

NEW *ASPICILIA* SPECIES FROM SOUTH KOREA PROVED BY MOLECULAR PHYLOGENY WITH A KEY TO THE EASTERN ASIAN *ASPICILIOID* LICHENS

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Abstract: Six species new for science, i.e. *Aspicilia pseudoabbasiana*, *A. pseudovulcanica*, *A. subepilypta*, *A. subgeographica*, *A. subgoettweigensis*, and *A. submamillata*, are described, illustrated and compared with closely related taxa. A new name *Aspicilia abbasiana* (for *Aspicilia volcanica*) and a new combination *Rimularia geumodoensis* (for *Aspicilia geumodoensis*) are proposed. *Aspicilia* cf. *pacifica*, *Buellia conioops*, *Circinaria contorta*, *C. leproscens*, *Lichenostigma bolacinae*, *Phaeospora peregrina*, and *Rosellinula frustulosae* are reported for the first time for Korea. A preliminary key to the identification of aspicilioid taxa in the Eastern Asian region is provided.

Key words: *Circinaria*, ITS nrDNA, molecular phylogeny, *Rimularia*

INTRODUCTION

Fourteen species of the genus *Aspicilia* were described by HUE (1912) from Korea based on the Urban Jean (Abbe) Faurie collections more than a century ago. Unfortunately, Hue's results were almost forgotten, and only recently some of his names were recorded in regional checklists (HUR *et al.* 2005, MOON 2013). A few species of the genus *Aspicilia* were also added during recent studies (APTROOT and MOON 2014, KONDRATYUK *et al.* 2016a, b). Totally 18 species of the genus *Aspicilia* have hitherto been recorded for the country.

The aim of this paper is to provide the first results of the taxonomic revision on the Korean representatives of the genus *Aspicilia*, which have already been proved by molecular study, and to provide a preliminary identification key of aspicilioid taxa in the Eastern Asian region. The revision of the Korean material is still in progress and other results will be published in another addition (see also KONDRATYUK *et al.* 2016b).

MATERIAL AND METHODS

More than 200 specimens previously identified on the generic level as *Aspicilia* and now deposited in the Korean Lichen Research Institute (KoLRI) (Sunchon, South Korea) were the basic material for our study, while herbarium specimens of BP, KW-L, and some other herbaria were included in comparative studies.

Procedures of extracting, sequencing, and phylogenetic analysis are described in our previous papers (KONDRATYUK *et al.* 2015*a, b, c, d*). Specimens included in the phylogenetic analysis based on ITS nr DNA sequences are listed with GenBank accession numbers in Table 1.

Table 1. Specimens included in analysis with GenBank accession numbers.

Name of species	Voucher/Publication	GenBank accession number	Country
<i>Aspicilia abbasiana</i>	ISMAYIL <i>et al.</i> (2015) as <i>A. volcanica</i>	KM609324	China
<i>Aspicilia blastidiosa</i>	PAUKOV <i>et al.</i> (2016)	KX129963	Russia
<i>Aspicilia cinerea</i>	130634 KoLRI, this paper	KY249596	South Korea
<i>Aspicilia cinerea</i>	090696 KoLRI, this paper	KY249597	South Korea
<i>Aspicilia cinerea</i>	Ismayil, unpubl.	KT443791	China
<i>Aspicilia cinerea</i>	NORDIN <i>et al.</i> (2007)	EU057899	Sweden
<i>Aspicilia cinerea</i>	ROUX <i>et al.</i> (2011)	JF710311	France
<i>Aspicilia goettweigensis</i>	PAUKOV <i>et al.</i> (2016)	KX159292	Russia
<i>Aspicilia goettweigensis</i>	PAUKOV <i>et al.</i> (2016)	KX159293	Russia
<i>Aspicilia goettweigensis</i>	PAUKOV <i>et al.</i> (2016)	KX159289	Russia
<i>Aspicilia pseudoabbasiana</i>	110218 KoLRI, this paper	KY249598	South Korea
<i>Aspicilia pseudoabbasiana</i>	140764 KoLRI – holotype, this paper	KY249599	South Korea
<i>Aspicilia pseudoabbasiana</i>	100188 KoLRI, this paper	KY249600	South Korea
<i>Aspicilia pseudovolcanica</i>	100584 KoLRI, this paper	KY249601	South Korea
<i>Aspicilia pseudovolcanica</i>	100698 KoLRI, this paper	KY249602	South Korea
<i>Aspicilia pseudovolcanica</i>	141375 KoLRI, this paper	KY249603	South Korea
<i>Aspicilia pseudovolcanica</i>	090722 KoLRI – holotype, this paper	KY249604	South Korea
<i>Aspicilia pseudovolcanica</i>	100574 KoLRI, this paper	KY249605	South Korea
<i>Aspicilia subdepressa</i>	ROUX <i>et al.</i> (2011)	JF703123	France
<i>Aspicilia subpiglypta</i>	100438 KoLRI, this paper	KY249606	South Korea
<i>Aspicilia subpiglypta</i>	100857 KoLRI, this paper	KY249607	South Korea
<i>Aspicilia subpiglypta</i>	110495 KoLRI – holotype, this paper	KY249608	South Korea

Table 1. (continued).

Name of species	Voucher/Publication	GenBank accession number	Country
<i>Aspicilia subgeographica</i>	110813 KoLRI, this paper	KY249609	South Korea
<i>Aspicilia subgeographica</i>	120356 KoLRI, this paper	KY249610	South Korea
<i>Aspicilia subgeographica</i>	130359 KoLRI – holotype, this paper	KY249611	South Korea
<i>Aspicilia subgeographica</i>	110673 KoLRI, this paper	KY249612	South Korea
<i>Aspicilia subgoettweigensis</i>	120188 KoLRI, this paper	KY249613	South Korea
<i>Aspicilia subgoettweigensis</i>	130234 KoLRI – holotype, this paper	KY249614	South Korea
<i>Aspicilia subgoettweigensis</i>	100588 KoLRI, this paper	KY249615	South Korea
<i>Aspicilia subgoettweigensis</i>	070103 KoLRI, this paper	KY249616	South Korea
<i>Aspicilia subgoettweigensis</i>	130489 KoLRI, this paper	KY249617	South Korea
<i>Aspicilia submamillata</i>	090631 KoLRI – holotype, this paper	KY249618	South Korea
<i>Aspicilia submamillata</i>	091073 KoLRI, this paper	KY249619	South Korea
<i>Aspicilia submamillata</i>	091096 KoLRI, this paper	KY249620	South Korea
<i>Aspicilia submamillata</i>	150737 KoLRI, this paper	KY249621	South Korea
<i>Circinaria contorta</i>	IVANOVA and HAFELLNER (2002)	AF332109	Austria
<i>Circinaria contorta</i>	IVANOVA and HAFELLNER (2002)	AF332108	Austria
<i>Circinaria contorta</i>	NORDIN <i>et al.</i> (2007)	EU057900	Sweden
<i>Circinaria contorta</i>	SCHMULL <i>et al.</i> (2011)	HQ650638	USA
<i>Rimularia badioatra</i>	RESL <i>et al.</i> (2015)	KR017116	Sweden
<i>Rimularia geumodoensis</i>	100632 KoLRI, this paper	KY249622	South Korea
<i>Rimularia geumodoensis</i>	160416 KoLRI – isotype, this paper	KY249623	South Korea
<i>Rimularia geumodoensis</i>	160406 KoLRI – holotype, this paper	KY249624	South Korea
<i>Rimularia geumodoensis</i>	090763 KoLRI, this paper	KY249625	South Korea
<i>Rimularia geumodoensis</i>	160418 KoLRI – isotype, this paper	KY249626	South Korea
<i>Rimularia geumodoensis</i>	161303 KoLRI, this paper	KY249627	South Korea
<i>Rimularia gibbosa</i>	RESL <i>et al.</i> (2015)	KR017107	USA
<i>Rimularia gibbosa</i>	RESL <i>et al.</i> (2015)	KR017111	USA
<i>Rimularia gibbosa</i>	RESL <i>et al.</i> (2015)	KR017129	Austria
<i>Rimularia intercedens</i>	RESL <i>et al.</i> (2015)	KR017119	Austria
<i>Rimularia intercedens</i>	RESL <i>et al.</i> (2015)	KR017134	Sweden
<i>Rimularia limborina</i>	SPRIBILLE <i>et al.</i> (2014)	KJ462273	USA
<i>Rimularia limborina</i>	RESL <i>et al.</i> (2015)	KR017108	Norway

