti (loc. 28). It is a typical representative of riparian plane forests in small ravines in the sense that it is partly modified by picnic amenities at the intersection of the road.



Fig. 4. Closer view of loc. 28. Note the light and dark patches on the tree trunks, representing the *Xanthorion* and hygrophytic elements of the flora, respectively.

34. Nomos Rethymnis, c. 19 km S of Rethymno town, just N of Kourtaliotiko Ravine, at the side road to Frati village, 35°12'N, 24°28'E, 275 m. – Single exposed, probably planted, *Platanus* above the riparian *Platanus* forest in the valley bottom. On *Platanus* tree c. 75 cm d.b.h. – 3 Apr 2011.

35. Nomos Rethymnis, N foothills of Mt Psiloritis, c. 7 km SW of Perama town, c. 2 km NE of Arkadi monastery, at Agia Paraskevi chapel, 35°19'N, 24°39'E, 380 m. – Riparian *Platanus* forest on N-facing slope, inclination 20°, with phrygana/maquis. Substrate limestone. On *Platanus* trees c. 50 cm d.b.h. – 5 Apr 2011.

36. Nomos Rethymnis, N foothills of Mt Psiloritis, c. 2 km ESE of Perama town, c. 1 km W of Agios Silas church, 35°21'N, 24°43'E, 75 m. – Level valley bottom with dried-out river bed. Riparian *Platanus* forest in area with small fields and orchards. Substrate limestone. On *Platanus* trees c. 30 cm d.b.h. – 5 Apr 2011.

37. Nomos Irakliou, c. 17 km NNW of Iraklio town, in the river valley between Fodele village and Agios Pan-

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Fig. 5. An old plane tree of an open riparian forest in a summer-dry rivulet (loc. 37). The non-scaly bark of the trunk was covered in dirt from the spring flood. Only three species of lichen were found on this the easternmost locality studied on Kriti, viz.: *Bacidia subincompta*, *Collema auriforme* and *Leptogium tenuissimum*.

deleïmon monastery, 35°22'N, 24°58'E, 75 m. – SE-sloping river valley with riparian *Platanus* forest. River bed dry. On *Platanus* trees 1–1.75 m d.b.h. – 6 Apr 2011. – Fig. 5.

Results

List of taxa

Lichens

**Agonimia tristicula* (Nyl.) Zahlbr. – (2) (*11686*); (8) *10731*; (11) (*12629*, *12631*, *12632*, *12636*), *12641*, (*12643*, *12646*, *12647*, *12654*); (12) (*12698*, *12699*); (15) *12050*, *12051*; (16) *11759*; (19) (*11847*, *11851*, *11863*, *11867*), *11872*, *11873*; (20) *11035*, *11037a*, (*11038a*); (23) (*12125*, *12127*), *12138*. – The specimens were all sterile, hence distinguished from *A. octospora* Coppins & P. James by the colour and shape of the squamules (James 1981). New to Ipiros, Makedonia and Thessalia.

Anaptychia ciliaris (L.) Körb. ex A. Massal. – On bark and among mosses. (10) *12678*; (21) (*12083*), *12101*, *12106*; (24) *5735*, *5749*.

**Arthonia dispersa* (Schrad.) Nyl. – (5) *10891* conf. B. J. Coppins. – Known from Kriti (Grube & al. 2001). – New to Makedonia.

Arthonia radiata (Pers.) Ach. – (10) (*12664*), *12665*.

****Arthonia* aff. *stellaris* Krempelh. – (15) *12061a* det. B. J. Coppins. – This species occurs in "temperate Europe in oceanic or montane areas" (Smith & al. 2009). In Italy it is extremely rare in Toscana and Lazio (Nimis & Martellos 2008). In the Balkans it is known from Slovenia (Suppan & al. 2000).

****Bacidia absistens* (Nyl.) Arnold – (10) (*12661*, *12667*) det. E. Llop; (11) *12648* det. E. Llop. – In Italy it is extremely rare to very rare along the Tyrrhenian coastal provinces and in Sicily (Nimis & Martellos 2008). In the Balkans it is known from Slovenia (Suppan & al. 2000; Mayrhofer 2006).

Bacidia arceutina (Ach.) Arnold – (10) (*12658*), *12661*, (*12662*, *12663*, *12667*) all conf. or det. E. Llop; (15) (*12061*) det. S. Ekman & E. Llop.

***Bacidia circumspecta* (Nyl. ex Vain.) Malme – (2) *11685a*, *11691*, *11694* all det. or conf. S. Ekman & E. Llop; (29) *14242*. – Known from the islands of Naxos, Kriti and Rodos (Abbott 2009).

***Bacidia fraxinea* Lönnr. – (4) *11708*; (11) (*12643*); (15) *12060*; (16) (*11755*); (21) *12104a*. All det. E. Llop. – Known from Kriti (Abbott 2009).

***Bacidia parathalassica* Llop & Gómez-Bolea – (11) *12645a*, *12646*, *12649*; (14) *12038*; (15) *12062*. All det. E. Llop. – New to Ipiros and Thessalia.

Bacidia rubella (Hoffm.) A. Massal. – On bark and mosses on bases and middle parts of trunks. (4) *11704*, (*11706*), *11715* all conf. S. Ekman & Llop; (10) (*12661*), *12679* conf. E. Llop; (12) *12712*, *12715* conf. E. Llop; (15) *12065* conf. E. Llop; (16) *11751*, *11753*; (19) (*11848*) conf. E. Llop; (21) (*12088*); (22) *12114* conf. S. Ekman & E. Llop.

***Bacidia subincompta* (Nyl.) Arnold – (10) (*12667*) conf. E. Llop; (17) *11903* conf. S. Ekman: (37) *14514*. – New to Ipiros.

Bacidia thyrrenica Llop – (10) (*12667*) det. E. Llop; (11) *12646* det. E. Llop; (14) *12038* det. E. Llop; (15) *12060*, *12062* both det. E. Llop. (31) *14167*. (35) *14494*, *14496*, *14497*, *14498*, *14499*. – The specimens determined by E. Llop were reported by Llop & al. (2007).

***Bacidina phacodes* (Körb.) Vězda (≡ *Bacidia phacodes* Körb.) – (16) *11752* det. E. Llop. – Known from the islands of Evvia, Naxos, Kalymnos and Kriti (Abbott 2009).

Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr. – (8) (*10733*); (10) (*12667*); (12) (*12701*, *12703*); (17) (*11903*); (19) *11884*; (24) (*5734*); (34) *14470*.

Caloplaca cerinella (Nyl.) Flagey – (7) *10838*; (12) (*12701*).

Caloplaca citrina (Hoffm.) Th. Fr. – (4) *11709*; (20) *11034*.

Caloplaca ferruginea (Huds.) Th. Fr. – (10) *12673*; (11) *12631*, (*12636*, *12640*).

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Caloplaca flavorubescens (Huds.) J. R. Laundon – (1) (*11662*), *11674*; (2) (*11686*), *11695*; (7) (*10839*), *10846*; (8) (*10709*), *10732*; (10) *12664*, (*12667*); (12) (*12701*); (19) (*11880*), *11883*; (24) (*5734*), *5738*; (28) (*14212*). (30) *14175*, *14180*; (33) *14463*; (34) *14469*; (35) (*14494*, *14495*, *14496*, *14499*); (36) (*14504*). – In agreement with Abbott (2009) I find that the two varieties, var. *flavorubescens* and var. *quercina* Giralt, Nimis & Poelt, are not always easy to separate. The species is therefore treated here in the broad sense.

Caloplaca haematites (Chaub. ex St.-Amans) Zwackh – (1) (*11668*, *11669*, *11677*, *11681*); (24) (*5738*).

Caloplaca herbidella (Hue) H. Magn. – (1) (*11662*, *11663*, *11668*, *11674*, *11677*), *11682*, (*11683*); (2) *11687*; (12) (*12703*); (13) *10854*.

Caloplaca pyracea (Ach.) Th. Fr. – (1) (*11662*, *11668*, *11669*, *11674*, *11681*, *11683*); (2) (*11699*); (3) (*11701*); (4) (*11716*), *11719*; (6) (*11735*); (7) (*10834*, *10839*, *10846*); (9) (*5804a*), *5809*, (*5810*); (11) (*12625*); (12) *12703*, (*12704*, *12705*, *12707*), *12708*, *12709*; (16) *11746*; (17) (*11908*); (18) (*11891*); (23) (*12128*); (28) (*14213*); (*30*) (*14196*); (32) (*14154*).

