Leiorreuma exaltatum and *Trapelia coarctata*, New to Korean Lichen Flora

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Abstract The present account briefly describes two crustose lichen species new to South Korea. Detailed taxonomic descriptions of *Leiorreuma exaltatum* and *Trapelia coarctata*, supported by distribution, ecology and illustrations, are provided. Both species were collected from warm-temperate, humid forests of Jeju Island.

Keywords Graphidaceae, New records, Saxicolous, Trapeliaceae

A recent survey of Jeju Island in South Korea revealed the occurrence of several noteworthy lichen taxa. The complex topography, prolonged humid conditions and warm-temperate climate of the island supports the most diverse lichen flora of Korea. However, there is little information available regarding the current occurrence of lichens in Jeju; therefore, it is necessary to identify and enumerate lichen taxa and develop a baseline list of lichen flora from the island, which further supplements the current species list for Korean lichens [1, 2]. In this study, two added records of *Leiorreuma* Eschw. (Ostropales: Graphidaceae) and *Trapelia* M. Choisy (Lecanorales: Trapeliaceae) are reported for the first time from Jeju Island in Korea. The genus *Leiorreuma* comprises species having an off-white to pale olive-green, smooth, dull thallus, conspicuous, sessile, lirellate ascomata with exposed, pruinose, black disc, laterally thin to basally wide, carbonized proper exciple, inspersed hymenium, 8-spored asci, hyaline to pale brown, elongate-ellipsoidal or cylindrical, transversely septate ascospores, and either stictic, hypostictic or norotatic

acids or no lichen compounds [3, 4]. *Trapelia* can be distinguished on the basis of a crustose, $\pm$ areolate thallus, biatorine thalline margin, colorless to slightly pigmented proper exciple, 8-spored asci, simple, hyaline ascospores, and the presence of gyrophoric or lecanoric acids as thallus compounds [5, 6].

The lichen specimens recently collected (June to July 2012) from Jeju Island, which have been preserved in the herbarium of the Lichen and Allied Bioresource Center, Korean Lichen Research Institute (KoLRI), were identified using standard microscopic techniques. The morphological and anatomical characteristics of the specimens were examined under a SMZ-168 dissecting microscope (Nikon, Tokyo, Japan) and Olympus BX 50 compound microscope (Olympus, Tokyo, Japan), respectively. The spot color reaction tests and thin layer chromatography (TLC) were performed using the methods described by Orange *et al.* [7]. The range of measurements for species anatomical characters are the minimum and maximum values recorded on thin, hand-cut thallus and ascomatal sections mounted on water. The photographs were taken using AxioCamERc 5c (Carl Zeiss, Jena, Germany) and plates were prepared in Coral Draw (ver. 12).

Leiorreuma exaltatum Fée (Fig. 1A and 1B).

Bibl. Lichenol. 85: 298 (2002).

Description. Thallus corticolous, epidermal, crustose, up to 600 μ m thick, hard, verrucose, continuous, dark green to olive green or gray green; cortex well developed, 30~75 μ m thick; algal layer continuous, well developed, up to 230 μ m thick; medulla distinctly white, mostly endoperidermal, up to 350 μ m thick. Vegetative propagules not seen. Ascomata apothecoid, numerous, sessile, small lirellate, mostly scattered, scarcely aggregate, simple or infrequently branched, 1.5~

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Fig. 1. *Leiorreuma exaltatum* Fée. A, Habit; B, Ascospores (scale bars: A = 2 mm, B = 20 μ m).

4 $\times$ 1~2 mm. Disc exposed, black, covered with white or grayish pruina. Thalline exciple distinct, 0.2~0.5 mm thick. Proper exciple completely carbonized, laterally 30~50 μ m to basally up to 150 μ m thick. Epihymenium distinct, brown, 7~15 μ m high. Hymenium hyaline, densely interspersed with oil droplets, 120~160 μ m high, I-. Subhymenium indistinct to absent. Paraphyses up to 2.5 μ m thick. Asci clavate, 8-spored, I-. Ascospores fusiform with round to subacute ends, colorless but becoming $\pm$ brown when over-mature, straight, transversely 8~10-septate, 26~43 $\times$ 7~8 μ m, halonate, I-; halo 2~6 μ m wide and predominate in immature ascospores.

Chemistry. Thallus K-, PD-, C-, KC-; secondary metabolites were not detected upon TLC (solvent system C).

Distribution and ecology. *Leiorreuma exaltatum* is distributed in the Neotropics, eastern Palaeotropics, the Pacific, New Zealand and Australia [4]. This corticolous species is widespread in the warm-temperate forests of Halla Mountain in Jeju Island of South Korea and was

collected at altitudes of c. 500~1,000 m.