RESULTS AND DISCUSSION

Taxa characterised by unique complex of morphological and anatomical characters, and taxa found to have support from molecular data after phylogenetic analysis based on ITS nrDNA sequences, as well as taxa for which we were not able to find proper existing names are described below. *Aspicilia cinerea* (L.) Körb. previously reported from South Korea is confirmed by molecular data for the first time.

Description of taxa

Aspicilia pseudoabbasiana S. Y. Kondr., L. Lökös et J.-S. Hur, *sp. nov.*
(Fig. 1)

MycoBank nr.: MB 819350.

Similar to *Aspicilia abbasiana*, but differs in having narrower ascospores.

Type: Republic of Korea. Jeju-do, Jeju-si, Chuja-do, Chuja-myeon, Yecho-ri, Mt Dondae, on rock, growing together with *Buellia* cf. *spuria*, *Lecanora oreinoides*, and *Caloplaca subconcilians*. Lat.: 33° 56' 53.9" N, Long.: 126° 19' 26.7" E, Alt.: ca 164 m a.s.l. Leg.: Joshi, Y. and So, J. E. (140764), 20.06.2014 (holotype: KoLRI 023239).

Thallus to 3(–5) cm diam., but may form larger aggregations, dark grey or lead-grey to dark lead-grey, areolate, somewhat shiny, while upper surface dull; areolae (0.5–)0.7–1.5 mm diam./across, very irregular; rather thick, to 0.35–0.4 (–0.5) mm thick in section, somewhat scattered in peripheral zone; cortical layer to 15–20 µm thick, upper portion more or less brownish or greyish, paraplectenchymatous, cell lumina to 5–7 µm across, K–, with epinecral zone to 10 µm thick (better seen in K); algal zone K+ yellow, reaction rather weak; algal cells ca 10–16(–22) µm diam.; medulla I–. Hypothallus not observed.

Apothecia (0.4–)0.5–1(–1.2) mm diam./across and to 0.25–0.3(–0.4) mm thick in section, lecanorine, 1–2(–3) per areole, disc immersed into thallus, black, thalline margin well developed, often thickened and highly uplifted above disc level; hymenium to (100–)110–140 µm high; epihymenium dull greenish, K– becoming lighter and brownish, N+ distinctly bluish/greenish; subhymenium to 60–70 µm thick, hyaline or sometimes dull yellow, with oil droplets; asci 8-spored; ascospores hyaline, simple, widely ellipsoid to widely fusiform with more or less attenuated ends, (15–)17–22(–27) × (6.5–)8–12(–14) µm; conidiomata to (60–)90–130 µm diam., and to 200 µm high; conidia cylindrical, straight, long and narrow, 13–17(–19) × 0.7–0.8 µm.

Chemistry: Thallus K⁻ or K⁺ yellow, medulla K⁺ yellow. Containing stictic acid (HPLC).

Ecology: Growing on siliceous rocks of coastal zone.

Distribution: So far known from scattered localities of South Korea.

Etyymology: It is named after its similarities with the species *Aspicilia abbasiana* S. Y. Kondr., L. Lőkös, Ismayil et Guo.

Taxonomic notes: *Aspicilia pseudoabbasiana* is similar to *A. abbasiana*, but differs in having narrower ascospores.

Aspicilia pseudoabbasiana is similar to *A. adamanticola* Hue, but differs in having dark thallus (vs. light grey), and in having narrower ascospores ((15–)17–22(–27) × (6.5–)8–12(–14) μm vs. 16–22 × 12–14 μm).

The other taxa differ in having different measurements of ascospores as well as in having medulla K⁺ yellowish reaction and in containing norstictic acid.

Aspicilia pseudoabbasiana is similar to *A. tofacea* Hue, but differs in having dark thallus (vs. whitish grey or white), in having larger thalline areolae (0.7–1.5 mm vs. 0.3–0.6 mm across), in having larger apothecia (0.5–1 mm vs. 0.2–0.3 mm diam.) and in having medulla K⁺ yellow, while ascospores are almost the same ((15–)17–22(–27) × (6.5–)8–12(–14) μm vs. 13–24 × 10–12 μm).

Aspicilia pseudoabbasiana is similar to *A. arizonica* Owe-Larss. et A. Nordin, recently described from North America, but differs in having lower hymenium (110–140 μm vs. (130–)150–200 μm), in having narrower ascospores ((15–)17–22(–27) × (6.5–)8–12(–14) μm vs. (15–)19–26(–29) × (9–)11–16(–21) μm), as well as in the lack of norstictic (major) and connorstictic (trace) acids. Unfortunately data on ITS sequences of *A. arizonica* (specimens Owe-Larsson 8763 and Owe-Larsson 8762) are still unavailable for wide access, while authors (LARSSON *et al.* 2004) have mentioned only similarities of *A. arizonica* and *A. knudsenii*, and no Hue's taxa or any Eastern Asian taxa were included in the comparison.

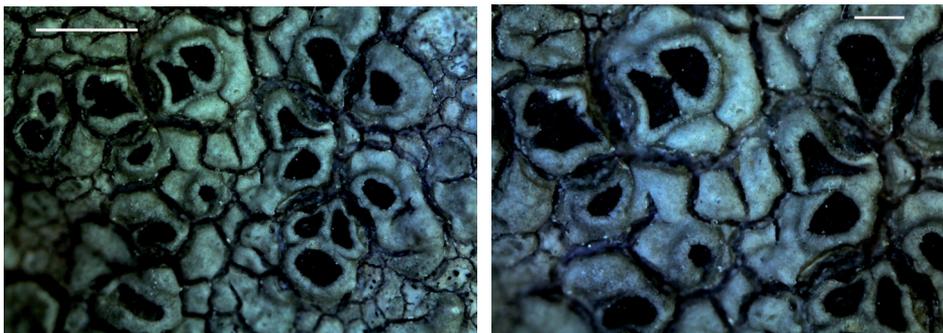


Fig. 1. *Aspicilia pseudoabbasiana* (holotype, KoLRI 018579), general habit (left) and enlarged portion with apothecia (right). Scale 1 mm (left) and 0.5 mm (right). (Photo: S. Y. Kondratyuk).