Caloplaca servitiana Szatala – (19) *11880* det. J. Vondrák. – Known from the Aegean island of Samos (Abbott 2009), Kriti and the Pindos Range of the mainland (Vondrák & al. 2012). "It is perhaps common in Greece" (Vondrák pers. comm.).

**Candelaria concolor* (Dicks.) Stein – (11) *12654*. – New to Ipiros.

Candelariella aurella (Hoffm.) Zahlbr. – (9) *5805*.

Candelariella reflexa (Nyl.) Lettau – (4) *11711*.

Candelariella vitellina (Hoffm.) Müll. Arg. – On middle parts and bases of trunks (1) (*11662*, *11681*); (7) (*10838*); (16) *11755*; (19) (*11863*), *11885*, *11848*, (*11859*).

Candelariella xanthostigma (Ach.) Lettau – (7) (*10838*); (11) (*12649*).

Catillaria chalybeia (Borrer) A. Massal. – (5) *10865a*, (*10868*); (7) *10835*.

Catillaria nigroclavata (Nyl.) J. Steiner – (7) (*10834*), *10839*, (*10846*); (10) (*12667*); (12) *12700*, (*12701*), *12707*, (*12708*); (19) (*11847*, *11880*).

Catinaria atropurpurea (Schaer.) Vězda & Poelt – (14) *12041*; (15) (*12059*, *12060*), *12063a*; (19) *11868a*.

Cladonia pyxidata (L.) Hoffm. – On mosses on a trunk. (20) *11040* (tlc: atranorin and fumarprotocetraric acid).

Collema auriforme (With.) Coppins & J. R. Laundon – On *Homalothecium sericeum*, *Hypnum cupressiforme*, *Leucodon sciuroides* and other mosses on bases as well as middle parts of trunks. (8) *10714*, *10715*, *10723*, *10729*; (11) (*12653*); (12) *12692a*, *12697*, (*12698*, *12699*, *12703*); (18) *11895*, *11898*, *11899*; (19) *11854*, *11870*, *11871*; (22) (*12115*), *12120*; (23) (*12125*, *12132*); (24) *5739* det. G. Degelius, *5746*; (28) *14210*; (29) *14236*, *14241*; (30) *14176*, *14201*, *14202*; (33) *14460*, *14462*; (37) *14513*. – At loc. 8 the specimens from the base were covered in clay, indicating inundation during the spring flood.

Collema conglomeratum Hoffm. – (6) *11723*, *11724*, *11725*, *11732*; (29) *14243*, *14244*.

Collema fasciculare (L.) F. H. Wigg. – (21) *12087*. – Otálora & Wedin (2013) showed that *C. fasciculare* belongs to *Arctomiaceae* and made the combination *Arctomia fascicularis* (L.) Otálora & Wedin. However, as the genus *Arctomia* is heterogeneous (Otálora & Wedin 2013) and new combinations are likely to take place in the future, I prefer to keep the established name until the taxonomy is settled.

Collema flaccidum (Ach.) Ach. – On *Homalothecium sericeum* and other mosses on bases as well as middle parts of trunks. (7) *10843*; (8) *10734*; (12) *12692b*, *12698*, (*12697*, *12712*); (17) *11905*, *11909*; (19) (*11863*); (20) *11046*; (22) (*12117*, *12120*), *12121*, *12122* (fertile); (24) *5733* conf. G. Degelius, *5750*; (29) *14239*.

****Collema fragrans* (Sm.) Ach. emend. Degel. – (27) *14137*; (30) *14185*. – In the Balkans known from Slovenia (Suppan & al. 2000), Bosnia & Herzegovina (Bilovitz & Mayrhofer 2011) and Bulgaria (Mayrhofer & al. 2005).

Collema furfuraceum (Arnold) Du Rietz – On bark and mosses on trunks. (8) *10712*, *10716*; (10) *12675*; (11) *12627*, *12639*; (12) (*12697*), *12714*; (19) *11881*; (20) *11037*; (21) *12095*, (*12100*); (26) (*13681*), *13683*, *13684*, *13685*, *13686*.

****Collema ligerinum* (Hy) Harm. – (8) *10737*; (23) *12126*, *12128a*, *12129a*, *12132*, *12133a*; (27) *14128*, *14140*, *14142*. – In the Balkans known from Slovenia (Suppan & al. 2000), Bosnia & Herzegovina (Bilovitz & Mayrhofer 2011) and Bulgaria (Mayrhofer & al. 2005).

Collema multipunctatum Degel. – (2) (*11686*), *11694a*, (*11697*); (16) *11748*; (21) (*12094*); (30) *14189*; (31) *14161*, *14166*, (*14167*, *14168*, *14170*), *14172*.

Collema nigrescens (Huds.) DC. – (1) *11660*, *11665*, *11671*, *11672*, *11673*, *11681*; (7) *10840*; (10) *12687*; (11) *12653*; (12) *12694*, *12698a*, (*12701*); (21) (*12083* cf., *12094*); (23) *12137*; (25) *13722*; (28) *14210*; (33) *14459*. – The specimens *12687*, *12694* and *12698a* puzzled me for some time. They have a typical *nigrescens*-type thallus, with prominent ridges and pustules. The isidia are, however, squamiform. This combination of characters could not be keyed out using Degelius (1954). The only taxon with a ridged and pustulate thallus in combination with squamiform isidia seems to be *C. hueanum* var. *squamosum* Degel., but the ridges are not as fine as described and illustrated by Degelius (1974) and the pustules are more prominent. Comparison with specimens of this taxon at UPS collected and determined by G. Degelius (South Africa, Cape Prov.,

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Wynberg Div., Kirstenbosch, Botanic Gardens, 29 Jan 1970, *SA-13*; South Africa, Cape Prov., Stellenbosch Div., Jonkershoek Valley, 28 Jan 1970, *SA-8* and *SA-5*) confirmed that the Greek specimens could not belong to *C. hueanum* var. *squamosum*. During a field trip to Spain, specimens of *C. nigrescens* (e.g. Cantabria, Picos de Europa, NW Potes, Christensen *13624*) with both granular and squamiform isidia were collected, which made it possible to key the specimens out as *C. nigrescens*. In the description of *C. nigrescens* by Degelius (1954) it is said that this taxon sometimes can have squamiform isidia in addition to the granular ones. The three Greek specimens must, therefore, be considered as an extreme form (of no taxonomic value) of *C. nigrescens* with only squamiform isidia.

Collema occultatum Bagl. – (8) (*10709*), *10710*, (*10717*), *10718*.

Collema subflaccidum Degel. – On bark and moss on trunks. (6) *11726*, *11735*; (7) *10837*; (8) *10717*, *10728*, *10730*; (10) (*12666*); (11) *12640*; (12) *12695*, (*12699*), *12710*; (17) (*11918*); (19) (*11847*, *11850*), *11859*, (*11862*), *11863*; (21) (*12093*, *12103*).

Collema subnigrescens Degel. – On bases and middle parts of trunks. (1) *11663*; (8) *10735*, *10736*; (10) *12657*, *12659*, *12671*, *12674*; (11) *12650*, (*12652*); (15) (*12055*), *12066*; (17) *11910*; (19) *11864*; (21) (*12091*); (23) *12141*; (24) *5744*, *5745*, *5747*; (28) *14203*, (*14213*); (31) *14162*, *14169*.

Diplotomma alboatrum (Hoffm.) Flot. – (34) (*14470*). – This is a variable species (Smith & al. 2009). The species concept of Clauzade & Roux (1985, as *Buellia alboatra* (Hoffm.) Th. Fr.) is adopted here.

Fuscopannaria mediterranea (Tav.) P. M. Jørg. (≡ *Pannaria mediterranea* Tav.) (Jørgensen 1994b) – (6) *11740*; (10) *12662*, *12670*; (17) *11918*; (21) (*12084a*), *12093* both cf.; (24) *5732*.

Fuscopannaria olivacea (P. M. Jørg.) P. M. Jørg. (≡ *Pannaria olivacea* P. M. Jørg.) (Jørgensen 1994b) – (17) *11917*; (21) *12086*, *12090*; (24) *5740*, *5742* conf. P. M. Jørgensen.

