

EPIPHYTIC LICHENS AND LICHENICOLOUS FUNGI FROM BAHÍA HONDA (VERAGUAS, PANAMA)

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Abstract: 67 epiphytic lichen species and 4 lichenicolous fungi are recorded from Bahía Honda (Veraguas, Panamá). The fungus *Opegrapha pigozziana* is described as new, being a parasymbiont of *Thelotrema glaucopallens*. *Anisomeridium consobrinum*, *A. indicum*, *Arthopyrenia malaccitula* and *Calopadia subcoerulescens* are reported for the first time from America.

Introduction

One of the most continuously repeated feature of the tropical forest is its extraordinary biodiversity. It is estimated that more than half of the plant and animal species are found in tropical rain forests though they only represent 6% of the emerged surface. A high percentage of these species is still unknown and the number is higher with regard to the smaller and less conspicuous organisms. The fungal world, and for extension lichens -that are fungi that can trap the energy produced in excess by algae-, is just starting to be known.

These symbiotic fungi, -that can live on all type of substrate without destructing it-, mainly colonize the leaves of trees in the lowland forests, like the ones we treat in this article. Lichens living in these niches are known as epiphyte or folicolous and as the main feature of the humid forests is the

abundance of leaves and frondes, one can imagine the high abundance and diversity of these organisms. A second important feature for lichenologists of temperate areas is the lack of lichens in barks and stones inside the tropical forest. It seems that in the very humid areas together with the absence of sunlight makes this type of lichenicolous fungi not as successful when competing with bryophytes and epiphytic algae. However the lichens become successful in ecotonic areas such as the coast line, orchards, forest edge, etc., where they completely cover the barks of trees. Lichenicolous fungi are the fungi that live on lichens without consideration to their system of nutrition. They can be saprophytes, when they live on dead lichens; parasites, when they cause damage to the infected lichen, or when they induce the formation of tumours known as galls; or parasymbiotic, when the fungi obtains carbohydrates from the photobiont, that is, the algae of lichens, without causing any visible damage.

Although in the last years the knowledge of the systematics of epiphytic lichens from tropical areas has increased, the studies of epiphytic lichens, especially the crustaceus taxa, are much rare and modern revisions are still unknown. In the lowland forests, these crustaceous lichens predominate, and Bahía Honda follows this pattern (8 foliaceous lichens and none fruticulous), but for the reason stated above we only report a relatively low number of lichens in this study. Also, the epiphytic lichens are not mentioned here, though they are abundant as in nearby lowland tropical forests (Etayo, 1997).

Although during the collecting process we paid special attention to sampling lichenicolous fungi, they are scarce in the lowland forests. For this reason only four species were determined; one of them is described for the first time in the present work, and for other three their distributional area is remarkably increased. In the inventory that follows we distinguish the lichenicolous fungi by an asterisk before the name.

The Bahía Honda area, situated in the Pacific coast of Panama, is composed of lowland and coastal well preserved forests, mangroves, palm groves and open or abandoned anthropical zones. The specimens were collected in places from 0-160m and emergent rocks colonized by lichens were not found.

Methods

The specimens mentioned in this work were studied in water solutions at 1000X, but for the observation of microscopic structures, KOH, sodium hypochlorite, Lacto phenol blue and cresil blue were also used.

The inventory is presented in alphabetical order of the species, and the locality, habitat, altitude, date of collection, as well as the collector's name and herbarium number are also recorded. For the most interesting taxa, the authors remark relevant observations, either chorological or ecological, as well as the original iconography.

The collected samples were deposited at the personal herbaria of the authors and at the herbarium of the Real Jardín Botánico in Madrid (MA) and the one at the University of Panama (PMA).

CATALOGUE

Agonimia octospora Coppins & P. James

It was found without perithecia and for this reason, its specific description is doubtful; nevertheless the thallus formed by small papillate squamules is very similar to other specimens from Europe. It seems to be a cosmopolitan species, although many of the records are sterile samples.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the beach, on trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18765 (MA, PMA, herb. Etayo).

Agonimia papillata (O. Eriksson) Diederich & Aptroot

[= *Flakea papillata* O. Eriksson]

Agonimia papillata has been recently combined in this genus by having papillate thallus (Aptroot & al. 1997). *Agonimia* has, however, small squamules, and its shape and aspect are very different from the big squamules almost foliaceous- in *Flakea*, the first generic name applied to it. As *A. papillata* has never been found fertile, its ascription to one or the other genus is uncertain.

This easily recognisable taxon is known from tropical Asia and America.

Bahía Honda, El Edén beach, mangrove, 0 m, 27-VII-2001, *J. Etayo* 18604 (MA, PMA, herb. Etayo).

***Anisomeridium consobrinum* (Nyl.) Aptroot**

It is easily distinguished by having hypofleodic thallus, white, UV+ yellow and uniseriate, haline ascospores, with submedial septa, from 25-32 x 9-12 μm , in the sample studied. In water, the ascospores seem to be ornamented, but this is not verified in KOH.

This taxon was only known from tropical Asia and Australia, and this is a first record for America.