Remarks. The reported specimens have diverse ascomatal morphology from round, scattered, unbranched lirellae to branched, aggregate, stellate lirellae with acute ends. The taxonomic description of *Leiorreuma exaltatum* (Mont. & v. d. Bosch) Staiger provided by Archer [4] revealed comparatively smaller (20~33 μ m) and up to six loculate ascospores. Nevertheless, the ascospore range of the examined material is more comparable to *L. yakushimensis* (M. Nakan.) M. Nakan. & Kashiw., but the wide distribution of *L. exaltatum* together with similarities in the thallus and apothecial morphology leads the investigated specimens to its current placement.

Specimens examined. Gwaneumsa Trail, Mt. Halla, Jeju-si, Jeju-do, on bark, 33°25'18.04" N, 126°32'58.09" E, alt. c. 577 m, 1 Jun 2012, Hur *et al.*, 120928, 120945 (KoLRI); on bark, 33°25'04.08" N, 126°32'52.01" E, alt. c. 619 m, 1 Jun 2012, Hur *et al.*, 120955, 120961, 120963 (KoLRI); on bark, 33°24'45.00" N, 126°32'55.01" E, alt. c. 702, 1 Jun 2012, Hur *et al.*, 120969 (KoLRI); on bark, 33°24'02.09" N, 126°32'26.00" E, alt. c. 851 m, 1 Jun 2012, Hur *et al.*, 121023, 121024 (KoLRI); Donnaeko Trail, Mt. Halla, Seogwipo-si, Jeju-do, on bark, 33°19'05.00" N, 126°34'10.06" E, alt. c. 646 m, 20 Jun 2012, Hur *et al.*, 121234 (KoLRI); on bark, 33°19'16.03" N, 126°33'21.03" E, alt. c. 957 m, 20 Jun 2012, Hur *et al.*, 121258 (KoLRI); on bark, alt. c. 700~1,000 m, 20 Jun 2012, Hur *et al.*, 121266, 121267 (KoLRI).

***Trapelia coarctata* (Turner ex Sm.) M. Choisy (Fig. 2A~2D).**

Bull. Soc. Sci. Nat. Maroc 12: 160 (1932).

Description. Thallus saxicolous, epilithic, crustose, 100~120 μ m thick, effuse, continuous to cracked, not effigurate, $\pm$ glossy, whitish gray, grayish green to greenish or slightly pinkish; epinecral layer of 6~10 μ m present; algal layer well developed, up to 100 μ m, photobiont a chlorococcoid; medulla indistinct to endolithic; prothallus white. Ascomata numerous, apothecioid, round, scattered to sometimes fused, up to 0.5 mm in diam. Disc red-brown, epruinose, up to 0.4 mm in diam. Margin biatorine, thin, pinkish to whitish, smooth to crenate, forming a halo-like rim around the ascospores mostly in the young stage, 20~40 μ m thick. Proper exciple thin, indistinct to 20 μ m thick. Epihymenium distinct, pale brown, 8~12 μ m high. Hymenium hyaline, clear, 100~120 μ m high, I-. Paraphysis simple, straight, apically anastomosing, 1~2 μ m thick. Hypothecium hyaline to pale, 100~160 μ m high, I-. Asci *Trapelia*-type, 8-spored, 90~115 $\times$ 15~25 μ m, I-. Ascospores oval or ellipsoidal, colorless, simple, 19~21 $\times$ 10~12 μ m, I-.

Chemistry. Thallus K-, PD-, C+ reddish or pink, KC-; gyrophoric acid chemosyndrome detected upon TLC

Fig. 2. *Trapelia coarctata* (Turner ex Sm.) M. Choisy. A, Habit; B, Ascospores; C, Cross section of ascomata; D, Ascus with ascospores (scale bars: A = 2 mm, B = 1 mm, C = 200 μ m, D = 50 μ m).

(solvent system C).

Distribution and ecology. This variable, saxicolous taxon is cosmopolitan in distribution and present in both northern and southern hemispheres [6]. In South Korea, it was collected from the smooth surface of volcanic rock of Jeju Island under humid conditions, where it was growing among mosses at an altitude of 600~700 m.

Remarks. *Trapelia glebulosa* (Sm.) J. R. Laundon and *T. placoidioides* Coppins & P. James resemble *Trapelia coarctata*

in possessing white to pinkish tinged thallus and similar ascomatal characteristics, but differ in that they lack effigurate, subsquamulose thallus and soralia, respectively.

Specimen examined. Jeju-si, Jeju-do, Gwaneum Temple, 33°25'29.4" N, 126°33'61.2" E, alt. c. 618 m, on rock, 7 July 2012, Hur *et al.*, 121540 (KoLRI).

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