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## An inventory of the lichen flora of Kalimnos and parts of Kos (Dodecanisos, Greece)

### Abstract

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An exploration in the Nomos of Dodecanisos, SE Aegean, Greece, mainly on the islands Kalimnos and Kos, and to a lesser extent on Telendos and Nisiros, revealed the presence of 290 lichen species. Of these, 12 were not recorded before from Greece, and four are described as new to science: *Acarospora pseudofuscata*, *Buellia epifimbriata*, *Caloplaca aegaea* and *Pertusaria pseudoparotica*. An annotated catalogue is presented, which includes notes on lichen records from Santorini and Paros. The lichen flora does not show any special affinity with the nearby Turkish mainland, in striking contrast to the phanerogam flora. It is similar to that of the Paros archipelago (Central Aegean Islands) and differences can be explained by different substrate availability and chance dispersal (island effect). The lichen flora of Santorini, a volcanic island recolonized 3500 years ago, differs by a larger representation of widespread species. 15 species appear to have a restricted, eastern distribution in the Mediterranean.

### Introduction

In a study on the effects of geological history on the lichen flora of the Aegean islands, the authors provide inventories of selected islands. Two Central Aegean Island groups have been reported before, the volcanic, recently recolonised Santorini group (Sipman & Raus 1995) and the Paros group with a long ecological continuity (Sipman & Raus 1999). A third site, reported here, was chosen in the Eastern Aegean. Unlike the islands of the Central Aegean, those of the Eastern Aegean were connected with the Turkish mainland during the Pleistocene (Greuter 1970). The effects of this on the phanerogam flora are so profound that the islands are excluded by the “Flora europaea” (Tutin & al. 1993: 574-575). It would be of interest to see if a similar effect can be observed in the lichen flora.

The island of Kalimnos was selected for the investigation because of its size and because the geological map indicates both calcareous and siliceous rock (Jacobshagen 1986) and small oc-

currences of volcanic deposits. During the fieldwork it turned out that most of the island consists of limestone, which is exposed in many cliffs and boulders from sea level to about 700 m at Mt Profitis Ilias. It is partly dolomitized, which probably explains why silicicolous lichens were occasionally found on it. Siliceous formations are present along the west coast near Emborios and Mirties. They are composed of easily fragmenting, scarcely exposed schist. Near Emborios this provides some suitable outcrops for silicicolous lichens. Further south, outcrops are more scarce and smaller, and the rock weakly calcareous, unsuitable for most silicicolous lichens. Similar outcrops are present on the southern part of the nearby island of Telendos. Volcanic rock exposures were not found and the indicated volcanic deposits probably consist of strongly weathered ashes.

Outside the settlements the vegetation is very scarce and restricted to low shrubs usually not over 50 cm. It is called phrygana and a product of many centuries of overgrazing and erosion. The soil is very thin and rock outcrops are common. Larger woody plants are very scattered, mainly occurring near the settlements in the valleys. Here epiphytic lichens are scarce, however.

Accordingly Kalimnos offered few opportunities to sample silicicolous and epiphytic lichens. Therefore the investigations were extended to parts of the island of Kos: the Kephalos peninsula in the west and Mt Dikeos in the centre. The peninsula has abundant rock outcrops of volcanic origin. They are mostly siliceous, but occasionally calcareous. Also a few limestone outcrops occur. Moreover there are abundant trees and shrubs providing ample substrate for epiphytic lichens. Mt Dikeos offers plenty siliceous and epiphytic substrata at higher elevation. It reaches to about 850 m, slightly higher than the highest point of Kalimnos. It consists of schistose rock composed of a dense alternation of siliceous and weakly calcareous layers. Its lower slopes are covered with *Cupressus sempervirens*-*Quercus coccifera* forest and orchards of *Prunus persica*.

Another option had been to include the island of Nisiros. A short visit confirmed that it is of recent volcanic origin. It is composed of a still active volcano with cultivated fields on its outer slopes and a deep crater containing sulphuric springs in the centre. Therefore its lichen flora can be expected to be rudimentary like that on Thira and was not investigated in detail.

For more details about landscape, climate and lichen substrate availability on Aegean islands we refer to Sipman & Raus (1999). Kalimnos and Kos deviate by the absence of granitic and ultramafic rocks. The schist-like rock is of a different texture and often weakly calcareous. Epiphytic substrate is much more common, due to the presence of *Juniperus oxycedrus* subsp. *macrocarpa* and *Pinus brutia* stands on the Kephalos peninsula and of *Quercus-Cupressus* forest on Mt Dikeos.

The published information about the lichen flora of the investigated region is summarized by Szatala (1943). He reports one species from Kalimnos, *Cladonia foliacea* var. *convoluta* (Lam.) Vain., and 15 species from Kos, all from 600-800 m elevation on Mt Dikeos: *Allarthonia calcicola* (Nyl.) Redgr., *Diploschistes actinostomus* (Pers.) Zahlbr., *Lecidea steriza* f. *submissiva* Vain., *Caillaria lenticularis* (Ach.) Lindau, *Rhizocarpon concentricum* (Davies) Beltr., *Cladonia rangiformis* var. *pungens* (Ach.) Vain., *Lecania erysibe* (Ach.) Mudd, *L. spadicea* (Flot.) Zahlbr., *Candelariella aurella* var. *decolorans* (Müll. Arg.) Zahlbr., *C. vitellina* var. *rechingeri* Servít, *Protoblastenia chondrodes* (A. Massal.) Zahlbr., *Caloplaca craspedia* (Ach.) Szatala, *C. flavovirescens* (Wulfen) Dalla Torre & Sarnth., *Gasparrinia aurantia* (Pers.) Syd. and *Diplotomma subochraceum* (Zahlbr.) Szatala. These are mostly widespread species, which were encountered regularly during our own investigations. Some are taxa where species concepts and nomenclature have changed considerably, so that a reinvestigation of the original material would be required to make sure which taxa are concerned.

## Material and methods

The procedures for the investigations were the same as described by Sipman & Raus (1999). All investigated localities are situated in the Nomos of Dodekanisos, East Aegean Islands, Greece.

The 32 investigated localities are as follows:

- 1 15 Sept. 2000 – Kalimnos, Armeos near Massouri, 37°00.2'N, 26°56.4'E, c. 60 m, W-facing slope with limestone boulders and outcrops and phrygana.
- 2 16 Sept. 2000 – Kalimnos, W of Emborios, c. 37°03'N, 26°55'E, c. 50 m, NW-facing slope with schistose rock outcrops and phrygana.
- 3 16 Sept. 2000 – Kalimnos, on ridge above Skali, c. 37°02.6'N, 26°57.2'E, c. 300 m, W-facing slope with limestone boulders and outcrops, and phrygana, on N-facing limestone outcrops.
- 4 17 Sept. 2000 – Kalimnos, upper end of Vathis valley, near Stimenia, c. 37°00'N, 26°57.7'E, c. 100 m, limestone rocks along dry stream in valley bottom.
- 5 17 Sept. 2000 – Kalimnos, upper end of Vathis valley, near Stimenia, c. 37°00'N, 26°57.7'E, c. 100 m, olive orchard in valley bottom.
- 6 17 Sept. 2000 – Kalimnos, Agia Ekaterini monastery, 36°55.9'N, 26°57.1'E, 180 m, hilltop with limestone boulders and outcrops, and phrygana. (scarcely investigated site).
- 7 18 Sept. 2000 – Telendos, SW of Potha, 36°59.7'N, 26°55.1'E, 30 m, hilltop with phrygana and weakly calcareous rock outcrops along the coast.
- 8 18 Sept. 2000 – Telendos, NW of Potha, 36°59.7'N, 26°55.1'E, 90 m, hilltop with phrygana and weakly calcareous rock outcrops along the coast.
- 9 18 Sept. 2000 – Telendos, trail from Potha to Agios Konstantinos chapel, 37°00'N, 26°55.1'E, 100 m, NE-facing slope with phrygana and calcareous rock outcrops, on vertical, N-facing cliff.
- 10 18 Sept. 2000 – Telendos, trail from Potha to Agios Konstantinos chapel, 37°00'N, 26°55'E, 30 m, NE-facing slope with calcareous rock outcrops and phrygana, on soil.
- 11 19 Sept. 2000 – Kalimnos, trail from Chorio to Mt Profitis Ilias, near the chapel on the top, 36°58.8'N, 26°58.4'E, c. 700 m, exposed hilltop with phrygana and limestone outcrops.
- 12 19 Sept. 2000 – Kalimnos, trail from Chorio to Mt Profitis Ilias, just below the top, 36°58.8'N, 26°58.4'E, c. 700 m, SW-facing rocky slope with phrygana and limestone outcrops.
- 13 19 Sept. 2000 – Kalimnos, trail from Chorio to Mt Profitis Ilias, fenced field just below the top, 36°58.7'N, 26°58.2'E, c. 650 m, gravely plain with phrygana and limestone outcrops.
- 14 19 Sept. 2000 – Kalimnos, trail from Chorio to Mt Profitis Ilias, fenced field just below the top, 36°58.7'N, 26°58.2'E, c. 650 m, N-facing limestone cliff in phrygana.
- 15 20 Sept. 2000 – Kalimnos, trail from Kantouni to Agia Fotini monastery, just outside the village, 36°58.0'N, 26°55.8'E, 30 m, N-facing limestone cliff in slope with phrygana at the coast.
- 16 20 Sept. 2000 – Kalimnos, Mirties, in sharp curve of new road above village. 36°59.2'N, 26°56.1'E, 100 m, outcrops of calcareous silicate in steep, S-facing slope with phrygana.
- 17 21 Sept. 2000 – Kalimnos, Vathis valley, above Metochi, c. 36°59'N, 26°59'E, 100 m, base of S-facing rocky slope with scattered dwarf *Juniperus phoenicea* shrubs and limestone outcrops (scarcely investigated site).
- 18 21 Sept. 2000 – Kalimnos, Vathis valley, N of Metochi, along road to chapel of Panagia Kira Psili, c. 36°59'N, 26°59'E, 300 m, N-facing steep rocky slope with phrygana and limestone outcrops and cliffs, near the ridge.
- 19 22 Sept. 2000 – Kos, Kefalos peninsula, near top of Mt Latra, c. 36°43'N, 26°57'E, c. 300 m, *Erica manipuliflora* dwarf shrub vegetation on SW-facing slope with scattered low *Pinus brutia* trees and siliceous rock outcrops.
- 20 23 Sept. 2000 – Kos, Kefalos peninsula, c. 4 km S of Kefalos, along road to Agios Ioannis. 36°43.5'N, 26°57.4'E, c. 200 m, phrygana on hilltop with siliceous rock outcrops.
- 21 23 Sept. 2000 – Kos, Kefalos peninsula, c. 4 km S of Kefalos, NE-slope of Mt Latra, 36°42.5'N, 26°57.3'E, c. 200 m, phrygana with siliceous rock outcrops and N-facing cliff.

- 22 23 Sept. 2000 – Kos, Kefalos peninsula, c. 4 km S of Kefalos, near road to Agios Theologos (Sunset beach), 36°43.3'N, 26°56.3'E, c. 100 m, scattered low trees of *Juniperus oxycedrus* subsp. *macrocarpa* in fields and phrygana (scarcely investigated site).
- 23 23 Sept. 2000 – Kos, Kefalos peninsula, c. 6 km S of Kefalos, near road to Agios Ioannis, 36°41.5'N, 26°57.3'E, c. 150 m, phrygana on S-facing hill slope with siliceous rock outcrops (small site).
- 24 23, 24 Sept. 2000 – Kos, Kefalos peninsula, c. 6 km S of Kefalos, Agios Mammias chapel near S-tip, 36° 40.7'N, 26°58.0'E, c. 200 m, phrygana with siliceous rock outcrops on hill-top near the coast.
- 25 24 Sept. 2000 – Nisiros, Mandrakion, near harbour, c. 36°34'N, 27°05'E, 5 m, N-side of wall of lava boulders along field (small site).
- 26 24 Sept. 2000 – Nisiros, crater bottom, near sulphidic springs, 36°34.6'N, 27°09.9'E, 50 m, on lava stone of wall along field (small site).
- 27 25, 27 Sept. 2000 – Kos, Kefalos peninsula, c. 4 km S of Kefalos, small volcano cone between Mt Latra and Zini, 36°42.7'N, 26°57.9'E, c. 250 m, phrygana with siliceous rock outcrops and N-facing cliff.
- 28 25 Sept. 2000 – Kos, Kefalos peninsula, c. 3 km S of Kefalos, Cape Akri Routhiano, 36°43.2'N, 26° 58.7'E, c. 50 m, NW-facing calcareous lava cliff in phrygana on hill slope near the coast.
- 29 25 Sept. 2000 – Kos, Kefalos peninsula, c. 3 km S of Kefalos, along road to Agios Ioannis, 36°43.3'N, 26° 57.5'E, c. 230 m, exposed calcareous rock outcrop in phrygana.
- 30 26 Sept. 2000 – Kos, Zia village on NW-slope of Mt Dikeos, 36°50.6'N, 27°12.7'E, c. 300–400 m, open *Quercus-Cupressus* forest on abandoned fields with calcareous and siliceous rock outcrops.
- 31 26 Sept. 2000 – Kos, trail from Zia village (Kefalovrisi spring) to the summit of Mt Dikeos, 36°50.1'N, 27°12.4'E, c. 700–800 m, calcareous and siliceous rock outcrops on steep, N-facing, scarcely vegetated mountain slope.
- 32 26 Sept. 2000 – Kos, trail from Zia village (Kefalovrisi spring) to the summit of Mt Dikeos, 36°50.1'N, 27°12.4'E, c. 600 m, open *Quercus-Cupressus* forest and abandoned fields with calcareous and siliceous rock outcrops.

## Results and discussion

Altogether 290 lichen species were recognised. The figures for the individual islands are: Kalimnos 169, Kos 206, Nisiros 11 and Telendos 41. They do not reflect the size of their respective lichen floras. Kalimnos is the most thoroughly explored island. However, much of it is of difficult access due to tall limestone cliffs and the lack of roads. In particular in the northern half only few localities were visited, and no good examples of N-facing coastal cliffs were reached. The exploration of Kos was restricted to the Kefalos peninsula and Mt Dikeos. Telendos was investigated for only one day and sampling time on Nisiros did not exceed one hour.

Of the encountered species, four are new to science: *Acarospora pseudofuscata*, *Buellia epifimbriata*, *Caloplaca aegaea* and *Pertusaria pseudoparotica*. One of these, *Caloplaca aegaea* appears to have a wide distribution in the Mediterranean, while the others are known only from the Aegean so far.

Another 12 species are probably recorded for the first time from Greece: *Arthonia cretacea*, *Buellia abstracta*, *Caloplaca atroflava* var. *submersa*, *C. chrysodeta*, *C. flavocitrina*, *C. limonia*, *Catillaria atomarioides*, *Lecanora lividocinerea*, *Opegrapha gyrocarpa*, *O. lutulenta*, *Peltula obscurans* and *Pyrenula chlorospila*. However, in the absence of a recent checklist for the lichens of Greece, it is difficult to be sure that they have never been reported. It concerns mostly species with a wider distribution in the western Mediterranean and Atlantic Europe. Only *Arthonia cretacea* seems to have a restricted distribution. It is known only from few collections from Croatia (Dalmatia) and Italy (Nimis 1993).

Table 1. Substrate of the lichen flora on Kalimnos, Telendos, Kos and Nisiros.

| substrate                 | species number |
|---------------------------|----------------|
| bark and wood             | 69             |
| soil                      | 47             |
| rock (all types)          | 196            |
| calcareous                | 83             |
| siliceous, schistose rock | 88             |

Table 2. Shared taxa (species, varieties and chemical strains) of three island groups in the Aegean Sea, Greece: Santorini (Sipman &amp; Raus 1995, 1999), Paros (Sipman &amp; Raus 1999) and Kalimnos/Kos (this study).

|       | Santorini | Paros | Kalimnos/Kos | Number of shared taxa |
|-------|-----------|-------|--------------|-----------------------|
|       | x         | x     | x            | 114                   |
|       | x         | x     |              | 16                    |
|       | x         |       | x            | 26                    |
|       | x         |       |              | 26                    |
|       |           | x     | x            | 79                    |
|       |           | x     |              | 67                    |
|       |           |       | x            | 77                    |
| Total | 182       | 276   | 295          | 406                   |

A preliminary evaluation suggests that the flora is comparable to that of Paros (Sipman & Raus 1999: table 1-4). Any differences can easily be explained by differences in substrate availability and by the different altitudinal distribution of the sampling points. Epiphytic and calcareous substrata were much better represented, while granitic and ultramafic rocks were absent (Table 1). Sampling points below 50 m are scarce (see Material and methods).

A comparison with the two similarly investigated Aegean island groups, Santorini and Paros (Sipman & Raus 1995, 1999) shows a closer similarity with Paros (Table 2). Both harbour similar numbers of taxa, 276 and 295, and similar contingents of taxa not found on the other island groups, 24% and 26%. The Santorini archipelago has a distinctly smaller flora, 182 taxa, and the contingent of taxa not found on the other island groups is only 15%. Santorini was recolonised after a volcanic eruption about 3500 years ago, and the figures suggest that its flora is still incomplete and composed to a larger extent of easily spreading species.

The following taxa were found only on Santorini (15% of its flora), with number of locations in brackets: *Anema* cf. *deciapiens* (A. Massal.) Forssell (1), *A.* cf. *nodulosum* (Nyl.) Forssell (1), *Arthonia clemens* (Tul.) Th. Fr. (1), *Bagliettoa parmigera* (J. Steiner) Vězda & Poelt (1), *B. parmigera* (Zahlbr.) Vězda & Poelt (1), *Caloplaca teicholyta* (Ach.) J. Steiner (2), *C. veneris* Cl. Roux & Nav.-Ros. (1), *Candelariella reflexa* (Nyl.) Lettau (1), *Cladonia humilis* (With.) J. R. Laundon (1), *Enterographa crassa* (DC.) Fée (1), *Epiphloea terrena* (Nyl.) Trevis. (1), *Lecanographa werneri* (Faurel, Ozenda & Schotter) Egea & Torrente (1), *L. meridionalis* H. Magn. (with roccellic acid) (1), *L.* cf. *urbana* Nyl. (1), *Lecanora* cf. *varia* (Hoffm.) Ach. (1), *Opegrapha subelevata* (Nyl.) Nyl. (1), *Pertusaria amara* (Ach.) Nyl. (3), *Psora gresinonis* Bouly de Lesd. (1), *Ramalina farinacea* (L.) Ach. (with protocetraric acid) (1), *Rinodina pyrina* (Ach.) Arnold (1), *Sclerophyton circumscriptum* (Taylor) Zahlbr. (1), *Solenopsis holophaea* (Mont.) Samp. (2), *Sphinctrina leucopoda* Tuck. (1), *Stereocaulon vesuvianum* Pers. (3), *Toninia toepfferi* (B. Stein) Navás (1), *Tornabea scutellifera* (With.) J. R. Laundon (4).

Exclusive for Paros (24% of its flora) are: *Acarospora* cf. *scotica* Hue (2), *A. subrufula* (Nyl.) H. Olivier (2), *Anaptychia runcinata* (With.) J. R. Laundon (2), *Anema* cf. *prodigulum* (Nyl.)



