

TAXONOMY OF CRUSTOSE LICHENS IN THE FOREST OF TAHURA R. SOERYO, BATU, EAST JAVA

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ABSTRACT

Lichen is a symbiotic organism consisting of a photobiont (green algae or cyanobacterium) and a mycobiont (fungal). A taxonomic study of the crustose lichens in the forest of TAHURA R. Soeryo had been conducted based on morphological, anatomical, and chemical characters. In this research we used the method of descriptive exploration to identify the crustose lichens and to study the distribution of the species in the forest of TAHURA R. Soeryo. Twenty species of crustose lichens with one unidentified species and one specimen identified to the group of family are reported. They are Graphina, Graphis, Phaeographis, Pertusaria, Pachyphiale, Phlyctis, Lepraria, Lecanora, Lecania, Cyphellium, and Megalospora. This research also found the new record species of Megalospora kalbii in Java. Crustose lichens are found in the areas with high light intensity of ≥ 1000 lux, average humidity of $\leq 90\%$, average temperature of $18-19^{\circ}\text{C}$, and at altitudes of ± 1640 dpl. Graphina ruiziana could only be found at the altitude of ± 1780 dpl. The identification key to its species and distributions of other species are presented also in the article.

Key words: Diversity, Crustose Lichen, Forest of Tahura R. Soeryo

INTRODUCTION

Everyone is familiar with plants as green chlorophyll-containing organisms that produce their own food. Lichens are also a plant, but a very special kind, for when we dissect and examine it under a microscope, we find that it is composed of two completely different organisms, microscopic green or blue-green algae and colorless fungal threads called hyphae. These two components grow together in a harmonious association referred to as symbiosis, or more simply a "living-together". Lichen symbiosis, however, differs basically from all other kinds in that a new

plant body, the thallus, is formed and this thallus has no resemblance at all to either a fungus or alga growing alone (Hale, 1969). Lichens can be found from extreme low tide level on the sea-shore to the tops of high mountains, and from arctic to tropical regions (Dobson, 1992).

Growth form means the overall shape and configuration of the lichen thallus. There are three major types: foliose, fruticose, and crustose (Hale, 1974; Rout *et al.*, 2010). A fourth type, the squamulose lichens, may also be recognized. The whole association grows at a rate ranging from one millimetre or less

per year for crust (crustose) lichens up to a few centimetres a year for the most rapidly growing leafy (foliose) or shrubby (fruticose) lichens (Richardson, 1992). The distribution of lichens is governed by many interacting factor i.e. topography, substrate, light intensity, moisture, humidity (Termina *et.al.*, 2009; Ramakantha *et.al.*, 2003; Hayward *et.al.*, 1975; Kenkel *et.al.*, 1986) and altitude (Hayward *et.al.*, 1975).

Tropical forest has a complex component either flora or fauna. One of the tropical forests in Indonesia is an Arjuno Lalijiwo forest which is more famous with Taman Hutan Raya R.Soeryo (TAHURA). Geographically, Tahura is located in Tulungrejo village, Bumiaji District, East Java. Topography in general has various configurations among superficial, hilly, mountain with 1000-3000 m high from the upper surface of sea shore. Its altitude is 1000-3000 m, the rainfall is about 2500-4500 mm per year, and the temperature is about 5°C - 10°C. Biotic potential of that area is flora condition dominated various kinds of plant. (Departemen Kehutanan, 2008). Deforestation is a major enviromental issue which may cause disappearance of many lichen species without being studied. Fifteen species of foliose lichen (Jannah *et.al.*, 2009) and eleven species of fruticose lichen (Jannah *et.al.*, 2011) is reported in this forest.

Lichens has a big diversity in this world, however, people pay very small attention in this subject. Lichens play a very important role in the ecosystem, as oxygen

supplier, bioindicator of air pollution and air quality biomonitoring (Richardson, 1992; Negi, 2003; Eva, 2003; Rout *et.al.*, 2010). This rich diversity indicates good forest health. Lichens can also be very usefull,as medicine, antibiotic, antimutagenic, cosmetic (Nash, 1996; Negi, 2003) and pesticide (Dayan *et.al.*,2001).