Bahía Honda, Canales de Tierra island, frog's path (*Dendrobates*), on way to the port, on undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18746 (PMA, MA, herb. Etayo).

***Anisomeridium indicum* (Makhija & Patw.) R.C. Harris**

This is a new record for America that was earlier known from India.

Bahía Honda, Playa Blanca to Caoba, abandoned vegetable garden and surrounding forest, on undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18556 (MA, PMA, herb. Etayo, herb. Aptroot).

***Arthonia cinnabarina* (DC.) Wallr.**

This is a cosmopolitan species characterised by red pruinose ascomata, especially on the margins.

Bahía Honda, Rosario, sufficient vegetable garden with coconuts and mangroves, undetermined trunk., 5 m, 26-VII-2001, *J. Etayo* 18631 (MA, PMA, herb. Aptroot, herb. Etayo.).

***Arthopyrenia malaccitula* (Nyl.) Zahlbr.**

In our samples the spores are longer, from 45-56 x 15-21, than in the bibliography (37-48 x 15-16 μm in Harris 1995).

It is known from tropical Asia and Australia; this is the first American record of this species.

Bahía Honda, path from Cabañita base to El Edén, Cocos, 0-25 m, 23-VII-2001, *J. Etayo* 18517 (MA, PMA, herb. Etayo).

***Arthothelium macrothecium* (Fée) Mass.**

This taxon is common on all type of phorophyte, especially on the exposed trunks of coconuts.

Bahía Honda, from Playa Blanca to Caoba, abundant in vegetable garden and surrounding forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18561 (MA, PMA, herb. Etayo). Bahía Honda, Playa de la Cascada, from the coconuts forest to the waterfall, thin branches, 0-20 m, 26-VII-2001, *J. Etayo* 18585 (MA, PMA, herb. Etayo). Bahía Honda, Rosario, autosufficient vegetable garden with palms and mangroves, undetermined trunk, in hedge, 5 m, 26-VII-2001, *J. Etayo* 18624 (PMA, herb. Etayo).

***Astrothelium versicolor* Müll. Arg.**

This is a species belonging to the complex group of *A. cinnamomeum*. The samples collected (18615, 18616) are without spores, that is an important distinctive character of this taxon, but we refer them to this species.

This taxon, with bright ascomata, is known from tropical Asia and America.

Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, undetermined trunk, in hedge, 5 m, 26-VII-2001, *J. Etayo* 18615, 18616 (herb. Etayo, herb. Aptroot). Bahía Honda, Canales de Tierra island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18747 (MA, PMA, herb. Etayo).

***Bacidina* cf. *squamellosa* S. Ekman**

Thallus with squamules that quickly dissolved in goniocysts. The ascospores are acicular, from 30-40 x 1-1,5 µm, and triseptate. This taxon seems to be common in Bahia Honda. *B. squamellosa* is known only from two localities (Ekman, 1996) in Florida (USA).

Bahía Honda, way to El Eden from Cabañita base, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18527 (MA, PMA, herb. Etayo). Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18540 (MA, PMA, herb. Etayo). Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, 160 m, 24-VII-2001, *J. Etayo* 18774 (MA, PMA, herb. Etayo). Bahía Honda, Sol beach (camp) with mangroves and coconuts, undetermined trunk, 0 m, 28-VII-2001, *J. Etayo* 18581 (MA, PMA, herb. Etayo).

***Bactrospora jenikii* (Vezda) Egea & Torrente**

Egea & Torrente (1993) mentioned that the Antillan samples of this species have scarcely coloured exciple under the subhymenium.

Our sample shows that the subhymenium is completely hyaline. The size and shape of the ascospores (*jeniki*-type) is, however, distinctive.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18532 (herb. Etayo). Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, 160 m, 24-VII-2001, *J. Etayo* 18778 (MA, PMA, herb. Etayo).

***Calopadia subcoerulescens* (Zahlbr.) Vezda**

This taxon is characterized by black apotecia, sometimes with a blue shade, epruinose, monosporus ascus and blue or grey-blue hypothecium. The spores inside the ascus can transform in halteriform conidia, from 2-2,5 x 1 µm.

It is known from tropical Asia and Australia; this is the first record from America, although Lüking (1992) reported an epiphyllous sample from Costa Rica.

Bahía Honda, from Playa Blanca to Caoba, vegetable garden, abandoned vegetable garden and surrounding forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18545 (PMA, herb. Etayo). Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18753 (MA).

***Celothelium aciculiferum* (Nyl.) Vainio**

The taxon is characterized by acicular ascospores, frequently helicoidally curved; seems to be abundant in Bahía Honda. It is known from the Central and South America (Aguirre-Hudson, 1991).

Bahía Honda, path from Cabañita base to El Edén, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18520, 18524, 18525, 18526 (MA, PMA, herb. Etayo).

***Chiodecton* cf. *aurantiacoflavum* B. de Lesd.**

Surely, this taxon belongs to the genus *Cryptothecia* and is distinguished from *C. rubrotincta* by its whitish thallus, P+ orange, and pink tipped isidia. The samples studied are sterile.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18766 (herb. Etayo). Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and small forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18535 (MA, PMA, herb. Aptroot, herb. Etayo).