**Gyalecta derivata* (Nyl.) H. Olivier – (2) *11687a* conf. A. Vězda. – New to Makedonia.

**Gyalecta truncigena* (Ach.) Hepp – (5) *10887* "*Gyalecta truncigena* ad var. *liguriensis* Vězda vergens (sp. citriformes)" (A. Vězda on label), (10888); (11) *12630* spores muriform, 18–21 × 10–12 µm; (15) *12059*, "*Gyalecta truncigena* var. *truncigena*. Sp. crebre muralidivisae, 20–22 × 10–12 µm" (A. Vězda on label); (27) *14129*, *14133*, *14141*. – New to Ipiros and Thessalia.

***Haematomma ochroleucum* var. *porphyrium* (Pers.) J. R. Laundon – On trunks and limbs. (10) (*12674*); (12) *12711*. – Known from Santorini (Abbott 2009).

Hyperphyscia adglutinata (Flörke) H. Mayrhofer & Poelt – (4) (*11716*), *11720*; (11) (*12631*, *12633*), *12634*, (*12637*, *12641*); (12) (*12701*, *12709*); (13) *10850*, *10851*, *10852*, *11922*; (14) *12036*, (*12037*, *12041*, *12042*), *12043*, *12044*, (*12046*).

**Koerberia biformis* A. Massal. – (8) *10709*; (22) *12115*; (24) (*5736*). – This specimen was erroneously reported as *Vestergrenopsis isidiata* (Degel.) E. Dahl by Christensen (1994b). On the Iberian Peninsula *K. biformis* occurs in warm and humid sites, mainly in the west, but in continental parts it occurs in deep valleys and ravines (Burgaz & Martínez 2001), i.e. under similar conditions as the present study. – New to Ipiros and Sterea Ellas.

Lecania cyrtella (Ach.) Th. Fr. – (12) *12701*; (24) (*5738*).

**Lecania cyrtellina* (Nyl.) Sandst. – On bases and middle parts of trunks. (19) *11869*, *11869a*. – New to Thessalia.

Lecania naegelii (Hepp) Diederich & Van den Boom – (1) (*11662*, *11668*), *11669*, (*11674*, *11681*, *11682*); (2) (*11686a*); (5) *10866b*, *10867*, *10868*, *10869*; (7) (*10838*, *10839*); (10) *12667*, (*12668*) conf. E. Llop; (13) *10853*; (14) (*12041*); (15) (*12053*); (16) (*11755*); (19) *11885a*; (28) *14216a*.

Lecanora chlarotera Nyl. subsp. *chlarotera* f. *chlarotera* – (1) (*11668*, *11669*, *11683*); (2) *11686*; (5) *10861a*, (*10863*), *10865*, (*10867*), *10874*; (9) *5811*; (15) (*12061*), *12067*; (19) *11874*, (*11881*); (25) *13717*; (30) *14179*, *14197*; (32) (*14154a*); (34) *14468*; (35) *14495*, (*14496*); (36) *14506*.

Lecanora chlarotera subsp. *chlarotera* f. *crassula* (H. Magn.) Poelt – (36) *14505*.

Lecanora dispersa (Pers.) Sommerf. – (1) (*11662*), *11675a*, *11677*, (*11669*, *11674*, *11681*, *11683*); (7) (*10839*); (18) *11891*; (28) (*14213*).

Lecanora hagenii (Ach.) Ach. – (5) *10866a*; (8) (*10709*, *10732*); (9) *5810*; (12) (*12708*); (16) (*11755*); (19) (*11867*); (20) (*11034*); (26) *13677*; (30) *14181*, (*14196*). – See note under *L. persimilis*.

Lecanora horiza (Ach.) Linds. – (4) *11713*; (7) *10847*; (10) *12669*; (19) *11882*; (21) (*12101*); (25) *13718*; (30) *14186*; (34) *14467*; (35) (*14494*, *14497*, *14499*); (36) *14507*.

Lecanora meridionalis H. Magn. – (19) (*11881*).

Lecanora persimilis (Th. Fr.) Nyl. – (7) (*10846*); (9) *5804a*. – Among the specimens originally determined as *Lecanora hagenii* mainly by use of Clauzade & Roux (1985), re-examination using the revision by Śliwa (2007) resulted in these records of a species recently reported as new to the Greek mainland (Christensen & Svane 2009).

Lecanora rugosella Zahlbr. – (1) (*11677*); (10) *12660*, (*12667*), *12668*, (*12669*); (19) (*11880*); (30) (*14181*), *14183*; (32) (*14153*); (35) (*14499*).

Lecanora sambuci (Pers.) Nyl. – (1) (*11668*, *11670*).

Lecanora sp. – (5) *10892*. – Thallus very thin, ecorticate, grey with yellowish white convex soralia, which become confluent, developing a thick, farinose thallus. Traces of usnic acid and zeorin by hptlc. Apothecia with pale discs and sorediate thallus margin, which

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is not raised above the disc. The brown colour and the granules of the epithecium disappear in KOH. Ascospores ellipsoid, colourless, non-septate, c. 10 × 5 µm. This specimen probably belongs to an undescribed taxon close to *L. leuckertiana* Zedda (Zedda 2000), *L. compallens* Herk & Aptroot, *L. sorediomarginata* Rodrigues, Terrón & Elix (Rodrigues & al. 2011) or *L. strobilina* (Spreng.) Kieff. However, the chemistry of *L sorediomarginata* differs, the thallus margin of *L. strobilina* is not sorediate and *L. compallens* has so far not been found with apothecia. *Lecanora leuckertiana* has been transferred to *Lepraria: Lepraria leuckertiana* (Zadda) L. Saag. The specimen is under study by T. Tønsberg.

Cf. *Lecanora* sp., det. T. Tønsberg – (4) *11717* with pigmented external soredia and zeorin (by tlc); (5) *10858* with unknown substance in rf 5-6; (12) *12689* with usnic acid and zeorin (by tlc); (19) on mosses on trunk *11866* with usnic acid and zeorin (by tlc); (20) (*11034*), *11039* with grey spot in rf 5-6 (above zeorin); (30) *14188*. – These are all crustose sorediate specimens in need of further study.

Lecidella achristotera (Nyl.) Hertel – (1) (*11662*, *11673*); (2) *11693*; (4) *11705*; (5) *10863*, (*19892*); (19) (*11885a*); (24) (*5745*).

Lecidella elaeochroma (Ach.) M. Choisy – (5) *10861*; (7) *10832*, *10844*, (*10847*); (11) (*12638*); (15) (*12067*); (19) (*11848*); (25) (*13714*), *13716*; (30) (*14175*), *14178*, (*14180*, *14181*), *14184*, *14187*, *14196*; (32) *14153*, (*14154*, *14155*); (35) (*14499*); (36) *14504*.

Lecidella euphorea (Flörke) Hertel – (1) (*11668*, *11674*, *11677*, *11681*); (5) *10870*; (7) (*10838*, *19839*), *10841*; (10) (*12669*); (15) *12068*; (17) *11912*; (19) (*11876*), *11879*, (*11880*); (20) *11045*; (24) (*5734*); (33) *14461*; (35) (*14495*).

****Lecidella laureri* (Hepp) Körb. – (5) *10864*. – In the Balkans known from Slovenia (Suppan & al. 2000, Mayrhofer 2006), Bosnia & Herzegovina (Bilovitz & Mayrhofer 2011), Montenegro (Knežević & Mayrhofer 2009) and Bulgaria (Mayrhofer & al. 2005).

****Lemmopsis* cf. *pelodes* (Stein) T. L. Ellis – (31) *14159a*, *14165* both det. P. M. Jørgensen. – No material for comparison was found in the lichen herbarium of Copenhagen University (C). Using the key of Ellis (1981) the specimens key out as *L. pelodes* (orange discs of apothecia and spores c. 18 × 9 µm). Morphological and anatomical characters are in accordance with this species, but the substrate is unusual, hence the "cf." (Jørgensen in litt.). *Lemmopsis affine* G. Samp., known only from the type locality in Portugal, has smaller spores (11–12.5 × 4.5–5.5 µm) and convex apothecial discs (Ellis 1981). The habitat of *L. pelodes* is non-calcareous sandy clay (Ellis 1981). However, in riparian forests in Greece the trunks of plane trees are often coated in clay and silt for a considerable height. This was also the case at the present locality on a bedrock of quartzite. The species was hitherto known from Sweden, Finland, Poland and Lithuania (Ellis 1981; Jørgensen 1988, 2007; Jørgensen & Motiejūnaite 2005), and Montenegro (Knežević & Mayrhofer 2009). According to Linda in Arcadia (pers. comm.) it also occurs in Norway, the Netherlands and Belgium. The present find together with that from Montenegro indicate that the species is far more widespread than the previous finds from N Europe suggest.