Therefore, we had conducted a lichen taxonomical research in purpose to study the diversity of crustose lichens in TAHURA R.SOERYO, to identify the species of lichen in the TAHURA R. Soeryo, and to provide the identification key of its species, in which the study would support the conservation of lichen in situ in the ecosystem.

METHODS

This research is descriptive explorative which has purpose to study the diversity of crustose lichens in TAHURA R. Soeryo. This researches was conducted from September - January 2015, in which involved a method of descriptive explorative technique. The identification involved the method of determining the shape and colour of the thallus, the presence or absence of soredia, soralia, and isidia and the size and septation of the spores within the fruit bodies and chemical tested. The chemical substances used are P (Phenylenediamin), K (Potassium hydroxide), and C (Calcium hypochlorite). The substances of thallus lichen are identified by their characteristic microcrystal formation in various reagents i.e. GAW (H₂O : glycerol: ethanol = 1:1:1), GE (acetic acid : glycerol =

1:3), An (aniline : glycerol : ethanol = 1:2:2), dan oT (o-toluidine : glycerol : ethanol = 1:2:2).

RESULTS AND DISCUSSION

The diversity of crustose lichen in the forest of TAHURA R. Soeryo, Batu, East Java consist of 9 families and 20 species of crustose lichen with one species unidentified and one specimen identified to the group of family. In this research the family Graphidaceae is the most common with 8 species being identified. This research is expected to be a preliminary study for further research such as in depth study of lichen diversity or genetic relation.

Identification Key

- 1. a. Soralia absent.....6
- b. Soralia white colour..... 2
- 2. a. Soredia whit colour(P+red, K-).....*Pertusaria amara*
- b.Sorediaabsent.....3
- 3. a. Isidia absent (K+yellow, P+red, C+yellow).....*Unidentified*
- b. Isidia white colour.....4
- 4. a. Soredia absent (K-, P-, C-).....*Pertusaria corallina*
- b. Soredia green colour.....5
- 5. a. Isidia reddish yellow colour (K+red, P+red, C+yellow).....*Lepraria* sp.
- b. Isidia green (K+red, P+red, C-).....*Pertusaria* sp.
- 6. a. Lirellate apothecia.....15
- b. Disc apothecia.....7
- 7. a. Margin and disc of apothecia cant be differentiated.....*Lecania cyrtella*
- b. Margin and disc of apothecia can be differentiated.....8
- 8. a. Spore one septate with epispor warted (K+yellow).....*Megalospora campylospora*
- b. Spore one septate with epispor smooth.....9

- 9. a. Apothecia margin greyish white (K+yellow,P+red).....*Cyphellium inquinans*
- b. Apothecia margin reddish orange.....10
- 10.a. Spore muriform, ≥ 2 in each ascus (K+red, C+yellow).....*Phlyctis agelaea*
- b. Spore muriform, one in each ascus.....11
- 11. a. Apothecia green pruinose (P +reddish yellow).....*Megalospora kalbii*
- b. Apothecia epruinose.....12
- 12. a. Spora multiseptate, 2-40 in each ascus (K+yellow).....*Pachyphiale carneola*
- b. Spora multiseptate, one in each ascus.....13
- 13. a. Apothecia with reddish brown disc (K-, C-, P-).....*Pachyphiale* sp.
- b. Apothecia with dark brown disc....14
- 14. a. Apothecia lecideine (K+yellow, C-P+red).....*Megalospora* cf. *sulphurata*
- b. Apothecia lecanorine (K+yellow, P+ red, C+yellow).....*Lecanora carpinea*
- 15. a. Margin and centre of apothecia can be differentiated (K+ kuning, C+kuning).....*Graphidaceae*
- b. Margin and centre of apothecia cant be differentiated.....16
- 16. a. Lirellae innate (P+red, C+yellow).....*Graphina anguina*
- b. Lirellae elevate17
- 17. a. Apothecia rarely branched (K+yellow)*Graphina ruiziana*
- b. Apothechia much branched.....18
- 18. a. Apothecia white pruinose (K+yellow).....*Graphina columbina*
- b. Apothecia brown pruinose.....19
- 19. a. Spore multiseptate with thick-walled (K+yellow).....*Phaeographis lyelli*
- b. Spore multiseptate with thin-walled.....20
- 20. a. Margins of lirellae with several furrows, often (K+red).....*Graphis elegans*
- b. Margins of lirellae unfurrowed.....21
- 21. a. Lirellae with dull black (P+red, C+yellow).....*Graphis scripta*
- b. Lirellae with pale brown (K+red,C+yellow).....*Graphis glaucescens*