***Chiodecton sphaerale* Ach.**

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18554 (MA, PMA, herb. Aptroot, herb. Etayo)

***Clathroporina* cf. *isidiifera* R. C. Harris**

We collected a sterile thallus from *Porina* with shining green thallus and black hypothallus, characteristic from the group included in *Clathroporina* by Harris (1995). Other species reported by Harris (op.cit.) in *Clathroporina* are included in this work under the genus *Porina*. The thallus has abundant, grouped, short and ramificate isidia.

C. isidiifera was earlier only known from Florida (Harris op.cit.)

Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, 160 m, 24-VII-2001, *J. Etayo* 18772 (PMA, herb. Etayo).

***Coccocarpia palmicola* (Spreng.) L. Arvidss. & D. Gall.**

The species is very variable, treated profoundly in Arvidsson (1982). Pantropical distribution, it has commonly been reported from Central America.

Bahía Honda, Playa del El Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18596 (MA, PMA, herb. Etayo). Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18765 (herb. Etayo). Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, 160 m, 24-VII-2001, *J. Etayo* 18771 (MA, PMA, herb. Etayo).

***Crocynia pyxinoides* Nyl.**

Abundant on mangrove branches, sometimes we found it fertile. This taxon can not be confused with other species as it has lobulate and bisaceus thallus. It is known from tropical America.

Bahía Honda, Playa del El Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18596, 18598 (MA, PMA, herb. Etayo).

***Cryptothecia rubrocincta* (Ehrenb.:Fr.) Thor**

Unmistakable by having bisceus thallus with chiodectonic acid that gives it an intense purple colour in more or less magnitude.

Bahía Honda, path from Cabañita base to El Edén, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18514 (MA, PMA, herb. Etayo). Bahía Honda, Playa del Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18598 (MA, PMA, herb. Etayo).

Cyclographina cubana Vain. ex Awas. & M. Joshi

Our sample is similar to the description of Awasthi & Joshi (1979). These authors only reported the taxon from Cuba. First record for Panama.

Bahía Honda, Playa de El Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18606 (MA, PMA, herb. Etayo).

Dictyonema interruptum (Carm. ex Hooker) Parm.

We found it abundant and forming big spots at the base of coconuts. Pantropical, but it is also reported from temperate areas (Etayo & *al.*, 1995)

Bahía Honda, path from Cabañita base to El Edén, Cocos, 0-25 m, 23-VII-2001, *J. Etayo* 18516 (MA, PMA, herb. Etayo). Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, Cocos, 5 m, 26-VII-2001, *J. Etayo* 18620, 18630 (MA, PMA, herb. Etayo).

Dirinaria picta (Sw.) Clem. & Shear.

Frequently on *Cocos nucifera* on the beaches, usually with soralia and without ascomata. Pantropical species, known from most of the American countries (Awasthi, 1975; Aptroot, 1987), but not from Panama.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18538, 18555 (MA, PMA, herb. Etayo). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, *J. Etayo* 18594 (MA, herb. Etayo).

Gassicurtia coccinea Fée

This species is characterized by scarcely purple medulla. The taxon is known from several countries, Central and South America, as well as from Africa (Marbach, 2000). First record for Panamá.

Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, mangrove, 5 m, 26-VII-2001, *J. Etayo* 18629 (MA, PMA, herb. Etayo).

Glyphis cicatricosa Ach.

Pantropical species, abundant in Bahía Honda.

Bahía Honda, path from Cabañita base to El Edén, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18530 (herb. Etayo). Bahía Honda, Rosario, selfsufficient vegetable garden with coconuts and mangroves, undetermined trunk in hedge, 5 m, 26-VII-2001, *J. Etayo* 18616 (PMA, herb. Etayo). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, thin branches, 0-20 m, *J. Etayo* 18585 (MA, PMA, herb. Etayo)

Graphina incrustans (Fée) Müll. Arg.

Pantropical distribution. The ascomata without any carbonized structure are a characteristic feature of the *Fissurina* group, which needs a profound study.

Bahía Honda, path from Cabañita base to El Edén, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18521 (herb. Etayo). Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18531 (MA, PMA, herb. Etayo). Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18587 (MA, herb. Etayo). Bahía Honda, Canales de Tierra island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18749 (herb. Etayo).

***Graphis caesiella* Vainio**

Tropical species.

Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, undetermined trunk in hedge, 5 m, 26-VII-2001, *J. Etayo* 18627 (MA, PMA, herb. Etayo, herb. Aptroot).

***Haematomma africanum* (Steiner) Dodge**

Abundant on coconuts and unmistakable by having sessile ascomata, with red disc, which ephymenium gives violet reaction with K, and has big spores, from 70-80 x 7 µm with 20-22 septates.

Pantropical distribution.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18552 (MA, PMA, herb. Etayo).

***Heterodermia albicans* (Pers.) Swinsc. & Krog**

Pantropical species; according to Aptroot (1987) this is the only species from the genus that is common in cultivated coastal areas in the Guianas.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18546 (MA, PMA, herb. Etayo). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18584 (MA, PMA, herb. Etayo).