Henssen (1), *Arthonia meridionalis* Zahlbr. (1), *A. muscigena* Th. Fr. (1), *Aspicilia cheresina* var. *justii* (Servit) Clauzade & Cl. Roux (3), *A. coronata* (A. Massal.) de Lesd. (1), *A. radiosa* (Hoffm.) Poelt & Leuckert (acid deficient strain) (1), *A. radiosa* (with norstictic and salazinic acids) (1), *A. radiosa* (with salazinic acid) (1), *Bacidia circumspceta* (Norrl. & Nyl.) Malme (1), *Buellia badia* (Fr.) A. Massal. (2), *Caloplaca circumalbata* var. *candida* (Stizenb.) Wunder (1), *C. pellodella* (Nyl.) Hasse (1), *C. aff. ferrarii* (Bagl.) Jatta (1), *Catapyrenium psoromoides* (Borrer) R. Sant. (1), *Cetraria aculeata* (Schreb.) Fr. (1), *Collema flaccidum* (Ach.) Ach. (1), *C. polycarpon* var. *corcyrense* (Arnold) Harm. (1), *Dimelaena oreina* (Ach.) Norman (1), *Diploschistes aeneus* (Müll. Arg.) Lumbsch (2), *Haematomma nemetzi* J. Steiner (3), *Heppia solorinoides* (Nyl.) Nyl. (1), *Hypogymnia physodes* (L.) Nyl. (1), *Ingvariella bispora* (Bagl.) Guderley & Lumbsch (3), *Lecania cyrtella* (Ach.) Th. Fr. (6), *L. koerberiana* Lahm (1), *Lecanora* cf. *albescens* (Hoffm.) Branth & Rostr. (3), *L. cf. dispersa* (Pers.) Sommerf. (1), *L. meridionalis* H. Magn. (gangaleoidin) (1), *L. sp. A* (1), *Lecidea sarcogynoides* Körb. (4), *Leptogium schraderi* (Ach.) Nyl. (1), *Lichinella nigritella* (Lettau) P. Moreno & Egea (1), *Opegrapha celtidicola* (Jatta) Jatta (1), *O. durieui* Mont. (1), *Pertusaria lecanorodes* Erichsen (1), *P. cf. pentelici* J. Steiner (4), *P. sp. (sterile)* (1), *P. sp. B* (1), *Phlyctis agelea* (Ach.) Flot. (2), *P. argena* (Spreng.) Flot. (5), *Physconia americana* Essl. (1), *P. cf. enteroxantha* (Nyl.) Poelt (1), *Polyblastia* sp. (1), *Polysporina simplex* (Davies) Vězda (6), *Psora testacea* Hoffm. (1), *Psorotichia?* (1), *Pyrenopsis subareolata* Nyl. (1), *Ramalina protecta* H. Magn. (1), *R. subfarinacea* (Cromb.) Nyl. (with norstictic acid) (1), *Rinodina bischoffii* (Hepp) A. Massal. (1), *R. cf. dalmatica* Zahlbr. (1), *R. insularis* (Arnold) Hafellner (1), *R. obnascens* (Nyl.) H. Olivier (8), *Sarcogyne regularis* Körb. (4), *Scoliciosporum sarothamni* (Vain.) Vězda (1), *Squamarina lentigera* (Weber) Poelt (3), *Thelenella modesta* (Nyl.) Nyl. (2), *Umbilicaria crustulosa* (Ach.) Frey (1), *Verrucaria* cf. *caerulea* DC. (2), *V. cf. muralis* Ach. (2), *V. aff. nigrescens* Pers. (3), *V. viridula* (Schrad.) Ach. (3), *V. cf. viridula* (Schrad.) Ach. (1), *Xanthoparmelia tinctoria* (Maheu & A. Gillet) Hale (4).

Exclusive for Kalimnos/Kos (26% of its flora) are: *Anema nummularium* (Durieu & Mont.) Nyl. (2), *Arthonia caesiella* Nyl. (1), *A. cretacea* Zahlbr. (2), *A. melanophthalma* Dufour (6), *A. radiata* (Pers.) Ach. (1), *A. sp.* (1), *Aspicilia cheresina* var. *microspora* (Arnold) Clauzade & Cl. Roux (4), *A. contorta* (Hoffm.) Kremp. (3), *Buellia schaeereri* De Not. (1), *Caloplaca aegatica* Giralt, Nimis & Poelt (2), *C. atrofava* var. *submersa* (Nyl.) H. Magn. (1), *C. carphinea* (Fr.) Jatta (1), *C. chlorina* (Flot.) Sandst. (1), *C. chrysodeta* (Räsänen) Dombr. (1), *C. limonia* Nimis & Poelt (1), *C. obscurella* (Körb.) Th. Fr. (1), *Catillaria* cf. *lenticularis* (Ach.) Th. Fr. (1), *Cladonia ramulosa* (With.) J. R. Laundon (2), *C. rangiformis* Hoffm. (without fumarprotocetraric acid) (2), *Clauzadea metzleri* (Körb.) Clauzade & Cl. Roux (1), *Collema* cf. *multipartitum* Sm. (1), *C. confertum* Arnold (1), *Heppia adglutinata* (Kremp.) A. Massal. (1), *H. psoromoides* (Nyl.) Nyl. (1), *Lecanora chlorotera* Nyl. (2), *L. lividocinerea* Bagl. (3), *Lecidea* cf. *erythrophaea* Sommerf. (1), *Lecidella carpathica* Körb. (1), *L. elaeochroma* (Ach.) Hazsl. (with isoarthothelin) (1), *Lepraria nivalis* J. R. Laundon (with stictic acid) (1), *Leptogium plicatile* (Ach.) Leighton (1), *L. turgidum* (Ach.) Cromb. (1), *Milospium graphideorum* (Nyl.) D. Hawksw. (1), *Mycobilimbia lurida* (Ach.) Hafellner & Türk (1), *Neocatapyrenium latzelii* (Zahlbr.) Breuss (2), *Neofuscelia loxodes* (Nyl.) Essl. (1), *Ochrolechia androgyna* (Hoffm.) Arnold (1), *Opegrapha atra* Pers. (1), *O. gyrocarpa* Flot. (2), *O. lutulenta* Nyl. (6), *O. niveoatra* (Borrer) J. R. Laundon (2), *O. ochrocincta* Werner (10), *O. variaeformis* Anzi (1), *Parmotrema chinense* (Osbeck) Hale & Ahti (1), *Peltula obscurans* (Nyl.) Gyeln. (3), *Pertusaria leucosora* Nyl. (1), *P. mammosa* Harm. (5), *P. pertusa* auct. (1), *P. cf. teneriffensis* Vain. (1), *P. werneriana* ined. (2), *P.?* (1), *Physcia biziana* var. *biziana* (3), *P. tenella* (Scop.) DC. (2), *Placidium lacinulatum* (Ach.) Breuss (2), *P. semaphoronense* (Breuss) Breuss (1), *P. subrufescens* (Breuss) Breuss (1), *Porina aenea* (Wallr.) Zahlbr. (2), *Porpidia cinereoatra* (Ach.) Hertel & Knoph (1), *Protoblastenia calva* (Dicks.) Zahlbr. (1), *Pyrenula chlorospila* Arnold (1), *Pyrrhospora querneae* (Dicks.) Körb. (5), *Rhizocarpon epispilum* (Nyl.) Zahlbr. (1), *R. obscuratum* (Ach.) A. Massal. (1), *Rinodina* cf. *colobina* (Ach.) Th. Fr. (1), *R. dubyana* (Hepp) J. Steiner (1), *R. c. sor.?* (3), *Schaereria fusco-cinerea* (Nyl.) Clauzade & Cl. Roux (1), *Schimatomma albocinctum* (Nyl.) Zahlbr. (2), *S. decolorans* (Sm.) Clauzade & Vězda (1), *Scoliciosporum umbrinum* (Ach.) Arnold (4), *Sole-*

*nopsora olivacea* (Fr.) H. Kiliyas (5), *Toninia albilabra* (Dufour) H. Olivier (2), *T. candida* (Weber) Th. Fr. (1), *T. tristis* subsp. *thalloedaemiformis* (Szatala) Timdal (2), *T. tumidula* (Sm.) Zahlbr. (1), *Topelia heterospora* (Zahlbr.) P. M. Jørg. & Vězda (2), *Trapelia coarctata* (Sm.) M. Choisy (1).

Most of these exclusive species were found only once. This suggests that they are uncommon taxa, found on one island by chance. They are unlikely to reflect any significant floristic difference between the islands. The exclusive species found more than two times are for statistical reasons more significant. However, they are all widely distributed species, as far as their distribution is known. Therefore they offer equally no indication for a special character of the lichen flora on any of the investigated island groups. This means that we found no indication for a close affinity of the lichen flora of the Dodecanese archipelago with Turkey, unlike in the phanerogams.

The results support the suggestion by Sipman & Raus (1999) that the lichen flora of the Aegean islands is probably reduced due to the strong human influence, which caused sensitive species to disappear and only species with sufficient recolonising capability to remain. Moreover, the large numbers of exclusive species suggest that the total lichen flora of the Aegean Islands is probably much larger than our results so far and that further investigations are likely to reveal many more taxa.

The considerable number of species newly reported for Greece shows that the knowledge of the distribution of lichens in the Mediterranean is still very incomplete. Therefore it seems premature to discuss lichen species restricted to the E Mediterranean and their ranges. However, it is possible to select some potential candidates from our observations. Table 3 lists all encountered species which are currently known only from the E Mediterranean (and sometimes also from adjacent, non-Mediterranean areas). Their absence from the western part can be considered as fairly certain in view of the extensive lichenological explorations in France, Spain and Italy.

Table 3. Lichens observed on Santorini (S), Paros (P) (Sipman & Raus 1995, 1999) and Kalimnos/Kos (KK) and known so far only from the eastern Mediterranean.

|                                   |                                                                                                                                                      |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Acarospora pseudofuscata</i>   | S, P, KK. – Only known from the Aegean, newly described below.                                                                                       |
| <i>Arthonia cretacea</i>          | KK. – Known from Italy (Sicily) and Croatia (Dalmatia) (Nimis 1993).                                                                                 |
| <i>Buellia epifimbriata</i>       | P, KK. – Only known from the Aegean, newly described below.                                                                                          |
| <i>Caloplaca limonia</i>          | KK. – Known from southern Italy (Nimis & al. 1994).                                                                                                  |
| <i>Caloplaca veneris</i>          | P. – Known from Cyprus, Greece and Italy (Nimis & Tretiach 1999).                                                                                    |
| <i>Dirina cretacea</i>            | S, P, KK. – Known from Croatia, Greece and Cyprus (Tehler 1983), Turkey (John 1996) and eastern Italy (Puglia) (Nimis & Tretiach 1999).              |
| <i>Haematomma nemetzi</i>         | P. – Known from Greece, Turkey, Bulgaria and Croatia (Pisut 1971, Staiger & Kalb 1995, John 1996).                                                   |
| <i>Lecidella aegaea</i>           | S, P. – Only known from the Aegean (Knoph & Sipman 1999), probably overlooked elsewhere while recently described and needing TLC for identification. |
| <i>Neocatapyrenium latzelii</i>   | KK. – Known from Yugoslavia (Breuß 1990, sub <i>Catapyrenium</i> ).                                                                                  |
| <i>Neocatapyrenium rhizinosum</i> | P, KK. – Known from Greece, Turkey, Irak, Iran, Usbekistan (Breuß 1998).                                                                             |
| <i>Neofuscelia attica</i>         | S, P, KK. – Known from Greece and Cyprus (Esslinger 1977, sub <i>Parmelia</i> ).                                                                     |
| <i>Pertusaria parotica</i>        | S, P, KK. – Only known from the Aegean (Sipman & Raus 1995).                                                                                         |
| <i>Pertusaria pentelici</i>       | S, P, KK. – Only known from Greece (Erichsen 1936, sub <i>Melanaria</i> )                                                                            |
| <i>Pertusaria pseudoparotica</i>  | P, KK. – Only known from the Aegean, newly described below.                                                                                          |
| <i>Pertusaria rhodiensis</i>      | P, KK. – Described from Rhodos, Greece; Hanko (1983) reports it also from southern Italy (GZU 4935), but may have misunderstood the species.         |



Some of the listed species are quite conspicuous and well known, and their distribution can be considered as fairly certain, in particular *Dirina cretacea*, a very common, large lichen in the Aegean, which has never been found west of the Adriatic side of Italy, and *Haematomma nemetzi*, a large lichen with conspicuous red apothecia, of which the westernmost locality is in Croatia. They seem to represent a phytogeographical element with a range centred on Croatia, Greece, Turkey and Cyprus.

Several species suggest that there is also a more restricted, Aegean element. For the fairly well known *Pertusaria pentelici* no literature reports exist from outside the Aegean area and the adjacent Greek mainland. Some of the new species described by us may have a similar distribution.

An Asiatic or Turkish element reaching its western limit in the Aegean, and supporting the inclusion of the Dodecanesos in an Anatolian flora province, seems very scarce among lichens, if existent at all. *Neocatapyrenium rhizinosum* may come close to this. Its Greek locations are mainly on Karpathos and Rhodos, and we found it several times on Kalimnos. However, there is also a report from Mt Olympus, and we found it on Paros.

For most of the listed species there are good reasons to consider the known distribution as very incomplete, certainly for those found in Greece and Cyprus but not in Turkey. The known distribution of a small microlichen such as *Caloplaca veneris* is more likely to mark the trails of lichenologists than the actual distribution of the species.

#### **Annotated list of the lichens found on the islands Kalimnos, Telendos, Kos and Nisiros**

Numbers in brackets refer to the localities listed above; the subsequent 5-digit numbers indicate voucher specimens, which are deposited in the herbarium Berlin-Dahlem (B), unless otherwise indicated.

Where no discussion of the species concept is presented, it is generally the same as in Sipman & Raus (1999) and usually follows recent revisions. Names of provisionally identified species are not in bold. An asterisk in front of the name denotes a seemingly first published record of this species for Greece. In the absence of a recent lichen checklist for Greece there is no certainty about this status.

In order to present a more complete impression of the lichen flora, the list includes all collected specimens, including those that could not be identified completely.

*Acarospora hilaris* (Dufour) Hue – (26) 47166. – Nisiros, c. 50 m, on lava stone of wall around field.

TLC: rhizocarpic acid. The specimen looks atypical because the thallus is rather thick and the marginal lobes are short and inconspicuous. This is perhaps because of the atypical habitat, on a wall. The species forms more typical, large patches on tall, vertical rock faces of the crater wall.

#### **\**Acarospora pseudofuscata* Sipman, sp. nova**

Holotype: Greece, East Aegean Islands, Nomos of Dodekanisos, Kalimnos Island, W of Emborios, c. 50 m, NW facing slope with schistose rock outcrops, with phrygana vegetation, on rock, 16.9.2000, *H. Sipman & Th. Raus* 46647 (B; isotype: ATHU). – Fig. 1.

Thallus fuscus, plagas areolatas, 10 cm superantes formans; areolae c. 0.2-1 mm latae, ad c. 0.5 mm crassae, angulares, paulo concavae, nonnumquam laeviter albopruinosae, latere inferiore nigro, marginales paulo elongatae ad c. 1.5 mm longae. Ascomata vulgo solitaria, immersa, emarginata, in initio rotunda et 0.1-0.2 mm diametro, postea angularia et partem grandem areolarum occupantia, disco laeve, hymenio 90-100  $\mu$ m crasso, paraphysibus 1.5-2 mm crassis, ascosporis numerosissimis, ad 4-6  $\times$  2-2.5  $\mu$ m. Acidum gyrophoricum et paulo lecanoricum continens.

Thallus crustose, forming dark brown, closed patches, often over 10 cm wide, areolate; areoles c. 0.2-1 mm wide, to c. 0.5 mm thick, angular, slightly concave with usually slightly raised, concolorous or occasionally somewhat darker margins, contiguous but not overlapping each

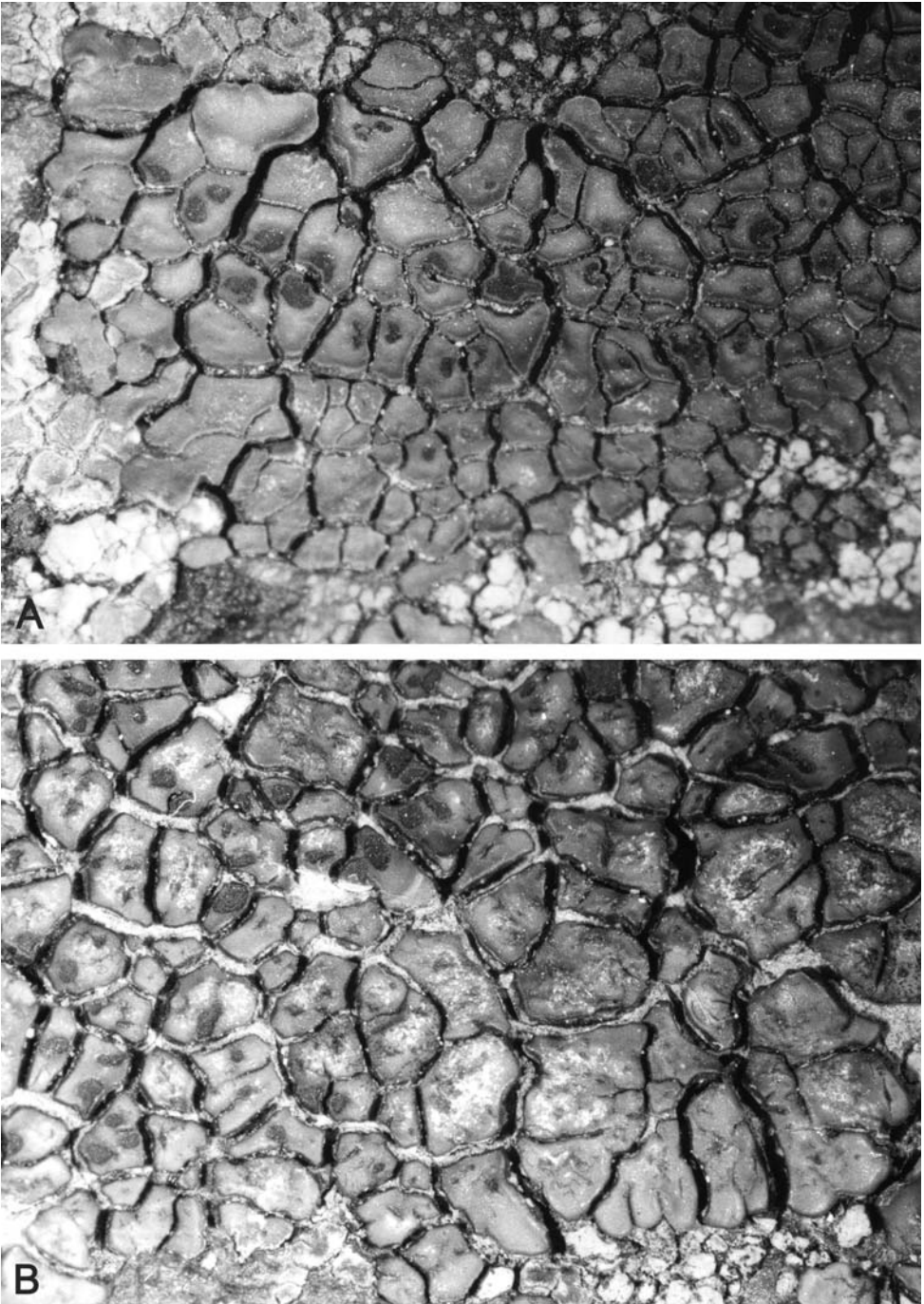


Fig. 1. Thallus of *Acarospora pseudofuscata* – A: part of type specimen, showing the flat to concave areoles, slightly effigurate at the margin; B: part of specimen 29167, showing the distribution of the whitish pruina on the areoles. – Scale: photograph length = 10 mm.

other, slightly glossy, occasionally slightly white-pruinose in the centre, with black lower side; marginal areoles slightly elongated, to c. 1.5 mm, with rounded outer margin; cortex 50-100  $\mu\text{m}$  thick, with 2-4  $\mu\text{m}$  wide cell lumina and 2  $\mu\text{m}$  thick cell walls; algal layer regular, c. 100  $\mu\text{m}$  thick; medulla of loose, c. 3  $\mu\text{m}$  wide hyphae often densely covered with c. 1-5  $\mu\text{m}$  diam. crystals; lower cortex c. 20-50  $\mu\text{m}$  thick, of dense, c. 0.3  $\mu\text{m}$  thick, thick-walled, incompletely agglutinated hyphae, with a c. 3-10  $\mu\text{m}$  thick, dark brown top layer; photobiont cells c. 5-10  $\mu\text{m}$  diam., rounded.

Ascomata mostly single in the areoles, immersed and without margin, initially rounded and 0.1-0.2 mm in diam., finally filling most of the areole and angular, with dark brown, slightly depressed, smooth disc; hymenium 90-100  $\mu\text{m}$ ; paraphyses 1.5-2 mm wide; ascospores several hundreds per ascus, c. 4-6  $\times$  2-2.5  $\mu\text{m}$ .

*Chemistry.* – Gyrophoric, trace of lecanoric acids (TLC); cortex K-, C+ red (brown top layer, visible only in section at high magnification); med. K-, C+ red; reaction often weak and sometimes negative, but gyrophoric acid found in all specimens by TLC.