Taxonomic Descriptions

***Graphina anguina* (Mont.) Müll. Arg.**

This lichen belongs to *Graphidaceae* family. **Thallus** grey, irregularly shaped, usually wrinkled and cracked; **chemistry**: 4-0-methylphysodic acid, roccellaric acid, and acetylportentol; **apothecia** lecideine, immersed, lirellate innate, margins with gray, centre with black, much branched and serpentine; **spores** 2-8 in each ascus, colourless, muriform, 1,5-2 x 1-2 µm; **Chemical test** in medulla are C+yellow, K-, P+red. **Habitat and ecology**: In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1730 dpl, temperature is about 16°-19°C, humidity is about 83-98%, and light intensity is about 475-1700 lux.

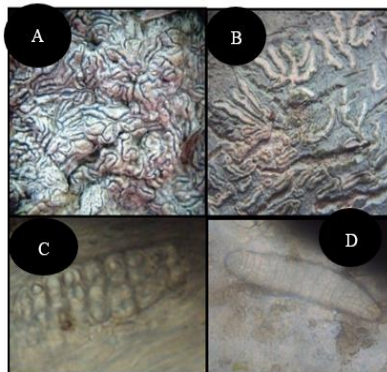


Figure 1. **Thallus.** A. *G. anguina*; B. *G. columbina*; **Spores.** C. *G. anguina*; D. *G. columbina*

***Graphina columbina* (Tuck.) Wirth et. Hale. Jr.**

This lichen belongs to *Graphidaceae* family. **Thallus** greenish to brownish, irregularly shaped; **chemistry**: dissectic acid with atranorin, fumarprotocetraric acid, acetylportentol,

barbatic acid, and retigeric acid; **apothecia** lecideine, lirellate, margins with pale green, centre with white and widely, white pruinose, much branched; **spores** 2-8 in each ascus, colourless, muriform, 6-15 x 1-3 µm; **Chemical test** in medulla are C-, K+yellow, P-. **Habitat and ecology**: In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1780 dpl, temperature is about 17,5-19°C, humidity is about 85-98%, and light intensity is about 600-1150 lux.

***Graphina ruiziana* (Fée) Müll. Arg.**

This lichen belongs to *Graphidaceae* family. **Thallus** greenish grey or whitish, irregularly shaped, sometimes scarcely developed, it has orange soredia; **chemistry**: dissectic acid with atranorin, 4-0-methylphysodic acid, acetylportentol, and retigeric acid; **apothecia** lecideine, lirellate, margins with whitish grey, centre with black, elevated, and rarely branched (unbranched); **spores** >1 in each ascus, colourless, muriform, 6-12 x 1-2 µm; **Chemical test** in medulla are C-, K+yellow, P-. **Habitat and ecology**: In forest, this species was found on old and cracked bark, at altitudes ranging from 1780 dpl, temperature is about 17,5°C, humidity is about 98%, and light intensity is about 600 lux.