***Laurera sphaeroides* (Mont.) Muell. Arg.**

Only known from tropical America.

Bahía Honda, Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18583 (MA, PMA, herb. Etayo, herb. Aptroot). Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18748, 18759 (herb. Etayo).

***Lecidea granifera* Nyl.**

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18548 (herb. Aptroot, herb. Etayo).

***Leptogium coralloideum* (Meyen & Flotow) Vainio**

A common species in tropical America.

Bahía Honda, path from Cabañita base to El Edén, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18515 (MA, PMA, herb. Aptroot, herb. Etayo).

***Leptogium cyanescens* (Rabenh.) Körber**

Cosmopolitan species common in the studied locality.

Bahía Honda, de Playa Limón a Sangrillal, sangrillo, 27-VII-2001, *J. Etayo* 18574 (herb. Etayo). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, thin branches, 0-20 m, 26-VII-2001, *J. Etayo* 18593 (herb. Etayo). Bahía Honda, Canales de Tierra island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18743 (MA, PMA, herb. Etayo).

***Leptogium phyllocarpum* (Pers.) Mont.**

Common species in Panama, especially in the mountain forests; but also found in mangroves.

Bahía Honda, Playa de El Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18602 (MA, PMA, herb. Etayo).

****Llimoniella pyrenulae* Diederich & Etayo**

The description of this species can be found in Diederich & Etayo (2000). New record for Panama, obligate parasite on *Pyrenula* species. Before Diederich & Etayo (2000) the taxon was known from Australia, Kenia and USA (Florida and Missouri).

Bahía Honda, Playa de la Cascada, from palm grove to waterfall, on *Pyrenula* in undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18589 (MA, PMA, herb. Etayo)

****Melaspilea epigena* Müll. Arg.**

Lireliform ascomata, black, first sunken in the host thallus, then emerged, elipsoids in the superficial view, pointed in the extremes; the disc is hidden by the excipular magins of the lirellae, from 0,25-0,30 x 0,15-0,20 mm. The ascomata wall is brown, with hyaline paraphysis included in a close hymenial layer from uncoloured gel, from 5-10 x 1 µm. Hymenium hyaline, from c. 30-35 µm thickness, KI+ pale-bluish. Paraphysis septate, mainly simple or scarcely branched in the apices. Ascus 8-spored, apically wide and with an ocular chamber, external wall thin, KI+ blue. Ascospores first hyaline, with halus, early brown and without halus, smooth, uniseptated, with unequal cells, from 11-12,5 x 4,5-5 µm.

Our sample is similar with the description of this taxon, except by the open lirellae, in the type material and at the mature stage, which seem to be more opened (Vouaux 1912-14; Clauzade & al.1989). This species is only known from the type locality in Asunción (Paraguay) and the host was *Leptotrema heterosporum* (Knight) Zahlbr. In the Panamanian locality we found it on a sterile thallus, maybe for the parasitism of the fungi, that can belong to the Thelotremaaceae family, as the host in the type material.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, on epiphyte lichen, undetermined crust, 0-50 m, 24-VII-2001, *J. Etayo* 18764 (MA).

***Nadvornikia hawaiiensis* (Tuck.) Tibell**

Our sample differs from the Tibell description (1987) in the chemical characters, that is P+ orange, K+ yellow and UV-. Also the excipular crown that surrounds the pore is fibrous and erected.

According to Tibell (1987) the taxon has a high probability of having a wide distribution in tropical and subtropical regions, and is known from Australia, Brazil and Hawaii. Harris (1995) also reported it from Florida. This is the first record for Panama.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18750 (MA, herb. Etayo, herb. Aptroot). Bahía Honda, Playa del Sol, (camp) with mangroves and coconuts, Cocos, 0 m, 28-VII-2001, *J. Etayo* 18790 (PMA, herb. Etayo).

Ocellularia papillata (Leighton) Zahlbr.

Pantropical distribution.

Bahía Honda, Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18590 (PMA, herb. Etayo). Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18757 (MA, PMA, herb. Etayo, det. Aptroot).

Ocellularia recondita (Stirton) Zahlbr.

Typically from low forest (Hale, 1978); this author reported it from Colombia and Panama. The species is differentiated from similar species by shine thallus, P-, ascomata with white margins and columella, and small spores with 5-6 septate, from 15-18 x 5, 5-7 μm .

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18755, 18756 (MA, PMA, herb. Etayo).

Ocellularia rhodostroma (Mont.) Zahlbr.

This taxon is distinguished by having pink medula, K+ scarcely green and big spores, in our samples, from 125-175 x 23-25 μm and until 30 locules, in number of one per ascus.

Bahía Honda, Playa del Sol (camp), with thick trees, Cocos, 0 m, 28-VII-2001, *J. Etayo* 18576 (MA, PMA, herb. Etayo).