**Lepraria alpina* (B. de Lesd.) Tretiach & Baruffo (= *Leproloma cacuminum* (A. Massal.) J. R. Laundon) – (5) *10890* P+ yellow, KC-, atranorin, unknown and porphyrylic acid by tlc. – New to Makedonia.

Lepraria eburnea J. R. Laundon – On bark and moss on trunks, (18) *11893*, *11901* both conf. T Tønsberg.

****Lepraria* cf. *impossibilis* Sipman – (20) *11041*, *11042* both with stictic acid complex by hptlc, both det. T. Tønsberg. These specimens, tentatively referred to *L. impossibilis*, known from Asia and tropical America (Kukwa & Sohrabi 2008), are in need of further study.

Lepraria lobificans Nyl. – (5) on moss and bark on trunk, *10889*; (15) on bark and moss on trunk, *12056*. Both conf. T. Tønsberg.

***Lepraria vouauxii* (Hue) R. C. Harris – (22) on moss on trunk, *12109* det. T. Tønsberg. – Known from the Aegean island of Ikaria (Abbott 2009).

Leproplaca xantholyta (Nyl.) Harm. – On moss and on *Opegrapha varia* Pers. on trunk. (12) *12690*; (20) *11043*.

****Leptogium aragonii* Otálora – On soil-infused (due to flooding) moss on base of trunk. (8) *10721*. – The species is widespread in Europe, where it grows on pleurocarpous mosses on the basal parts of tree trunks (Otálora & al. (2008).

Leptogium brebissonii Mont. – (10) *12676*, *12677*, *12683*, *12685*. – The report (as *L. ruginosum* (Dufour ex Schaer.) Nyl.) from Mt Taïgetos by Degelius (1956) is based on a specimen of *L. coralloideum* (Meyen & Flot.) Vain. (Jørgensen 1994a), as noted by Abbott (2009).

***Leptogium cyanescens* (Rabenh.) Körb. – (11) *12636*, *12651*. – Known from the islands of Evvia and Naxos (Abbott 2009).

**Leptogium furfuraceum* (Harm.) Sierk – On *Lepraria* s. lat. on *Homalothecium sericeum* on trunk. (28) *14207*. – New to Kriti.

Leptogium gelatinosum (With.) J. R. Laundon – (28) *14206*, (*14210*), *14211*.

**Leptogium intermedium* (Arnold) Arnold – (22) *12117*; (28) (*14210*). – New to Sterea Ellas and Kriti.

Leptogium lichenoides (L.) Zahlbr. – On *Homalothecium sericeum*, *Hypnum cupressiforme*, *Leucodon sciuroides* and among other mosses on bases and middle parts of trunks (6) *11728*, (*11740*), (*11738*, *11740*), *11742*; (15) *12057*; (16) *11756*; (17) (*11911*), *11916*; (18) *11888*, *11890*; (19) *11857*; (22) (*12113*), *12124*.

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***Leptogium microphylloides* Nyl. – (26) (*13678*), *13679* conf. M. G. Otálora; (28) *14204*, *14205*, *14208*; (29) *14240*, *14244a*; (31) *14163*. – The specimens referred to without specimen citation by Abbott (2009) are from Kosmas, Peloponnisos (loc. 26). The specimen reported as *L. microphylloides* Nyl. by Christensen (1994b) belongs to *L. microphylloides* auct. (see below); hence, the species is here formally reported as new to Greece. It seems that the species is mainly known from W, C and S France (Clauzade & Roux 1985), though its distribution is unclear as it is uncertain whether literature records refer to *L. microphylloides* Nyl. or *L. microphylloides* auct.

Leptogium microphylloides auct. non Nyl. – (2) (*11698*); (11) (*12651*); (12) *12702*, (*12703*), *12705*, (*12706*, *12707*, *12709*); (19) *11858*, (*11860*, *11880*); (21) *12084a*; (23) *12135*, *12136*, (*12137*); (24) *5734*, *5736* both conf. P. M. Jørgensen; (26) *13678*. – Broad-lobed specimens with marginal, and sometimes also laminal, isidia are referred to *L. microphylloides* by European authors. They do not belong to *L. microphylloides* Nyl. They are regarded as a growth form of *L. teretiusculum* by Jørgensen (1994a) and Jørgensen & Tønsberg (1999). However, as I have never observed any intermediate specimens, I am inclined to agree with Nimis & Tretiach (1999), who regard such specimens as belonging to a distinct taxon.

Leptogium pulvinatum (Hoffm.) Otálora var. *pulvinatum* – On mosses on bases of trunks, some of which are covered in clay and silt, and on *Homalothecium sericeum*, *Leucodon sciuroides* and other mosses on middle parts of trunks. (6) *11727*, *11731*, *11734*, *11736*; (8) *10713*, (*10715*), *10722*; (12) *12692c*; (17) (*11912*, *11920*, *11906*); (18) *11896*; (22) (*12120*), *12110*, *12116*, *12118*; (20) *11047*; (29) *14235*, (*14236*), *14237*, (*14239*, *14240*), *14241a*, (*14244*); (30) (*14173*).

***Leptogium pulvinatum* var. *quercicola* (Otálora, Aragón, I. Martínez & Molina) Otálora – (6) (*11741*); (8) (*10728*); (17) (*11908*); (22) (*12115*), *12121*; (23) (*12125*, *12128*), *12129*, (*12133*), *12134*, (*12135*); (24) (*5734*); (26) (*13678*), *13681* conf. M. G. Otálora, *13682*. This taxon is hitherto known from the C and S part of the Iberian Peninsula (Otálora & al. 2004, 2008), where it "mainly grows in humid valleys and ravines, inside well-preserved forests, from the meso- to supra-Mediterranean belts (750–1,280 m)" frequently together with species of *Collema*, *Fuscopannaria*, *Koerberia*, *Leptogium*, *Lobaria* and *Waynea* (Otálora & al. 2008). In the present study the conditions at the localities where *L. pulvinatum* var. *quercicola* was found are largely similar. Though present in the supra-Mediterranean belt, the altitude of loc. 6 and 8 was lower, 550 m and 425 m, respectively. Localities 22, 24 and 26 are in the montane-Mediterranean belt and loc. 23, at 75 m altitude, is in the thermo-Mediterranean belt (Table 1).

Leptogium saturninum (Dicks.) Nyl. – On bases and middle parts of trunks. (17) *11904*; (21) (*12083*), *12089*.

**Leptogium subaridum* P. M. Jørg. & Goward – (11) (*12650*), *12650a*, (*12651*, *12652*, *12654*); (24) (*5735*); (27) (*14137*), *14138*, (*14140*, *14142*), *14144*; (30) *14173*, *14192*; (32) (*14158*). – The specimen from loc. 24 was published as *L. lichenoides* by Christensen (1994b). Re-examination of the specimen showed it to be *L. subaridum* (Jørgensen & Goward 1994), described from North America and recently found in Europe (Aragón & al. 2004). This isidiate species grows on moss-covered ground in relatively dry conditions in forests of *Pinus ponderosa* P. Lawson & C. Lawson and *Pseudotsuga menziesii* (Mirb.) Franco in North America. In Europe it seems to be mainly epiphytic on broad-leaved trees in semi-arid to humid conditions (Aragon & al. 2004). *Leptogium subaridum* is reported from the Ionian island of Kerkyra (Corfu) (Aragon & al. 2004) and from Kriti (Christensen & Svane 2007). – New to Ipiros.

