RESEARCH ARTICLE

Mycobiology 40(3) : 147-150 (2012)
http://dx.doi.org/10.5941/MYCO.2012.40.3.147

pISSN 1229-8093
eISSN 2092-9323

Three New Records of Lichen Genera *Opegrapha* and *Phaeographis* from the Republic of Korea

Santosh Joshi, Udeni Jayalal, Soon Ok Oh and Jae-Seoun Hur*

Korean Lichen Research Institute, Sunchon National University, Suncheon 540-950, Korea

(Received June 27, 2012. Revised July 29, 2012. Accepted August 6, 2012)

This paper provides a description of *Opegrapha herbarum*, *Opegrapha viridis* and *Phaeographis subdividens*, all newly identified in the Republic of Korea. The characteristic features of *O. herbarum* include *Varia*-type asci, *Subelevata*-type ascospores, a lack of secondary metabolites and a saxicolous habitat. *O. viridis* possesses *Calcarea*-type asci, *Vulgata*-type ascospores and no chemicals in the thallus. *P. subdividens* is recognizable by its curved to sinuous lirellae, divergent labia, a brown and uniformly thick proper exciple which is open at its base, 3~4-septate ascospores, and lack of secondary metabolites. All three taxa are now reported to exist on Bogil Island in the Republic of Korea.

KEYWORDS : Bogil Island, Graphidaceae, Lichen, Morphology, New records, Roccellaceae

Introduction

Continuous field excursions have resulted in the identification and documentation of several interesting Korean lichen taxa. Recent studies [1-3] have added numerous remarkable lichen species to the known lichen flora existing in the Korea. The diverse remaining unidentified lichen material preserved within the herbarium at the Lichen and Allied Bioresource Center of the Korean Lichen Research Institute (KoLRI), as well as the approximately 3,000 large and small islands which circumscribe the country whose lichen population have yet to be assessed, provides a vast opportunity for lichen taxonomists. Regardless of the future investigative work to be done, certain cursory collections were made from Bogil and Jeju islands that resulted in the identification of numerous notable species in Korea.

The present study provides identification of three species reported for the first time to exist in the Republic of Korea, two belonging to the genus *Opegrapha* and one in the genus *Phaeographis*. The genus *Opegrapha* Ach. (Roccellaceae) is superficially similar to *Graphis* Adans. but differs by having branched and anastomosing paraphyses, I– ascospores with cylindrical lumina, and distinct perispore. *Phaeographis* Müll. Arg. (Graphidaceae) differs from that of *Graphis* by having uncarbonized, brown proper exciple, a clear hymenium, and trans-septate, brownish, I– ascospores [4-8].

The newly reported species located in Korea include: *Opegrapha herbarum*, *Opegrapha viridis* and *Phaeographis subdividens*, and are described in brief.

Materials and Methods

Standard microscopic techniques were used to identify the taxa of the collected samples up to species level. Morphological features were evaluated under an SMZ-168 dissecting microscope (Nikon, Tokyo, Japan) while hand cut thin sections of the thallus and apothecia, mounted in tap water, were observed using an Olypmus BX50 microscope (Olympus, Tokyo, Japan). All measurements were made prior to the application of potassium hydroxide (K). Lactophenol blue solution was used to enhance the clarity of ascospores, ascus and paraphyses, whereas the amyloidity of the epihymenium, hymenium, ascus and ascospores were evaluated using Lugol's solution. For producing the spot color reaction, 10% potassium hydroxide (K), paraphenylenediamine (PD) and calcium hypochlorite (C) were applied to the thallus, medulla, and sections of the apothecia. Thin layer chromatography (TLC) was performed using solvent systems C (toluene : acetic acid = 85 : 15) and A (toluene : 1, 4-dioxane : acetic

*Corresponding author <E-mail : jshur1@sunchon.ac.kr>

acid = 180 : 60 : 8) in order to detect any secondary metabolites [9-11].