Ocellularia* cf. *subpraestans (Hale) Hale

It is characterized by large ascomata and enormous spores that can be seen, even with a binocular magnifying glass, from 500-680 x 40-55 μm . In order to distinguish this species from his closely related *O. praesans* (Müll. Arg.) Hale, the use of TLC is needed. According to Hale (1978) *O. praesans* occurs usually at higher altitude than *O. subpraestans*. It forms conspicuous thallus at the base of coconuts.

Bahía Honda, Playa del Sol (camp), with thick trees, Cocos, 0 m, 28-VII-2001, *J. Etayo* 18578 (MA, PMA, herb. Etayo, det. Aptroot). Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, 160 m, 24-VII-2001, *J. Etayo* 18773 (MA, herb. Etayo)

****Opegrapha pigozziana*** Etayo & Aptroot sp. nov.

Fungus lichenicola. Ascomata lirelliformia, 0,2-0,8 x 0,12-0,2 mm, erumpentia, marginata, nigra, non pruinosa, in sectione transversali excipulo nigrofusco, K-, 40-50 μm . Hymenio hyalino jodo caeruleo, strato ephymeniali fusco. Paraphysoides simplices vel ramosae et anastomosae, 1,5-2 μm latae. Asci clavati, bitunicati, 40-50 x 12-13 μm , (4-)6-8-spori. Ascospores anguste ellipsoideae vel fusiformae, (2-)3-septatae, primum laeves et

hyalinae, posteam brunneae et verruculosae, 17-24 x 5-6 µm. Conidia bacillariae, 3-4,5 x 0,5 µm.

Veraguas, Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, on *Thelotrema glaucopallens* in undetermined trunk, 0-10 m, 25-VII-2001, J. Etayo 18534 (MA-holotypus; PMA, herb. Etayo-isotypus).

Lirelliform ascomata, on *Thelotrema glaucopallens* thallus, black, epruinose, simple or scarcely branched, usually curve or very curve and grouped, forming rounded structures; lirellae first immerse, early breaking and emerging, when young with the exciple closed on the disc, but later it opens and finally form a well developed rim, thick and elevate on the disc, from 0,2-0,8 mm longer and 0,12-0,2 mm wide. Exciple dark-brown, K-, from 40-50 µm in thickness, apparently continuous under the hymenium, but here with more laxness and paler in colour than in the lateral side. Epihymenium brown, K-, Hymenium hyaline or yellowish, K-, I+ red, KI+ blue. Hypothecium hyaline, thin. Hamathecia formed by simple or branched paraphysis, not much anastomosing, from 1,5-2 µm thickness, septate, scarcely expanded in the apical part. Ascus clavate, bitunicate, from 40-50 x 1-13 µm, an apical ring KI+ is not appreciated. Ascospores (4-) 6-8 per ascus, narrowly ellipsoid to fusiform, (2-)3-septate, the hypermature sometimes with two more pseudosepta, scarcely constricts in the septa. Hyaline and with a fine sheath, from 1-2 µm thickness when they are young, and brown and coarsely verrucose when they are mature, even into the ascus, from 17-24 x 5-6 µm. Abundant conidiomata, black, projecting, first rounded and after irregular, from 0,1-0,12mm diameter. Conidioma wall equal to the ascoma. Conidial cells from 6-8 x 1,5-2 µm, enlarged in the base. Conidia bacilliform, from 3-4,5 x 0,5 µm.

Recently, Coppins (1987) described two species from the *Opegrapha* genus, which obligate habitat is on taxa of the *Thelotrema* genus: *O. brevis* Coppins (on *Thelotrema subtile* Tuck.) and *O. thelotrematis* Coppins (on *T. lepadinum* (Ach.) Ach. and *T. monosporum* Nyl.). *O. brevis*, only known from Scotland, have ascomata with K+ greenish exciple. Ascus 4-spored and ascospores smaller, from (14-)15-18 x 4,5-5(-6) µm, as well as bigger conidia, from 5-7 x 1 µm. *O. thelotrematis*, also known from Scotland and Macaronesia (Hafellner 1995), but it is differentiated from *O. pigozziana* by exciple also K+ greenish and smaller ascospores, from 13,5-17 x (4-)4,5-5,5(-6) µm.

Other similar species to the treated is *O. encephalographoidea* Diederich & Aptroot (Aptroot & al., 1997), known from a mountainous locality (1950 m) in New Guinea, on thallus and ascomata from an undetermined *Pyrenula*. This taxon has (3-)4 spored ascus and its ascoma are very branched and form a mass that cover an area, depending on the description, until 1 cm². *O. wetmorei* M. S. Cole & D. Hawksw., that was described on *Ochrolechia trochophora* in USA, moreover also found on a different host has smaller ascus and ascospores (Cole & Hawksworth).

O. pigozziana is known only from the type locality, at sea level, on *Thelotrema glaucopallens*, a kind of ascoma totally immersed in the thallus. Etymology, *O. pigozziana* is named in honour of Mr. Pigozzi, who has financed the tropical scientific research in the Bahía Honda area.