***Graphis galucescens* Wirth et. Hale. Jr.**

This lichen belongs to *Graphidaceae* family. **Thallus** white to greenish grey, irregularly shaped; **chemistry**: fumarprotocetraric acid, bellidiflorin,

nephroarctin, dan pseudo-norrangiformic acid; **apothecia** lecideine, lirellate, margins with greenish grey, centre with pale brown, spiral and much branched; **spores** 4-) 6 (8- in each ascus, colourless, multiseptate, 4-6 x 1 µm; **Chemical test** in medulla are C+yellow, K+red, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1780 dpl, temperature is about 17,5°C, humidity is about 98%, and light intensity is about 600 lux.

***Graphis elegans* (Sm.) Ach.**

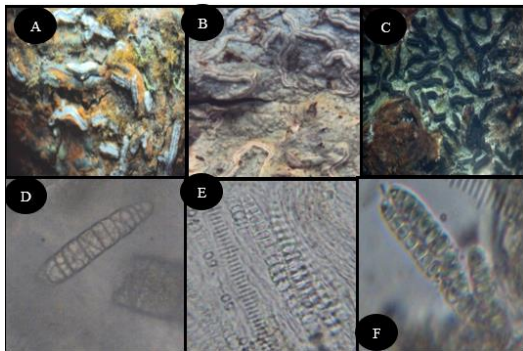


Figure 2. **Thallus.** A. *G. ruiziana*; B. *G. galucescens*; C. *G. elegans*; **Spores.** D. *G. ruiziana*; E. *G. galucescens*; F. *G. elegans*.

This lichen belongs to *Graphidaceae* family. **Thallus** greenish grey, irregularly shaped, smooth, rather thin, slightly, and wrinkled; **chemistry:** barbatic acid and acetylportentol; **apothecia** lecideine, lirellate, margins with black and several furrows, centre with black, spiral and carbonaceous; **spores** 6-13 in each ascus, colourless, multiseptate, 5 x 0,5-1 µm; **Chemical test** in medulla are C+yellow,

K+red, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1800 dpl, temperature is about 17,5°-19°C, humidity is about 85-98%, and light intensity is about 600-1700 lux.

***Graphis scripta* (L.) Ach.**

This lichen belongs to *Graphidaceae* family. **Thallus** grey, smooth or wrinkled, irregularly shaped; **chemistry:** 4-0-methylphysodic acid and acetylportentol; **apothecia** lecideine, lirellate, margins with gray and unfurrowed, centre with pale black, sometimes pruinose and carbonaceous; **spores** 11-15 in each ascus, colourless, multiseptate, 4-5 x 0,5-1 µm; **Chemical test** in medulla are C+yellow, K-, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1730 dpl, temperature is about 16°-19°C, humidity is about 85-98%, and light intensity is about 475-1150 lux.

***Phaeographis lyelli* (Sm.) Zahlbr.**

This lichen belongs to *Graphidaceae* family. **Thallus** green, smooth, glossy, irregularly shaped; **chemistry:** thamnolic acid with decarboxythamnolic acid, acetylportentol, nephroarctin, and α-acetylsalazinic acid; **apothecia** lecanorine, lirellate, margins with green, centre with brown; **spores** > 3 in each ascus, colourless, multiseptate, 3-4 x 1 µm; **Chemical test** in medulla are C-, K+yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18,5°-

19°C, humidity is about 83-85%, and light intensity is about 1050-1150 lux.

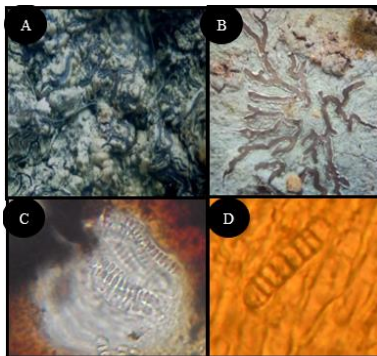


Figure 3. **Thallus.** A. *G. scripta*; B. *P. Lyelli*;; **Spores.** C. *G. scripta*; D. *P. Lyelli*.