Additional specimens examined: Republic of Korea. Gyeongnam-do Prov., Namhae-gun County, seaside, on rock. Lat.: 34° 48' 51.18" N, Long.: 127° 49' 41.88" E, Alt.: ca 2 m a.s.l. Leg.: Wang, X. Y. and Ryu, J. A. (110218), 28.04.2011 (KoLRI 013432). – Jeollanam-do, Wando-gun, Bogil myeon, Bogil-do Island, Tong-ri, near Tongri Beach, on rock, growing together with *Buellia* cf. *coniops* (Ach.) Th. Fr.*, and *Acarospora* sp. Lat.: 34° 9' 28.05" N, Long.: 126° 35' 9.00" E, Alt.: ca 3 m a.s.l. Leg.: Joshi, Y., Jeon, H. S. and Jeong, M.-H. (100188), 06.02.2010 (KoLRI 011688 sub *Aspicilia*).

Aspicilia pseudovulcanica S. Y. Kondr., L. Lökös et J.-S. Hur, *sp. nov.*
(Fig. 2)

Mycobank nr.: MB 819351.

Similar to *Aspicilia vulcanica*, but differs in having larger apothecia and wider ascospores.

Type: Republic of Korea. Gangwon-do, Hongcheon-gun, Nae-myeon, Mt Eungbok, Tongbaram Valley, on rock. Lat.: 37° 51' 41.5" N, Long.: 128° 31' 31.3" E, Alt.: ca 705 m a.s.l. Leg.: Joshi, Y., Wang, X. Y. and Ryu, J. A. (090722), 23.05.2009 (holotype: KoLRI 010391).

Thallus 5–10 cm diam., areolate or only slightly cracked to continuous, very thin, to 0.15(–0.3) mm thick in section, whitish grey or light grey; areolae 0.5–1.5 (–2) mm diam./across; in section thallus to 150–200(–270) µm thick, cortical layer to 20–25 µm thick, hyaline in upper portion, paraplectenchymatous, cell lumina 7–8 µm diam./across; algal layer K+ yellow (if section rather thick), or weakly yellow (in thin section sometimes hardly observed), algal cells ca 14–20(–25) µm diam.; medulla I–; lower portion of thallus (medulla below of algal zone) with numerous crystals not dissolving in K. Hypothecium well developed, black, to 0.5–0.8 mm wide in peripheral zone as entire circle around thallus.

Apothecia 0.5–0.9 mm diam./across and to 0.13(–0.3) mm thick in section, aspicilioid, immersed, disc concave seems to have white pruina, whitish blackish while at larger magnification greyish or greyish black; thalline edge somewhat hanging above deeply concave disc (seems to be thelotrematoid-like apothecium), often white and well contrasting to grey thallus; in section seems to be lecanorine; true exciple to 25–30 µm wide in lateral portion; hymenium to (80–)110–130 µm tall, often with oil droplets to 8 µm diam.; epihymenium dirty greenish brown, K– becoming lighter and brownish, N+ bluish/greenish; subhymenium to 40–50 µm thick, with oil droplets to 5–8 µm diam. or often in irregular aggregations; paraphyses to 5–6 µm wide towards the tips, brownish and moniliform; asci 8-spored; ascospores hyaline, simple, widely ellipsoid, 18–

* *Buellia coniops* is reported for the first time from Korea.

23(–25) × (9–)10–12(–14) μm, if spherical to 12(–15) μm diam. Conidiomata and conidia not seen.

Chemistry: Epithemium K– brown (green shade disappearing), N– or intensifying green, sometimes N+ bluish green. Containing stictic acid (HPLC).

Ecology: Growing on siliceous rocks, from coastal zone to high localities in mountains.

Distribution: So far known from scattered localities of South Korea.

Etymology: It is named after its similarities with the species *Aspicilia vulcanica* Hue.

Taxonomic notes: *Aspicilia pseudovulcanica* is similar to *A. vulcanica*, but differs in having larger apothecia and wider ascospores.

Additional specimens examined: Republic of Korea. Gangwon-do, Pyeongchang-gun, Jin-bu-myeon, Suhang-ri, Mt Duta (Mt Bakji), on rock. Lat.: 37° 33' 56.6" N, Long.: 128° 35' 1.5" E, Alt.: ca 720 m a.s.l. Leg.: Wang, X. Y., Jeon, H. S., Lü, L. and Ryu, J. A. (100698), 27.05.2010 (KoLRI 012420). – Gangwon-do, Chuncheon-si, Buksan-myeon, Jogyo-ri, Mt Maebong, on rock, growing together with *Lecania* sp. Lat.: 37° 54' 38.28" N, Long.: 127° 58' 54.48" E, Alt.: ca 610 m a.s.l. Leg.: Wang, X. Y., Jeon, H. S., Lü, L. and Ryu, J. A. (100574), 26.05.2010 (KoLRI 012329 sub *Aspicilia*); the same locality, growing together with *Lecania*

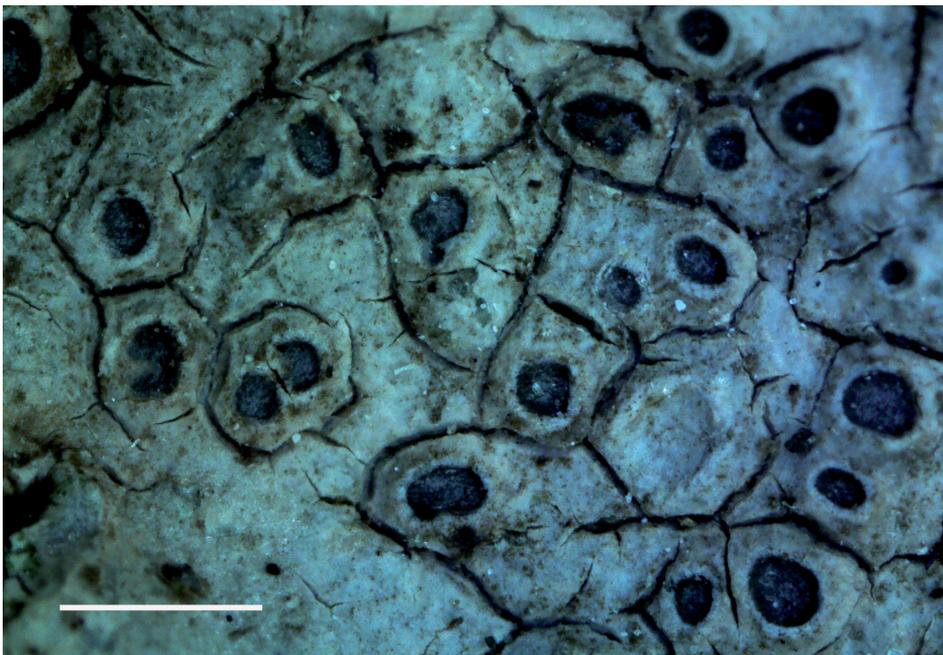


Fig. 2. *Aspicilia pseudovulcanica* (holotype, KoLRI 010391), general habit. Scale 1 mm. (Photo: S. Y. Kondratyuk).

sp. Leg.: Wang, X. Y., Jeon, H. S., Lü, L. and Ryu, J. A. (100584), 26.05.2010 (KoLRI 012338 sub *Aspicilia*). – Gangwon-do, Chuncheon-si, Buksan-myeon, nearby Road of Soyang dam, on rock. Lat.: 37° 59' 48.89" N, Long.: 127° 49' 9.13" E, Alt.: ca 539 m a.s.l. Leg.: Jayalal, R. U. G., Park, J. S. and Woo, J.-J. (141375), 14.07.2014 (KoLRI 023829).