***Parmotrema endosulphureum* (Hillm.) Hale**

It is known from tropical America. In the studied area it is frequent on illuminated and exposed trunks.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18571 (herb. Etayo). Bahía Honda, Playa Limón a Sangrillal, , 27-VII-2001, *J. Etayo* 18573 (MA, PMA, herb. Etayo). Bahía Honda, Playa del Sol (camp), with thick trees, undetermined trunk, 0 m, 28-VII-2001, *J. Etayo* 18580 (herb. Etayo). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, Cocos, 0-20 m, 26-VII-2001, *J. Etayo* 18595 (MA, PMA, herb. Etayo)

***Phaeographina caesiopruinosa* (Fée) Müll. Arg.**

Bahía Honda, Playa de El Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18597 (MA).

***Phyllopsora confusa* Swinscow & Krog**

Pantropical species, with very fine incised squamules, P-, that was known from Panama (Brako, 1991) in a locality at 400 m in altitude, but never at sea level.

Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, undetermined trunk in hedge, 5 m, 26-VII-2001, *J. Etayo* 18621 (MA, PMA, herb. Etayo).

***Porina mastoidea* (Ach.) Müll. Arg.**

[= *Clathroporina mastoidea* (Ach.) R. C. Harris]

The description of this taxon and the differentiation from the next are available in McCarthy (1993). According with this author *P. mastoidea* is common in tropical and subtropical regions, especially as epiphyte, and is reported more frequently from Central and South America.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18549 (PMA, herb. Etayo). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18592 (PMA, herb. Etayo). Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18745 (MA, PMA, herb. Etayo).

***Porina nucula* Ach.**

This taxon is characterized by having 7 septate ascospores surrounded by a gelatinous sheath, from 36-48 x 9-10,5 µm. Pantropical.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18770 (MA, PMA, herb. Etayo).

***Porina subrudiuscula* Malme**

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, 0-10 m, 25-VII-2001, *J. Etayo* 18536 (MA, PMA, herb. Etayo, herb. Aptroot).

***Porina tetracerae* (Afz. in Ach.) Müll. Arg.**

[= *Clathroporina tetracerae* (Afz. in Ach.) R. C. Harris]

Pantropical species frequently reported from Central and South America (McCarthy, 1993)

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18744 (MA, PMA, herb. Etayo).

Pseudopyrenula subnudata Müll. Arg.

Pantropical distribution, it seems to be common in Bahía Honda, and especially notable on coconuts.

Bahía Honda, path from Cabañita base to El Edén, Cocos, 0-25 m, 23-VII-2001, *J. Etayo* 18518 (MA, PMA, herb. Etayo, herb. Aptroot). Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, thin branches, 160 m, 24-VII-2001, *J. Etayo* 18769, 18778 (MA, PMA, herb. Etayo).

Pyrenula acutalis R. C. Harris

Characterized by having spores with one or two apiculate extremes, from 24-27 x 10-11 μm in our sample.

Distributed in tropical America.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, 0-50 m, 24-VII-2001, *J. Etayo* 18739 (MA).

Pyrenula aspistea (Ach.) Ach.

Characterized by having small ascospores, from 13-15,5 x 5,5-6 μm in our sample. Pantropical distribution.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18742 (MA).

Pyrenula astroidea (Fee) R. C. Harris

Pantropical distribution.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18542 (MA, PMA, herb. Etayo).

Pyrenula cryptothelia (Müll. Arg.) Aptroot & Etayo

This species known from several South American localities, is reported from Bahía Honda in Etayo & Aptroot (2003).

Pyrenula falsaria (Zahlbr.) R.C. Harris

This species is extraordinarily variable, or a group of several taxa having in common big muriform spores. Some thallus are white, darker ones can have simple ascomata or with a lot of united chambers. The sample 1874 has bipored ascus.

The taxon has a restricted distribution in tropical America.

Bahía Honda, de Playa Limón a Sangrillal, undetermined trunk, 27-VII-2001, *J. Etayo* 18572 (MA, PMA, herb. Etayo, herb. Aptroot). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18588 (MA, PMA, herb. Etayo,

herb. Aptroot). Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18740 (PMA, herb. Etayo).

***Pyrenula luteopruinosa* Etayo & Aptroot**

The species was recently described (Etayo & Aptroot, 2003). It is similar to *P. pileata* Vainio, which characteristic features are: sulphur yellow pruina on the ascomata and smaller ascospores *pseudobufonia* type. The species is only known from its type locality in Bahía Honda

***Pyrenula mamillana* (Ach.) Trevisan**

[= *P. marginata* Hook. in Kunth]

Dark brown thallus, hymenium insperse and spores 21-23 x 8-10 µm.

Pantropical distribution.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18557 (herb. Etayo). Bahía Honda, Playa de El Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18601 (MA, PMA, herb. Etayo).

***Pyrenula microtheca* R. C. Harris**

Lateral ostiole and spores from 22-23 x 9-11 µm in our sample. This species is distributed in tropical America.

Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, 160 m, 24-VII-2001, *J. Etayo* 18775 (MA, PMA, herb. Etayo).

***Pyrenula pseudobufonia* (Remh.) R. C. Harris**

Pantropical distribution.