*Distribution and ecology.* – Known so far only from the Aegean in Greece, from the island groups of Santorini, Paros, Kalimnos and Kos, where it grows on rather steep faces of siliceous, exposed boulders between 50 and 400 m. It is probably more widespread and overlooked because of confusion with *A. fuscata* (Nyl.) Arnold.

*Notes.* – This species is probably closest to *Acarospora fuscata* (Magnusson 1929, Roux 1981, Purvis & al. 1992). However, *A. fuscata* differs by the conspicuous C+ red reaction of its surface. Further its areoles are paler brown, subsquamulose, they frequently overgrow each other and have an undulated to grooved surface; usually its thallus forms smaller patches, often on top of boulders, and its medulla always reacts C-negative.

*Acarospora scotica* Hue is very similar in morphology. It differs by the absence of gyrophoric acid and by the consistent presence of black margins at the areoles (Roux 1981).

Pruinose specimens from Santorini were reported before as *Acarospora umbilicata* (Sipman & Raus 1995: no. 29167, 29215). They were the reason why that species was considered very variable. In fact, *A. umbilicata* is clearly distinct by its strongly concave, often scattered areoles with free margins (Roux 1981).

*Additional specimens seen.* – GREECE: EAST AEGEAN ISLANDS: (2) 46687 (TSB); (20) 47040, 47043 (herb. Pirintosos); (24) 47132. — CYCLADES ARCHIPELAGO: Paros, along road from Lefkes to Aspro Chorio, in Kavouropotamos valley, c. 300 m, gneissic rock outcrops in S-facing slope with low scrub, on gneissic rock, 15.6.1998, *H. Sipman & Th. Raus* 42833 (B); id., c. 350-400 m, gneissic rock outcrops in S-facing slope with low scrub, 22.6.1998, *H. Sipman & Th. Raus* 43355(B). — SANTORINI ISLANDS, THIRA: Mt Megalo Vouno, c. 300 m, W-slope, on andesitic lava outcrops on slope with scarce low vegetation, 24.5.1990, *H. Sipman & Th. Raus* 29167 (B); Mt Mikro Profitis Ilias, around the top, c. 300 m, lava outcrops on steep slopes with scarce low vegetation, 25.5.1990, *H. Sipman & Th. Raus* 29215 (B).

*Acarospora umbilicata* Bagl. – (2) 46656, 46677 [ATHU]; (20) 47049. – Kalimnos and Kos, c. 50-200 m, on exposed siliceous rocks in phrygana.

Our material is easily confused with *A. versicolor* Bagl. & Carestia, a morphologically similar species without gyrophoric acid (Roux 1981), because the C-reactions on cortex and medulla are often negative. However, TLC showed the presence of gyrophoric with a trace of probably lecanoric acid in all specimens.

*Acarospora veronensis* A. Massal. – (2) 46689; (8) 46800. – Kalimnos and Telendos, c. 50-90 m, on siliceous and weakly calcareous, low rocks in phrygana.

The species was not found on Kos or Nisiros. The thallus is of a paler colour than in material from Paros and Santorini, and the apothecia are not well developed. Therefore the identity is not completely certain.

*Acarospora* sp. – (2) in 46698; (23) 47116; (27) in 47441; (27) 47443. – Kalimnos and Kos, c. 50-250 m, on siliceous rocks in phrygana.

The material is mostly poorly developed and may belong to more than one species.

*Anaptychia ciliaris* (L.) A. Massal. – (11) 46826; (27) 47413 [ATHU]; (30) in 47352, in 47354; (31) 47411. – Kalimnos and Kos, c. 250-850 m, on trunks in open forest and in or among shrubs and low vegetation on very exposed, rocky places. On *Cupressus sempervirens* L.

*Anema nummularium* (Durieu & Mont.) Nyl. – (1) 46614 [ATHU, B]; (9) 46806. – Kalimnos and Telendos, c. 60-100 m, on limestone boulders and a calcareous, N-facing cliff in phrygana.

*Arthonia albopulverea* Nyl. [Syn.: *Arthothelium crozalsianum* (de Lesd.) de Lesd. (Boqueras 2000)] – (3) 46745; (7) 46784; 46785 [ATHU]; (16) 46899; (19) 47003; (22) in 47106 [herb. Pirintosos]; (27) 47256 [ATHU], in 47261 [herb. Pirintosos], 47262, 47265 [herb. Pirintosos]. – Kalimnos, Telendos and Kos, c. 30-300 m, on rather smooth bark and occasionally on decorticated wood of branches and twigs of scattered trees and shrubs in phrygana and cultivated fields, probably the commonest epiphyte in the lower, dry zone. On *Ceratonia siliqua* L., *Pistacia lentiscus* L., *Ficus carica* L., *Inula heterolepis* Boiss., *Quercus coccifera* L., *Olea europaea* subsp. *oleaster* (Hoffmanns. & Link) Negodi.

The material lacks properly developed spores. Only in one specimen an incompletely developed, transversely septate spore was seen. Such material is easily mistaken for other species of *Arthonia*. The shape of the ascomata is rather variable, from linear and lirella-like to almost rounded.

Specimens with short ascomata have been erroneously called *A. caesiella* Nyl. by Sipman & Raus (1999). The similar *A. beccariana* (Bagl.) Stizenb. (= *Arthothelium sardoum* Bagl., Boqueras 2000) differs by the I+ red iodine reaction of the hymenium.

*Arthonia caesiella* Nyl. – (3) 46744. – Kalimnos, c. 300 m, epiphyte on isolated *Ceratonia siliqua* shrub in phrygana.

The hymenium reacts I+ blue and the spores measure  $15 \times 6 \mu\text{m}$ . Easily confused with immature *A. albopulverea* (see above). However, the spores are uniseptate and the asci more elongate, c.  $40 \times 15 \mu\text{m}$  instead of c.  $30 \times 25 \mu\text{m}$ .

\**Arthonia cretacea* Zahlbr. – (3) in 46719; (29) 47295 [ATHU, B]. – Kalimnos and Kos, c. 230-300 m, on N-exposed limestone rock faces of cliffs and big boulders in phrygana.

*Arthonia impolita* (Ehrh.) Borrer – (21) in 47083. – Kos, c. 200 m, on thick trunk of *Ceratonia siliqua* in abandoned pasture.

*Arthonia melanophthalma* Dufour – (21) 47085, 47090; (27) 47250 [ATHU], 47257 [ABL], 47261 [herb. Pirintosos], 47264. – Kos, c. 200-250 m, on rather smooth bark of branches of scattered trees and shrubs in the dry lower zone, in phrygana and cultivated fields. On *Ceratonia siliqua*, *Ficus carica*, *Pistacia lentiscus*, *Quercus coccifera*, *Olea europaea* subsp. *oleaster*.

Remaining spores in old asci become brown. The hymenium is thinner than often indicated, about 30-40  $\mu\text{m}$  thick. Therefore the species might be confused with *A. arthonioides* (Ach.) A. L. Sm., a normally saxicolous species occasionally found on trunks (Purvis & al. 1992).

*Arthonia radiata* (Pers.) Ach. – (30) 47339. – Kos, c. 300-400 m, found once on a *Quercus coccifera* trunk in open *Quercus-Cupressus* forest.

*Arthonia varians* (Davies) Nyl. – (19) in 46997 [ATHU, B]; (20) in 47042; (21) in 47072 [ATHU]; (24) in 47129, in 47142; (27) in 47183. – Kos, c. 200-300 m, a lichenicolous fungus on the apothecia of *Lecanora rupicola* subsp. *rupicola* and subsp. *sulphurata*.



*Arthonia* sp. – (14) 46877. – Kalimnos, c. 650 m, on N-facing limestone cliff in phrygana.

The material consists of tiny, black apothecia without distinct thallus on limestone. The spores are 3-septate with slightly enlarged end cell,  $15 \times 5 \mu\text{m}$ .

*Aspicilia calcarea* (L.) Mudd – (3) 46730; (11) 46842; (12) 46863; (18) 46952, 46965 [ATHU]; (28) 47283 [ATHU]; (30) 47327; (31) in 47400 [ATHU]. – Kalimnos, Kos, c. 50-800 m, on exposed calcareous rocks, usually in phrygana.

TLC, 3 types: 1. tr. norstictic, stictic, tr. cryptostictic acids (46842, 46863, 46965, 47283, 47327); 2. norstictic, tr. stictic, tr. connorstictic acids (46730, 47400); 3. none (46952). In specimen 47283 only stictic acid was found, in 47400 only norstictic acid.

Unlike in W Europe (Purvis & al. 1992, Clauzade & Roux 1985), the encountered material of *A. calcarea* mostly contains lichen substances. Also specimens from Santorini and Paros were found to contain mostly lichen substances. From Santorini (Sipman & Raus 1995) a stictic acid race (no. 29308 p.p.; TLC: stictic, trace of cryptostictic acids) and a deficient race (no. 28602 p.p., 28631 p.p.) were present. The samples from Paros (Sipman & Raus 1999) belong all to the stictic acid race: Sipman & Raus 42776 p.p., 42894, 42973, 43142, 42143 p.p., 43174 p.p., all with a trace of norstictic acid, except 43142.

Nimis (1993) reports *A. calcarea* containing lichen substances from Italy, as var. *reagens* (Zahlbr.) Szatala and indicates that it is confined to the Mediterranean and probably under-recorded. Since the deficient specimens show no further difference, they are treated here as a chemical strain, and the other specimens are not reported as separate variety.

*Aspicilia cheresina* var. *microspora* (Arnold) Clauzade & Cl. Roux – (11) in 46839; (13) in 46871; (18) 46940; (31) 47400 [ATHU]. – Kalimnos and Kos, 300-800 m, lichenicolous on *A. calcarea* on exposed calcareous rocks in phrygana.

TLC: norstictic acid. Contrary to the Paros material studied before (Sipman & Raus 1999) the material lacks stictic acid and therefore belongs to var. *microspora* instead of var. *justii* (Servít) Clauzade & Cl. Roux. The thalli in no. 46839 and 46940 are small and were not investigated by TLC.

The separation of poorly developed specimens from *A. calcarea* was not always clear. In well developed specimens the 8 small spores per ascus and the lichenicolous habit set *A. cheresina* clearly apart from *A. calcarea*, which has 4 large spores per ascus and grows directly on rock. However, often the ascocarps do not contain spores, and thalli of *A. cheresina* may remain after its host has disappeared, so that the lichenicolous habit is no longer visible. Then thalli of *A. cheresina* may be recognized by their smaller size and by their radiating areoles; however, this morphological differentiation is also not always clear. Following Purvis & al. (1992) and Clauzade & Roux (1985) there would also be a chemical difference, *A. cheresina* often containing stictic and/or norstictic acid, while *A. calcarea* constantly lacking these substances. However, as reported above, the Aegean material of *A. calcarea* is different and often contains these substances.

*Aspicilia contorta* (Hoffm.) Kremp. – (7) in 46778; (27) 47204. – Telendos and Kos, 30-250 m, on weakly calcareous rock in phrygana.

The thallus is composed of 0.5-1 mm wide, rounded, scattered to contiguous, convex, white-pruinose areoles. The apothecia are poorly developed, with 0.2-0.4 mm wide, irregularly rounded, dark grey, weakly pruinose discs.

*Aspicilia cupreoglauca* de Lesd. – (24) 47128; (27) 47432 [ATHU]. – Kos, 200-250 m, on exposed siliceous rocks in phrygana.

TLC: norstictic acid; medulla K+ yellow turning red.

*Aspicilia intermutans* (Nyl.) Arnold – (2) 46640, 46642, 46659, 46688; (8) 46793 [ATHU]; (16) 46904; (19) in 46988; (20) 47055; (21) 47078 [ATHU]; (23) in 47124 [ATHU]; (24) 47152, 47155 [herb. Pirintsos]; (25) 47164; (27) 47171, 47176, 47194 [herb. Pirintsos], 47197 [ATHU],

47201, 47425, 47445; (30) 47312, 47318; (31) 47379, 47394. – Kalimnos, Telendos, Kos and Nisiros, 5-800 m, on siliceous, occasionally weakly calcareous rocks in open places in forest and in phrygana, and on walls.

TLC, 4 types: 1. norstictic, trace of conorstictic acids (46640, 46659, 46688, 47055, 47078, 47124, 47155, 47171, 47176, 47194, 47197, 47425, 47445, 47312, 47379, 47394); 2. stictic, tr. cryptostictic? acids (46793, 47318); 3. none (46642, 46904, 47200, 47429); 4. norstictic, tr. stictic, tr. cryptostictic? acids (47152, 47321).

As in our previous publication (Sipman & Raus 1999: 254), this taxon is used here as a dustbin for most of the available *Aspicilia* specimens from siliceous substrata. They vary greatly in morphology and chemistry, but we were unable to find clear discontinuities enabling species delimitations among them. Characters of ascomata and conidiomata are of little help for further differentiation because they were observed only in a few specimens.

*Aspicilia radiosa* (Hoffm.) Poelt & Leuckert – (12) 46864; (13) 46871; (30) 47331 [ATHU]. – Kalimnos and Kos, c. 300-700 m, on limestone rocks in open places, usually phrygana.

All material contains norstictic with a trace of conorstictic acid and is from limestone, contrary to the situation on Paros (Sipman & Raus 1999), where the species is chemically variable and occurs also on weakly calcareous rock.

*Aspicilia* sp. A – (20) 47052. – Kos, c. 200 m, on siliceous rock in phrygana on hilltop. Only one specimen from Kos fits this group reported from Paros (Sipman & Raus 1999: 255). This leaves the question open, whether it is an independent, rare taxon or an extreme form of *A. intermutans*.

*Aspicilia* sp. – (30) in 47312. – Kos, c. 300-400 m, on siliceous schist in open *Quercus-Cupressus* forest.

This is a single, tiny specimen which is lichenicolous on *A. intermutans*. It looks quite distinct from its host and is therefore considered to belong to a different, unidentified species.

*Bacidia rosella* (Pers.) De Not. – (27) in 47249; (30) 47338 [herb. Pirintsos], 47344, 47358; (32) 47362 [ATHU]. – Kos, c. 250-600 m, epiphytic on trunks and shrub branches in light woodland, occasionally in phrygana. On *Pistacia lentiscus*, *Quercus coccifera*, *Cupressus sempervirens*, *Prunus persica* (L.) Batsch.

*Bacidina phacodes* (Körb.) Vězda – (18) in 46923. – Kalimnos, 300 m, on isolated *Olea europea* subsp. *sativa* trunk in phrygana.

The material is very scarce and not typical because the apothecium margin is indistinct. The hymenium has a pure I+ blue reaction before treatment with K.

*Bactrospora patellarioides* (Nyl.) Almq. – (20) 47013 [ATHU]; (21) 47082, in 47094; (22) 47107, 47115 [herb. Pirintsos]; (27) 47249, 47252 [ATHU], in 47258 [ATHU], in 47263. – Kos, c.100-250 m, on branches of scattered trees and shrubs in fields and phrygana. On *Juniperus oxycedrus* subsp. *macrocarpa* (Sm.) Ball, *Ceratonia siliqua*, *Ficus carica*, *Pistacia lentiscus*, *Inula heterolepis*, *Quercus coccifera*, *Olea europaea* subsp. *oleaster*.

*Bagliettoa* cf. *baldensis* (A. Massal.) Vězda – (1) 46620, 46623; (4) 46758; (11) 46853; (15) 46896; (28) in 47280, in 47283 [ATHU]. – Kalimnos and Kos, c. 30-700 m, on calcareous rocks in open vegetation, mostly phrygana.

The identification is uncertain. Most of the material is without properly developed asci.

\**Buellia abstracta* (Nyl.) H. Olivier – (2) 46675 [ATHU], 46702, 46703; (8) 46792, 46796, 46798 [herb. Pirintsos]; (19) in 46996; (27) in 47235. – Kalimnos, Telendos and Kos, c. 50-300 m, preferably on schistose stones on soil, and on low, siliceous rocks in phrygana.



In our earlier paper (Sipman & Raus 1999) this taxon was treated as *B. vilis*? According to Scheidegger (1993) it is perhaps better included in *B. sequax* (Nyl.) Zahlbr. Our material consists of two distinct groups, one with a visible thallus containing norstictic acid, treated here as *B. sequax*, and one without visible thallus, treated here as *B. abstracta*. Only one specimen of *B. abstracta*, no. 46796, has traces of thallus, which appears to be without substances (TLC). The spores are in the range of  $4.5\text{-}5 \times 9\text{-}10\text{-}(14) \mu\text{m}$ , and usually not so narrow as indicated by, e.g. Purvis & al. (1992).

**\**Buellia epifimbriata* Sipman, sp. nova**

Holotype: Greece, Cyclades archipelago, Antiparos, NW of Hagios Georgios,  $36^{\circ}\text{E}58.5'\text{N}$ ,  $25^{\circ}\text{E}01.5'\text{E}$ , c. 50 m, schistose rock outcrops on top of coastal hill with low scrub, 16.6.1998, *H. Sipman & Th. Raus 42864* (B; isotype: ATHU). – Fig. 2.

Thallus in thallo *Buelliae fimbriatae* crescens, areolatus, griseofuscus, ad 3-5 mm latus; areolae angulares, ad 0.2-0.4 mm diametro, superficie plano vel leviter convexo, opaco, margine vulgo elevato pallido; cortex superior typo phenocorticis, ad  $15 \mu\text{m}$  crassus. Apothecia solitaria, immersa in areolis, nigra, rotunda vel leviter angulata, ad c. 0.3 mm diametro, disco plano vel paulo convexo, margine indistincto; excipulum tenue, hyalinum strato externo tenui fusco; hypothecium pallide fuscum; ascosporae octonae, griseae, biloculares, septo mediano non incrassato, sine constrictio ad septam,  $10 \times 5\text{-}7 \mu\text{m}$ , pariete laeve. Acidum norsticticum continens.

Thallus lichenicolous on *Buellia fimbriata* (Tuck.) Sheard, crustose, areolate, dark grey-brown, usually forming 3-5 mm wide, rounded or more irregular, to 10 mm long patches on the thallus of the host; areoles angular, mostly 0.2-0.4 mm diam., with flat to slightly convex, grey-brown, dull surface and often bordered by a thin, raised, pale line; cortex composed of a c.  $5 \mu\text{m}$  thick (in KOH solution), necrotic layer on top of a c.  $10 \mu\text{m}$  thick layer of dense, short-celled, thick-walled hyphae with dark brown pigmentation (phenocortex, cf. Scheidegger 1993: fig. 3A); algal layer c.  $60 \mu\text{m}$ ; medulla and algal layer in KOH solution producing a yellow solution which crystallises to form red needles. Apothecia immersed, one per areole, black, rounded or somewhat angular, to c. 0.3 mm diam., with flat to slightly convex disc, with indistinct margin; excipulum thin, hyaline with thin, dark brown outer layer; hypothecium pale brown to brown, thicker than the hymenium and containing remains of it; hymenium  $40\text{-}50 \mu\text{m}$ , clear; epithecium dark brown; ascospores 8 per ascus, grey, bilocular with median, transverse, thin septum, not constricted at septum,  $10 \times 5\text{-}7 \mu\text{m}$ , oblong, with smooth wall.

*Chemistry.* – Norstictic acid (TLC, no. 42864, 47119).

*Distribution and ecology.* – Known only from the southern Aegean in Greece, from the islands Antiparos and Kos, on volcanic rock at 50-200 m. The thalli are evidently lichenicolous on *Buellia fimbriata*, and, like the host, found on steep faces of exposed rock, usually cliffs in phrygana.

*Notes.* – The new species is characterised by its small, dark thalli growing on *Buellia fimbriata* (Scheidegger 1987, 1993). It differs from the other lichenicolous *Buellia* species with an own thallus by the presence of norstictic acid. It is also the only lichenicolous *Buellia* known from *B. fimbriata*.

The contact zone between *B. fimbriata* and *B. epifimbriata* is often black, suggesting that their thalli are clearly delimited and independent. However, in some places *B. epifimbriata* seems to invade the areoles of *B. fimbriata*. If *B. epifimbriata* turns out not to be a lichenicolous species, it has to be compared with *B. atrocinerella* (Nyl.) Scheid. and *B. tiroliensis* Körb. (Scheidegger 1993). Both have rather dark thalli, smooth spores and norstictic acid. *B. atrocinerella* differs by its rimose-areolate thallus with elongated marginal lobes and *B. tiroliensis* by its glossy, brown thallus. *B. aethalea* (Ach.) Th. Fr. has a paler thallus, its apothecia have a concave to flat disc and a trace of a white thalline margin when young, and the ascospores are larger,  $13\text{-}18 \mu\text{m}$  long, with rugulose surface.