**Leptogium subtile* (Schrad.) Torss. – (2) (*11697*), *11698*, *11699*; (6) *11741*, *11743*; (8) *10726*, *10727*; (10) (*12664*); (11) *12629*, (*12630*, *12631*), *12632*, *12633*, (*12634*), *12635*, (*12636*), *12638*, *12639a*, (*12640*, *12641*, *12647*); (12) (*12698*, *12703*, *12706*, *12708*); (15) *12064*; (16) *11745*, *11754*, (*11756*, *11757*, *11758*), *11758a*; (17) *11905a*, (*11918*); (19) (*11847*), *11850*, *11851*, (*11859*, *11860*, *11862*, *11863*, *11869*); (20) (*11038a*); (21) (*12083*); (23) *12127*, (*12133*, *12136*); (25) *13724*, *13725*; (29) (*14237*); (31) *14171a*. – Jørgensen (1994a) stated that this species "usually grows on rotting wood or debris", whereas Aragón & Otálora (2004) stated that it grows on old trees "in well-preserved forests with humid and shaded conditions at altitudes of 750 to 1300 m". The latter is more in accordance with the conditions found in the riparian *Platanus* forests of Greece. Known from the Ionian island of Kerkyra (Corfu) (Christensen & al. 1997) and from Kriti (Grube & al. 2001). – New to Ipiros, Makedonia, Sterea Ellas and Peloponnisos.

Leptogium tenuissimum (Dicks.) Körb. – On silt-impreganted moss cushions on lower parts of trunks. (31) *14164*; (32) *14157*, *14158*; (37) *14512*.

Leptogium teretiusculum (Wallr.) Arnold – (2) (*11686*, *11687*), *11688*, (*11693*, *11694*, *11695*), *11696*, *11697*, (*11698*), *11700*; (4) *11703*, (*11708*), *11714*, (*11719*); (6) (*11731*, *11735*, *11741*); (8) *10709*, (*10717*, *10727*, *10733*); (10) (*12675*, *12681*, *12682*); (11) *12625*, (*12630*, *12636*, *12637*, *12638*, *12639*, *12640*, *12641*, *12647*, *12650*, *12651*, *12653*); (12) (*12698*, *12699*, *12701*, *12703*, *12706*); (14) *12046*; (15) (*12051*), *12055*, (*12066*); (16) (*11746*, *11754*, *11755*, *11756*), *11757*, *11758*, (*11759*); (17) *11908*, *11920a*; (19) (*11851*, *11859*, *11860*, *11862*, *11863*); (20) (*11035*), *11036*, *11037b*, *11038a*; (21) (*12083*, *12091*), *12092*, (*12093*, *12094*), *12096*, *12105*, (*12108*); (23) *12125*,

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Table 1. Number of hygrophytic species per locality in relation to the potential vegetation/vegetation zones of Greece. The number of species is shown as the range and (in brackets) the average.

Vegetation zone	Potential vegetation	Localities	Hygrophytic species
Thermomediterranean	Maquis (*Ceratonia siliqua* L., *Olea europaea* L., *Pistacia lentiscus* L.)	23, 25–37	0–9 (3.9)
Mesomediterranean	Sclerophyllous forests (*Quercus coccifera* L.)	2, 3, 4, 9–15, 17, 18, 20	0–18 (7.7)
Supramediterranean	Deciduous forests (*Quercus cerris* L., *Q. frainetto* Ten.)	1, 5–8, 16, 19	4–17 (7.8)
Montane Mediterranean	Montane forests (*Abies borisii-regis* Mattf., *Fagus sylvatica* L., *Pinus nigra* J. F. Arnold)	21, 22, 24, 26	5–23 (12.3)

(*12127*), *12128*, (*12130*), *12131*, (*12132*), *12133*, (*12134*), (*12136*); (24) (*5734*, *5736*, *5738*), *5741* conf. P. M. Jørgensen; (25) *13714*, *13715*, *13723*, (*13725*); (26) (*13679*); (27) (*14128*, *14138*, *14140*, *14141*, *14142*, *14144*); (28) *14214*; (29) (*14236*, *14237*, *14242*, *14243*); (30) *14174*, (*14176*), *14190. 14191*, *14193*, *14199*; (31) *14168*; (33) *14458*; (34) *14468a*.

Lobaria pulmonaria (L.) Hoffm. – On *Homalothecium sericeum*, *Leucodon sciuroides* and other mosses on trunks. (18) *11887* (var. *meridionalis* (Vain.) Zahlbr.); (21) *12081*; (22) *12112*.

Melanelixa glabra (Schaer.) O. Blanco & al. – (1) (*11683*); (21) (*12084*), *12085*.

Melanelixa glabratula (Lamy) Sandler Berlin & Arup. – (5) *10859*.

Melanohalea exasperatula (Nyl.) O. Blanco & al. – (1) *11679*; (19) *11875*, (*11876*).

Micarea prasina Fr. – (19) *11867*, *11868*; (21) (*12093*) sterile.

Mycocalicium subtile (Pers.) Szatala s. lat. – (16) *11749* det. L. Tibell.

Nephroma laevigatum Ach. – Among mosses on trunks. (21) *12082*, *12108*; (22) *12111*; (24) *5748*.

***Normandina pulchella* (Borrer) Nyl. – (11) *12642*, *12643*, (*12651*, *12654*). – Known from the Ionian island of Kefallonia (Mucina & al. 2000) and from Kriti (Grube & al. 2001).

Opegrapha atra Pers. – (5) *10886* conf. Egea & Torrente.

***Opegrapha culmigena* Lib. (= *O. varia* var. *herbarum* (Mont.) Källsten) – (15) *12054*. – Known from the islands of Kerkyra (Corfu) and Naxos (Abbott 2009).

***Opegrapha ochrocheila* Nyl. – (5) (*10882*, *10883*, *10884*), *10885*, *10888* all det. or conf. Egea & Torrente. – A doubtful record exists for the Aegean island of Amorgos (Abbott 2009).

****Opegrapha rufescens* Pers. – (5) *10882*, *19883* both det. Egea & Torrente, (*19885*, *10886*, *10891* all three conf. Egea & Torrente); (14) *12049*. – In the Balkans known from Slovenia (Suppan & al. 2000), Bosnia & Herzegovina (Bilovitz & Mayrhofer 2011) and Montenegro (Knežević & Mayrhofer 2009).

Opegrapha varia Pers. var. *varia* – (2) *11685*, *11689*, *11690*, *11692*; (15) (*12059*, *12060*), *12063*; (19) *11865*; (20) *11032*, *11033* both conf. Egea & Torrente, (*11034*, *11036*), *11044* conf. Egea & Torrente; (23) *12139*, *12140*. – No. *11689* has white pruinose apothecia (= *O. lichenoides* var. *nigrocaesia* Chev.).

Opegrapha sp. – (5) *10883*.

Parmelia sulcata Taylor – (5) *10878*.

Parmelina quercina (Willd.) Hale – (21) *12088*; (32) *14152*.

Parmelina tiliacea (Hoffm.) Hale – (1) *11676*; (4) *11718*; (11) *12637*, *12645*; (21) (*12088*); (28) *14215*.

Parmotrema perlatum (Huds.) M. Choisy – On *Hypnum cupressiforme* and on bark on trunks. (5) *10871*, *10877*; (10) *12686*.

Peltigera collina (Ach.) Schrad. – (21) *12083*, (*12088*).

Peltigera praetextata (Sommerf.) Zopf. – On *Homalothecium sericeum* and among other mosses on trunks. (17) *11911*; (22) *12113*, *12123*.

Pertusaria albescens (Huds.) M. Choisy & Werner – (5) *10876*; (11) *12647*; (12) (*12715*); (15) *12052*; (19) *11852*, *11877*; (21) *12091*, *12098*.

**Pertusaria albescens* var. *corallina* (Zahlbr.) J. R. Laundon – On bark and moss on trunks. (1) *11666*, *11675*; (5) *10872*; (21) *12103*. – New to Sterea Ellas.

Pertusaria hemisphaerica (Flörke) Erichsen – (5) *10879*.

Pertusaria pertusa (Weigel) Tuck. – (30) *14194*.

Pertusaria sp. – (14) *12042* sterile and without vegetative diaspores.

Pertusaria sp. – (15) *12069*. – Thallus "grey" crustose, verrucose, with pycnidia resembling narrow-based fruits of the genus, with rather broad openings; conidia acicular. No apothecia present.