Graphidaceae

This lichen belongs to *Graphidaceae* family. **Thallus** brownish gray, smooth, irregularly shaped, it has yellowish white soredia; **chemistry:** 4-0-methylphysodic acid, acetylportentol, and pseudo-norrangiformic acid; **apothecia** lirellate, elevated, unbranched; **Chemical test** in medulla are C+yellow, K+yellow, P-.

Habitat and ecology: In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18°-19°C, humidity is about 75-85%, and light intensity is about 1050-1700 lux.

Notes: Identification of this species is only to family, because of no spores was found on the surface of the talus. Spore type is a very important aspect for identification as a special characteristic of a species and genus (Dobson, 1992).

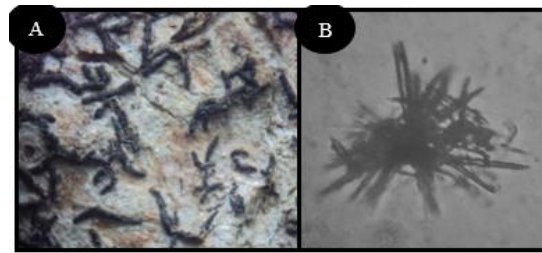


Figure 4. Graphidaceae. A. Thallus; B. 4-0-methylphysodic acid.

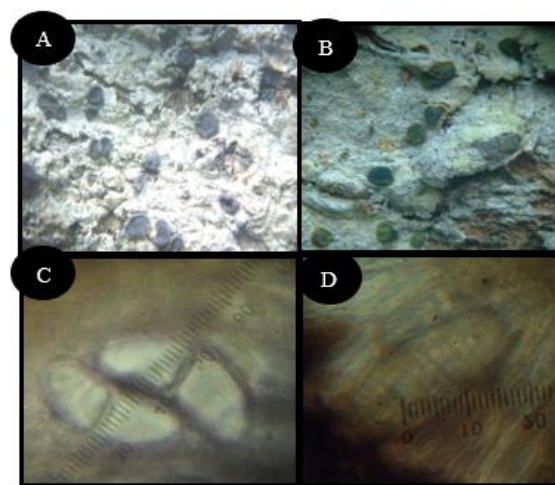


Figure 5. **Thallus.** A. *M. campylospora*; B. *M. Kalbii*;; **Spores.** C. *M. campylospora*; D. *M. Kalbii*.

Megalospora campylospora (Stirt.) Sipman

This lichen belongs to *egalosporaceae* family. **Thallus** greenish gray, irregularly shaped, rather thick, very rugulose with little cracks; **chemistry:** *diffractaic acid* and *acetylportentol*;; **apothecia** lecidine, scattered, sessile, orbicular or oblong and the large ones becoming lobed to reniform to irregularly shaped, margins with black, disc with black, up to 3 mm diam; **spores** 4-6 in each ascus, colourless, one septate with epispore warted, 10-25 x 20-28 µm; **Chemical test** in medulla

are C+yellow, K+yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1800 dpl, temperature is about 16°-18,5°C, humidity is about 75-98%, and light intensity is about 45-1700 lux.

***Megalospora cf. sulphurata* Meyen**

This lichen belongs to *Megalosporaceae* family. **Thallus** greenish gray, irregularly shaped, rather thin to rather thick, smooth to very rugulose, small cracks or with longitudinal, epruinose; **chemistry:** *diffractaic acid*, *haemathamnic acid*, *barbatic acid* dan *acetylportentol.*; **apothecia** lecidine, scattered, sessile, orbicular to oblong and the large ones becoming lobed or irregularly shaped, margins with black, disc with brown to black, up to 3 mm diam; **Chemical test** in medulla are C-, K+yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18,5°-19°C, humidity is about 83-85%, and light intensity is about 1050-1150 lux.

Notes: In this species, further identification is still needed, because at the time of the identification process there were no spores found in all the apothecia in the talus. This species is identified as *Megalospora* genus, because has special characteristics of dark colored apothecia, between the margin and the disc can be clearly distinguished, there is oil droplet in the himenium (Sipman, 1983).