Fig. 2. *Buellia epifimbriata* – type specimen, dark, areolate thalli with immersed apothecia, surrounded by the white, areolate thalli of its host, *B. fimbriata*, with larger, prominent apothecia. – Scale: photograph length = 10 mm.

*Additional specimens seen.* – GREECE: EAST AEGEAN ISLANDS: (20) in 47015 (B) (*Caloplaca grimmiae*), in 47033 (B) (*Buellia fimbriata*); (23) 47119 (B).

***Buellia fimbriata*** (Tuck.) Sheard – (19) 46993 [herb. Pirintsos]; (20) in 47033, in 47063; (23) 47123 [ATHU]; (24) 47149; (27) in 47239. – Kos, c. 150-300 m, on exposed, siliceous rocks in phrygana, preferably on N-exposed cliff faces.

In our earlier publication (Sipman & Raus 1999) this species was erroneously stated to contain diffractaic acid. Comparison with extracts from *Alectoria ochroleuca* and *Thelomma mammosum* shows that the TLC pattern resembles that of the latter and that in accordance with Scheidegger (1993) 3-chlorodivarcatic acid is present.

Ricoi & al. (2000) suggest that the species is better placed in the genus *Dimelaena*.

***Buellia schaeferi*** De Not. – (19) in 47006. – Kos, c. 300 m, on old cones on low twigs of *Pinus brutia* trees scattered in *Erica manipuliflora* heath.

***Buellia sequax*** (Nyl.) Zahlbr. – (2) 46693; (3) 46738a; (27) 47225. – Kalimnos and Kos, c. 50-250 m, on siliceous and calcareous rocks in phrygana.

See also note under *B. abstracta*.

***Buellia stellulata*** (Taylor) Mudd – (19) 46980 [ATHU]; (20) 47057; (21) in 47075; (23) in 47117 [ATHU]; (27) in 47175, in 47206 [ATHU]. – Kos, c. 150-300 m, on exposed, siliceous rocks in phrygana.

***Buellia subdisciformis*** (Leighton) Vain. – (2) 46676; (19) 46988; (20) 47054 [ATHU]; (24) in 47136, in 47141; (27) 47209 [herb. Pirintsos]. – Kalimnos and Kos, c. 50-300 m, on exposed, siliceous rocks in phrygana, preferably on N-facing cliffs.

TLC: atranorin, norstictic, connorstictic acids (46988).

*Caloplaca aegatica* Giralt, Nimis & Poelt – (19) 47004; (21) 47092. – Kos, c. 200-300 m, epiphytic in scattered trees and shrubs in open vegetation, phrygana and cultivated fields. On *Pinus brutia* Ten. and *Ficus carica*.

The material agrees with W Mediterranean specimens by the presence of black pycnidia, but deviates by thicker apothecium margins; this, however, is not a key character.

**\**Caloplaca aegaea* Sipman, sp. nova**

Holotype: Greece, Cyclades archipelago, Paros, hill Gorakas, c. 4 km NE of Paros town, 37°07.5'N, 25°11.5'E, c. 150-200 m, schistose rock outcrops on W and S-facing slopes and ridge of coastal hill with low scrub, 21.6.1998, *H. Sipman & Th. Raus 43204* (B; isotype: ATHU).

Thallus saxicola, placodioideus, centro areolatus, aurantiaco-flavus ad aurantiaco-ferrugineus; areolae ad 0.2-0.4 mm latae, convexae; areolae marginales elongatae, ad 1-1.5 mm longae, lobuliformes; cortex superior crassitudine irregulari, ad 20-60 µm; stratum algiferum ad 100 µm crassum; hyphae medullares ad 4 µm crassae. Apothecia frequentia, sessilia, basi constricto, rotunda, ad 0.4-0.8(-1.5) mm diametro, margine distincto, ad 0.1 mm crasso, plano, thallo concolore, disco paulo obscuriore; excipulum pallidum, algas continens; hypothecium pallidum; hymenium 60-70 µm crassum; ascospores octonae, 10-15 × 9-11 µm, septo 4-5 µm crasso, initio ellipsoidales, postea citriformia. Thallus et apothecia K+ obscure violaceo-rubra.

Thallus saxicolous, placodioid, areolate in the centre, with lobed margin, non-pruinose, yellowish to brownish orange; areoles c. 0.2-0.4 mm wide, convex; marginal lobes c. 1-1.5 mm long, 0.2-0.3 mm wide, loosely appressed; upper cortex of irregular thickness, 20-60 µm, composed of small-celled, pachydermatic parenchyma with 2-4(-6) µm wide lumina and c. 2 µm thick walls, the uppermost c. 10 µm with yellow crystals (parietin?); algal layer c. 100 µm thick, interrupted by scattered bundles of periclinal hyphae; medulla with c. 4 µm thick hyphae and scattered algal cells, without crystals. Apothecia frequent, sessile with constricted base, rounded, c. 0.4-0.8 (-1.5) µm in diam., with c. 0.1 mm wide, distinct, usually not prominent margin of the same colour as the thallus, and somewhat darker disc; hypothecium and excipulum colourless, excipulum with algal layer; hymenium 60-70 µm, clear; paraphyses c. 2 µm thick, with few inflated top cells 10 × 4 to 5 × 5 µm; ascospores 8 per ascus, hyaline, polarilocular, ellipsoid when young, finally with much widened septum and citriform, 10-15 × 9-11 µm, with 4-5 µm thick septum.

*Chemistry.* – Thallus, apothecia K+ dark purple.

*Distribution and ecology.* – This species is known from Paros, Antiparos and Kalimnos in the Aegean Sea, Greece, from Sardinia, Italy, and from southeastern Spain. It grows mainly on horizontal faces of low siliceous rocks and boulders in open vegetation, at altitudes of c. 5-150 m, not far from the sea. It seems to prefer rather fresh rock surfaces.

*Notes.* – *Caloplaca aegaea* externally resembles *C. saxicola* most closely. It differs most clearly by the presence of citriform ascospores. The differentiation needs care, however, since the ascospores become citriform only in a late stage and in preparations the majority of the spores is often ellipsoid. The loosely appressed marginal lobes also help to separate the species.

The other placodioid species of *Caloplaca* in Europe with citriform spores, *C. aurantia* (Pers.) J. Steiner, *C. flavescens* (Huds.) J. R. Laundon and *C. thallincola* (Weddell) Du Rietz (Clauzade & Roux 1985, Purvis & al. 1992, Nimis 1992) differ by the following characters: *C. aurantia* has flat, closely appressed, usually wider marginal lobes, often with white-pruinose zones; it resembles *C. aegaea* in colour. *C. flavescens* and *C. thallincola* have longer and more strongly convex, closely appressed marginal lobes with a yellowish colour, the first sometimes with white-pruinose zones. *C. aurantia* and *C. flavescens* differ also in habitat preference: in the same localities as *C. aegaea* they grow on limestone, not on siliceous stone.

*Additional specimens seen.* – GREECE: EAST AEGEAN ISLANDS: (2) 46649 (B). — CYCLADES ARCHIPELAGO, ANTIPAROS: W of Hagios Georgios, c. 50 m, schistose rock outcrops on top of

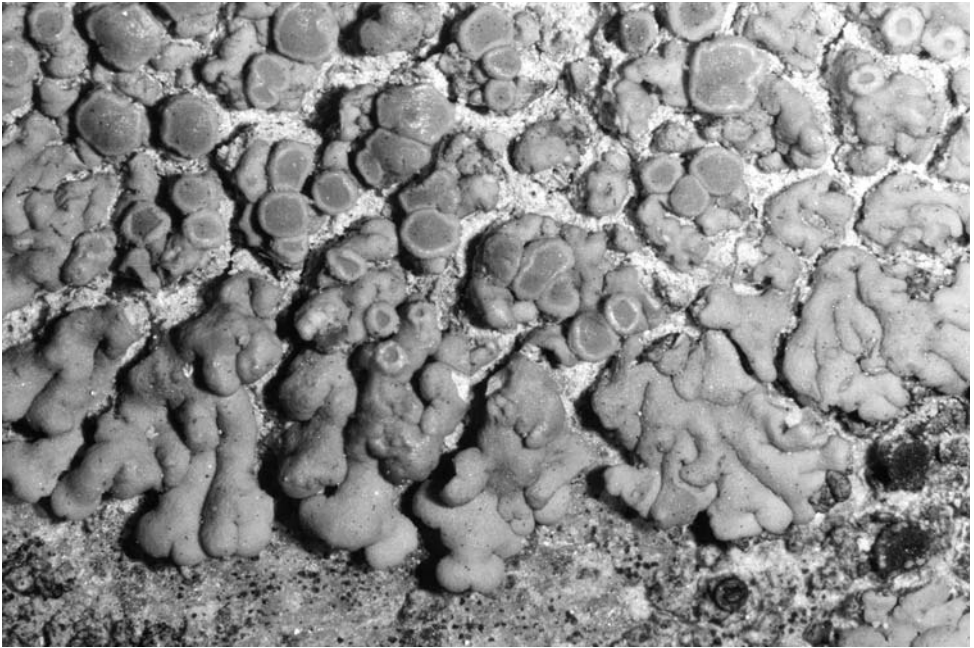


Fig. 3. *Caloplaca aegaea*, detail of type specimen, showing the convex, loosely appanate marginal lobes and rather thick apothecium margins. – Scale: photograph length = 10 mm.

coastal hill with low scrub, 16.6.1998, *H. Sipman & Th. Raus 42845* (B); sideway towards W coast from road from Agios Georgios to Mt Agios Ilias, about halfway, c. 150 m, large schist outcrop in low scrub near valley bottom on S-facing slope, 19.6.1998, *H. Sipman & Th. Raus 43093* (B); S-point of the island, cap Kavos Skilos, near Faneromeni chapel, 5 m, weathered volcanic rock outcrops on low, largely barren coastal hill, 19.6.1998, *H. Sipman & Th. Raus 43129* (B). — PAROS: Hill Gorakas, c. 4 km NE of Paros town, 37°07.5'N, 25°11.5'E, c. 150-200 m, schistose rock outcrops on W- and S-facing slopes and ridge of coastal hill with low scrub, 21.6.1998, *H. Sipman & Th. Raus 43204* (ATHU, B).

ITALY, SARDINIA: Prov. Sassari, W coast S of Alghero, Torre Argentina near Bosa, tuff outcrops on rocky garrigue slope at seashore, just above high-water level, 19.7.1987, *H. Sipman 24014* (B).

SPAIN: Almeria, 54 km ENE of Almeria, 3 km N of Carboneras, along road to Garrucha, on SE-exposed acid rock slope, 100 m, 13.7.1989, *P. v. d. Boom 8766* (herb. v.d. Boom).

*Caloplaca agardhiana* (A. Massal.) Clauzade & Cl. Roux – (1) 46619; (3) in 46728 [herb. Pirintsos]; (28) in 47283 [ATHU]. – Kalimnos and Kos, c. 50-300 m, on limestone rocks in phrygana.

*Caloplaca alociza* (A. Massal.) Migula – (3) 46742 [ATHU]; (6) 46773; (14) in 46877. – Kalimnos, c. 180-650 m, on limestone rocks in phrygana.

*Caloplaca aractina* (Fr.) Häyryén – (2) 46669; (27) 47170. – Kalimnos and Kos, c. 50-250 m, on siliceous rocks in phrygana.

*Caloplaca arenaria* (Pers.) Müll. Arg. – (19) 46985; (20) 47038; (27) 47185. – Kos, c. 200-300 m, on low siliceous rocks in phrygana.

This is the same taxon as reported under this name by Sipman & Raus (1999). As indicated there, its identity is not completely certain because it looks somewhat different from specimens in



the herbarium Berlin-Dahlem originating from northern and central Europe. 47038 deviates by its more numerous, congested apothecia and seems to be lichenicolous on *Aspicilia intermutans*.

\**Caloplaca atroflava* var. *submersa* (Nyl.) H. Magn. – (2) 46694. – Kalimnos, c. 50 m, on schistose rock in phrygana.

The material agrees well with a specimen from Sardinia (*Sipman 23995* [B]). Nimis (1993) indicates that the relation of var. *submersa* with typical *C. atroflava* seems unclear and that this variety may represent an independent taxon.

*Caloplaca aurantia* (Pers.) J. Steiner – (1) 46610, 46612; (3) 46732; (7) 46782 (cf.); (10) 46819 [ATHU]; (11) 46834; (13) 46867; (29) in 47288. – Kalimnos, Telendos and Kos, c. 60-700 m, on limestone boulders and rocks in open places, usually in phrygana.

*Caloplaca carphinea* (Fr.) Jatta – (2) 46671 [ATHU, B]. – Kalimnos, c. 50 m, on schistose rock in phrygana.

The material fits *C. carphinea* sensu stricto (Breuß 1989).

*Caloplaca cerina* (Hedw.) Th. Fr. – (30) 47350; (31) in 47402; (32) 47364 [ATHU]. – Kos, c. 300-800 m, on trunks and old shrub branches in cultivated fields and phrygana. On *Cupressus sempervirens*, *Olea europaea* subsp. *oleaster*, *Prunus persica*.

*Caloplaca cerinelloides* (Erichsen) Poelt – (5) 46769; (22) in 47110. – Kalimnos and Kos, c. 100 m, on trunks in cultivated fields. On *Olea europaea* subsp. *sativa* and *Juniperus oxycedrus* subsp. *macrocarpa*.

*Caloplaca chlorina* (Flot.) Sandst. – (27) 47431 [ATHU, B, herb. Pirintosos]. – Kos, c. 250 m, in rainwater run-off area of larger siliceous rock in phrygana.

\**Caloplaca chrysodeta* (Räsänen) Domb. – (12) 46861. – Kalimnos, c. 700 m, on limestone rock, SW facing, in rocky phrygana.

*Caloplaca citrina* (Hoffm.) Th. Fr. – (21) 47066. – Kos, c. 200 m, on vertical face of siliceous rock in phrygana.

The specimen belongs to the completely sorediate morph (*Caloplaca citrina* s.str.), contrary to the specimens reported from Santorini (Sipman & Raus 1995), which are corticate with delimited soralia and belong to *C. flavocitrina* (Nyl.) H. Olivier (Boom & al. 1998).

*Caloplaca crenularia* (With.) J. R. Laundon – (2) 46697; (19) 46986; (27) 47236, 47437; (30) 47314. – Kalimnos and Kos, c. 50-400 m, on siliceous rocks in phrygana and open woodland.

The identification of 46986 and 47437 remains uncertain because the material is scarce with whitish thallus traces. For possible confusion with *C. erythrocarpa* on weakly calcareous substrata see below.

*Caloplaca erythrocarpa* (Pers.) Zwackh – (3) 46729 [ATHU]; (8) 46797; (13) 46870; (16) 46902 [herb. Pirintosos]; (30) 47330. – Kalimnos, Telendos and Kos, c. 90-650 m, on limestone and calcareous schist in open situations, usually in phrygana.

On weakly calcareous substrata *C. erythrocarpa* tends to have a thin and scarce thallus. Then it resembles specimens of *C. crenularia* with a poorly developed thallus, and the hymenium size may be useful for distinction. In *C. erythrocarpa* it is c. 80-90 µm thick, in *C. crenularia* c. 60 µm.

*Caloplaca flavescens* (Huds.) J. R. Laundon – (3) 46717 [ATHU, B]; (11) in 46834; (15) 46886 [herb. Pirintosos]; (16) in 46909; (18) 46941, 46946; (28) 47272. – Kalimnos and Kos, 30-700 m, on calcareous rocks and boulders in phrygana.

\**Caloplaca flavocitrina* (Nyl.) H. Olivier – (8) 46790. – Telendos, 90 m, on weakly calcareous rocks along the coast in phrygana.

For the differentiation from *C. citrina*, see the note under that species.

*Caloplaca flavorubescens* (Huds.) J. R. Laundon – (27) 47255; (29) 47296. – Kos, c. 250 m, on calcareous rock and on branches of *Inula heterolepis* in phrygana.

*Caloplaca fuscoatroides* J. Steiner – (2) 46701, in 46626, in 46648; (8) 46791 [ATHU]; (20) 47050; (27) 47444. – Kalimnos, Telendos and Kos, c. 50-250 m, on siliceous rocks in phrygana.

*Caloplaca grimmiae* (Nyl.) H. Olivier – (20) 47015; (23) 47121. – Kos, 150-200 m, on siliceous rocks in phrygana, lichenicolous on *Candelariella vitellina*, but much rarer than the host.

*Caloplaca holocarpa* (Ach.) A. E. Wade – (28) in 47286. – Kos, c. 50 m, on NW facing calcareous lava cliff in phrygana, near the coast.

*Caloplaca inconnexa* (Nyl.) Zahlbr. – (13) 46869; (20) 47036; (27) 47168; (27) 47429 [ATHU, B, herb. Pirintsos]; (27) 47447; (31) 47398. – Kalimnos and Kos, 200-800 m, lichenicolous on rocks in phrygana. Hosts *Aspicilia intermutans* on siliceous rock and *A. calcarea* on calcareous rock, occasionally *A. radiosa* and *Lecanora rupicola* subsp. *rupicola*.

*Caloplaca* cf. *interna* Poelt & Nimis – (2) 46682. – Kalimnos, c. 50 m, on schistose rock in phrygana.

The identification is uncertain. The specimen is very similar to no. 42482 from Paros (Sipman & Raus 1999).

*Caloplaca limitosa* (Nyl.) H. Olivier – (2) 46648, 46664 [ATHU, B], 46698; (20) 47061, 47062; (21) 47069; (27) 47227, in 47435, 47193 (cf.). – Kalimnos and Kos, c. 50-250 m, on siliceous rocks in phrygana, usually on rather sheltered, steep faces.

A species of the *C. crenularia* group, characterized by an areolate thallus bordered by a black hypothallus. The apothecium colour is rather variable, usually rusty red, but sometimes more rusty orange or very dark, almost black.

\**Caloplaca limonia* Nimis & Poelt – (29) 47287. – Kos, c. 230 m, on soil among exposed calcareous rocks in phrygana.

The specimen agrees fairly well with an isotype at GZU(!), except in the absence of apothecia.

*Caloplaca* cf. *marina* (Weddell) Du Rietz – (2) 46696; (3) 46739; (8) 46788 [ATHU]; (9) 46814; (16) 46909; (18) 46959; (20) 47035; (27) 47234 [herb. Pirintsos], 47450; (28) 47285. – Kalimnos, Telendos and Kos, c. 50-300 m, on low rocks and boulders of calcareous and siliceous stone in phrygana.

For this taxon, see remarks by Sipman & Raus 1999.

*Caloplaca* cf. *marmorata* (Bagl.) Jatta – (1) 46593; (7) 46777; (18) 46947a; (28) 47286. – Kalimnos and Kos, c. 30-300 m, on limestone and weakly calcareous rocks in phrygana.

The material deviates by spores with thick septa. Perhaps it is a form of *C. polycarpa* with reddish apothecia. However, thalli with such apothecia are sometimes found on limestone next to thalli with more yellowish, smaller apothecia, and then they give the impression of a separate species. Another possibility is that it concerns a form of *C. subochracea* Werner without epilithic thallus. However, no specimens with better developed thallus, as usual in *C. subochracea*, have been found.

*Caloplaca obscurella* (Körb.) Th. Fr. – (30) 47341. – Kos, c. 300-400 m, on *Cupressus sempervirens* trunk in open *Quercus-Cupressus* forest.



*Caloplaca polycarpa* (A. Massal.) Zahlbr. – (1) 46611, 46613; (3) 46735, 46736; (6) 46774; (11) 46836, 46849; (15) 46892; (18) 46958, 46960; (27) in 47454; (28) in 47273; (29) in 47289; (30) 47328. – Kalimnos and Kos, c. 50-700 m, on calcareous rocks in phrygana and other open habitats.

Here all specimens with a thin and more or less areolate, or endolithic thallus growing on limestone and yellow to orange apothecia have been included. They do not seem to be parasitic on *Bagliettoa*, however.