**Phaeophyscia cernohorskyi* (Nádv.) Essl. – (28) *14212*. – New to Kriti.

****Phaeophyscia chloantha* (Ach.) Moberg – (10) *12680*. – In the Balkans known from Slovenia (Suppan & al. 2000; Mayrhofer 2006), Croatia (Christensen 1994a), Montenegro (Knežević & Mayrhofer 2009) and Bulgaria (Mayrhofer & al. 2005).

Phaeophyscia ciliata (Hoffm.) Moberg – (1) *11661*, *11680*; (19) *11878*. All det. or conf. R. Moberg.

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**Phaeophyscia hirsuta* (Mereschk.) Essl. – (14) *12037* conf. R. Moberg; (19) *11847* det. R. Moberg. – New to Thessalia.

Phaeophyscia orbicularis (Neck.) Moberg – (1) *11678*; (9) *5806* conf. R. Moberg; (10) *12681*, *12682*; (12) *12706*; (19) (*11860*); (26) *13676*; (27) (*14129*), *14132*, (*14134*); (28) (*14213*).

Phlyctis agelaea (Ach.) Flot. – (15) *12061*.

Phlyctis argena (Spreng.) Flot. – (5) *10862*, *10873*, *10875*; (6) *11730*; (10) *12655*, *12666*; (12) *12713*; (20) *11048*; (21) (*12098*), *12104*.

Physcia adscendens H. Olivier – (4) *11706*, (*11720*); (5) (*10874*, *10878*); (7) *10834*; (8) *10733*; (9) (*5806*); (10) (*12667*, *12682*); (11) (*12627*), *12628*; (12) (*12698*, *12701*), *12704*, (*12710*); (14) (*12037*, *12041*); (19) *11860*, *11861*, (*11881*); (21) (*12094*, *12099*), *12100*, (*12104*); (27) (*14129*), *14131*, *14139*; (28) *14209*; (30) *14182*; (31) (*14166*), *14170*; (32) *14150*.

Physcia aipolia (Ehrh. ex Humb.) Fürnr. – (19) *11862*; (32) *14154a*.

Physcia biziana (A. Massal.) Zahlbr. var. *biziana* – (9) *5804*; (13) *11924* det. R. Moberg; (14) *12045* det. R. Moberg; (21) *12107*; (32) (*14150*), *14151*.

Physcia biziana var. *leptophylla* Vězda – (31) *14160*.

Physcia leptalea (Ach.) DC. – (1) (*11669*); (21) *12094*, *12099*, (*12104*).

Physcia stellaris (L.) Nyl. – (13) *10849*; (27) *14130*, *14135*.

Physcia tenella (Scop.) DC. – (4) (*11715*); (11) (*12649*); (14) *12040*; (21) (*12080*, *12093*).

Physconia distorta (With.) J. R. Laundon – On *Leucodon sciuroides* and other mosses on trunks. (1) *11664*; (12) *12699*; (19) *11846*, (*11859*); (21) *12084*, (*12084a*, *12085*); (22) *12119*; (26) *13675*, *13680*.

Physconia enteroxantha (Nyl.) Poelt – On moss on trunks. (5) *10880*, *10881*.

Physconia grisea (Lam.) Poelt – (4) *11710*; (6) *11739*; (16) (*11756*).

Physconia perisidiosa (Erichsen) Moberg – (1) *11670*; (6) *11738*; (19) (*11847*) det. R. Moberg, *11856*; (21) (*12088*, *12099*).

Physconia servitii (Nadv.) Poelt – (11) *12652*; (19) *11876*; (31) *14171*; (32) *14154*.

Physconia venusta (Ach.) Poelt – (19) *11855*; (24) *5737*; (28) *14217*; (30) *14198*; (32) *14156*.

Porina aenea (Wallr.) Zahlbr. – (4) *11712*; (5) (*10883*), *10884*, (*10885*); (10) *12658*, (*12660*), *12663*, (*12664*, *12665*, *12667*, *12668*); (14) *12048*; (15) *12053*; (17) *11913*; (23) *12130* cf., thallus grey.

***Porina chlorotica* (Ach.) Müll. Arg. – (15) *12058*; (18) *11889*. – Known from the Ionian island of Kerkyra (Corfu) (Abbott 2009).

**Punctelia subrudecta* (Nyl.) Krog – (11) *12644*. – New to Ipiros.

Ramalina pollinaria (Westr.) Ach. – (10) *12684*.

Ramalina sp. – (30) *14196a*, juvenile specimen.

****Rinodina anomala* (Zahlbr.) H. Mayrhofer & Giralt – (2) *11686a* conf. H. Mayrhofer. – In Europe it is previously known from Portugal, Spain, S France and Dalmatia (Croatia) (Clauzade & Roux 1985). Poelt (1969) mentioned a Portuguese specimen with brown hypothecium as deviating from the description by Zahlbruckner (1914, as *Buellia anomala* Zahlbr.), where it is stated to be colourless. The present specimen has colourless hypothecium and concurs with the description given by Giralt (2001), who characterized the species as rather oceanic. In Italy it is rare in Puglia and very rare in Sardinia (Nimis & Martellos 2008). Its general distribution is W Mediterranean-Macaronesian. The specimens from Dalmatia and Greece may represent the E fringe of its area.

Rinodina colobina (Ach.) Th. Fr. – (1) *11683*; (24) (*5736*) both det. H. Mayrhofer; (28) (*14212*), *14213*.

Rinodina exigua (Ach.) Gray – (9) *5809a*.

Rinodina plana H. Magn. – (30) *14195*.

Rinodina pyrina (Ach.) Arnold – (1) (*11662*), *11668*, (*11677*) all det. or conf. H. Mayrhofer.

Sclerophora sp. – (5) (*10888*) det. L. Tibell.

Staurolemma omphalarioides (Anzi) P. M. Jørg. & Henssen – (7) *10833*, *10836*; (10) *12672*; (17) *11915*; (21) *12087a*, *12102*; (22) (*12115*); (24) *5743*; (25) *13720*.

Xanthoria parietina (L.) Th. Fr. – (1) (*11677*), on *Phaeophyscia* sp. *11667*; (4) *11716*; (6) *11737*; (8) (*10733*); (9) *5807*, *5808*; (10) *12656*, (*12667*, *12668*, *12669*); (11) (*12654*); (12) (*12700*); (13) *11923*; (14) (*12041*); (16) (*11755*, *11759*); (21) (*12092*, *12093*, *12094*), *12097*, (*12099*, *12100*, *12101*, *12107*); (27) *14134*; (28) *14216*, *14218*; (30) *14197a*; (32) (*14150*, *14154a*), *14155*; (34) *14471*.

Bryophytes

In a number of cases the dominant bryophytes were collected. They were also present together with a large number of the collected lichen specimens.

Homalothecium sericeum (Hedw.) Schimp. – (4) (*11703*); (6) (*11728*), *11744*; (12) *12692*; (16) (*11746*, *11751*, *11756*); (17) (*11911*), *11914*, *11921*; (18) (*11891*); (19) *11853*, (*11865*, *11872*); (21) (*12096*); (22) (*12112*, *12116*, *12123*); (28) *14207a*.

Hypnum cupressiforme Hedw. – (15) (*12052*); (17) (*11916*, *11920*); (18) (*11895*); (21) (*12083*, *12108*).

Leptodon smithii (Hedw.) F. Weber & D. Mohr – (8) *10719* det. G. R. Hansen.

Leucodon sciuroides (Hedw.) Schwägr. – (2) (*11688*); (4) *11707*; (6) (*11731*), *11733*; (8) *10711*; (12) *12691*; (16) (*11746*); (17) *11902*, (*11916*, *11920*); (18) (*11887*, *11898*); (19) *11845*, (*11850*, *11854*, *11863*, *11871*, *11872*, *11873*); (21) (*12083*, *12084*, *12108*).

Pterogonium gracile (Hedw.) Sm. – (12) *12693*.

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Discussion

Species composition in relation to environment

From the relatively high number of localities that include lay-bys, picnic sites, etc. it may seem as if this collector has an inclination towards the comfortable. However, where rivulets with riparian plane forests intercept roads, amenities providing resting place and drinking water are often provided (Fig. 3 & 4). Also, in general, the narrow, bending mountain roads with steep slopes next to roadways and an abundance of blind bends, along with a rather fatalistic attitude of many Greek drivers, in many cases made parking less than appealing. A lot of promising sites were therefore left unstudied.