Results and Discussion

Taxonomic description of the species.

***Opegrapha herbarum* Mont. (Fig. 1A~C)**

Guillem. Arch. Bot. 2: 302 (1833).

Description: The thallus saxicolous is ± epilithic, thin, sometimes inconspicuous or immersed, smooth and continuous, and primose to ash-gray or dull olive-green; the medulla is indistinct. Ascomata apothecioid are numerous, sessile, small lirellate, mostly scattered, simple or infrequently branched and 0.5~1 × 0.15~0.3 mm. Disc is slit like, becoming exposed in late maturity, black, and epruinose to scarcely pruinose. The thalline exciple is absent to basal. The proper exciple is closed, dark brown to blackish and 4~50 μm thick. The epihymenium is brown to reddish brown and up to 10 μm high. The hymenium hyaline is clear, 50~75 μm high and I+ reddish. The hypothecium is pale brown to reddish brown, 20~25 μm high and I+ reddish. The paraphysis is up to 1.5 μm thick. The asci are 8-spored, claviform (*Varia*-type), 50~60 × 12~15 μm and I+ reddish. The ascospores are ellipsoidal to fusiform, transversely 3-septate, straight or occasionally curved, colorless but becoming ± reddish brown when over-mature, the wall is not swollen at the septa (*Subelevata*-type), 17~25 × 4~7 μm, and the perispore is 0.5~1.5 (~1.9) μm wide and I–.

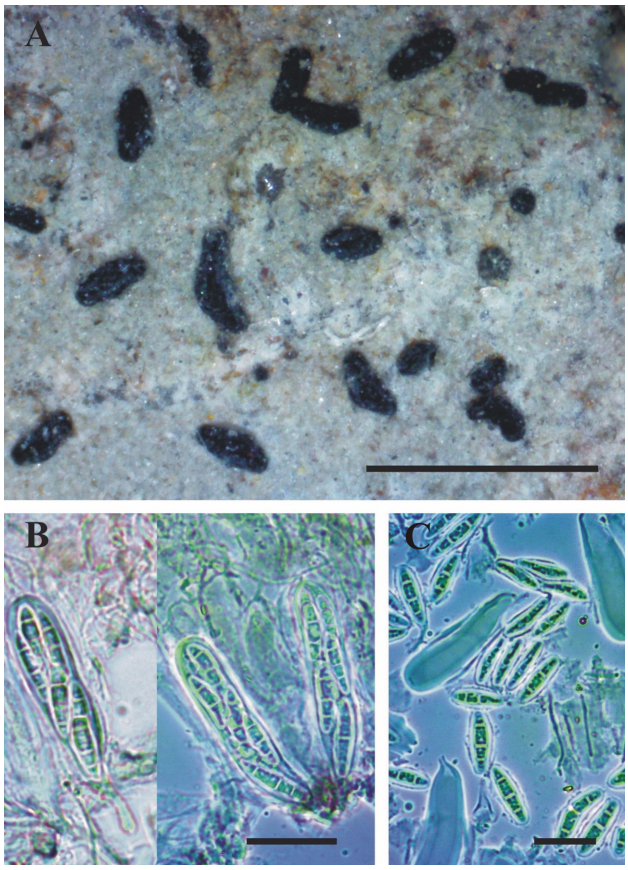

Fig. 1. *Opegrapha herbarum* Mont. A, Habit; B, Ascus with ascospores; C, Ascospores (scale bars: A = 2 mm, B, C = 20 μm).

Chemistry: The thallus is K–, PD–, C–, and KC–; secondary metabolites were not detected using TLC.

Habitat and geographical distribution: The species inhabited rocks, acidic to basic ± smooth bark and dead herbs. It has a wide distribution in the Northern Hemisphere, including Europe, Australia and the Sonoran Desert [4]. It was observed growing on rock and reported from Jeonnam Province, Shinan County, Bogil Island in South Korea at an altitude of c. 2 m.