Bahía Honda, path from Cabañita base to El Edén, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18529 (MA, PMA, herb. Etayo).

***Pyrenula pyrenuloides* (Mont.) R. C. Harris**

It is characterized by having brown and muriform spores, with 8 rows of rounded cells by a thick surrounding wall, from 40-58 x 17-26, obtuse apices.

Pantropical species.

Bahía Honda, Canales de Tierra Island, frog's path (*Dendrobates*), on way to the port, undetermined trunk, 0-50 m, 24-VII-2001, *J. Etayo* 18754, 18758 (MA, PMA, herb. Etayo).

***Pyrenula ravenelii* Tuck.**

The species is common in the Southeast USA and has also been reported from New Guinea (Aptroot & *al.*, 1997).

Bahía Honda, Canales de Tierra Island, Limón Agrio beach, train slope, 160 m, 24-VII-2001, *J. Etayo* 18776 (MA).

***Pyrenula santensis* (Nyl.) Müll. Arg.**

According to Aptroot & *al.* (1997) it is apparently a pantropical species.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18544 (MA).

***Ramonia microspora* V_za**

Unmistakable species by having polisporate ascus and simple ascospores, ellipsoid and with sheath, from 4-6 x 2,5-3,5 µm. The thallus is practically leprarioid with thinly coralloid isidia. The species is only known from the type locality of Jujuy, Argentina (V_zda, 1966). First record for Central America. We collected the specimens covering a big surface in isolated thick mangrove tree, shady and in supravertical situation.

Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, mangrove, 5 m, 26-VII-2001, *J. Etayo* 18613, 18623 (MA, PMA, herb. Etayo).

Sarcographa heteroclita (Mont.) Zahlbr.

This species is frequently mistaken with the representative genus *Phaeographis*. It shows a pantropical distribution but is more common in the Paleotropical area.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18558 (MA, herb. Aptroot).

Sarcographa leprieurii (Mont.) Redinger sense Redinger

One description of this taxon is presented in Redinger (1933). Although it has often been mistaken with the former taxon, it is distinguished by laberintiformes lirellae, that forms big stroma until 1cm longer and red brown coloured, by a soluble substance, K⁺ greenish-yellow.

Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, undetermined trunk in hedge, 5 m, 26-VII-2001, *J. Etayo* 18616, 18627 (MA, PMA, herb. Etayo, herb. Aptroot).

****Sphinctrina tubiformis*** Massal.

This is a calicials parasite that grows especially on *Pertusaria* species and it is almost cosmopolitan.

Bahía Honda, Playa de El Edén (the Biologist), on *Pertusaria* aff. *flavida* on mangrove, 0 m, 27-VII-2001, *J. Etayo* 18605 (MA, PMA, herb. Etayo).

Syncesia decussans (Nyl.) Tehler

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18541 (MA, PMA, herb. Aptroot, herb. Etayo)

Thelotrema glaucopallens Nyl.

According to Hale (1978), pantropical. *T. glaucopallens* is one of the most common species growing in low altitude forest, and he recognised it as the most frequent lichen in Barro Colorado. In Bahía Honda we collected it only from one locality.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18533, 18534 (MA, PMA, herb. Etayo).

Thelotrema leprocarpoides Hale

Pantropical distribution.

Bahía Honda, Playa del Sol (camp), with thick trees, Cocos, 0 m, 28-VII-2001, *J. Etayo* 18577 (PMA, herb. Etayo, herb. Aptroot).

Thelotrema reclusum Krempelh.

The species seems to be pantropical; its type is known from Andaman Islands (Hale, 1978). This author also reported it from Panama.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, Cocos, 0-10 m, 25-VII-2001, *J. Etayo* 18539, 18570 (MA, herb. Etayo).

Thelotrema reconditum Stirton

It is known from tropical America.

Bahía Honda, from Playa Blanca to Caoba, abandoned vegetable garden and surrounding (small) forest, undetermined trunk, 0-10 m, 25-VII-2001, *J. Etayo* 18550 (MA).

Trypethelium ochroleucum (Eschw.) Nyl.

Pantropical distribution.

Bahía Honda, path from Cabañita base to El Edén, undetermined trunk, 0-25 m, 23-VII-2001, *J. Etayo* 18528 (herb. Etayo). Bahía Honda, Playa de la Cascada, from palm grove to waterfall, undetermined trunk, 0-20 m, 26-VII-2001, *J. Etayo* 18582 (herb. Etayo). Bahía Honda, Playa de El Edén (the Biologist), mangrove, 0 m, 27-VII-2001, *J. Etayo* 18607 (herb. Etayo). Bahía Honda, Rosario, self sufficient vegetable garden with coconuts and mangroves, undetermined trunk in hedge, 5 m, 26-VII-2001, *J. Etayo* 18614 (MA, PMA, herb. Etayo, herb. Aptroot).

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Fig. 1. *Opegrapha pigozziana* (holotype); A, ascomata and conidiomata on *Thelotrema* thallus; B, semiesquematic transvers section of ascomata; C, ascospores in different grades of maturity (upward) and conidia (underneath). Scales, A = 100 µm; B = 50 µm y C = 10 µm.