*Caloplaca pyracea* (Ach.) Th. Fr. – (20) 47010 [ATHU]; (22) 47113; (27) 47247; (30) 47334 (cf.); (31) in 47402 (cf.); (32) 47361. – Kos, 100-800 m, epiphytic on trunks and branches of scattered trees and shrubs in open woodland and cultivated fields. Phorophytes include: *Juniperus oxycedrus* subsp. *macrocarpa*, *Pistacia lentiscus*, *Quercus coccifera*, *Olea europaea* subsp. *oleaster*, *Prunus persica*.

*Caloplaca saxicola* (Hoffm.) Nordin – (3) 46716; (27) 47223; (29) 47290, 47291. – Kalimnos and Kos, 230-300 m, on calcareous rock in phrygana.

Of the same colour as *C. aegaea*, but easily recognizable by the absence of citriform spores and by its smaller apothecia, to c. 0.5 mm wide.

47223 deviates by its larger apothecia, which resemble *C. aegaea*. However, no citriform spores were found. Its marginal lobes are poorly developed and its status is uncertain.

*Caloplaca variabilis* (Pers.) Müll. Arg. – (13) in 46871; (18) 46962. – Kalimnos, c. 300-650 m, on limestone rocks in phrygana.

*Caloplaca* sp. 1. – (27) in 47451. – Kos, c. 250 m, on siliceous rock in phrygana.

The material is very scarce. It reminds *C. fuscoatroides* by its subsquamose, brownish grey thallus but differs by the paler colour of the apothecia.

*Caloplaca* sp. 2. – (12) 46862. – Kalimnos, c. 700 m, on limestone in phrygana.

This specimen has yellowish apothecia and a thick, warty, yellowish thallus, and it overgrows *Verrucaria* s.l. It may be close to *C. polycarpia*, but differs clearly from the material cited above under this name by its thick thallus and larger apothecia.

*Candelariella aurella* (Hoffm.) Zahlbr. – (7) 46778; (8) in 46792; (19) in 46985; (20) no voucher; (27) 47235, 47452 [ATHU]; (29) in 47291, in 47297 [ATHU, B]. – Telendos and Kos, 30-300 m, on siliceous and weakly calcareous rocks in phrygana.

In the investigated area this species seems to avoid strongly calcareous substrate; it was not found on the abundant limestone rocks of Kalimnos.

*Candelariella vitellina* (Hoffm.) Müll. Arg. – (2) 46695; (19) in 46986; (20) 47060; (23) in 47121; (24) in 47155 [herb. Pirintsos]; (27) 47167 [ATHU]. – Kalimnos and Kos, c. 50-300 m, on siliceous rocks and boulders in open phrygana.

*Candelariella vitellina* f. *granulosa* Hakul. – (19) 46976; (21) in 47075. – Kos, c. 200-300 m, on siliceous rocks and boulders in phrygana and open woodland.

In most specimens of *C. vitellina* the thallus granulations are somewhat squamulae-like and 0.2-0.5 mm wide with crenulate margins. Two specimens differ significantly because the thallus granulations are only 0.05-0.1 mm in diam., and do not become flattened. A similar specimen was also found on Santorini (28870). This material is referred to as f. *granulosa* Hakul. A larger number of records is needed to establish whether it merits a higher rank than that of a forma.

*Candelariella xanthostigma* (Ach.) Lettau – (31) in 47405. – Kos, c. 850 m, on small *Cupressus sempervirens* tree on steep, N-facing slope.

\**Catillaria atomarioides* (Müll. Arg.) H. Kiliias – (18) in 46941; (32) 47370. – Kalimnos and Kos, 300-600 m, on calcareous rock in open woodland and phrygana.

*Catillaria chalybeia* (Borrer) A. Massal. var. *chalybeia* – (16) 46906; (20) 47045 [ATHU]; (27) 47435. – Kalimnos and Kos, c. 100-250 m, on siliceous and weakly calcareous rock in phrygana.

This variety includes the specimens with a blue-green pigment in the lower part of the hymenium. Those lacking this pigment are treated as var. *chloropoliza*, below.

*Catillaria chalybeia* var. *chloropoliza* (Nyl.) H. Kiliias – (2) in 46640, 46681; (19) 46996; (30) 47342; (31) 47412. – Kalimnos and Kos, 50-850 m, on siliceous and weakly calcareous rock, and on bark, in phrygana and open woodland. Observed phorophyte: *Cupressus sempervirens*.

*Catillaria* cf. *lenticularis* (Ach.) Th. Fr. – (2) 46628. – Kalimnos, c. 50 m, on soil on NW-facing slope with schistose rocks and phrygana.

The excipulum pigment is restricted to a narrow outer zone. The identification is with doubt, because the substrate is unusual and the hypothecium is yellowish brown. The hypothecium colour suggests that it might belong to *C. nigroclavata* (Nyl.) Schuler, but that species grows on bark.

*Catillaria praedicta* Tretiach & Hafellner – (5) 46768; (32) in 47363. – Kalimnos and Kos, c. 100-600 m, on trunks in cultivated fields. On *Olea europaea* and *Prunus persica*.

*Cladonia cervicornis* (Ach.) Flot. – (4) 46765; (12) 46857; (18) 46929; (21) in 47105. – Kalimnos and Kos, c. 100-700 m, on soil and among moss on usually calcareous rock in phrygana, preferably on N-facing slopes.

TLC: fumarprotocetraric acid (46765, 46857, 46929, 47105).

*Cladonia firma* (Nyl.) Nyl. – (19) 46969; (21) 47102. – Kos, c. 200-300 m, on soil in phrygana over siliceous rocks.

TLC: atranorin, fumarprotocetraric acid (46969, 47102). The specimens are not very luxuriant and externally indistinguishable from *C. cervicornis*. They have been recognized by the presence of atranorin.

*Cladonia foliacea* (Huds.) Willd. – (2) 46629; (3) in 46709; (4) in 46765; (10) 46815 [herb. Pirintsos]; (11) 46828; (12) in 46857; (18) 46927 [ATHU]; (19) 46966; (21) 47097. – Kalimnos, Telendos and Kos, c. 50-700 m, on soil in phrygana over calcareous and siliceous rock, mainly in mossy, usually N-facing spots.

TLC: usnic, fumarprotocetraric, protocetraric acids (46629, 46927, 46966, 47097).

*Cladonia furcata* (Huds.) Schrad. – (11) 46830. – Kalimnos, c. 700 m, on soil on exposed hilltop with phrygana and limestone rocks.

TLC: fumarprotocetraric acid.

*Cladonia mediterranea* Duvign. & des Abb. – (21) 47064, 47098 [ATHU]. – Kos, c. 200 m, on soil in phrygana with siliceous rocks on mossy, N-facing spot without signs of recent burning or grazing.

TLC: usnic, perlatolic acids (47064, 47098).

*Cladonia pyxidata* (L.) Hoffm. – (2) 46627, 46633; (3) in 46710; (4) 46766; (10) 46817 [ATHU]; (11) 46829 [ATHU]; (14) in 46875; (16) in 46898 [herb. Pirintsos]; (19) 46968; (21) 47099; (27) 47211; (28) 47267 [herb. Pirintsos]. – Kalimnos, Telendos and Kos, c. 30-700 m, on soil and among moss in phrygana over calcareous and siliceous rock, preferably on mossy, N-facing spots.

TLC, 2 types: 1. fumarprotocetraric acid alone (46766); 2. fumarprotocetraric acid, atranorin (46627, 46633, 46817, 46829, 47099, 47211, 47267). The species name is applied here in a wide

sense. The available specimens belong to the morphotype with often lacerate and crumbling thallus lobe margins, a pale colour and short scyphi, which is the dominant type in the Mediterranean lowlands and may be related to *C. dimorpha* Hammer.

***Cladonia ramulosa*** (With.) J. R. Laundon – (21) 47100, 47101 [ATHU, B]. – Kos, c. 200 m, on soil in phrygana with siliceous rocks, on mossy, N-facing spot.

TLC: fumarprotocetraric acid, trace of zeorin? (47100, 47101).

***Cladonia rangiformis*** Hoffm. – (3) 46709; (11) 46827 [ATHU]; (12) in 46857; (18) 46928 [ATHU], 46939; (19) 46970 [herb. Pirintsos]; (21) 47096; (27) 47210. – Kalimnos and Kos, c. 200-700 m, among moss on soil in phrygana over calcareous and siliceous rocks.

TLC: atranorin, rangiformic acid, with a trace of fumarprotocetraric acid (46709, 46827, 46928, 46939, 47210) or without (46968, 46970, 47096).

***Clauzadea immersa*** (Hoffm.) Hafellner & Bellem. – (1) 46618, 46624 [herb. Pirintsos]; (3) no voucher; (4) 46757; (7) 46776 [ATHU]; (11) 46844, 46847 [ATHU]; (28) 47281. – Kalimnos, Telendos and Kos, c. 30-700 m, on calcareous rocks in phrygana.

***Clauzadea metzleri*** (Körb.) Clauzade & Cl. Roux – (28) 47280. – Kos, c. 50 m, on NW-facing calcareous lava cliff in phrygana.

***Clauzadea monticola*** (Ach.) Hafellner & Bellem. – (29) 47288. – Kos, c. 230 m, on exposed calcareous rock in phrygana.

***Collema auriforme*** (With.) Coppins & J. R. Laundon – (27) in 47421. – Kos, c. 250 m, on siliceous rock in phrygana.

***Collema confertum*** Arnold – (16) 46901. – Kalimnos, 100 m, on calcareous silicate rock in steep, S-facing slope with phrygana.

***Collema crispum*** (Huds.) Wigg. – (12) in 46860; (17) 46912; (18) 46937. – Kalimnos, c. 100-700 m, on loamy soil in phrygana over calcareous rock.

***Collema cristatum*** (L.) Wigg. – (3) 46705; (11) 46838; (12) 46860; (14) 46875. – Kalimnos, c. 300-750 m, on limestone rocks and soil in phrygana.

*Collema* cf. *multipartitum* Sm. – (4) 46761. – Kalimnos, c. 100 m, on limestone rocks along dry stream in valley bottom, N-facing.

The identification is uncertain because the specimen is poor.

***Collema ryssoleum*** (Tuck.) A. Schneid. – (2) 46641; (19) 46971 [ATHU]; (21) 47068; (27) 47421. – Kalimnos and Kos, c. 50-300 m, on siliceous rocks in phrygana.

***Collema tenax*** (Sw.) Ach. – (1) 46622, 46625 [ATHU]; (3) 46706; (15) 46895; (16) in 46903; (18) in 46937; (27) 47205, 47422; (28) 47269 [herb. Pirintsos]. – Kalimnos and Kos, c. 30-300 m, on soil in phrygana, mostly over calcareous rock.

***Dermatocarpon miniatum*** (L.) Mann – (27) 47245. – Kos, c. 250 m, at the base of a large siliceous rock in phrygana.

***Dimelaena radiata*** (Tuck.) Hale & Culb. – (21) 47074 [B, herb. Pirintsos]; (23) 47125 [ATHU]; (27) 47219. – Kos, c. 150-250 m, on siliceous rocks in phrygana, mainly on steep, S exposed rock faces.

***Diploicia canescens*** (Dicks.) A. Massal. – (19) 46991; (20) 47024, in 47011; (21) in 47087; (23) 47122; (27) 47222 [ATHU]; (29) 47301 [herb. Pirintsos]; (29) 47305. – Kos, c. 150-300 m, on

siliceous and calcareous rocks and on bark, in phrygana. On *Juniperus oxycedrus* subsp. *macrocarpa*, *Ficus carica* and *Quercus coccifera*.

TLC: atranorin, ?diploicin, ?dechlorodiploicin, traces of unidentified substances (46991, 47024, in 47087, 47122, 47222, in 47239, 47301, 47305). Unlike on Paros (Raus & Sipman 1999), gyrophoric acid was absent, even in specimens from siliceous rock. The absence of the species from Kalimnos is remarkable.

***Diploschistes actinostomus*** (Ach.) Zahlbr. – (2) 46667, 46673, 46678 [ATHU]; (8) 46795; (16) 46905 [herb. Pirintosos]; (20) 47022; (21) in 47071; (23) in 47120 [ATHU]; (24) 47150 [ATHU]; (27) 47173 [herb. Pirintosos], 47224; (30) 47310. – Kalimnos, Telendos and Kos, c. 50-400 m, on siliceous rocks in open vegetation, usually phrygana.

The chemistry was tested only by spot test: medulla C+ red.

***Diploschistes diacapsis*** (Ach.) Lumbsch – (3) 46707, 46713; (4) 46753 [ATHU]; (11) 46833; (12) in 46861a; (16) 46898 [herb. Pirintosos]; (27) 47415. – Kalimnos and Kos, c. 100-700 m, on soil among calcareous rocks in phrygana.

The distinction of this species from the closely resembling *D. muscorum* follows Lumbsch (1989).

***Diploschistes euganeus*** (A. Massal.) J. Steiner – (19) in 46995; (20) 47027. – Kos, c. 200-300 m, on siliceous rocks in phrygana.

The chemistry was tested only by spot test: medulla C-.

***Diploschistes muscorum*** (Scop.) R. Sant. – (3) in 46710; (4) 46753a; (10) in 46818; (19) in 46968; (30) 47307. – Kalimnos, Telendos and Kos, c. 30-400 m, on soil among calcareous rocks in phrygana and open woodland.

***Diploschistes ocellatus*** (Vill.) Norman – (12) 46861a. – Kalimnos, c. 700 m, on limestone rocks facing SW in phrygana.

***Diploschistes scruposus*** (Schreb.) Norman – (31) 47392. – Kos, c. 800 m, on rock on steep, N-facing, scarcely vegetated mountain slope.

***Diplotomma alboatrum*** (Hoffm.) Flot. – (2) 46653; (15) 46894; (16) 46908 [ATHU]; (20) in 47049, in 47060; (23) in 47118; (25) 47162; (27) 47238, 47451, 47453 [ATHU]; (27) in 47247; (30) 47335. – Kalimnos, Nisiros and Kos, c. 5-400 m, on siliceous and weakly calcareous rocks and bark in open vegetation, mostly phrygana. On *Pistacia lentiscus* and *Quercus coccifera*.

***Diplotomma venustum*** Körb. – (3) 46738 [herb. Pirintosos]; (7) 46780; (18) 46956 [ATHU, B]; (29) 47289; (31) 47399. – Kalimnos, Telendos and Kos, c. 30-800 m, on calcareous rocks in open vegetation, mostly phrygana.

***Dirina ceratoniae*** (Ach.) Fr. – (21) 47081 [herb. Pirintosos], in 47093; (22) 47108, in 47111; (27) in 47254 [ATHU, B], 47263, in 47249; (29) 47303 [ATHU]. – Kos, c. 100-250 m, on trunks and branches of trees and shrubs in phrygana and cultivated fields. On *Ceratonia siliqua*, *Ficus carica*, *Juniperus oxycedrus* subsp. *macrocarpa*, *Inula heterolepis*, *Olea europaea* subsp. *oleaster*, *Pistacia lentiscus*, *Quercus coccifera*.

***Dirina cretacea*** (Zahlbr.) Tehler – (9) 46803; (15) 46884; (28) 47277; (29) 47292 [ATHU, herb. Pirintosos]. – Telendos, 30-230 m, on usually steep, N-exposed faces of calcareous cliffs in phrygana.

***Dirina massiliensis*** Durieu & Mont. f. *massiliensis* – (2) 46638; (3) 46719; (9) 46804; (15) 46891; (18) 46957 [ATHU]; (20) in 47041 [ATHU]; (21) in 47076 [ATHU]; (27) 47230, 47419,

47449 [ATHU]; (28) 47276 [herb. Pirintosos]; (29) 47299. – Kalimnos, Telendos and Kos, c. 30-300 m, on N-exposed and sheltered, vertical faces of calcareous and siliceous rock cliffs and boulders in open vegetation, usually phrygana.

*Dirina massiliensis* f. *sorediata* (Müll. Arg.) Tehler – (1) 46596; (3) in 46726; (9) 46805; (15) 46887 [ATHU]; (18) 46954 [herb. Pirintosos]; (19) in 46992; (21) 47079; (25) in 47163; (27) 47226, (27) 47228 [ATHU], 47229 [herb. Pirintosos]; (28) 47274. – Kalimnos, c. 5-300 m, in similar situations as f. *massiliensis*, but slightly more widespread.

*Evernia prunastri* (L.) Ach. – (30) 47353; (32) in 47360. – Kos, c. 500-600 m, on *Prunus persica* trunks on abandoned fields.

*Fulgensia fulgida* (Nyl.) Szatala – (1) no voucher; (3) 46708; (9) in 46810; (11) in 46832 [herb. Pirintosos]; (12) 46858a [ATHU]; (18) 46934. – Kalimnos and Telendos, c. 60-700 m, in fissures of calcareous rocks in open phrygana.

*Fulgensia subbracteata* (Nyl.) Poelt – (10) in 46816; (17) 46918; (18) 46936. – Kalimnos and Telendos, c. 30-300 m, on soil in phrygana over calcareous rock.

*Haematomma ochroleucum* (Necker) J. R. Laundon – (14) in 46878; (18) in 46953. – Kalimnos, c. 300-650 m, on N-facing limestone (dolomitic?) cliffs in phrygana.

TLC: atranorin, usnic acid, zeorin, unidentified substances (in 46878, in 46953).

*Hafellia leptoclinoides* (Nyl.) Scheid. & H. Mayrhofer – (19) 46989; (20) 47026, 47041 [ATHU]; (24) in 47145; (25) in 47162; (27) 47191 [herb. Pirintosos], 47239. – Kos and Nisiros, c. 5-300 m, on steep faces of siliceous rocks in open habitats, usually phrygana.

*Heppia adglutinata* (Kremp.) A. Massal. – (17) 46911. – Kalimnos, 100 m, on loamy soil at the base of a S-facing rocky limestone slope.

*Heppia solorinoides* (Nyl.) Nyl. – (17) 46916. – Kalimnos, 100 m, on loamy soil at the base of a S-facing rocky limestone slope.

*Hymenelia prevostii* (Duby) Kremp. – (1) 46603; (4) 46756 [ATHU]; (11) 46843 [herb. Pirintosos]; (30) 47329. – Kalimnos, c. 60-700 m, on exposed limestone rocks in phrygana and open woodland.

*Immersaria athrocarpa* (Ach.) Rambold & Pietschmann – (31) 47395, in 47379. – Kos, 700-800 m, on weakly calcareous rocks on a steep, largely barren mountain slope. Specimen 47395 is lichenicolous on *Aspicilia intermutans*.

*Lecania inundata* (Hepp ex Körb.) M. Mayrhofer – (25) 47160; (29) in 47297 [ATHU, B]. – Nisiros and Kos, c. 5-230 m, on lava boulder of wall along field and on calcareous rock in phrygana.

*Lecania naegelii* (Hepp) Diederich & v.d. Boom – (27) in 47247; (30) 47332. – Kos, c. 250-400 m, on trunks and branches in open woodland and phrygana. On *Pistacia lentiscus*, *Quercus coccifera*.

*Lecania spadicea* (Flot.) Zahlbr. – (1) 46592 [B, herb. Pirintosos]; (9) 46810; (15) 46885; (28) 47266 [ATHU]; (29) 47300. – Kalimnos, Telendos and Kos, c. 30-230 m, on calcareous rocks in phrygana.

*Lecania turicensis* (Hepp) Müll. Arg. – (7) 46779; (9) 46812; (29) 47294. – Telendos and Kos, 30-230 m, on (weakly) calcareous rocks in phrygana.

*Lecanographa grumulosa* (Dufour) Egea & Torrente – (3) 46714 [ATHU]; (9) 46808; (15) 46888 [herb. Pirintsos]; (18) in 46957 [ATHU]; (29) 47293. – Kalimnos, Telendos and Kos, c. 30-300 m, together with *Dirina massiliensis*.

*Lecanora albescens* (Hoffm.) Branth & Rostr. – (7) 46783; (9) in 46810; (13) in 46871; (18) in 46962; (20) in 47035; (29) 47297 [ATHU, B]. – Telendos, Kalimnos and Kos, 30-650 m, on calcareous rocks in open sites, mostly phrygana.

*Lecanora bolcana* (Pollini) Poelt – (2) 46665; (20) 47025 [ATHU, B]. – Kalimnos, c. 50-200 m, on siliceous rocks in phrygana.