Remarks: Our specimen description fits well to that of *O. herbarum* except for the presence of green pruina on the apothecial disc which is infrequently observed in this species. In addition, most of the apothecia of the specimens were concealed except a few with exposed discs. Occasionally, scattered crystals were observed on the open discs. Similar saxicolous *Opegrapha brattiae* Egea & Ertz differ from *O. herbarum* in several respects. It has a C+ reddish thallus, a *Vulgata*-type ascus, *Calcarea*-type ascospores, and erythrin and lecanoric acid as thallus compounds [4].

Location of specimen examined: Jeollanum-do, Wando-gun, Bogil-myeon, Bogil Island, N 34°09'29.2", E 126°34'7.21", alt c. 2 m, growing on rocks as observed by X. Y. Wang and J. A. Ryu, 110590 (KoLRI).

***Opegrapha viridis* (Ach.) Nyl. (Fig. 2A and 2B)**

Syn. Meth. Lich. (Lund): 73 (1814).

Description: The thallus typically appears in small patches, is corticolous, epiphloeodal, thin, evanescent, ± smooth, pale green to greenish or dull to ± brownish, and up to 60 μm thick; the medulla is indistinct. The ascomata are apothecioid, numerous and mostly scattered, sessile, small lirellate or ± round, simple or infrequently branched, and 0.5~1 × 0.15~0.2 mm. The disc is slit like, black, epruinose and becomes exposed in late maturity. The thalline exciple is absent to basal. The proper exciple is closed, convergent, dark brown to black, complete, and 70~90 μm thick. The epihymenium is thin, hyaline to pale, and rather indistinct. The hymenium hyaline is clear, 70~80 μm high and I+ reddish. The hypothecium is indistinct to 24 μm high and I+ reddish. The paraphysis is up to 1.5 μm thick. The asci are 8-spored, clavate-subglobose (*Calcaria*-type), ± parallel, 45~56 × 15~18 μm and I+ reddish. The ascospores are elongate, fusiform, possess acute ends, are transversely 11-septate (*Vulgata*-type), straight ± curved, colorless, become ±reddish brown when over-mature, (33~) 40~45 × 5~6 μm, and possess perispore up to 2 μm wide which are I– or pale.

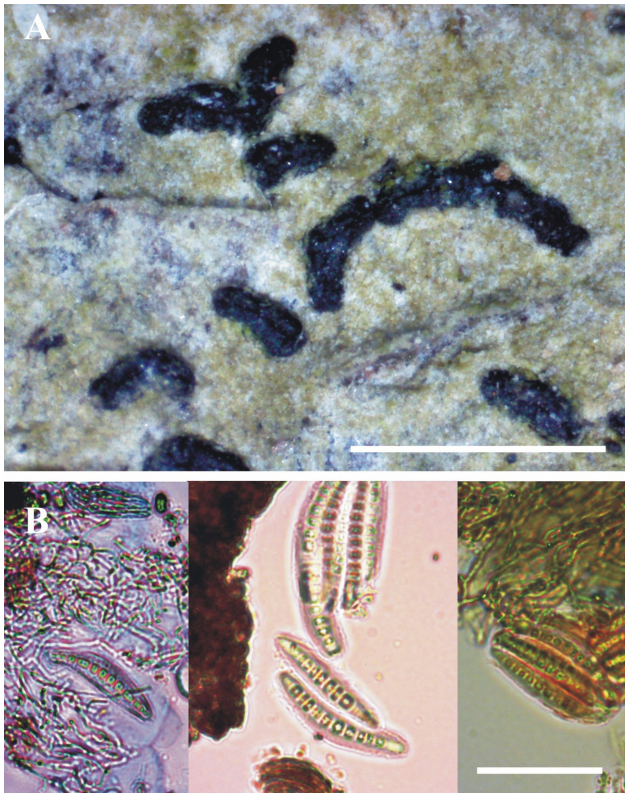

Fig. 2. *Opegrapha viridis* (Ach.) Nyl. A, Habit; B, Ascospores (scale bars: A = 1 mm, B = 40 μm).