Aspicilia subepiglypta S. Y. Kondr., L. Lökös et J.-S. Hur, *sp. nov.*
(Fig. 3)

Mycobank nr.: MB 819352.

Similar to *Aspicilia epiglypta*, but differs in having not zonated thallus, less number of apothecia per areolae, larger apothecia, different thalline margin, narrower paraphyses towards the tips, smaller ascospores, and slightly shorter conidia.

Type: Republic of Korea. Jeollanam-do Prov., Jindo-gun County, Jeob-do Island, on rock, growing together with *Lichenothelia* sp. and *Buellia* sp. Lat.: 34° 23' 41.14" N, Long.: 126° 18' 8.80" E, Alt.: ca 1 m a.s.l. Leg.: Wang, X. Y. and Ryu, J. A. (110495), 03.06.2011 (holotype: KoLRI 013539).

Thallus to 3–5 cm across, but probably forms much larger aggregations, areolate, white-greyish or light grey to grey-brownish, especially in peripheral zone; K+ yellow becoming blood red later; hypothallus black well developed [100438]; areolae 0.4–0.7(–1.2) mm across, very thick (to 0.2–0.4 mm); after keeping in herbarium becomes somewhat yellowish; algal zone K+ yellow washing out in solution later with red or rusty crystals, reaction very fast. Hypothallus as dark grey line, 0.6–1 mm wide, rarely observed, while sometimes (specimen 100438) well developed to 1 mm width as dark grey or greyish dark brown or greyish-blackish in the outermost narrow portion.

Apothecia 0.2–0.3(–0.5) mm diam./across, very variegated, (1–)3–5(–8) per areole, very irregular in shape, totally immersed into the thallus, aspicilioid, disc at the same level with thalline areole level; hymenium to 90–100 µm tall; epihymenium dull or dirty brown, K– brownish, N+ greenish; asci 8-spored; ascospores hyaline, simple, rounded or slightly elongated, ascospores (13–)16–20 (–22) × (7–)8–12 µm; conidia cylindrical, straight, long and narrow, 15–20 × 0.7–0.9 µm.

Chemistry: Containing norstictic acid (HPLC).

Ecology: Growing on siliceous rocks, from coastal zone to high localities in mountains.

Distribution: So far known from scattered localities of South Korea.

Etymology: It is named after its similarities with the species *Aspicilia epiglypta* (Nyl.) Hue.

Taxonomic notes: *Aspicilia subepiglypta* is similar to *A. epiglypta* in having dark olive green epihymenium, N+ intensifying in bright green, in having

norstictic acid, It seems to be the rarest of the trio including *A. cinerea* and *A. intermutans*, which differs principally in conidial and ascospores size, lacks the yellow tinge, has small number of apothecia (2–5, rarely single) per areolae, has small apothecia (0.2–0.3(–0.5 or –1) mm diam.), species growing on schistose and granite rocks, maritime, often in sunny, nutrient rich situations, but differs in having not zonated thallus (vs. usually markedly zonate at the margin, sometimes to 15 mm), in the lack of thalline margin (vs. thalline margin raised, thick, angular-indentated or convoluted, persistent), in having smaller ascospores ((13–) 16–20(–22) × (7–)8–12 μm vs. 20–25 × 12–15 μm), and slightly shorter conidia (15–20 × 0.7–0.9 μm vs. 15–28 × 1 μm).

Aspicilia subepiglypta is similar to *A. adamanticola* Hue, an Eastern Asian taxon, but differs in having somewhat shorter and distinctly narrower ascospores (16–20 × 8–12 μm vs. 16–22 × 12–14 μm), and longer conidia (15–20 × 0.7–0.9 μm vs. 14–16 × 0.6–0.8 μm).

Aspicilia subepiglypta is similar to the widely distributed *Aspicilia cinerea*, but differs in having longer conidia (15–20 × 0.7–0.9 μm vs. 11–16 × 1 μm).

Additional specimens examined: Republic of Korea. Gyeongsangnam-do, Hamyang-gun, Seosang-myeon, Mt Baekunsan, on rock, growing together with

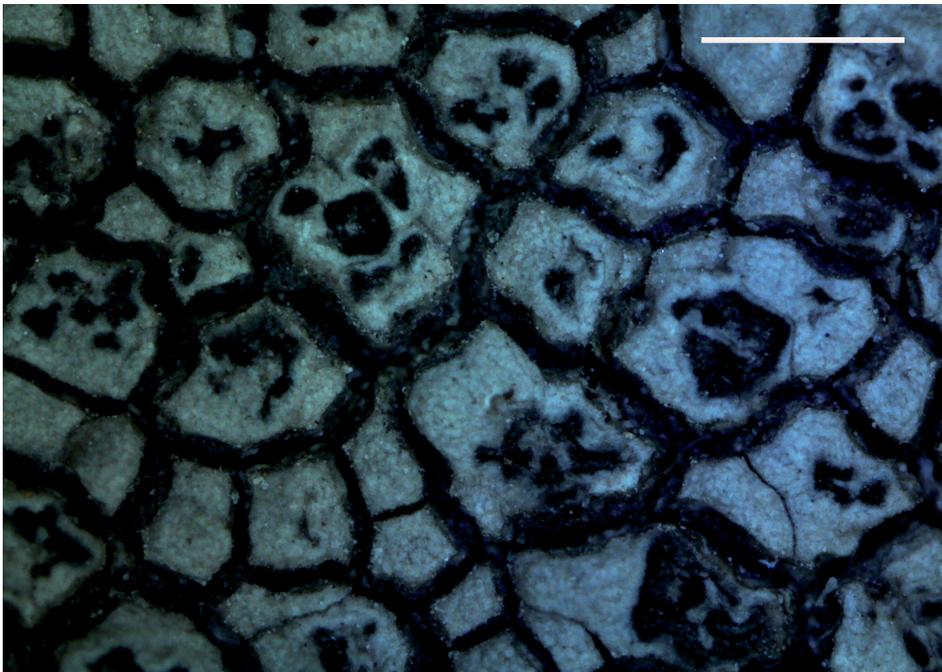


Fig. 3. *Aspicilia subepiglypta* (holotype, KoLRI 013539), general habit. Scale 1 mm. (Photo: S. Y. Kondratyuk).