***Megalospora kalbii* Sipman**

This lichen belongs to *Megalosporaceae* family. **Thallus** grayish white, irregularly shaped, rather thin to rather thick, smooth to very rugulose, epruinose; **chemistry:** 4-0-methylphysodic acid and acetylportentol; **apothecia** lecidine, scattered, adnate, orbicular to oblong and the large ones becoming lobed or irregularly shaped, margins with black, disc with brown to black, dull green pruinose, up to 1 mm diam; **spores** one in each ascus, colourless, muriform, 10-15 x 20-50 µm; **Chemical test** in medulla are C-, K-, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18°-18,5°C, humidity is about 75-83%, and light intensity is about 1050-1700 lux.

Notes: This species in Sipman (1983) states that having a brown or dark color apothecia and there is no pruina, whereas in the Sipman (1999) online identification key, it is written that this species has a pale brown to brownish and white pruina on the disc. The species found in the Cangar Forest are dark colored (dark green) and pruina is dark green.

***Pertusaria amara* (Ach.) Nyl.**

This lichen belongs to *Pertusariaceae* family. **Thallus** grayish white, irregularly shaped, thick and delimited, it has white soredia and soralia, very bitter taste of the soralia; **chemistry:** baeomycesic acid, 4-0-methylphysodic acid and acetylportentol;

Chemical test in medulla are C-, K-, P+red.

Habitat and ecology: In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18°-18,5°C, humidity is about 83%, and light intensity is about 1050-11650 lux.

***Pertusaria corallina* (L.) Arn.**

This lichen belongs to *Pertusariaceae* family. **Thallus** white to pale gray, irregularly shaped, thick, warted, it has white isidia; **chemistry:** fumarprotocetraric acid, pseudo-norrangiformic acid, hiassic acid, and acetylportentol; **Chemical test** in medulla are C-, K-, P-. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18,5°-19°C, humidity is about 83-85%, and light intensity is about 1050-1150 lux.

Notes: This species was found in the stone (Dobson, 1992).

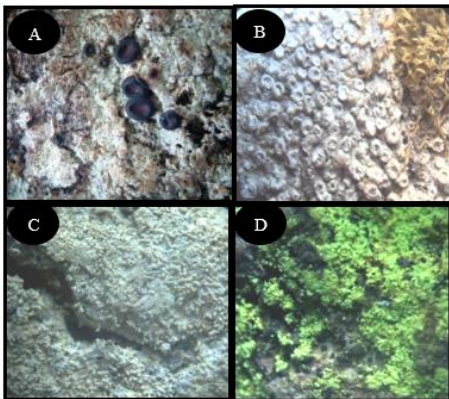


Figure 6. Thallus. A. *M. cf. sulphurata*; B. *P. amara*, C. *P. corallina*, D. *Pertusaria* sp.

***Pertusaria* sp.**

This lichen belongs to *Pertusariaceae* family. **Thallus** gray, irregularly shaped, thick, warted, it has green soredia and isidia; **chemistry:** dissectic acid with atranorin, thamnolic acid with decarboxythamnolic acid, atranorin, barbatic acid, and acetylportentol; **Chemical test** in medulla are C-, K+red, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1780 dpl, temperature is about 17,5°-19°C, humidity is about 85-98%, and light intensity is about 600-1150 lux.

***Pachyphiale carneola* (Ach.) Arnold**

This lichen belongs to *Gyalectaceae* family. **Thallus** dull green, thin, irregularly shaped, smooth, epruinose; **chemistry:** 4-0-methylphysodic acid, baeomycesic acid, lichesterinic acid, retigeric acid, and acetylportentol; **apothecia** lecidine, scattered, sessile, orbicular to oblong and irregularly shaped, margins with reddish brown, disc with reddish brown, up to 2 mm diam; **spores** 2-40 in each ascus, multiseptate, fusiform shaped, colourless, 6-8 x 0,5 µm; **Chemical test** in medulla are C+yellow, K+yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18°C, humidity is about 75-83%, and light intensity is about 1650-1700 lux.