Fig. 2. Crustose lichens forming coloured mosaics on the exposed trunks of the cost lines. Arthoniaceae, Pyrenulaceae and Strigulaceae are representative families in this niches. In the centre the foliaceous thallus of *Coccocarpia*.

Fig. 3. One of the most apparent crustaceous lichens can be found in this forest: *Cryptothecia rubrocinta*, unmistakable for his cottony thallus (bisaceous) intense purple coloured in the central part and hypothallus.

Fig. 4. *Dirinaria picta*, with soralia and scarcely with abundant apothecia, is frequent in coconuts.

Fig. 5. Lichens from the Pyrenulaceae family are abundant in the studied area and completely colonised many trunks.

Fig. 6. The epiphylic lichens, like coloured splash on the leaves, are abundant in Bahía Honda, although in this work are not studied.

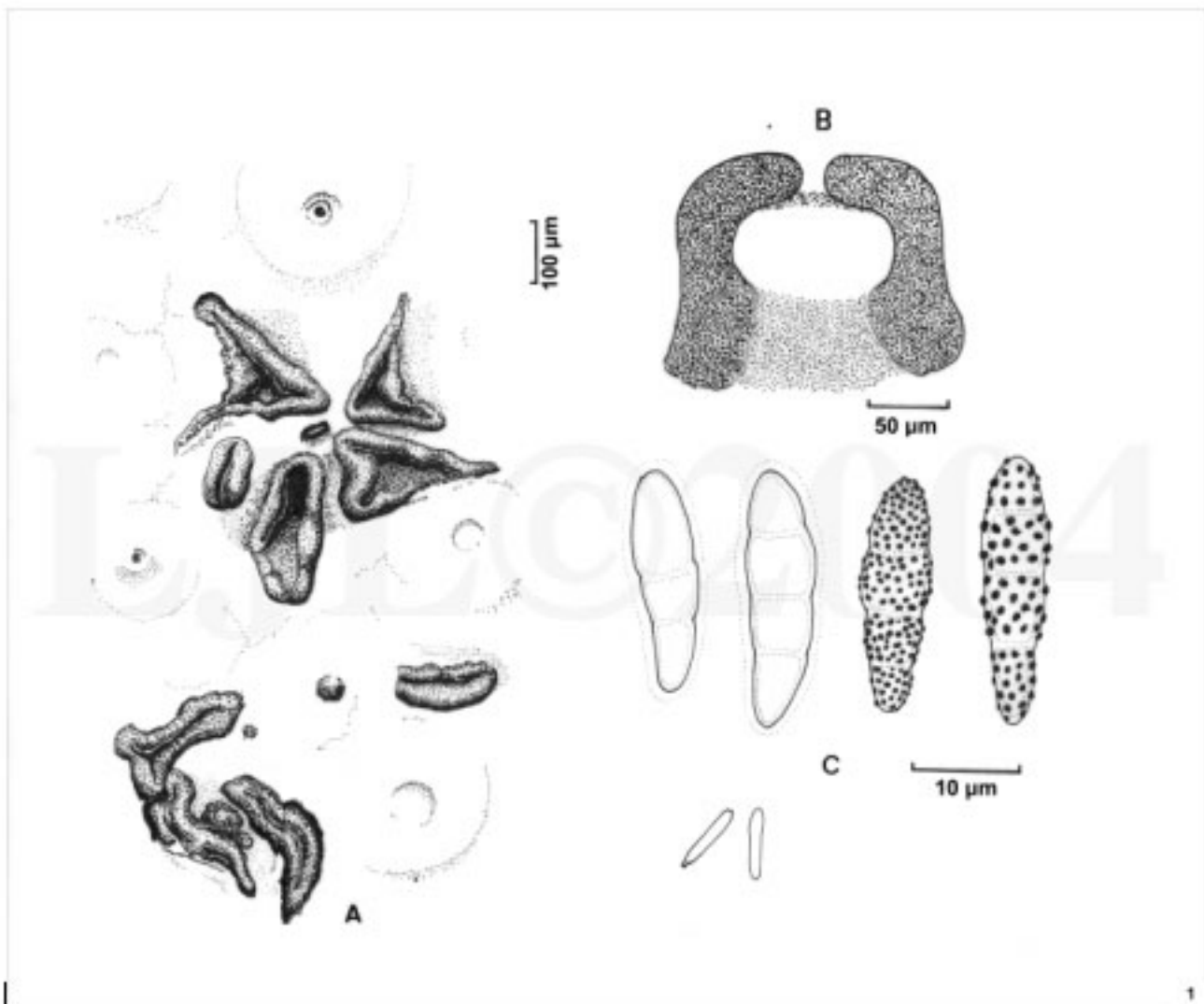


Fig. 1. *Opegrapha pigozziana* (holotype); A, ascomata and conidiomata on *Thelotrema* thallus; B, semischematic transversal section of ascomata; C, ascospores in different grades of maturity (upward) and conidia (underneath). Scales, A = 100 µm; B = 50 µm y C = 10 µm.

Scheme