Sarcogyne privigna, *Aspicilia* is partly damaged by *Lichenostigma* sp., Lat.: 35° 36' 36.8" N, Long.: 127° 39' 37.4" E, Alt.: ca 903 m a.s.l. Leg.: Wang, X. Y., Jeon, H. S., Han, G. S. (100438), 24.06.2010 (KoLRI 012059 sub *Aspicilia*). – Gangwon-do, Jeongseon-gun, Buk-myeon, Mt Bannonsan, on rock, growing together with *Scoliciosporum chlorococcum*. Lat.: 37° 26' 37.1" N, Long.: 128° 45' 29.4" E, Alt.: ca 1,064 m a.s.l. Leg.: Wang, X. Y., Jeon, H. S., Lü, L. and Ryu, J. A. (100857-2), 28.05.2010 (KoLRI 012535-2 sub *Aspicilia*); the same locality, on rock, growing together with *Scoliciosporum* cf. *umbrinum*, *Protoparmeliopsis* aff. *muralis* damaged by lichenicolous fungus *Rosellinula frustulosae* (Vouaux) R. Sant.*, and *Lobothallia* sp. 100857-1 (KoLRI 012535-1 sub *Aspicilia*).

Aspicilia subgeographica S. Y. Kondr., L. Lökös et J.-S. Hur, *sp. nov.*

(Fig. 4)

Mycobank nr.: MB 819353.

Similar to *Aspicilia geographica*, but differs in having smaller conidia and larger ascospores.

Type: Republic of Korea. Jeollanam-do, Sinan-gun, Aphae-do, seaside, on rock growing together with *Buellia* cf. *spuria*, *Lichenothelia* sp. Lat.: 34° 54' 27.4" N, Long.: 126° 18' 58.7" E, Alt.: ca 8 m a.s.l. Leg.: Oh, S.-O., Park, J. S. and Woo, J.-J. (130359), 07.06.2013 (holotype: KoLRI 018704).

Thallus 3–5 cm diam., but may form larger aggregations, light grey or slightly brownish grey, distinctly areolate, upper surface matt, K– or K+ very slowly purely yellow; areolae 0.5–1(–1.3) mm diam./across, very irregular; rather thick, to (0.2–)0.4–0.5 mm thick in section; cortical layer to 20–30 µm thick, somewhat indistinct in places; algal cells ca 16–18 µm diam.; medulla I–. Hypothallus only rarely present, usually thallus in peripheral zone somewhat excavated, undulating and uplifted and hypothallus absent / not observed, while sometimes black and filamentous (specimen 110813).

Apothecia to 0.9–1 mm diam./across and to 0.35 mm thick in section, lecanorine, with thalline margin to 0.1–0.25(–0.35) mm wide or much wider, very often highly uplifted and covering disc to 50% or more (see Fig. 4); hymenium to 150 µm tall, with oil droplets often richly; epihymenium dull greenish, K– becoming lighter and brownish, N+ distinctly bluish; asci 8-spored; ascospores hyaline, simple, widely ellipsoid to spherical, (16–)19–22(–30) × (9–)12–16(–17) µm; conidiomata to 120 µm diam., and to 130–140 µm high; conidia cylindrical, straight, very short and narrow, 3.5–5.5 × 0.7–0.8(–1) µm.

Chemistry: Thallus K–, medulla K+ yellow to brownish yellow. Containing stictic acid (HPLC).

* *Rosellinula frustulosae* is reported for the first time from Korea.

Ecology: Growing on siliceous rocks, from coastal zone to high localities in mountains.

Distribution: So far known from scattered localities of South Korea.

Etymology: It is named after its similarities with the species *Aspicilia geographica* Hue.

Taxonomic notes: *Aspicilia subgeographica* is similar to *A. geographica*, but differs in having smaller conidia and larger ascospores.

Aspicilia subgeographica is similar to *A. adamanticola* Hue, but differs in having very weak reaction of the thallus (vs. K+ yellow becoming intense reddish later), in having larger algal cells, and longer conidia.

Aspicilia subgeographica is similar to *A. cyanescens* Owe-Larss. et A. Nordin, which is the only Californian *Aspicilia* species growing on bark or wood, but differs in having larger and lecanoroid apothecia (0.9–1 mm vs. 0.2–0.6 mm diam., aspicilioid), lower hymenium (to 150 μm vs. 130–200 μm high), shorter conidia ($3.5\text{--}5.5 \times 0.7\text{--}0.8(-1) \mu\text{m}$ vs. $(12\text{--})16\text{--}27(-35) \times 0.6\text{--}1 \mu\text{m}$), while ascospores are almost the same ($(16\text{--})19\text{--}22(-30) \times (9\text{--})12\text{--}16(-17) \mu\text{m}$ vs. $(16\text{--})18\text{--}25(-31) \times (8\text{--})10\text{--}15(-17) \mu\text{m}$).

Aspicilia subgeographica is similar to *A. caesiocinerea* (Malbr.) Arnold, but differs in having lecanorine apothecia (vs. aspicilioid, 1(–5) per areole), a hy-

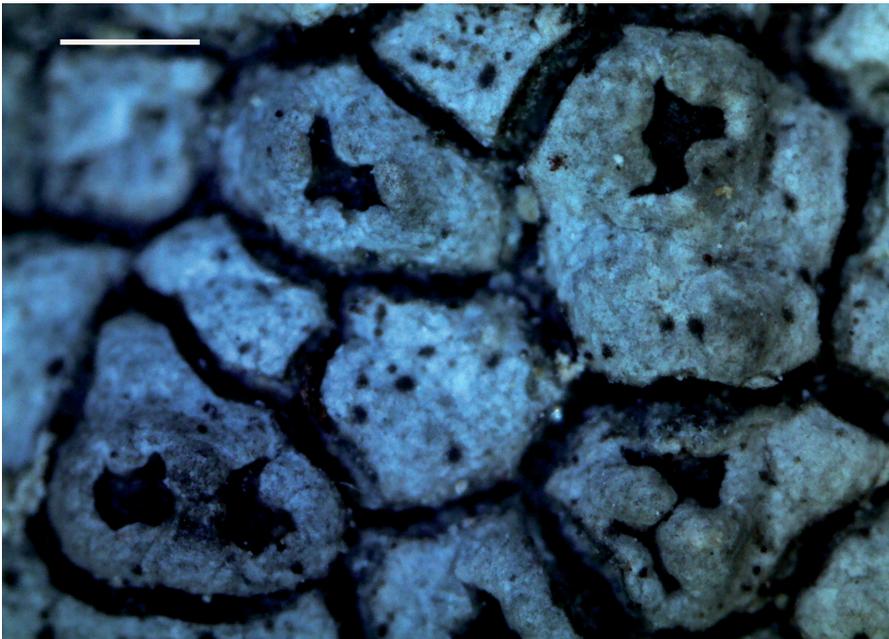


Fig. 4. *Aspicilia subgeographica* (holotype, KoLRI 018704), general habit. Scale 0.5 mm. (Photo: S. Y. Kondratyuk).

menium interspersed with oil, very wide ascospores ($19\text{--}22 \times 12\text{--}16 \mu\text{m}$ vs. $20\text{--}25 \times 13\text{--}14 \mu\text{m}$), shorter conidia ($3.5\text{--}5.5 \times 0.7\text{--}0.8 \mu\text{m}$ vs. $6\text{--}10\text{--}12 \times (0.8\text{--})1 \mu\text{m}$), in having stictic acid, and in the lack of aspicilin.