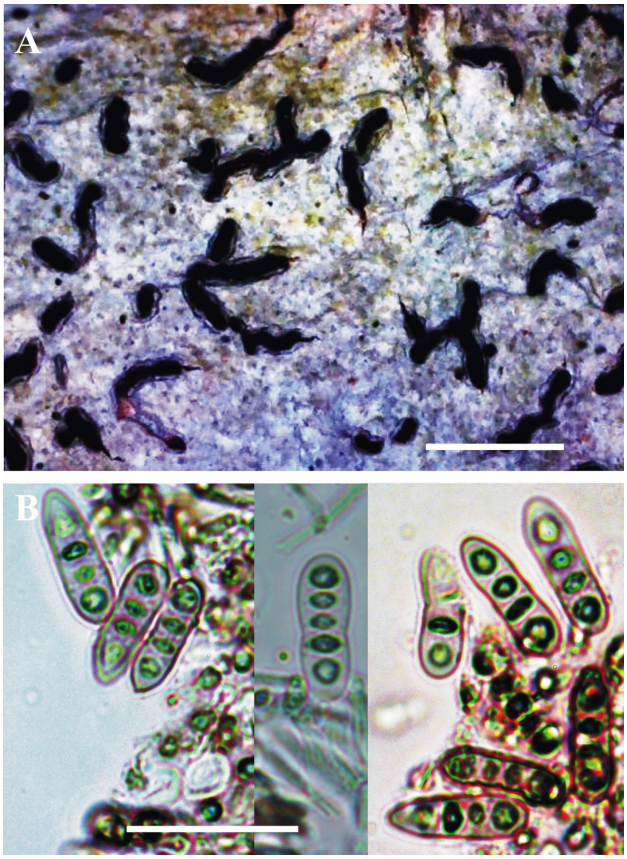

Fig. 3. *Phaeographis subdividens* (Leight.) Müll. Arg. A, Habit; B, Ascospores (scale bars: A = 1.5 mm, B = 20 μm).

Chemistry: The thallus is K–, PD–, C–, and KC–; secondary metabolites were not detected using TLC.

Habitat and geographical distribution: The species is known to exist in S. W. England, W. Scotland, S. W. Ireland, Sweden, France, Germany, North America, Tasmania, and India [5, 8]. In South Korea it is commonly distributed on tree barks in the Gyeokja mountain forests of Bogil Island at an altitude of c. 128 m.

Remarks: *Opegrapha prosodea* Ach. appears similar to *O. viridis* but differs in having larger, more extended and coarser lirellae. The other closely related *O. sorediifera* P. James, differs as appearing sorediate with C+ orange-pink soralia.

Location of specimen examined: Jeollanam-do, Wando-gun, Bogil-myeon, Bogil Island, Mt. Gyeokja, N 34°08'6.36", E 126°33'0.86", alt c.128 m, growing on bark as observed by Y. Joshi, H. S. Jeon and M. H. Jeon, 100032 (KoLRI).

***Phaeographis subdividens* (Leight.) Müll. Arg. (Fig. 3A and 3B)**

Flora 65: 383 (1882).