Being conducted as a purely floristic study, no attempt to quantify the abundance of the species at the localities was undertaken. However, the abundance of the taxa on the different localities is to some degree reflected in the number of co-occurrences enumerated in the species list, at least with regard to the minor species. Particularly abundant at many localities are *Leptogium subtile* and *L. teretiusculum*. To a lesser extent this applies to *Agonimia tristicula*, *Caloplaca flavorubescens*, *C. pyracea*, *Leptogium lichenoides*, *L. pulvinatum* var. *quercicola* and *Physcia adscendens*.

The encountered lichens can be grouped as (1) hygrophytic species, including *Lobarion* species, (2) *Xanthorion* and other species of nutrient-rich environments and (3) other lichens that do not belong to either of the above categories (Fig. 6). Ecological information for Fig. 6 was extracted from Nimis (1993) and Puntillo (1996). Some species have, according to these authors, a clear hygrophilous bias in the C Mediterranean area (Italy), though they generally have wider ecological amplitudes or even opposing ecological niches. That lichen species may inhabit different ecological niches in different climatic zones was documented by Poelt (1987). However, the similar geography of Greece and Italy – both being mountainous north-south-oriented peninsulas in the NC Mediterranean area – gives reason to believe that the ecological statements of Nimis (1993) and Puntillo (1996) can be applied more or less directly in a Greek context.

Climate and vegetation zones

In general, the climatic conditions of the E Mediterranean riparian plane forests are those of warm summers with a prolonged dry spell, mild winters and frequent precipitation during autumn, winter and spring (Bohn & al. 2003). However, being an azonal vegetation type ranging through more vegetation zones (Horvat & al. 1974), the climatic conditions vary with altitude: the cooler environment of higher altitudes creates a more humid environment than similar precipitation does at a lower altitude.

When relating the localities to the potential vegetation of their respective areas (Quézel & Barbero 1985), there appears to be a direct relationship between the vegetation zones and the number of hygrophytic species (Table 1).

Stand parameters

A large number of parameters both within the stand and in the immediate surroundings influence the composition of the epiphytic lichen flora, and human influence in varying degrees is present at all sites. No standardized method to quantify these parameters was used. The following is based on observations in the field. The sites modified or altered by humans are mainly found in the lowland and at lower elevations of the E part of the mainland, while at higher elevations on the steeper slopes on the W side of the Pindos Range the surrounding vegetation of the localities is more natural. This gradient in naturalness is, however, paralleled by an increase in precipitation. These two factors are likely to affect the lichen flora in concert. Natural or near-natural riparian plane forests (loc. 2, 5, 6, 7, 8, 10, 11, 12, 15, 16, 17, 19, 20, 21 & 24) generally have a higher number of species and a higher percentage of hygrophytic species than degraded, modified or artificial sites (Fig. 6). Especially the natural riparian forests of the high-precipitation area on the W slope of the mountains of Ipiros (loc. 10, 11 & 12) have high hygrophytic percentages. Two sites in sheltered river valleys in the C part of the Pindos Range (loc. 19 & 21) have the highest species numbers and a large hygrophytic element. Isolated small pockets of riparian plane forests, though low in number of species, may harbour *Lobarion* and other hygrophytic species together with less demanding species. For example, loc. 22 has *Bacidia rubella*, *Collema auriforme*, *C. flaccidum*, *Koerberia biformis*, *Lepraria vouauxii*, *Leptogium intermedium*, *L. lichenoides*, *L. pulvinatum* var. *pulvinatum*, *L. pulvinatum* var. *quercicola*, *Lobaria pulmonaria*, *Nephroma laevigatum*, *Peltigera praetextata*, *Physconia distorta* and *Staurolemma omphalarioides*. Chance colonization and/or random extinction may have influenced the species composition of such localities.

Highly modified stands may be low in species and have only few or no hygrophytic species (e.g. loc. 13). Other modified sites, e.g. by surrounding farmland, may harbour a high percentage of hygrophytic species despite a low number of species (e.g. loc. 33 & 37). At loc. 18 the presence of *Lobaria pulmonaria* may indicate a former richer flora of this degraded riparian forest in a small, isolated ravine. Random extinction may account for its present species composition (*Caloplaca pyracea*, *Collema auriforme*, *Lecanora dispersa*, *Lepraria eburnea*, *Leptogium lichenoides*, *L. pulvinatum* var. *pulvinatum*, *Lobaria pulmonaria* and *Porina chlorotica*).

Plane trees in artificial environments (loc. 1, 3, 9 & 26) generally have a low number of species and few hygrophytic species in particular due to reduced humidity compared to natural riparian stands. The high percentage of hygrophytic species at loc. 26 is due to the humid environment of this mountain village at 1125 m altitude (Fig. 2). Nutrient-enrichment may, however, result in a high number of *Xanthorion* species (loc. 1, a single tree outside a monastery).

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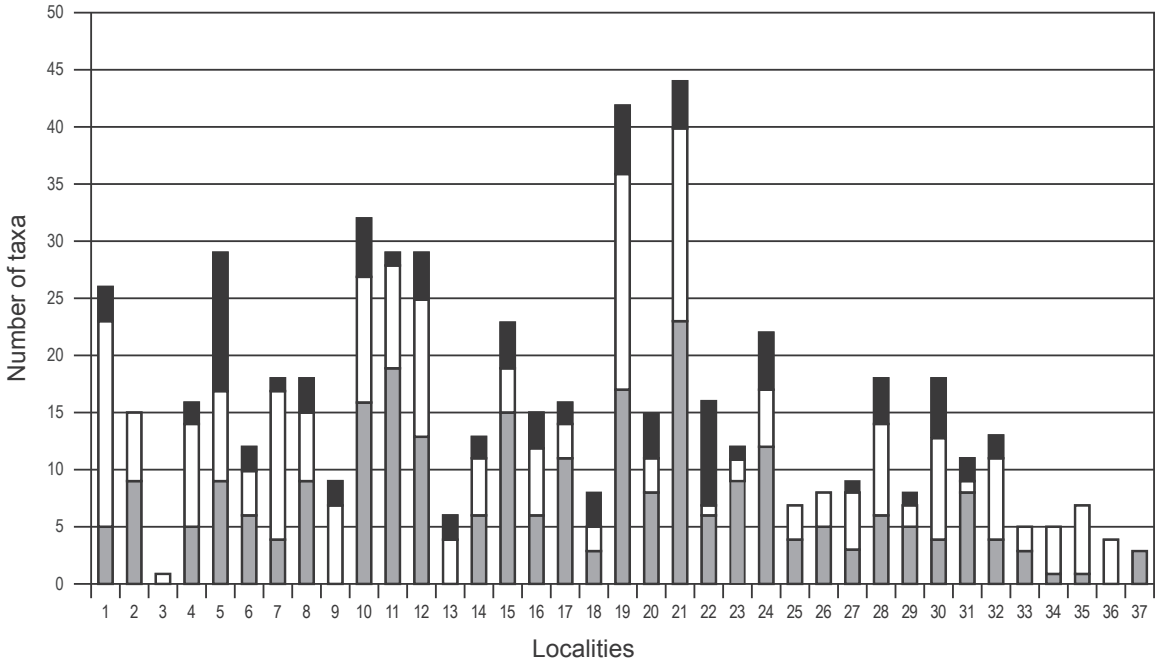


Fig. 6. The total number of taxa of each locality classified as hygrophytic (grey), *Xanthorion* (white) and other species (black). Hygrophytic species include *Lobarion* species. Some taxa are hygrophytic and require nutrient-enriched bark, e.g. *Gyalecta derivata*, *G. truncigena* and *Opegrapha rufescens* (Nimis 1993). They are classified as hygrophytic only. The localities belong to the following provinces: Makedonia (1–6), Ipiros (7–12), Thessalia (13–19), Sterea Ellas (20–23), Peloponnisos (24–26) and Kriti (27–32, nomos Chanion; 33–36, nomos Rethymnis; 37, nomos Irakliou).

Localities with picnic sites and other recreational activities (loc. 1, 3, 9, 10, 16, 20 & 21) generally have above average numbers of *Xanthorion* and other nitrophytic species or at least a bias towards such species. Nearby dirt roads and intensive grazing by herds of sheep and goats may also promote establishment of nutrient-favoured species.