Additional specimens examined: Republic of Korea. Jollabuk-do Prov., Gunsam-si city, Shinsi-do Island, on rock, growing together with *Scoliciosporum jasonhurii*, and *Lichenothelia* sp. Lat.: $35^\circ 49' 8.8''$ N, Long.: $126^\circ 27' 55.8''$ E, Alt.: ca 19 m a.s.l. Leg.: Wang, X. Y. and Ryu, J. A. (110813), 22.10.2011 (KoLRI 013822 sub *Aspicilia*). – Jeollanam-do, Yeosu-si, Nam-myeon, Geumoh-do, Dumo-ri, Jickpo coast, on rock growing together with *Buellia spuria*. Lat.: $34^\circ 30' 45.00''$ N, Long.: $127^\circ 44' 14.08''$ E; Alt.: ca 6 m a.s.l. Leg.: Jayalal, U., Park, J.-S. and Ryu, J. A. (120356), 26.04.2012 (KoLRI 015345 sub *Aspicilia*)*. – Jeollanam-do Prov., Sinan-gun Co., Bogil-do Island, on rock, growing together with *Lecanora oreinoides*, and *Caloplaca aequata* damaged by lichenicolous fungus *Lichenostigma* aff. *bolacinae* Nav.-Ros., Calat. et Hafellner. Lat.: $34^\circ 7' 51.72''$ N; Long.: $126^\circ 30' 43.68''$ E; Alt.: ca 19 m a.s.l. Leg.: Wang, X. Y. and Ryu, J. A. (110673), 23.06.2011 (KoLRI 013701 sub *Lecanora oreinoides***).

Aspicilia subgoettweigensis S. Y. Kondr., L. Lökös et J.-S. Hur, *sp. nov.*

(Fig. 5)

Mycobank nr.: MB 819354.

Similar to *Aspicilia goettweigensis*, but differs in having longer ascospores, and in the lack of norstictic and conorstictic acids, as well as in having lecanorine apothecia and much thicker subhymenium.

Type: Republic of Korea. Jeollanam-do, Sinan-gun, Bigeum-myeon, Imja-do, nearby wharf Jinri, on rock, growing together with *Ramalina* sp. Lat.: $35^\circ 5' 21.1''$ N, Long.: $126^\circ 7' 17.6''$ E, Alt.: ca 11 m a.s.l. Leg.: Oh, S.-O., Park, J.-S. and Woo, J.-J. (130234), 06.06.2013 (holotype: KoLRI 018579).

Thallus 3–5 cm diam., but may form larger aggregations, light grey or whitish grey to pure grey or lead-grey, areolate, areolae 0.3–1.5(–2.3) mm diam./across, sometimes areoles well developed only in the centre while thallus only cracked in the peripheral portion, with portions to 3–4 mm across; with numerous apothecia in the centre, upper surface even, sometimes with small finger-like outgrowth to 0.15–0.2 mm diam, with somewhat darker uppermost portion; rather thick, to (0.45–)0.5–0.6(–0.8) mm thick in section; cortical layer to (15–)20–30(–40) μm thick with distinct epinecral zone to 20 μm thick sometimes, K–; algal zone K+ yellow, reaction rather weak; algal cells ca 15 μm diam.; medulla I–; lower portion of thallus (medulla below algal zone) with numerous crystals not dissolving

* Specimen included with some hesitation since it contains stictic and thiophanic acids.

** Specimen was extremely small, but enough for getting DNA.

in K. Hypothecium well developed, black, to 0.5–0.8 mm wide in peripheral zone as entire circle around thallus.

Apothecia 0.4–0.8(–1) mm diam./across and to 0.3–0.5 mm thick in section, lecanorine, 1–2(–4) per areole, at first immersed into thallus, but later thalline margin well distinct to 0.1–0.15 mm wide, rather thick, uplifted above thalline level, concolorous with thallus, pure grey; disc 0.2–0.5 mm diam./across, mainly concave, grey-black to bluish black, with somewhat greyish pruina or seem to be pruinose (but under larger magnification (more of $\times 100$) epruinose); in section thalline margin 90–100 μm thick in lateral portion, well developed; true exciple to 40 μm wide in lateral portion, hymenium to (100–)170–180 μm tall often with oil droplets; epihymenium dull or dirty brown, K– becoming lighter and brownish, N+ bluish/greenish; subhymenium to 100 μm thick, with oil droplets to 3 μm diam., somewhat more greyish than hymenium; paraphyses to 4–5(–6) μm wide, brownish and moniliform towards the tips; asci 8-spored; ascospores hyaline, simple, rounded or slightly elongated, ascospores (16–)19–23(–25)[–27?] \times (9–)11–14(–15)[–17] μm , spore wall to 0.7 μm thick; conidia cylindrical, straight, long and narrow, (13–)14–19 \times 0.7–0.8 μm .

Chemistry: Containing stictic acid (HPLC).

Ecology: Growing on siliceous rocks, from coastal zone to high localities in mountains.

Distribution: So far known from scattered localities of South Korea.

Etymology: It is named after its similarities with the species *Aspicilia goettweigensis* (Zahlbr.) Hue.

Taxonomic notes: *Aspicilia subgoettweigensis* is similar to *Aspicilia goettweigensis*, but differs in having longer ascospores, and in the lack of norstictic and connorstictic acids (see PAUKOV *et al.* 2016), as well as in having lecanorine apothecia and much thicker subhymenium.

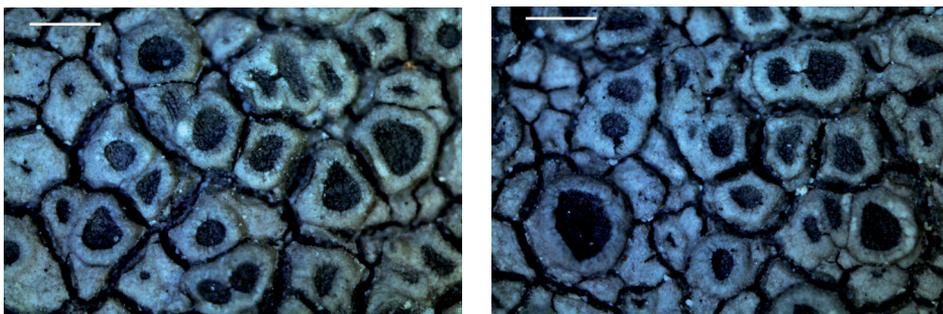


Fig. 5. *Aspicilia subgoettweigensis* (holotype, KoLRI 018579), general habit. Scale 0.5 mm. (Photo: S. Y. Kondratyuk).

This taxon is accepted here in rather wide sense because it is so far heterogeneous. However, they are all characterised by having stictic acid in thallus, as well as large ascospores and long conidia. With further accumulation of specimens and molecular data on this group, it is probable that some of the specimens cited under this name will belong to different taxa in the future. Specimen 100588 (KoLRI 012341) having very light, almost white thallus and smaller apothecia is the most different from the others.

In general specimens of this taxon are very similar to *A. cinerea* based on measurements of ascospores and conidia, but differ in having only stictic acid, and the lack of norstictic acid, as well as in having different spot reactions.