TLC: usnic acid, fatty (rangiformic?) acid (46665, 47025). The material differs chemically from the local population of the closely related *L. muralis* by the absence of terpenoids.

*Lecanora campestris* (Schaer.) Hue – (3) in 46720; (8) 46794; (20) in 47048; (30) 47313. – Kalimnos, Telendos and Kos, c. 90-400 m, on siliceous and calcareous (dolomitic?) rocks in phrygana and open woodland.

TLC: atranorin, unknown Lcm-1 (Brodo 1984), unidentified traces (46794, 47313).

*Lecanora chlarotera* Nyl. – (30) 47348; (30) 47355. – Kos, c. 300-500 m, on trunks in open woodland and abandoned fields. Observed phorophyte: *Cupressus sempervirens*.

TLC: atranorin, gangaleoidin (47348, 47355).

*Lecanora conferta* (Fr.) Grognot – (2) in 46699; (8) in 46788 [ATHU]. – Kalimnos and Telendos, c. 50-90 m, on schistose and weakly calcareous stones in phrygana.

Chemistry investigated by spot test only: C+ red.

*Lecanora crenulata* Hook. – (1) in 46603; (3) in 46726. – Kalimnos, c. 60-300 m, on N-facing limestone rocks in phrygana.

*Lecanora dispersa* (Pers.) Sommerf. – (2) 46679, 46699; (5) in 46769; (20) no voucher; (25) in 47160; (27) 47454, in 47247; (28) in 47271, in 47273; (31) in 47402. – Kalimnos, Kos and Nisiros, c. 5-800 m, on bark and on siliceous stones in open vegetation, mostly phrygana. On *Pistacia lentiscus*, *Olea europaea* subsp. *sativa* and subsp. *oleaster*.

TLC: 2,7-dichlorolichexanthone (47454, 46679). The species is treated here in a wide sense, as in our earlier publication (Sipman & Raus 1999).

*Lecanora expallens* Ach. – (19) 46998, 47000 [ATHU, B]. – Kos, c. 300 m, on trunk and sheltered twigs in open woodland. On *Erica manipuliflora* Salisb. and *Pinus brutia*.

TLC: usnic acid, zeorin, unidentified traces (47000).

*Lecanora gangaleoides* Nyl. – (19) 46975; (24) in 47147 [ATHU]; (27) 47202; (30) 47317 [ATHU]; (31) 47382. – Kos, c. 200-700 m, on siliceous rocks in phrygana and open woodland.

TLC: atranorin, gangaleoidin, unidentified traces (47382, 46975, 47202, 47317). 47383 also contains skyrin.

*Lecanora horiza* (Ach.) Lindsay – (3) 46746; (30) 47347 [ATHU]; (30) 47356; (32) 47363. – Kalimnos and Kos, c. 300-600 m, on trunks and branches in open woodland and phrygana. On *Ceratonia siliqua*, *Cupressus sempervirens* and *Prunus persica*.

TLC: atranorin, unknown Lcm-1 (Brodo 1984), unidentified traces (47356, 46746, 47347, 47363).

*Lecanora hybocarpa* (Tuck.) Brodo – (3) 46748, 46750; (21) 47089; (30) 47337 [ATHU]. – Kalimnos, c. 200-400 m, on trunks and branches in open woodland and phrygana. On *Ceratonia*



*siliqua*, *Ficus carica* and *Quercus coccifera*.

TLC: atranorin, roccellic acid (46748, 46750, 47089, 47337).

*Lecanora leuckertiana* Zedda – (2) in 46636; (4) 46752; (27) in 47205; (30) 47306, 47349. – Kalimnos and Kos, c. 50-100 m, on soil banks, shady rocks and *Cupressus sempervirens* trunk, in phrygana and in open woodland.

TLC: trace of isousnic, usnic acid, zeorin, unidentified traces (in 46636, 46752, in 47205, 47306, 47349).

\**Lecanora lividocinerea* Bagl. – (19) 47005; (19) in 47004; (21) 47088. – Kos, c. 200-300 m, on branches of trees in open woodland and on fields. On *Pinus brutia* and *Ficus carica*.

TLC: atranorin, 3,5-dichloro-2'-methylanziaic acid, unidentified depsid (47005, 47088). The medullary excipulum gives a C+ red reaction.

*Lecanora muralis* (Schreb.) Rabenh. – (30) 47311. – Kos, c. 300-400 m, on siliceous schist in open *Quercus-Cupressus* forest on abandoned fields with calcareous and siliceous rocks.

TLC: trace of usnic acid, diverse terpenoids.

*Lecanora poeltiana* Clauzade & Cl. Roux – (3) 46743; (18) in 46955. – Kalimnos, c. 300 m, on limestone rocks in phrygana on hill top.

*Lecanora polytropa* (Hoffm.) Rabenh. – (30) 47326. – Kos, c. 300-400 m, on siliceous schist in open *Quercus-Cupressus* forest on abandoned fields with calcareous and siliceous rocks.

The specimen is tiny and the identification is not completely certain.

*Lecanora prominens* Clauzade & Vězda – (11) 46841. Kalimnos, c. 700 m, on limestone rock on exposed hilltop with phrygana.

This species has a strong resemblance to forms of *Caloplaca agardhiana* with exserted apothecia.

*Lecanora pruinosa* Chaub. – (1) 46598, 46606; (3) 46726; (6) 46772 [ATHU]; (9) 46809; (11) 46837; (14) 46878; (18) 46949 [herb. Pirintsos], 46950 [ATHU]; (28) 47273. – Kalimnos, Telendos and Kos, c. 50-700 m, on limestone rocks and boulders in phrygana. The species grows on vertical, rather sheltered faces and on rather horizontal, strongly sun-exposed faces. Under sheltered conditions it has a pale, slightly yellowish colour, while in exposed situations it looks very different, brownish.

Chemistry investigated by spot test only: thallus C+ orange.

*Lecanora puniceofusca* Bagl. – (2) 46657. – Kalimnos, c. 50 m, on siliceous rock on NW-facing slope with phrygana.

TLC: atranorin, ?2'-O-methylperlatolic acid.

*Lecanora rupicola* (L.) Zahlbr. subsp. *rupicola* – (19) 46978, 46997 [ATHU, B]; (20) 47051 [herb. Pirintsos]; (21) in 47071, in 47075; (24) 47151. – Kos, c. 200-300 m, on siliceous rocks in phrygana and open woodland.

*Lecanora rupicola* subsp. *sulphurata* (Ach.) Leuckert & Poelt – (2) 46660; (19) 46995; (20) 47063; (23) 47124 [ATHU]; (24) in 47129; (27) 47237 [herb. Pirintsos]; (30) 47324. – Kalimnos and Kos, c. 50-400 m, on siliceous rocks in phrygana and open woodland.

Chemistry investigated by spot test only: thallus C+ orange.

*Lecanora sardoa* Bagl. – (27) 47196. – Kos, c. 250 m, on siliceous rock in phrygana.

TLC: atranorin, norstictic acid. This rarely reported species resembles *L. schistina* by the presence of norstictic acid. It differs by its apothecia that are more strongly raised and have thicker margins. A specimen from Santorini was identified by Th. Lumbsch (Sipman & Raus 1999).

*Lecanora schistina* (Nyl.) Cromb. – (2) 46652; (19) 46987 [herb. Pirintsos]; (20) 47042; (21) 47076 [ATHU]; (24) 47141; (27) 47187. – Kalimnos and Kos, c. 50-300 m, on siliceous rocks in phrygana and open woodland.

TLC: atranorin, norstictic acid (46652, 46987, 47042, 47141, 47187, 47076).

No. 47076 showed a trace of connorstictic acid, and morphologically somewhat deviates by the absence of pycnidia and the thicker apothecium margin.

*Lecanora sulphurea* (Hoffm.) Ach. – (2) 46645; (3) 46737 [ATHU]; (18) 46955; (19) in 46997 [ATHU, B]; (20) in 47063; (21) 47073 [herb. Pirintsos]; (24) 47148. – Kalimnos and Kos, c. 50-300 m, on siliceous and calcareous (dolomitic?) rocks in phrygana and open woodland.

TLC: usnic acid, zeorin, unidentified fatty acid and other substances, with atranorin (46997, 47073, 47148, all three from Kos) or without (46645, 46673, 46737, 46955, 47063, 47071).

*Lecidea* cf. *erythrophaea* Sommerf. – (31) 47405. – Kos, c. 850 m, on low *Cupressus sempervirens* on rocky hill top with scarce vegetation.

The identification is doubtful because the hypothecium is brown and the asci seem to be of a different type as illustrated by Boqueras (2000). The specimen does not belong to *Lecidea* s. str.

*Lecidea fuscoatra* (L.) Ach. – (30) 47316, 47325 [ATHU, B, herb. Pirintsos]. – Kos, c. 300-400 m, on siliceous schist in open, rocky *Quercus-Cupressus* forest.

TLC: gyrophoric acid, unidentified traces (47316). Spot tests: cortex C+ red, medulla C-, I-.

*Lecidella asema* (Nyl.) Knoph & Hertel – (2) 46639 [herb. Pirintsos], 46643 [ATHU], 46661, 46684; (20) 47032 [herb. Pirintsos], 47053; (21) 47072 [ATHU]; (24) 47142; (27) 47175, 47192, 47433 [ATHU]. – Kalimnos and Kos, c. 50-250 m, on siliceous rocks in phrygana.

TLC: thiophanic acid, unidentified traces (46639, 46643, 46661, in 46680, 46684, 47032, 47048, 47053, 47072, 47142, in 47147, 47175, 47192, 47433).

*Lecidella carpathica* Körb. – (30) 47322. – Kos, c. 300-400 m, on siliceous schist in open, rocky *Quercus-Cupressus* forest.

*Lecidella chodatii* (Samp.) Knoph & Leuckert – (2) 46674; (24) 47145; (25) in 47163, in 47164. – Kalimnos, Kos and Nisiros, c. 5-200 m, on siliceous rocks in phrygana and on lava stone in wall around a field.

TLC: granulysin, arthothelin, unidentified trace (46674, 47145, in 47163, 47164).

*Lecidella elaeochroma* (Ach.) Hazsl. – (3) 46747 [ATHU], 46749; (21) 47094; (30) in 47337 [ATHU], in 47339, in 47343; (31) 47404, in 47402. – Kalimnos and Kos, c. 200-850 m, on trunks and branches of scattered trees and shrubs in open woodland and in phrygana. On *Ceratonia siliqua*, *Daphne gnidioides* Jaub. & Spach, *Ficus carica*, *Quercus coccifera*, *Cupressus sempervirens*, *Olea europea* subsp. *oleaster*.

TLC, 4 types: 1. aotearone, capistratone, unidentified trace (47094, chemotype A after Knoph & al. 1995); 2. capistratone (47339); 3. isoarthothelin, unidentified xanthenes (47343, 47404); 4. granulysin, arthothelin (46747, 46749, chemotype B after Knoph & al. 1995).

*Lecidella scabra* (Taylor) Hertel & Leuckert – (1) in 46601 [ATHU]; (2) 46651. – Kalimnos, c. 50-60 m, on siliceous rock and (46601) on thin soil cover on calcareous rock, in phrygana.

TLC: thuringione, unidentified traces (46651; chemotype II of Knoph & al. 1995).

*Lepraria nivalis* J. R. Laundon – (2) 46632; (11) in 46833; (12) in 46861; (15) 46882; (18) in 46937; (21) 47067 [herb. Pirintsos]; (24) 47127; (27) 47181. – Kalimnos and Kos, c. 30-700 m, on soil on rocky slopes with open vegetation, usually phrygana.

TLC, 2 types: 1: atranorin, roccellic, fumarprotocetraric, protocetraric acids, unidentified traces (in 46861, 46822, 47067, 47127, 47181, in 46833, in 46937; two samples with incomplete

spectrum, 46833 without fumarprotocetraric acid and 46937 without roccellic acid; 2: atranorin, roccellic, stictic, cryptostictic, constictic acids (46632).

Stictic acid was already reported by Leuckert & al. (1995). The stictic acid race is chemically similar to *L. lobificans* Nyl., which differs by the presence of zeorin and its preference for trees and mossy rock.

*Leprocaulon microscopicum* (Vill.) D. Hawksw. – (27) 47414; (31) 47386. – Kos, c. 250-800 m, in rock fissures in siliceous rocks in phrygana.

TLC: trace of isousnic, usnic acids, zeorin, unidentified terpenoids, unidentified traces (47386, 47414). The chemotype is the same as on Santorini and Paros.

*Leptogium gelatinosum* (With.) J. R. Laundon – (14) 46874. – Kalimnos, c. 650 m, on moss on N-facing limestone cliff in phrygana.

*Leptogium plicatile* (Ach.) Leighton – (32) 47367. – Kos, c. 600 m, on *Prunus persica* trunk in abandoned field.

*Leptogium teretiusculum* (Wallr.) Arnold – (18) 46923. – Kalimnos, 300 m, on isolated *Olea* trunk in phrygana on N-facing steep rocky slope.

*Leptogium turgidum* (Ach.) Cromb. – (1) 46617. – Kalimnos, c. 60 m, on W-facing limestone rocks in phrygana.

*Lichinella cribellifera* (Nyl.) P. Moreno & Egea – (27) 47200. – Kos, c. 250 m, on siliceous rock in phrygana.

*Lichinella stipatula* Nyl. – (27) 47190 [ATHU, B, herb. Pirintsos], 47423. – Kos, c. 250 m, in phrygana with siliceous rocks and N-facing cliff.

*Milospium graphideorum* (Nyl.) D. Hawksw. – (29) 47304. – Kos, c. 230 m, on *Quercus coccifera* shrub in phrygana on exposed slope.

This is a lichenicolous fungus. In the available specimen it is hosted by sterile thalli resembling *Opegrapha niveoatra*, but larger and without ascomata.

*Miriquidica deusta* (Stenh.) Hertel & Rambold – (2) 46655. – Kalimnos, c. 50 m, on NW-facing, schistose rock in phrygana.

*Mycobilimbia lurida* (Ach.) Hafellner & Türk – (14) 46873a. – Kalimnos, c. 650 m, on soil on N-facing limestone cliff in phrygana.

*Neocatapyrenium latzelii* (Zahlbr.) Breuss – (1) 46599; (17) 46917. – Kalimnos, c. 60-100 m, on soil and in rock fissure in phrygana with limestone boulders and rocks.

*Neocatapyrenium rhizinosum* (Müll. Arg.) Breuss – (1) 46605; (3) 46712 [B, herb. Pirintsos]; (18) 46926 [ATHU], 46930. – Kalimnos, c. 60-300 m, on soil in fissures of limestone boulders and rocks in phrygana.

*Neofuscelia attica* (Leuckert, Poelt & B. Schwarz) Essl. – (20) 47020; (27) 47206 [ATHU], 47208, 47216 [herb. Pirintsos]; (30) 47308. – Kos, c. 200-400 m, on siliceous rocks in phrygana and open *Quercus-Cupressus* forest.

TLC: gyrophoric acid, unknown substances PP1, PP2 (47020, 47206, 47208, 47216, 47308). Norstictic and a trace of connorstictic acid were additionally present in 47308, where the content of PP1 and PP2 was lower. Norstictic acid is apparently much less common in the investigated population than on Paros and Santorini (Sipman & Raus 1999).

*Neofuscelia loxodes* (Nyl.) Essl. – (27) 47172 [ATHU, B]. – Kos, c. 250 m, on N-facing cliff of siliceous rock on N-facing slope with phrygana.

TLC: glomelliferic acid, unidentified spots.

*Neofuscelia perrugata* (Nyl.) Elix – (2) 46646. – Kalimnos, c. 50 m, on NW-facing, schistose rock in phrygana.

TLC: divaricatic, traces of stenosporic and norstictic acids.

The specimen fits in *N. pulla* (Ach.) Essl. sensu Esslinger (1977). Elix (2002) recognized three species in this group, restricting *N. pulla* to specimens with stenosporic acid as dominant substance. The specimen of *N. pulla* reported from Paros (Sipman & Raus 1999) belongs equally to *N. perrugata*.

*Ochrolechia androgyna* (Hoffm.) Arnold – (18) 46931. – Kalimnos, 300 m, on soil in phrygana on N-facing steep rocky limestone slope.

TLC: gyrophoric, trace of lecanoric acids.

*Ochrolechia parella* (L.) A. Massal. – (2) 46637, 46690; (19) 46990; (20) 47044 [ATHU], 47047; (21) in 47076 [ATHU]; (25); (27) 47207 [herb. Pirintosos]; (30) in 47356. – Kalimnos and Kos, c. 50-500 m, on siliceous rocks, occasionally on a trunk and on soil, in open vegetation, usually phrygana.

TLC: variolaric with a trace of gyrophoric acid (46990, 47047) or without (47207). Apothecium disc C+ red; thallus, apothecium margin and medullary excipulum C-.

*Ochrolechia tartarea* (L.) A. Massal. – (31) 47373. – Kos, c. 600 m, on rock on steep, N-facing, scarcely vegetated mountain slope.

TLC: trace of lecanoric, gyrophoric and variolaric acids. Thallus C+ red, apothecium C-.

*Opegrapha atra* Pers. – (27) 47246. – Kos, c. 250 m, on branches of *Pistacia lentiscus* shrub in phrygana.

*Opegrapha calcarea* Sm. – (3) 46725; (15) 46889 [ATHU]; (18) 46961 [herb. Pirintosos]; (28) 47275. – Kalimnos, c. 30-300 m, on N-exposed faces of calcareous rocks and cliffs in phrygana.

\**Opegrapha gyrocarpa* Flot. – (19) 46992; (21) 47080. – Kos, c. 200-300 m, on vertical faces of siliceous rocks in phrygana and open woodland.

Thallus C+ red.

\**Opegrapha lutulenta* Nyl. – (2) 46666; (19) 46984 [ATHU]; (21) 47070 [herb. Pirintosos]; (24) in 47148; (25) 47163; (27) 47220. – Kalimnos, Kos and Nisiros, c. 5-300 m, on siliceous rocks and boulders in open vegetation, usually phrygana.

*Opegrapha niveoatra* (Borrer) J. R. Laundon – (21) 47083; (22) 47114. – Kos, c. 100-200 m, on trunks of scattered trees in open vegetation, abandoned fields and phrygana. On *Ceratonia siliqua* and *Juniperus oxycedrus* subsp. *macrocarpa*.

*Opegrapha ochrocincta* Werner – (20) 47012; (21) 47086, 47091; (22) 47106 [herb. Pirintosos], 47109; (27) 47258 [ATHU], in 47249, in 47252 [ATHU], in 47262, in 47247. – Kos, c. 100-250 m, on trunks and branches of scattered trees and shrubs in open vegetation, usually phrygana. On *Juniperus oxycedrus* subsp. *macrocarpa*, *Ceratonia siliqua*, *Ficus carica*, *Quercus coccifera*, *Pistacia lentiscus*, *Inula heterolepis*, *Olea europaea* subsp. *oleaster*.

*Opegrapha rupestris* Pers. – (9) 46813, in 46810; (28) 47282. – Telendos and Kos, c. 50-100 m, on N-exposed faces of calcareous rocks in open phrygana.

*Opegrapha variaeformis* Anzi – (28) 47271. – Kos, c. 50 m, on NW-facing calcareous lava cliff in phrygana.

*Parmelia saxatilis* (L.) Ach. – (32) 47369. – Kos, c. 600 m, on rock in open *Quercus-Cupressus* forest.

TLC: atranorin, lobaric and salazinic acids.

*Parmelina tiliacea* (Hoffm.) Hale – (18) 46921; (27) 47420 [ATHU]; (30) 47357. – Kalimnos, 250-500 m, on *Olea europaea* trunks and N-exposed siliceous rock in open vegetation, phrygana and open woodland.

TLC: atranorin, lecanoric acid (46921, 47420). Medulla C+ red.

*Parmotrema chinense* (Osbeck) Hale & Ahti – (31) 47388. – Kos, c. 800 m, on rock on steep, N-facing, scarcely vegetated mountain slope.

TLC: atranorin, trace of norstictic, stictic, menegazziaic, constictic acids.

*Peccania coralloides* (A. Massal.) A. Massal. – (4) 46751. – Kalimnos, c. 100 m, on S-facing limestone rocks.