In many cases (e.g. loc. 8, 31, 32 & 37) trunks of riparian plane trees were covered high up by clay and silt deposited by the spring flood (Fig. 5). The height of the flood could often be estimated by the debris caught in the branches of the crowns. This mineral-enrichment of the trunks may be responsible for the presence of some epigeic species, viz.: *Lemmopsis pelodes* and *Leptogium tenuissimum*.

The number of hygrophytic species appears to be negatively associated with two parameters: (1) sites where the trees are either planted and/or are found outside the natural biotopes of *Platanus orientalis* (loc. 1, 3 & 9) or (2) strongly modified to nearly natural habitats at low altitudes of the driest parts of Greece (loc. 4, 13 & 25). In natural habitats at low altitudes within the dry-climate types, the highest number of hygrophytic species is found on shaded sites where the crown cover is more or less closed (loc. 15 & 23). In natural habitats at high altitudes the highest number of hygrophytic species were found at sites along rivers and rivulets that are water-bearing during the whole year (loc. 8, 17, 19, 21 & 24), while at sites with summer-dry streams, fewer hygrophytic species were encountered (loc. 5, 6, 16, 18 & 22). In the high-precipitation area W of the Pindos Range, natural or near-natural plane forests along permanent streams harbour a high percentage of hygrophytic species (loc. 10 & 11).

Allowing for some deviations from the general pattern, which can be ascribed to local conditions, on Kriti an E-W gradient in species richness and number of hygrophytic species is found with the highest values in the west, in nomos Chanion (loc. 27–32), decreasing to the east in nomi Rethymnis and Irakliou (loc. 33–37). This is most likely caused by the gradient in precipitation along the island, though different land-use practices may contribute (more arable land to the east). The number of species per locality is generally lower on Kriti than on the mainland, especially in the easternmost localities (Fig. 6).

Although many variables influence the species composition of the investigated localities, it may be concluded that the general climate and the potential natural vegetation/vegetation zones govern the general pattern of the epiphytic flora, while the stand parameters and the conditions of the immediate surroundings, notably the topography-influenced local climatic conditions and the present vegetation surrounding the plane stands, may modify the overall pattern to a considerable extent.

Communities

Based on a study of a large number of mainly NW European sites, Rose (1988) concluded that the *Lobarion* community originally hosted members of the genera *Collema*, *Leptogium*, *Nephroma* and other genera with cyanobacterial photobionts. *Lobarion* communities in-

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cluding this contingent are today restricted to the oceanic coastal part of W Europe, some mountain areas of C Europe and to montane areas of the C Mediterranean area (France, Italy) (Rose 1988).

The *Lobarion* communities in S Europe, the *Lobaria-Anaptychia* nodum (nom. prov., Rose 1988), including species of *Collema*, *Leptogium*, *Physcia* and *Physconia*, and the bryophytes *Leptodon smithii*, *Leucodon sciuroides* and *Pterigynandrum filiforme* Hedw., as well as *Xanthoria parietina*, thus accommodate taxa of the *Lobarion* s.str. and *Xanthorion* communities. Rose (1988) gave only a very short description of this community and presented a short list of species (Rose 1988: Table 1). No-one has reported on this community since. It is therefore unclear which species are faithful and how many of the species of the above mentioned genera are to be included in the *Lobaria-Anaptychia* community. Varying with the ecological and historical conditions of the sites, the epiphytic communities (including the few collected mosses) found on *Platanus orientalis* in this study seem to represent more or less well-developed examples of this *Lobaria-Anaptychia* community. However, the floristic approach of this study can not solve this topic: sociological studies are needed. In Fig. 6, the distribution of *Xanthorion* species and hygrophytic species (sensu Nimis 1993) at the 37 localities is presented. Both of these groups include species of the *Lobaria-Anaptychia* community (Rose 1988).

The presence of *Xanthorion* species within the *Lobarion* community under Mediterranean conditions may not only be due to nutrient enrichment, as dust deposition alone has been shown to stimulate development of communities dominated by species of *Xanthoria* and *Physcia* (Loppi & Pirintsos 2000).

The most common *Lobarion* species (in the narrow sense of Nimis 1993) were *Catinaria atropurpurea*, *Fuscopannaria mediterranea*, *Lobaria pulmonaria* and *Nephroma laevigatum* (only 3–5 localities each). Among the hygrophytic species (sensu Nimis 1993, which include *Lobarion* species in the broader sense of Rose 1988), *Leptogium subtile* and *L. teretiusculum* were by far the most common (16 and 24 localities, respectively), followed by *Agonimia tristicula*, *Collema auriforme*, *C. flaccidum*, *C. furfuraceum*, *C. nigrescens*, *C. subflaccidum* and *C. subnigrescens* (8–13 localities each). *Xanthorion* species were most frequently represented by *Caloplaca pyracea*, *Lecania naegelii*, *Physcia adscendens* and *Xanthoria parietina* (11–17 localities each). Among other nitrophytic species, the most frequent were *Lecanora hagenii* and *Lecidella euphoria* (9 and 11 localities, respectively).

Conservation

Lichen species are not evenly distributed in the landscape. Particular circumstances induce a higher number of species than average, or result in a high number of more demanding and therefore rarer species (hotspots – Peterson & McCune 2003). In forest types dominated by a single or a few tree species, other tree species that constitute only a minor element in the stand structure may contribute significantly to the total biodiversity of the epiphytic lichens. In Swedish forests of *Picea abies* (L.) H. Karst., for example, Esseen (1981) found *Lobarion* species on trees of *Salix caprea* L. and *Populus tremula* L., but not, or only infrequently and in small amounts, on *Betula*, *Picea*, *Pinus* and *Sorbus*. Comparable results were obtained from Finnish mixed *Picea* forests by Kuusinen (1996b), who also found a higher species richness and more host-specific species on *Salix caprea* than on the dominant forest tree, *Picea abies*. In Finland in *Populus tremula* pockets on boggy ground within stands of *Picea abies*, cyanobacterial lichens occurred exclusively or more frequently in old-growth plots (Kuusinen 1996a). Habitats such as trees on lake sides or riparian forests often harbour a number of hygrophytic, often cyanophilic lichens. A survey of Danish *Lobarion* localities showed that in *Fagus* forests trees with *Lobaria pulmonaria* were almost exclusively found on N-facing slopes, in forest bogs, along rivulets and in other more humid places (Christensen & Søchting 1996). In the drier parts of the British Isles, *Lobarion* communities are found in similar places (James & al. 1977). In the NW United States, hotspots of hardwood, though richer in species, were shown to be similar in species composition to the surrounding communities. In contrast, riparian hotspots were unique in species composition, including a high number of cyanophilic lichens (Peterson & McCune 2003). McCune & al. (2002) studied macrolichen species richness of streams in the NW United States and found that species listed as rare or threatened were more concentrated along streams than macrolichens in general, especially along the larger streams. There was also a tendency for cyanolichens to increase with stand age. These few examples underline the importance of azonal vegetation types for increasing biodiversity in a given area.

Conservation of lichen-rich epiphytic habitats in Europe has mainly focused on old-growth forests and habitat continuity (e.g. Rose 1992). This is rightly important for the conservation of lichens, as indeed it is for the conservation of many other organisms. Although they often support a rich and interesting lichen flora, riparian habitats have so far attracted limited attention (McCune & al. 2002; Peterson & McCune 2003; present study).

In general, riparian plane forests in Greece are important in maintaining a high diversity of lichens on a landscape scale. The lichen flora of the plane trees in riparian forests in the mountainous areas of Greece would appear to be unique on a European scale. It is, therefore, important, both on a European level and on a national Greek level, to preserve this special habitat. It not only harbours as many as 13 species not found in other biotopes in Greece, it also harbours an array of cyanophilic and other hygrophytic species that, though they each are not exclu-

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sive to *Platanus*, compose an epiphytic vegetation unique to riparian plane forests.

In planning a protection programme for the riparian plane forests it is important to preserve not only those sites with the richest flora. Riparian forest within different zonal vegetation types should be represented, as should examples of riparian forest along both water-bearing and summer-dry streams. Greek authorities are strongly recommended to initiate measures for the protection and proper management of representative riparian plane forests in order to preserve this unique habitat and its special epiphytic flora. It is not only important in a Greek context, but is also of high conservation value on a European scale.

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