***Pachyphiale* sp.**

This lichen belongs to *Gyalectaceae* family. **Thallus** dull green, thin, irregularly shaped, smooth, it has reddish yellow soredia; **chemistry:** 4-0-methylphysodic acid, acetylportentol, lichesterinic acid, baemycesic acid, and retigeric acid; **apothecia** lecidine, scattered, sessile, orbicular to oblong and irregularly shaped, margins with brownish black, disc with brown, up to 1,2 mm diam; **spores** one in each ascus, multiseptate, fusiform shaped, colourless, 5-6 x 0,5 μm ; **Chemical test** in medulla are C-, K-, P-; **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1780 dpl, temperature is about 17,5°-18,5°C, humidity is about 75-98%, and light intensity is about 600-1700 lux.

***Lepraria* sp.**

This lichen belongs to *Stereocaulaceae* family. **Thallus** grayish white, irregularly shaped, thin, pruinose, it has white soredia and reddish yellow isidia; **chemistry:** 4-0-methylphysodic acid, obtusatic acid, diffractaic acid, and acetylportentol; **Chemical test** in medulla are C+yellow, K+red, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1730 dpl, temperature is about 16°-19°C, humidity is about 85-98%, and light intensity is about 475-1150 lux.

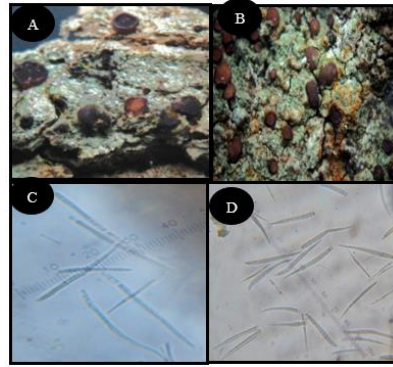


Figure 7. **Thallus.** A. *Pachyphiale carneola*; B. *Pachyphiale* sp.; **Spores.** C. *P. carneola*, D. *Pachyphiale* sp.

***Phlyctis agelaea* (Ach.) Fw.**

This lichen belongs to *Phlyctidaceae* family. **Thallus** gray, thin, cracked or warted, irregularly shaped; **chemistry:** fumarprotocetraric acid, obtusatic acid, acetylportentol, and bellidiflorin; **apothecia** lecanorine, scattered, sessile, orbicular to oblong and irregularly shaped, margins with reddish orange, disc with green, green pruinose, up to 1,5 mm diam; **spores** >2 in each ascus, muriform, colourless, 4-7x 1-2 μm ; **Chemical test** in medulla are C+yellow, K+reddish yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18,5°-19°C, humidity is about 83-85%, and light intensity is about 1050-1150 lux.

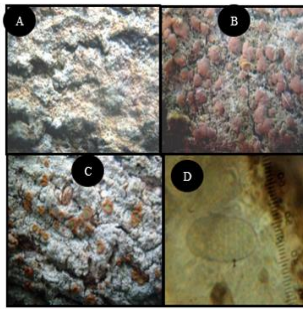


Figure 8. **Thallus.** A. *Lepraria* sp.; B. *Lecania cyrtella*; C. *Phlyctis agelaea*; **Spores.** D. *Phlyctis agelaea*

***Lecanora carpinea* (L.) Vain.**

This lichen belongs to *Lecanoraceae* family. **Thallus** grayish green, thin, smooth or warty, irregularly shaped; **chemistry:** 4-0-methylphysodic acid, baeomycesic acid and acetylportentol; **apothecia** lecanorine, scattered, sessile or adnate, roundish to irregularly shaped, margins with brownish gray, disc with pale black, reddish green pruinose, up to 2 mm diam; **spores** 4-9 in each ascus, simple, colourless, 1x1 µm; **Chemical test** in medulla are C+yellow, K+yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18°C, humidity is about 75%, and light intensity is about 1700 lux.