*Peltula euploca* (Ach.) Poelt – (20) 47019; (27) in 47200. – Kos, c. 200-250 m, on siliceous rock in phrygana on hilltop.

\**Peltula obscurans* (Nyl.) Gyeln. – (2) 46672; (8) 46786; (20) in 47019a. – Kalimnos, Telendos and Kos, c. 50-200 m, on rock in phrygana over siliceous and weakly calcareous rock.

Not reported from Greece by Egea (1989).

*Peltula omphaliza* (Nyl.) Wetmore – (20) 47019a; (27) 47179. – Kos, c. 20-250 m, on siliceous rock in phrygana.

*Pertusaria albescens* var. *corallina* Zahlbr. – (31) 47389; (31) 47410. – Kos, c. 800-850 m, on rock and on low *Cupressus sempervirens* growing on a steep, scarcely vegetated mountain slope.

TLC: 3 unidentified fatty substances (47389, 47410).

*Pertusaria flavicans* Lamy – (27) 47189. – Kos, c. 250 m, on siliceous rock in phrygana.

TLC: thiophaninic, trace norstictic, stictic, trace of cryptostictic acids.

*Pertusaria leucosora* Nyl. – (31) 47391. – Kos, c. 800 m, on siliceous rock on steep, N-facing, scarcely vegetated mountain slope.

TLC: protocetraric acid.

*Pertusaria mammosa* Harm. – (24) 47130, 47139 [ATHU, herb. Pirintsos]; (24) 47140 (cf.); (27) 47178; (31) 47374. – Kos, c. 200-700 m, on N-facing, siliceous rock in open vegetation.

TLC: fumarprotocetraric, succinprotocetraric acids (47130, 47139, 47178, 47240, 47374, 47385, 47390).

*Pertusaria monogona* Nyl. – (2) 46680; (27) 47177, 47183, 47188 [herb. Pirintsos], 47427 [ATHU]. – Kalimnos and Kos, c. 50-250 m, on siliceous rock in phrygana.

TLC: norstictic, trace of connorstictic acids (46680, 46691, 47177, 47183, 47188, 47427).

All specimens are sterile, therefore the identification is provisional; however, the material agrees well with specimens from Paros (Sipman & Raus 1999).

*Pertusaria parotica* Sipman – (31) 47393. – Kos, c. 800 m, on siliceous rock on a steep, N-facing slope.

TLC: salazinic acid, low fatty substances.

*Pertusaria pentelici* J. Steiner – (20) 47034 [ATHU], 47046; (24) 47144 [herb. Pirintsos]; (27) 47240, 47424; (31) 47381. – Kos, c. 200-700 m, on siliceous rock in phrygana.

TLC: norstictic, trace of gyrophoric, trace of connorstictic acids (47034, 47046, 47144, 47240, 47381, 47424).

*Pertusaria pertusa* var. *pertusa* – (18) 46920. – Kalimnos, 300 m, on isolated *Olea* trunk in phrygana on N-facing steep rocky limestone slope.

TLC: coronaton, stictic, trace of cryptostictic, constictic acids.

*Pertusaria pertusa* auct. var. *rupestris* (DC.) Dalla Torre & Sarnth. – (20) 47017, 47021 [ATHU]; (21) 47105; (24) 47131, 47137; (27) 47182 [herb. Pirintsos], 47184, 47212 [ATHU], (27) 47438; (31) 47377. – Kos, c. 200-700 m, on siliceous rocks in open vegetation, usually phrygana.

TLC: coronaton, stictic, trace of cryptostictic, constictic acids (47017, 47021, 47105, 47131, 47137, 47182, 47184, 47212, in 47426, 47377).

**\**Pertusaria pseudoparotica* Sipman, sp. nova**

Holotype: Greece, East Aegean Islands, Nomos of Dodekanisos, Kos Island, Kefalos peninsula, c. 6 km S of Kefalos, Agios Mammias chapel near S-tip, c. 200 m, phrygana vegetation with siliceous rock outcrops on hilltop near the coast, 23.-24.9.2000, H. Sipman & Th. Raus 47134 (B) (TLC: protocetraric, trace of gyrophoric acid, unidentified traces). – Fig. 4.

Thallus saxicola, griseoalba ad pallide rufoalba, opaca, magna, 10 cm diametro vulgo excedens, areolato-papillata, areolis ad 0.2-0.6 mm latis. Ascomata discoidea, immersa, vulgo solitaria, disco 0.3-0.5 mm lato, cinereo, pruinoso, ascis ad 200 × 50 µm, ascosporis binis ellipsoideis ad 100-125 × 50 µm, pariete glabro, apicibus non incrassatis. Pycnidia ignota. Acidum protocetraricum continens.

Thallus saxicolous, greyish to pale brownish white, dull, sometimes slightly pruinose, large, often over 10 cm across, c. 0.5-1 mm thick, areolate-papillose; areoles c. 0.2-0.6 mm wide, initially rather flat but soon vaulted and finally strongly raised and forming a papilla to c. 0.5 mm wide and tall, or the larger areoles a fold to over 0.5 mm tall; fertile areoles c. 0.5-1 mm raised, to about 2 mm wide, with usually a single, sometimes up to 5 ascomata; thallus margin locally thick and zoned over a narrow zone to 1 mm wide, with dark prothallus.

Ascomata discoid, immersed in the fertile areoles, with 0.3-0.5 mm wide, grey, whitish-pruinose disc, seemingly short-lived and regenerating, causing the development of 1-3 concentric rims around the disc, sometimes leaving yellowish scars; these scars usually single, rounded, 0.2-0.5 mm in diam.; asci c. 200 × 50 µm; ascospores 2 per ascus, ellipsoid, c. 100-126 × 50 µm, smooth-walled, not thickened at the poles (47129, 47134). Pycnidangia not seen.

*Chemistry.* – protocetraric acid (TLC: 29165, 47129, 47133, 47134, 47135, 47136, 47138, 47154, 47203, 47372), sometimes with traces of gyrophoric acid, atranorin or other, unidentified substances.

*Distribution and ecology.* – So far known only from the Kefalos peninsula and Mt Dikeos on Kos, East Aegean islands, and from the Santorini islands, Cyclades archipelago, Greece, at 200-600 m elevation. The species grows on slanting faces of fully exposed, siliceous rock and is locally common.

*Notes.* – The presence of protocetraric acid as major substance and of two spores per ascus is an uncommon combination in the genus *Pertusaria*. According to Archer (1993, 1995) it occurs in only three species worldwide, *P. composita* Zahlbr., *P. digrediens* Nyl. and *P. thwaitesii* Müll. Arg. All three differ by their corticolous habitat and verruciform ascomata; moreover, *P. digrediens* is sorediate.



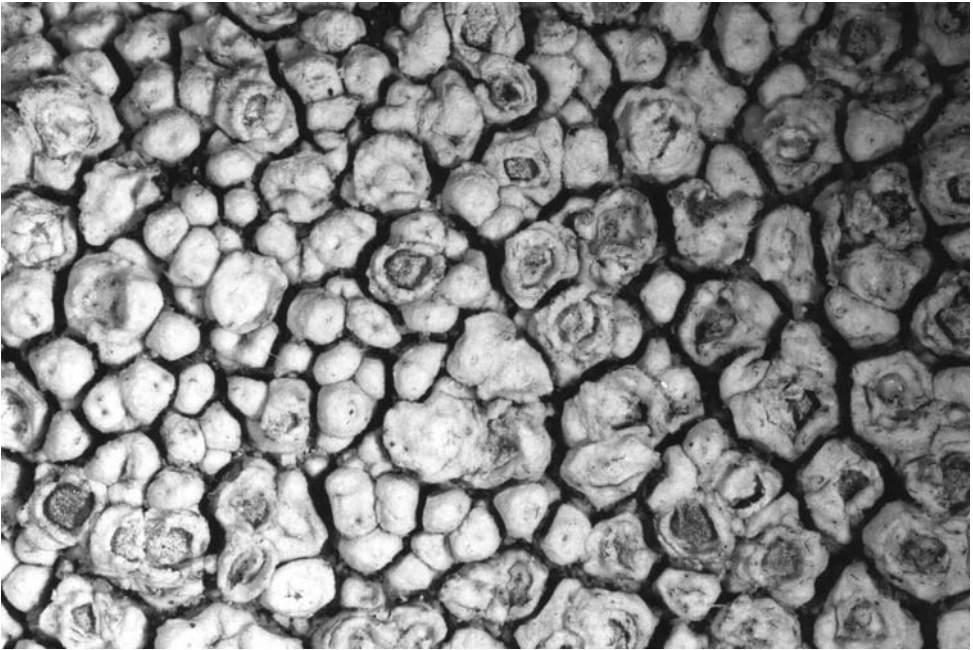


Fig. 4. *Pertusaria pseudoparotica*, detail of type specimen, showing vaulted areoles and regenerating apothecia. – Scale: photograph length = 10 mm.

*P. pseudoparotica* is very similar to *P. parotica* in external morphology and in the presence of two spores per ascus, and a chemical test is necessary for the distinction. It is treated here as a separate species in accordance with the appreciation of chemical differences in recent monographs on the genus (Archer 1993).

*Additional specimens seen.* – GREECE: EAST AEGEAN ISLANDS: (24) 47129, 47133 (ATHU), 47134, 47135 (herb. Pirintosos), 47136, 47138, 47154 (TSB); (27) 47203; (31) 47372; Kos, c. 200–600 m, on siliceous rocks in open vegetation, usually phrygana. – CYCLADES ARCHIPELAGO: Santorini Islands, Thira, Mt Megalo Vouno, c. 300 m, on andesitic lava, 24.5.1990, *H. Sipman & Th. Raus* 29165 (B).

*Pertusaria rhodiensis* Erichsen – (31) 47401, 47403. – Kos, c. 800 m, on dwarf *Olea europaea* subsp. *oleaster* and *Cupressus sempervirens* on steep, N-facing, scarcely vegetated mountain slope.

TLC: norstictic acid (43285, 47401, 47403). The material fits the description by Erichsen (1938). The presence of norstictic acid is in contradiction with Hanks (1983), who states that the type lacks lichen substances. However, in the original description Erichsen (1938) mentions positive P- and K-reactions, which would be in accordance with the presence of norstictic acid. One of the specimens investigated by Hanks (Monte Pollino, leg. *Poelt* [GZU]) appears to be externally indistinguishable from our material. However, microscopical examination showed that it deviates from the description by Erichsen (1938) and our material by having smaller asci, c. 210  $\mu\text{m}$  long, containing only one, larger spore, c. 190  $\times$  60–80  $\mu\text{m}$ , and by not producing red needles in KOH solution. Perhaps two separate, but externally very similar species are at hand.

*Pertusaria* sp. C from Paros (Sipman & Raus 1999) belongs here.

*Pertusaria rupicola* (Fr.) Harm. – (27) 47195, 47215 [ATHU]; (31) 47371. – Kos, c. 250–600 m, on siliceous rock in phrygana.

TLC: thiophanic, trace of norstictic, stictic, trace of cryptostictic acids (47159, 47215, 47371, in 47396).

This species was erroneously reported from Paros by Sipman & Raus (1999) as *P. lecanorodes*.

*Pertusaria* cf. *teneriffensis* Vain. – (19) 46973. – Kos, c. 300 m, on siliceous rock in *Erica manipuliflora* heath on SW-facing slope.

TLC: picrolichenic, norstictic, trace of connorstictic and protocetraric acids, unidentified traces (47973).

The specimen deviates by the presence of protocetraric acid. In this way it resembles *Pertusaria amara* (Ach.) Nyl., from which it deviates by the presence of norstictic acid. This may indicate that *P. teneriffensis* is better included in *P. amara*, and that this species is chemically diverse in the Mediterranean. A morphologically similar specimen from Santorini (Sipman & Raus 29052) lacks norstictic acid and is included in *P. amara*.

*Pertusaria werneriana* Boqueras, ined. – (27) 47260; (30) 47336. – Kos, c. 250-400 m, on *Quercus coccifera* trunk and branches in phrygana.

TLC: coronaton, 2'-O-methylperlatolic acid, unidentified traces (47260, 47336).

The species is under study by Boqueras (2000).

*Pertusaria* sp.? – (27) 47418. – Kos, c. 250 m, on siliceous rock in phrygana.

TLC: atranorin, norstictic, trace of connorstictic acids, fatty substances.

The specimen is sterile, therefore the generic attribution is provisional.

*Phaeophyscia orbicularis* (Necker) Moberg – (5) 46771; (31) 47409. – Kalimnos and Kos, c. 100-850 m, epiphytic in olive orchard in valley bottom and on dwarf *Cupressus sempervirens* tree on hill top.

*Physcia adscendens* (Fr.) H. Olivier – (2) 46668; (3) 46727; (13) in 46869; (18) 46942 [ATHU]; (20) in 47011, in 47016; (21) in 47087; (23) in 47121; (27) in 47247, in 47263; (30) in 47355; (31) 47402; (32) 47368. – Kalimnos and Kos, c. 50-800 m, epiphytic and on siliceous and calcareous rock in phrygana and in cultivated areas. On *Juniperus oxycedrus* subsp. *macrocarpa*, *Ficus carica*, *Pistacia lentiscus*, *Olea europaea* subsp. *oleaster* and *Prunus persica*.

*Physcia albinea* (Ach.) Nyl. – (2) 46670. – Kalimnos, c. 50 m, on NW-facing, schistose rock in phrygana.

*Physcia biziana* (A. Massal.) Zahlbr. var. *biziana* – (5) 46770; (18) 46922 [ATHU, B, herb. Pirintosos]; (30) 47346. – Kalimnos and Kos, c. 100-400 m, epiphytic in orchards and open woodland. On *Olea europaea* subsp. *sativa* and *Cupressus sempervirens*.

*Physcia biziana* var. *leptophylla* Vězda – (2) 46700; (8) 46787; (20) in 47019; (27) 47218 [ATHU], 47446 (c. apoth.). – Kalimnos, Telendos and Kos, c. 50-250 m, on siliceous and weakly calcareous rocks in phrygana.

*Physcia semipinnata* (Gmelin) Moberg – (30) 47354; (31) in 47405; (32) 47365. – Kos, c. 500-850 m, epiphytic in open *Quercus-Cupressus* forest on abandoned fields and on dwarf trees on exposed hill top. On *Prunus persica* and *Cupressus sempervirens*.

*Physcia tenella* (Scop.) DC. – (21) in 47069; (31) 47407. – Kos, c. 200-850 m, epiphytic on scattered shrubs and on siliceous rock in phrygana and other low vegetation. Observed phorophyte: *Cupressus sempervirens*.

*Placidiopsis cinerascens* (Nyl.) Breuss – (17) 46910 [ATHU, B, herb. Pirintosos]. – Kalimnos, 100 m, on loamy soil at the base of a S-facing rocky limestone slope.

*Placidiopsis custnani* (A. Massal.) Körb. – (17) 46913. – Kalimnos, 100 m, on loamy soil at the base of a S-facing rocky limestone slope.

*Placidium lacinulatum* (Ach.) Breuss – (14) 46873; (27) 47199. – Kalimnos and Kos, c. 250–650 m, on soil and in rock fissures of siliceous and calcareous rocks in phrygana.

*Placidium semaforonense* (Breuss) Breuss – (17) in 46916. – Kalimnos, 100 m, on soil at the base of a S-facing rocky limestone slope.

*Placidium squamulosum* (Ach.) Breuss – (12) in 46859. – Kalimnos, c. 700 m, on soil in phrygana on a SW-facing limestone slope.

*Placidium subrufescens* (Breuss) Breuss – (11) 46824. – Kalimnos, c. 700 m, in fissure of limestone rocks in phrygana.

*Placidium tenellum* (Breuss) Breuss – (3) in 46711. – Kalimnos, c. 300 m, on soil near N-facing limestone rocks in phrygana on W-facing slope.

*Placopyrenium bucekii* (Nadv. & Servít) Breuss – (27) 47430. – Kos, c. 250 m, on siliceous rock in phrygana.

The specimen agrees closely with material from Sardinia in B, incl. Vězda, Lich. Sel. Exs. 2201 and with the description of Ménard & Roux (1995). These authors report the species from Greece (Peloponnesus). The material reported before by us from Santorini and Paros (Sipman & Raus 1995, 1999) and included in *P. trachyticum* (Haszlsinsky) Breuss is poorly developed. Therefore the possibility cannot be ruled out that it is misidentified and belongs to *P. bucekii*.

*Placynthium nigrum* (Huds.) Gray – (3) 46740; (16) 46900. – Kalimnos, c. 100–300 m, on limestone rocks in phrygana.

*Placynthium subradiatum* (Nyl.) Arnold – (1) in 46622; (28) 47279. – Kalimnos, c. 50–60 m, on sheltered faces of calcareous rocks in phrygana.

*Porina aenea* (Wallr.) Zahlbr. – (27) in 47246; (30) 47333. – Kos, c. 250–400 m, epiphytic in open *Quercus-Cupressus* forest and on small tree in phrygana. On *Pistacia lentiscus* and *Quercus coccifera*.

*Porina ginzbergeri* Zahlbr. – (18) 46964; (29) 47298. – Kalimnos and Kos, 230–300 m, on calcareous rocks in phrygana.

A specimen from Paros attributed with doubt to *P. linearis* (Sipman & Raus 1999: *Sipman & Raus 43230a*) belongs here.

*Porina linearis* (Leighton) Zahlbr. vs. (no spores) – (11) 46852; (15) in 46890; (28) in 47271. – Kalimnos, c. 30–700 m, on N-face of limestone rocks in phrygana.

*Porocyphus* sp.? – (1) in 46618. – Kalimnos, c. 60 m, on limestone rock in phrygana.

The specimen is small and lacks ascomata therefore the identification is provisional.

*Porpidia cinereoatra* (Ach.) Hertel & Knoph – (30) 47309. – Kos, c. 300–400 m, on siliceous schist in open *Quercus-Cupressus* forest.

TLC: confluent acid, unidentified traces.

*Porpidia macrocarpa* (DC.) Hertel & A. J. Schwab – (20) 47030; (27) 47214 [ATHU], 47416; (30) 47319. – Kos, c. 200–400 m, on siliceous rocks in phrygana and open *Quercus-Cupressus* forest.

TLC: stictic acid (47030, 47214, 47416). No. 47030 has additionally a trace of an unidentified depsid, no. 47416 of probably cryptostictic acid.

*Protoblastenia calva* (Dicks.) Zahlbr. – (18) 46947. – Kalimnos, 300 m, on limestone cliff in phrygana on N-facing steep rocky slope.

*Protoparmelia psarophana* (Nyl.) Sancho & A. Crespo var. *psarophana* – (2) 46644, 46654, 46663 [ATHU]; (20) 47028 [ATHU], 47056, 47058; (24) 47146; (27) 47186 [herb. Pirintosos], 47217, 47441; (31) 47376. – Kalimnos and Kos, c. 50-700 m, on siliceous rocks in phrygana.

TLC: lobaric acid, unidentified fatty substances (46654, 46663, 47028, 47056, 47058, 47146, 47186, 47217, in 47232, 47441, 47376). No. 46644 seems to have an intermediate chemistry: lobaric, trace of gyrophoric acids, traces of fatty substances.

*Protoparmelia psarophana* var. *reagens* (J. Steiner) Sipman – (20) 47018, 47039 [ATHU]; (24) 47153 [herb. Pirintosos]; (27) 47231; (31) 47383. – Kos, c. 200-700 m, on siliceous rocks in phrygana and other open vegetation.

TLC: gyrophoric acid, unidentified fatty substances (47731, 47018, 47039, 47153, 47383).

*Psora decipiens* (Hedw.) Hoffm. – (3) 46711; (11) in 46833; (17) 46919 [ATHU, B]. – Kalimnos, c. 100-700 m, on soil among limestone rocks in phrygana.

\**Pyrenula chlorospila* Arnold – (27) 47259 [ATHU, B]. – Kos, c. 250 m, on branches of dwarf *Quercus coccifera* shrub, in W-facing phrygana on siliceous rock.

*Pyrrhospora quernea* (Dicks.) Körb. – (19) 46999, 47002, 47007 (c. apoth.), in 47003; (21) in 47094. – Kos, c. 200-300 m, epiphytic in open woodland and in phrygana on siliceous rock. On *Erica manipuliflora* (twigs), *Pinus brutia* (trunk, twigs and cones), *Ficus carica* (trunk and branches).