Description: The thallus appears mostly in small patches and is corticolous, epiphloeodal, thin, off-white, green to pale-green, pale-grey, ± glossy to matt and 60~85 μm thick; the medulla is indistinct to thin and whitish. The ascomata are apothecioid, numerous, lirellate, and emergent to semi immersed; the lirellae are short, simple to branched, curved or sinuous, mostly appear with acute ends, and are up to 1.5 mm long; the labia are divergent, entire, brownish and thin; the discs are open, ± concave, dark brown to blackish, and epruinose. The thalline margin is persistent, ± completely covered by labia, and up to 60 μm thick. The proper exciple is open, entire, thin, uniform throughout, brown to dark brown at the tips, and 21~24 μm. The epihymenium is dark, brownish, ± granular, crystalline, I– and 9~10 μm high. The hymenimum is hyaline, clear, 75~85 μm high, and the subhymenium is hyaline to ± pale, I– and 25~30 μm high. The asci are clavate, 8-spored, 55~75 μm and I–. The ascospores are light brown and may darken with age, elongate-ellipsoidal, thick walled, possess 3~4 transverse septa, are 18~22 (~24) × 6~8 μm and I–.

Chemistry: The thallus is K+ reddish, PD–, C–, and KC–; secondary metabolites were not detected using TLC.

Habitat and geographical distribution: The species most commonly grows on bark and is found in India, Sri Lanka, the Solomon Islands, and Australia [7]. In South Korea, it was observed on Bogil Island at an altitude of c.

69 m.

Remarks: *Phaeographis subdividens* closely resembles *P. intricans* (Nyl.) Staiger but is distinguished by its lack of chemical compounds. Another similar species, *P. angulosa* Müll Arg. has somewhat larger ascospores which reach up to 40 μm and with greater trans-septation [12].

Location of specimen examined: Jeollanam-do, Wando-gun, Bogil-myeon, Bogil Island, Mt. Gyeokja, N 34°08'6.91", E 126°32'8.71", alt c. 69 m, growing on bark by Y. Joshi, H. S. Jeon and M. H. Jeon, 100023 (KoLRI).

Acknowledgements

This work was supported by a grant from the Korea National Research Resource Center Program and the Korean Forest Service Program (KNA 2012) through the Korea National Arboretum.

References

1. Hur JS, Koh YJ, Harada H. A checklist of Korean lichens. Lichenology 2005;4:65-95.
2. Joshi Y, Nguyen TT, Wang XY, Lõkös L, Koh YJ, Hur JS. Contribution to the lichen mycota of South Korea. Mycotaxon 2011;116:61-74.
3. Wang XY, Joshi Y, Hur JS. The genus *Cladonia* (lichenized Ascomycota, Cladoniaceae) in South Korea. Myotaxon 2011; 117:405-22.
4. Ertz D, Egea JM. *Opegrapha*. In: Nash TH 3rd, Rayan BD, Gries C, Bungartz F, editors. Lichen flora of the Greater Sonoran Desert Region: most of the microlichens, balance of the macrolichens, and the lichenicolous fungi. Vol. 2. Tempe: Lichens Unlimited, Arizona State University; 2004. p. 255-66.
5. Awasthi DD. A key to the microlichens of India, Nepal and Sri Lanka. Bibl Lichenol 1991;40:1-337.
6. Staiger B. Die Flechtenfamilie Graphidaceae. Bibl Lichenol 2002;85:1-526.
7. Archer AW. Graphidaceae. In: McCarthy PM, editor. Flora of Australia. Vol. 5. Canberra and Melbourne: ABRS and CSIRO Publishing; 2009. p. 84-194.
8. Smith CW, Aptroot A, Coppins BJ, Fletcher A, Gilbert OL, James PW, Wolseley PA. The lichens of Great Britain and Ireland. London: The Lichens of Great British Lichen Society; 2009.
9. Orange A, James PW, White FJ. Microchemical methods for the identification of lichens. 2nd ed. London: British Lichen Society; 2010.
10. Culberson CF. Improved conditions and new data for the identification of lichen products by a standardized thin-layer chromatographic method. J Chromatogr 1972;72:113-25.
11. White FJ, James PW. A new guide to microchemical techniques for the identification of lichen substances. Br Lichen Soc Bull 1985;57(Suppl):1-41.
12. Singh KP, Awasthi DD. Lichen genus *Phaeographis* from India and Sri Lanka. Bull Bot Serv India 1979;21:97-120.