***Lecania cyrtella* (Ach.) Th. Fr.**

This lichen belongs to *Ramalinaceae* family. **Thallus** grayish green, thin, smooth, not strongly attached on substrate, pruinose, irregularly shaped; **chemistry:** baeomycesic acid, roccellaric acid, pseudo-norrangiformic

acid and acetylportentol; **apothecia** lecanorine, scattered, sessile, roundish to irregularly shaped, margins and disc with brown, thalline margin which usually becomes excluded as the apothecia mature and become convex, up to 2 mm diam; **Chemical test** in medulla are C-, K-, P-. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 18°C, humidity is about 75%, and light intensity is about 1700 lux.

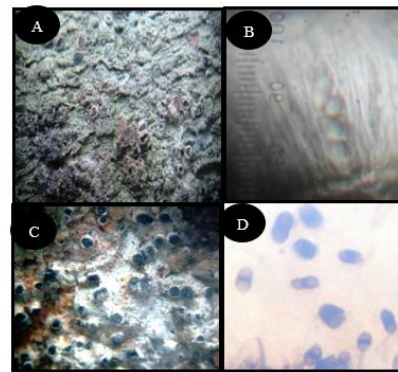


Figure 9. **Thallus.** A. *Lecanora carpinea*; C. *Cyphellium inquinans*; **Spores,** C. *L. carpinea*; D. *C. Inquinans*

***Cyphellium inquinans* (Sm.) Trev.**

This lichen belongs to *Caliceaceae* family. **Thallus** gray to reddish yellow, thin, warty, irregularly shaped, it has white and orange soredia; **chemistry:** norstictic acid, alectorialic acid and pseudo-norrangiformic acid; **apothecia** lecanorine, scattered, innate or sessile, roundish to irregularly shaped, margins with grayish white, disc with black, black pruinose, up to 1 mm diam; **spores** one septate, septate with black, brown, 1-3x 1 µm; **Chemical test** in medulla are C+yellow,

K+yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640-1800 dpl, temperature is about 16°-19°C, humidity is about 75-98%, and light intensity is about 450-1650 lux.

Unidentified

Thallus grayish white, thin, warted, irregularly shaped; **chemistry:** fumarprotocetraric acid, dissectic acid with atranorin, roccellaric acid, pseudo-norrangiformic acid, and acetylportentol; **Chemical test** in medulla are C+yellow, K+yellow, P+red. **Habitat and ecology:** In forest, this species was found on old and cracked bark, at altitudes ranging from 1640 dpl, temperature is about 19°C, humidity is about 85%, and light intensity is about 1150 lux.

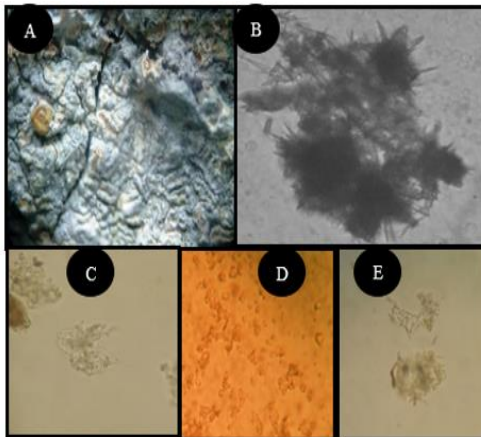


Figure 10. **Thallus.** A. *Unidentified*, B. *Fumarprotocetraric acid*, C. *Pseudo-norrangiformic acid*, D. *Acetylportentol*, E. *Roccellaric acid*

CONCLUSION

In conclusion, new record of crustose lichen was collected for the first time in east java, which was discussed in this study. Twenty species of crustose lichens have been found and the family Graphidaceae is the most common with 8 species being identified. This research also found the new record species of *Megalospora kalbii* in Java. The results of this study are expected to be the basis for further lichen research and studies of the diversity of crustose lichen in other areas. All species were identified based on morphological, anatomical and chemical characteristics.

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