*Ramalina breviscula* Nyl. – (19) 46982; (20) 47016; (21) 47104; (24) 47157 [ATHU], 47158 [ATHU]; (27) 47241 [herb. Pirintosos]. – Kos, c. 200-300 m, on siliceous cliffs, best developed on N-faces, in open woodland and phrygana.

TLC: evernic acid, unidentified traces (46982, 47016, 47104, 47157, 47158, 47241).

*Ramalina canariensis* J. Steiner – (19) 47001, 47006, 47008 [ATHU], in 46982, in 46998; (21) 47077, 47095 [ATHU], in 47082; (27) in 47255. – Kos, c. 300 m, epiphytic and on siliceous rocks in open woodland, cultivated fields and phrygana. On *Pinus brutia* (twigs, dry twigs, cones), *Erica manipuliflora* (twigs), *Ficus carica* (branches), *Ceratonia siliqua* (trunk), *Inula heterolepis* (branches).

TLC: divaricatic acid, unidentified traces (47001, 47077, in 47082, 47095).

*Ramalina farinacea* (L.) Ach. – (30) 47352; (32) 47360. – Kos, c. 500-600 m, on *Prunus persica* trunks in open *Quercus-Cupressus* forest.

TLC: trace of norstictic, salazinic acids (47352, 47360).

*Ramalina fastigiata* (Pers.) Ach. – (30) 47351 [ATHU, B, herb. Pirintosos]; (32) 47359. – Kos, c. 500-600 m, on *Prunus persica* trunk in open *Quercus-Cupressus* forest.

TLC: evernic acid, unidentified traces (47351, 47359).

*Ramalina fraxinea* (L.) Ach. – (30) in 47352. – Kos, c. 500 m, on trunk in open *Quercus-Cupressus* forest.

TLC: none.

*Ramalina lacera* (With.) J. R. Laundon – (29) 47302. – Kos, c. 230 m, on exposed calcareous rock in phrygana.

TLC: fatty acids (incl. boureganic acid?).

*Ramalina pusilla* Duby – (19) in 46983, in 47006; (21) 47087. – Kos, c. 200-300 m, epiphytic and occasionally on siliceous cliff, in open woodland, abandoned fields and phrygana. On *Pinus brutia* (cones), *Ficus carica*.

TLC: trace of usnic, sekikaic acids (47087).

*Ramalina requienii* (De Not.) Jatta – (3) 46721 [ATHU, B, herb. Pirintosos]; (18) 46945; (19) 46983; (21) 47103; (24) 47156, 47159; (27) 47242 [ATHU], 47243. – Kalimnos and Kos, c. 200-300 m, on siliceous rocks and cliffs in open vegetation, usually phrygana; occasionally on limestone (dolomitic?).

TLC: divaricatic acid, unidentified traces (46721, 46945, 46983, 47103, 47159).

*Ramalina subfarinacea* (Cromb.) Nyl. – (31) 47387. – Kos, c. 800 m, saxicolous on steep, N-facing, scarcely vegetated mountain slope.

TLC: trace of usnic, norstictic, salazinic acids. The material is chemically identical with the local population of *R. farinacea*, but distinguished by its bluish soralia.

*Rhizocarpon distinctum* Th. Fr. – (2) 46662; (19) 46974, 46979; (23) 47117 [ATHU]; (24) in 47148; (30) 47321. – Kalimnos and Kos, c. 50-400 m, on siliceous rock in phrygana and open woodland.

*Rhizocarpon epispilum* (Nyl.) Zahlbr. – (31) 47396. – Kos, c. 800 m, lichenicolous on *Pertusaria rupicola* on a siliceous rock on a steep, N-facing, scarcely vegetated mountain slope.

Reported from Greece by Poelt (1990).

*Rhizocarpon geographicum* (L.) DC. – (31) 47380. – Kos, c. 700 m, silicicolous on a steep, N-facing, scarcely vegetated mountain slope.

*Rhizocarpon obscuratum* (Ach.) A. Massal. – (30) 47322a. – Kos, c. 300-400 m, on siliceous schist in open *Quercus-Cupressus* forest.

*Rhizocarpon viridiatrum* (Wulfen) Körb. – (2) 46650. – Kalimnos, c. 50 m, saxicolous on NW-facing, schistose rock in phrygana.

*Rinodina alba* (Metzler) Arnold – (2) 46683 [herb. Pirintosos], 46686, 46692 [ATHU, B]; (25) 47161. – Kalimnos and Nisiros, c. 5-50 m, on the N-face of siliceous rocks and lava boulders in phrygana and cultivated fields.

*Rinodina beccariana* Bagl. var. *beccariana* – (20) 47014, 47023 [herb. Pirintosos]; (21) 47071; (24) 47143; (27) 47213, 47232, 47428 [ATHU], 47434. – Kos, c. 200-250 m, on siliceous rocks in phrygana.

TLC: atranorin, zeorin, unidentified terpenoids (47014 tr., 47023, 47071 tr., 47143, 47213 tr., 47232 tr., 47434, 47428 tr.). In the specimens marked “tr.” little lichen substance was present and only atranorin was clearly recognizable on the chromatogram.

*Rinodina* cf. *colobina* (Ach.) Th. Fr. – (5) 46767. – Kalimnos, c. 100 m, on olive trunks in olive orchard in valley bottom.

TLC: no substance found. This is a bluish grey, completely blastidiate, crustose lichen without apothecia. Therefore the possibility cannot be ruled out that it belongs to *Rinodina pityrea* Ropin & H. Mayrhofer instead of *R. colobina* (Ropin & Mayrhofer 1995).

*Rinodina dubyana* (Hepp) J. Steiner – (13) 46872. – Kalimnos, c. 650 m, on limestone in a gravelly plain with phrygana.

*Rinodina gennarii* Bagl. – (2) in 46696; (19) in 46986; (25) in 47162; (27) 47233, 47448. – Kalimnos, Kos and Nisiros, c. 5-300 m, on siliceous rocks in phrygana and abandoned fields.



*Rinodina immersa* (Körb.) Arnold – (3) 46728 [herb. Pirintsos], 46731; (4) 46762; (11) 46851 [ATHU]. – Kalimnos, c. 100-700 m, on limestone rocks in open vegetation, mainly phrygana.

*Rinodina luridescens* (Anzi) Arnold – (27) 47417, 47426 [ATHU, herb. Pirintsos]; (31) 47375. – Kos, c. 250-700 m, on siliceous rocks in phrygana and other open vegetations.

*Rinodina nimisii* Giralt & H. Mayrhofer – (22) 47110. – Kos, c. 100 m, on stem of scattered low trees of *Juniperus oxycedrus* subsp. *macrocarpa* in abandoned fields.

The identification is uncertain, because the apothecia are lecidine from the beginning, without distinct lecanorine juvenile stage (Giralt & al. 1995).

*Rinodina oleae* Bagl. – (30) 47343; (30) in 47335; (32) 47366. – Kos, c. 300-600 m, on trunks in open *Quercus-Cupressus* forest and abandoned fields. On *Cupressus sempervirens*, *Quercus coccifera*, *Prunus persica*.

*Rinodina pruinnella* Bagl. – (30) in 47339. – Kos, c. 300-400 m, on *Quercus coccifera* trunk in open *Quercus-Cupressus* forest.

*Rinodina santorinensis* J. Steiner var. *santorinensis* – (20) 47031. – Kos, c. 200 m, on siliceous rock in phrygana.

TLC: atranorin, pannarin.

The specimen seems morphologically indistinguishable from *R. beccariana* but differs in chemistry.

*Rinodina* sp. – (2) in 46698. – Kalimnos, c. 50 m, on schistose rock, NW-facing, in phrygana.

A single, c. 0.5 cm wide specimen with a grey, areolate thallus and *Pachysporaria* type spores, c. 15 × 9 µm, which differs clearly from all other listed species. Its small size did not allow a chemical investigation. It seems to be lichenicolous on *Acarospora veronensis*.

*Roccella phycopsis* Ach. – (3) 46722 [ATHU, B, herb. Pirintsos]; (9) 46807; (15) 46883 [ATHU], 46897; (18) 46924; (19) 46981; (20) in 47041 [ATHU]; (21) in 47079, in 47080; (21) in 47081 [herb. Pirintsos]; (24) in 47145; (27) 47254 [ATHU, B]; (27) in 47230. – Kalimnos, Telendos and Kos, 30-300 m, on N-faces of calcareous and siliceous cliffs and epiphytic in open vegetation, mainly on exposed hill tops. On *Ceratonia siliqua* and *Inula heterolepis*.

TLC: erythrin, trace of lecanoric acid, unknown substance (46722, 47254).

*Schaereria fuscocinerea* (Nyl.) Clauzade & Cl. Roux – (31) 47378. – Kos, c. 700 m, on siliceous rock on steep, N-facing, scarcely vegetated mountain slope.

*Schismatomma albocinctum* (Nyl.) Zahlbr. – (21) 47084; (21) 47093. – Kos, c. 200 m, on thick trunks in abandoned pasture. On *Ceratonia siliqua* and *Ficus carica*.

*Schismatomma decolorans* (Sm.) Clauzade & Vězda – (21) 47093a. – Kos, c. 200 m, on trunk and branches of thick *Ficus carica* tree in abandoned pasture.

*Schismatomma dirinellum* (Nyl.) Zahlbr. – (22) 47111; (27) in 47258 [ATHU], in 47263. – Kos, c. 100-250 m, on shrubs in phrygana. On *Juniperus oxycedrus* subsp. *macrocarpa*, *Quercus coccifera*, *Olea europaea* subsp. *oleaster*.

*Scoliosporum umbrinum* (Ach.) Arnold – (19) in 46973; (21) 47075; (27) 47442 [ATHU]; (30) 47320. – Kos, c. 200-400 m, on siliceous rock in phrygana and other open vegetation.

*Solenopsora candicans* (Dicks.) J. Steiner – (3) 46733; (18) 46943; (29) in 47288. – Kalimnos, c. 230-300 m, on limestone rocks in phrygana.

*Solenopsora cesatii* var. *grisea* (Bagl.) Nimis – (1) 46608; (3) in 46712 [B, herb. Pirintsos]; (9) 46811 [herb. Pirintsos]; (10) 46818; (12) 46865 [ATHU]; (14) 46879, 46880; (15) in 46881; (18) 46935; (28) 47284. – Kalimnos, Telendos and Kos, c. 30-700 m, on calcareous rocks and on soil in between, in phrygana.

*Solenopsora olivacea* (Fr.) H. Kiliias – (1) 46595; (3) 46715; (14) in 46879; (15) 46890; (18) 46953. – Kalimnos, c. 30-650 m, on N-exposed, vertical faces of calcareous rocks in phrygana.

The identification is not completely certain because the apothecia are distinctly lecanorine during much of their development.

*Solenopsora vulturiensis* Bagl. – (2) 46626; (2) in 46640; (19) 46967. – Kalimnos and Kos, c. 50-300 m, on soil and stone in phrygana over siliceous rock.

*Squamarina cartilaginea* (With.) P. James – (1) 46600; (3) 46710; (9) 46802; (11) 46831 [ATHU]; (18) 46925 [ATHU]; (30) in 47307; (31) 47384. – Kalimnos and Kos, c. 60-700 m, on soil and in rock fissures in phrygana and other open vegetation over calcareous rock.

TLC, 2 types: 1. isousnic, usnic, ?roccellic, psoromic, 2-O-demethylpsoromic acids, ?zeorin, unidentified traces (46600, 46925, 47307, 47384); 2. trace of isousnic, usnic, ?roccellic acids, ?zeorin, unidentified traces (46710, 46802, 46831). Isousnic acid was sometimes absent in type 2.

*Squamarina concrescens* (Müll. Arg.) Poelt – (2) 46630 [ATHU]; (3) in 46708; (10) 46816; (12) 46858; (15) 46881; (17) in 46911; (18) in 46936; (28) 47268. – Kalimnos, Telendos and Kos, c. 30-700 m, on soil in phrygana and other open vegetation over more or less calcareous rock.

TLC, 2 types: 1. usnic, ?roccellic, psoromic, 2-O-demethylpsoromic acids, ?zeorin, unidentified traces (46630, 46858, 47286); 2. trace of isousnic, usnic, ?roccellic acids, ?zeorin, unidentified traces (in 46708, 46816, 46911, in 46936). The presence of two chemotypes differs from Paros where only one chemotype was found (Sipman & Raus 1999).

*Squamarina gypsacea* (Sm.) Poelt – (1) 46604 [ATHU]; (11) 46823. – Kalimnos, c. 60-700 m, on limestone rocks in phrygana.

TLC: usnic, ?roccellic, psoromic, 2-O-demethylpsoromic acids, unidentified traces (46604, 46823).

*Squamarina periculosa* (Schaer.) Poelt – (1) 46609; (11) 46825. – Kalimnos, c. 60-700 m, on limestone rocks in phrygana.

TLC: usnic, 4-O-demethylbarbatic acids, unidentified trace (46609, 46825).

*Tephromela atra* (Huds.) Hafellner – (2) 46658; (3) 46720; (11) 46845; (18) 46944; (19) 46994; (20) in 47051 [herb. Pirintsos]; (21) in 47072 [ATHU], in 47079; (24) 47147 [ATHU]; (27) 47180; (30) 47315 [herb. Pirintsos]; (31) 47397. – Kalimnos and Kos, c. 50-800 m, on mostly siliceous rocks and boulders in open vegetation, usually phrygana.

TLC, 2 types: 1. atranorin, “-collatolic acid, unidentified traces (46685 with gyrophoric acid, 46944, 47180); 2. atranorin, unidentified traces (47397).

*Thelomma siliceum* (Fée) Tibell – (19) 46977 [herb. Pirintsos]; (20) 47029; (23) 47120 [ATHU]; (27) 47169, 47440. – Kos, c. 150-300 m, on exposed, N-facing siliceous rock in open vegetation, mostly phrygana.

TLC: 3-chlorodivarcatic acid (47196, 47440).

*Thelopsis isiaca* Stizenb. – (20) 47011; (22) 47112. – Kos, c. 100-200 m, on *Juniperus oxycedrus* subsp. *macrocarpa* stem and branches in phrygana and abandoned fields.

TLC: none (47112).

*Toninia albilabra* (Dufour) H. Olivier – (12) 46859; (18) in 46933. – Kalimnos, c. 300-700 m, on soil in phrygana over limestone.

*Toninia aromatica* (Sm.) A. Massal. – (2) in 46637; (3) in 46705; (8) 46799; (9) 46801 [ATHU]; (16) 46903; (27) 47439. – Kalimnos, Telendos and Kos, c. 50-300 m, on soil and rock in phrygana over siliceous and calcareous rock.

46637, scarce material with a uniformly brown, rather crustose thallus, is of uncertain identity.

*Toninia candida* (Weber) Th. Fr. – (1) 46594. – Kalimnos, c. 60 m, on a vertical face of a limestone boulder in phrygana.

*Toninia episema* (Sm.) Timdal – (3) 46723. – Kalimnos, c. 300 m, lichenicolous on *Aspicilia calcarea* on N-facing limestone rock in phrygana.

*Toninia opuntioides* (Vill.) Timdal – (18) 46938. – Kalimnos, 300 m, on soil in phrygana on N-facing steep rocky limestone slope.

*Toninia sedifolia* (Scop.) Timdal – (1) 46601 [ATHU]; (2) 46631; (11) 46832 [herb. Pirintosos]; (12) in 46859; (16) in 46900; (18) 46933; (27) 47198; (28) 47270. – Kalimnos and Kos, c. 50-700 m, on thin or thicker soil layers over more or less calcareous rock in open vegetation, usually phrygana.

*Toninia tristis* subsp. *thalloedaemiformis* (Szatala) Timdal – (1) 46615; (4) 46754. – Kalimnos, c. 60-100 m, in fissures of limestone rocks in open vegetation.

*Toninia tumidula* (Sm.) Zahlbr. – (3) 46718. – Kalimnos, c. 300 m, on N-facing limestone rocks in phrygana.

*Topelia heterospora* (Zahlbr.) M. Jørg. & Vězda – (4) 46760; (18) 46951. – Kalimnos, c. 100-300 m, on limestone rock in open vegetation.

*Trapelia coarctata* (Sm.) M. Choisy – (2) 46635. – Kalimnos, c. 50 m, on soil in phrygana over schist.

*Verrucaria* cf. *calciseda* auct. – (1) 46621; (3) 46734; (6) 46775; (7) 46781; (9) in 46810; (11) 46840, 46854, 46855; (13) in 46872; (18) 46963. – Kalimnos and Telendos, c. 30-700 m, on limestone rocks, often N-exposed faces, in open vegetation, usually phrygana.

The identification is provisional and follows the delimitation used by Sipman & Raus (1999).

*Verrucaria compacta* (A. Massal.) Jatta – (2) 46672a; (8) in 46787, in 46790; (20) 47037; (26) 47165 (cf., no spores). – Kalimnos, Telendos, Kos and Nisiros, c. 50-200 m, on siliceous and weakly calcareous rock in open vegetation, mostly phrygana.

*Verrucaria fuscella* (Turner) Winch – (11) 46835; (18) 46948. – Kalimnos, c. 300-700 m, on limestone rocks in phrygana.

No. 46948 is lichenicolous on *Aspicilia calcarea*.

*Verrucaria fusconigrescens* Nyl. – (2) in 46682; (16) 46907; (21) 47065; (23) 47118; (27) 47174, 47221. – Kalimnos and Kos, c. 50-250 m, on siliceous and weakly calcareous rocks in phrygana.

The material may be heterogeneous. Two specimens (in 46682, 46907) agree well with W European material in B, while the others have smaller, paler areoles with less distinct prothallus. The specimen reported from Santorini (Sipman & Raus 1995) belongs to the second type.

*Verrucaria fuscula* Nyl. – (11) 46839. – Kalimnos, c. 700 m, lichenicolous on *Aspicilia calcarea* on limestone rock on exposed hilltop with phrygana.

*Verrucaria nigrescens* Pers. – (1) 46607; (4) 46755; (9) in 46811 [herb. Pirintosos]; (11) in 46835. – Kalimnos and Telendos, c. 60-700 m, on limestone rocks in phrygana.

*Xanthoria calcicola* Oksner – (3) 46724; (13) 46868; (20) in 47060; (21) in 47071; (23) 47126; (24) in 47135 [herb. Pirintosos]; (27) in 47179. – Kalimnos and Kos, c. 150-650 m, on limestone (dolomite?) and siliceous rocks in phrygana.

Contrary to the situation on Santorini and Paros (Sipman & Raus 1999) the distinction between *Xanthoria calcicola* and *X. parietina* is not completely clear. Epilithic specimens usually have the dark orange colour characteristic of *X. calcicola*, but often lack a pronounced warty area in the centre of the thallus. Such specimens have been included here in *X. parietina*.

*Xanthoria parietina* (L.) Th. Fr. – (5) in 46770; (15) in 46886 [herb. Pirintosos]; (19) 46972; (20) 47009, in 47045 [ATHU]; (21) in 47069, in 47082, in 47087; (27) 47244, 47248 [ATHU], 47251, 47253 [herb. Pirintosos]; (29) in 47305; (30) in 47354; (31) 47408, in 47401. – Kalimnos and Kos, c. 30-850 m, epiphytic and silicicolous, in open woodland, orchards and phrygana. On *Juniperus oxycedrus* subsp. *macrocarpa*, *Ceratonia siliqua*, *Ficus carica*, *Pistacia lentiscus*, *Genista acanthoclada* DC., *Inula heterolepis*, *Quercus coccifera*, *Cupressus sempervirens*, *Olea europaea* subsp. *sativa* and subsp. *oleaster*.

ster. crust. A (*Rinodina*?)

(2) in 46668; (27) in 47208, in 47226. – Kalimnos and Kos, c. 50-250 m, on siliceous rocks in phrygana.

TLC: atranorin, trace of ?chloroatranorin, trace of ?zeorin (in 47208, in 47726, in 46668).

This is a sterile, grey, areolate, crustose lichen forming small patches c. 1 cm in diam. Except for a narrow marginal zone, the areoles have a very irregularly folded surface so that the thallus looks pustulate.

ster. crust. B

(11) 46846. – Kalimnos, c. 700 m, on limestone rock on exposed hilltop with phrygana.

TLC: norstictic, connorstictic acids.

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