Aspicilia subgoettweigensis is similar to *A. pseudoabbasiana* described above, but differs in having better developed hypothallus, seemingly pruinose dull greyish disc of apothecia, higher hymenium interspersed with oil, and in having somewhat wider ascospores.

Based on the rather thick K⁻ thallus, medulla K⁺ yellow, and almost the same areole and hymenium measurements, *Aspicilia subgoettweigensis* is similar to Japanese *A. straminella* Hue, but differs in having pure grey thallus (vs. straw-yellow-greenish thallus), larger apothecia (0.4–0.8 mm vs. 0.2–0.4 mm wide), K⁻ epihymenium (K⁺ blue), larger ascospores (16–)19–25(–26) × (9–)10–13(–15) vs. 16–20 × (10–)11–14(–15) μm or to 10–11 μm diam. if spherical), and narrower ascospore wall (to 0.7 μm vs. to 1.5 μm thick). Unfortunately data on conidia and conidiomata of *A. straminella* are so far missing.

Based on its description, *Aspicilia subgoettweigensis* is similar to *A. umbrinella* Hue, but differs in having negative iodine reaction of medulla, as well as in having grey thallus, larger thalline areoles, higher hymenium, and weak K⁺ yellow reaction of medulla. Unfortunately, data on the conidia of *A. umbrinella* are so far missing too.

In the key of “Lichen flora of the Greater Sonoran Desert region” this material can be keyed to *Aspicilia fumosa* Owe-Larss. et A. Nordin. In this paper it was mentioned that type specimens of *A. fumosa* were analysed for DNA (ITS), and it shows similarities to *A. glaucopsina* (Nyl.) Hue and *A. phaea* Owe-Larss. et A. Nordin (OWE-LARSSON *et al.* 2004). However, results of sequencing of these three species are still not available for wide access and cannot be included in our comparison. *A. subgoettweigensis* is similar to *A. fumosa* in having similar thick thallus, similar size of apothecia and often elevated fertile areoles, however it differs in having lighter and only greyish thallus (vs. partly brown-grey to olive-grey or light brown), either aspicilioid or lecanorine apothecia (vs. only aspicilioid), in having thalline margin concolorous with thallus (not becoming darker of thallus), while measurements of ascospores and conidia partly overlap.

Additional specimens examined: Republic of Korea. Jeollanam-do, Yeosu-si, Samsan-myeon, Geomun-do Island, on rock, growing together with *Buellia stellulata* (Taylor) Mudd. Lat.: 34° 0' 39.0" N, Long.: 127° 19' 2.7" E, Alt.: 8 m a.s.l. Leg.: Hur, J.-S. (070103), 24.03.2007 (KoLRI 007090). – Gangwon-do, Chuncheon-si, Buksan-myeon, Mt Maebong, Jogyo-ri, on rock, growing together with *Melanophloaea coreana* and *Scoliciosporum* sp., and overgrown by *Scoliciosporum* sp. in parts. Lat.: 37° 54' 38.28" N, Long.: 127° 58' 54.48" E, Alt.: ca 610 m a.s.l. Leg.: Wang, X. Y., Jeon, H. S., Lü, L. and Ryu, J. A. (100588), 26.05.2010 (KoLRI 012341 sub *Aspicilia*). – Jeollanam-do, Wando-gun, Saengil-myeon, Saengil-do, Geumdok-ri coast, on rock, growing together with *Rinodina confragosa*, *Buellia stellulata* and *Lecanora oreinoides*, as well as species of the genera *Aspicilia*, *Xanthoparmelia* and *Ramalina*. Lat.: 34° 20' 2.02" N, Long.: 126° 57' 51.02" E, Alt.: ca 7 m a.s.l. Leg.: Jayalal, U., Park, J.-S. and Ryu, J. A. (120188), 18.04.2012 (KoLRI 014782 sub *Aspicilia*). – Incheon, Ongjin-gun, Deokjeok-myeon, Deokjeok-do, Seopori wharf, on rock, *Aspicilia* damaged in parts by lichenicolous fungus *Cercidospora* sp. Lat.: 37° 12' 45.09" N, Long.: 126° 6' 44.05" E, Alt.: ca 1 m a.s.l. Leg.: Oh, S.-O. and Park, J.-S. (130489), 14.06.2013 (KoLRI 018834). – *Jeju-do, Jeju-si, Chuja-do, Chuja-myeon, Mt Dondae, Yecho-ri, on rock growing together with *Lecanora lojkaehugoi*, *Candelariella corallina*, *Buellia* and *Ramalina* spp. Lat.: 33° 56' 53.9" N, Long.: 126° 19' 26.7" E, Alt.: ca 164 m a.s.l. Leg.: Lökös, L. (140756-3), 20.06.2014 (KoLRI 023232 sub *Aspicilia*).

Aspicilia submamillata S. Y. Kondr., L. Lökös et J.-S. Hur, *sp. nov.*
(Fig. 6)

MycoBank nr.: MB 819355.

Similar to *Aspicilia mamillata*, but differs in having narrower ascospores.

Type: Republic of Korea. Gangwon-do, Yangyang-gun, Seo-myeon, Galjeongokbong, on rock. Lat.: 37° 52' 52.8" N, Long.: 128° 26' 50.9" E, Alt.: ca 1,101 m a.s.l. Leg.: Joshi, Y., Wang, X. Y. and Ryu, J. A. (090631), 22.05.2009 (holotype: KoLRI 010299).

Thallus more than 10 cm diam./across, white to dull white, light grey or greenish grey in places, distinctly areolate; areolae (0.5–)0.7–1.2(–2) mm diam./across in the centre, while in peripheral zone not so well developed and not so distinguished; rather thick, to 0.5 mm thick in section; algal cells to 18 µm diam.; medulla I–. Hypothallus not developed, or not observed.

Apothecia to 0.4–1(–1.3) mm diam./across and to 0.2–0.25 mm thick in section, cryptolecanorine, 1–2 per areole, with well developed, entire, somewhat

* Specimen included with some hesitation since chemical and molecular data were not checked for this taxon.

lighter thallus, whitish; disc seems to be with white pruina, but at larger magnification (more than $\times 100$) epruinose, matt, grey or brownish grey (not black); immersed into thallus; hymenium (90–)120–140 μm tall, with often abundant oil droplets; epihymenium green dark brown, K– becoming lighter and brownish, N+ bluish; subhymenium to 30–50 μm thick, with oil droplets to 3–4 μm diam.; asci 8-spored; ascospores hyaline, simple, widely ellipsoid to spherical, (15–)20–25(–27) \times (7–)10–12(–14) μm ; ascospore wall to 1 μm thick.

Conidiomata and conidia not seen.

Chemistry: Thallus K– or K+ yellow, reaction very slow and weak; medulla K – or K+ yellow. No substances detected or only stictic acid is present (HPLC).

Ecology: Growing on siliceous rocks, from coastal zone to high localities in mountains.

Distribution: So far known from scattered localities of South Korea.

Etymology: It is named after similarities with the species *Aspicilia mamillata* Räsänen.

Taxonomic notes: This species is characterised by having areolate thallus without well developed hypothallus, concave aspicilioid apothecia, where disc

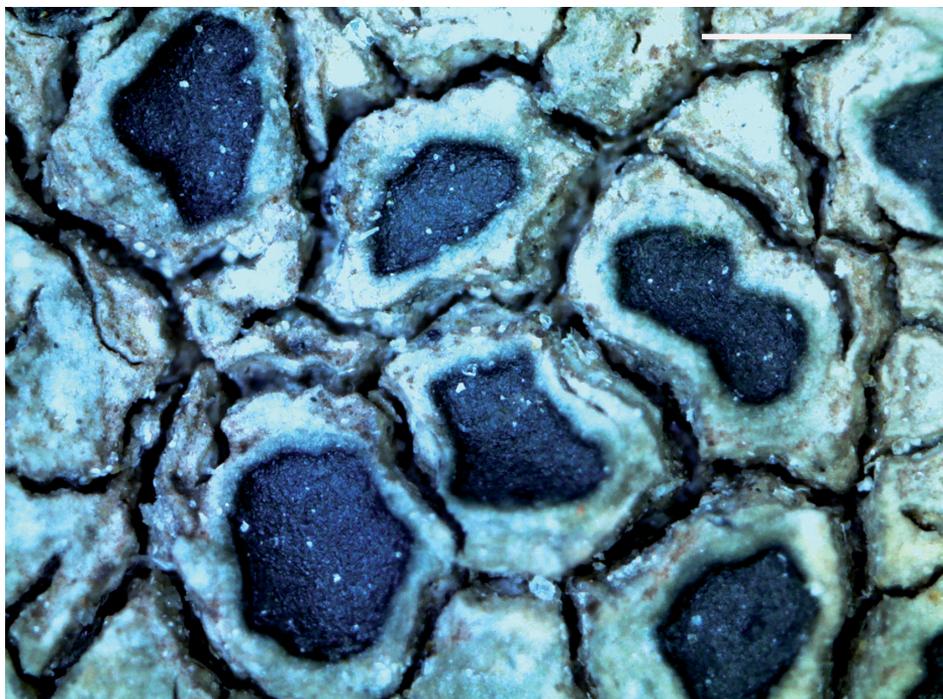


Fig. 6. *Aspicilia submamillata* (holotype, KoLRI 010299), general habit. Scale 0.5 mm. (Photo: S. Y. Kondratyuk).

often seem to be pruinose, medium high hymenium interspersed with oil, and rather long and medium wide ascospores.

Aspicilia submamillata is similar to *A. mamillata*, but differs in having narrower ascospores*.

Additional specimens examined: Republic of Korea. Jeollanam-do, Gurye-gun, Jirisan Mts, Masan-myeon, Nogodan-Yeon baceon, on rock. Lat.: 35° 17' 50.3" N, Long.: 127° 33' 11.9" E, Alt.: ca 1,364 m a.s.l. Leg.: Joshi, Y., Wang, X. Y. and Hur, J. Y. (091073), 13.10.2009 (KoLRI 010540); the same locality, 091096 (KoLRI 011146). – Gyeongsangnam-do, Hamyang-gun, Macheon-myeon, Mt Baekun, on rock. Lat.: 35° 38' 22.5" N, Long.: 127° 37' 23.2" E, Alt.: ca 1,058 m a.s.l. Leg.: Woo, J.-J., Park, G. S. and Oh, S.-O. (150737), 04.07.2015 (KoLRI 036046).**

New name and new combination

Aspicilia abbasiana S. Y. Kondr., L. Lökös, Ismayil et Guo, *nom. nov.* – MycoBank nr.: MB 819356. – Synonym: *Aspicilia volcanica* Ismayil, A. Abbas et S. P. Guo, Mycotaxon 130: 545 (2015), *nom. illeg.* (Code 53.3), non *Aspicilia vulcanica* Hue.

Rimularia geumodoensis (S. Y. Kondr., L. Lökös et J.-S. Hur) S. Y. Kondr., L. Lökös et J.-S. Hur, *comb. nov.* – MycoBank nr.: MB 819357. – Basionym: *Aspicilia geumodoensis* S. Y. Kondr., L. Lökös et J.-S. Hur, in Kondratyuk et al. *Acta Bot. Hung.* 58(3–4): 326 (2016).

Specimens of *Rimularia geumodoensis* examined: Republic of Korea. Jeollanam-do, Yeosu-si, Nam-myeon, Geumo-do, Simjang-ri, on rock, growing together with *Lepraria* and *Endocarpon* spp. Lat.: 34° 31' 19.7" N, Long.: 127° 43' 52.1" E, Alt.: ca 51 m a.s.l. Leg.: Kondratyuk, S. Y. (160406), 10.06.2016 (holotype: KoLRI 038551); the same locality, growing together with *Pyxine*, *Lepraria* and *Caloplaca* sp., (160418), (isotype: KoLRI 038563); the same locality, growing together with *Lecania*, *Lepraria* and *Endocarpon* sp., (160416), (isotype: KoLRI 038561). – Gangwon-do, Chuncheon-si, Buksan-myeon, Mt Maebongsan, Jogyori, on rock. Lat.: 37° 54' 54.24" N, Long.: 127° 59' 1.86" E, Alt.: ca 705 m a.s.l. Leg.: Wang, X. Y., Jeon, H. S., Lü, L. and Ryu, J. A. (100632), 26.05.2010 (KoLRI 012373). – Gangwon-do, Sokcho-si, Mt Seoraksan, on rock, *Rimularia geumodoensis* damaged by lichenicolous fungus *Phaeospora peregrina* (Flot.) Arnold***. Lat.: 38° 9' 58.9" N, Long.: 128° 27' 16.0" E, Alt.: ca 463 m a.s.l. Leg.: Joshi, Y., Wang, X. Y. and Ryu, J. A. (090763), 22.05.2009 (KoLRI 010435).

* Unfortunately original description of *A. mamillata* is rather pure, no measurements on elements of thallus or apothecia are provided.

** Specimen included with some hesitation, it may belong to another separate taxon.

*** *Phaeospora peregrina* is reported for the first time from Korea.

As it is seen from the phylogenetic tree of the genus *Aspicilia* s. str. (Fig. 7) taxa with stictic acid, i.e. *A. pseudoabbasiana*, *A. pseudovulcanica*, *A. subgeographica*, *A. subgoettweigensis*, and *A. submamillata* are members of the separate phylogenetic branch. Taxa containing norstictic acid, i.e. *A. cinerea*, *A. blastidiosa*, and *A. subepiglypta* are members of the second branch within the *Aspicilia* s. str. branch of the phylogenetic tree.

Key to aspicilioid lichens of Korean and Eastern Asian region*

1	Thallus with cephalodia	2
–	Thallus without cephalodia	3
2	Areoles 0.6–1.5(–2) mm across; ascospores 10–12 × 5–6 μm	(<i>Aspicilia cremicolor</i>)
–	Areoles 0.3–0.5 mm across; ascospores 14–20 × 8–10 μm	(<i>Aspicilia tephroda</i>)
3	Thallus effusely isidiate or granular sorediate. Apothecia usually absent	<i>Circinaria leproscens</i>
–	Thallus without isidia or soredia; Apothecia usually present	4
4	Thallus C+ red	5
–	Thallus C–	7
5	Thallus of scattered areoles divided by well distinct black hypothallus; isidia 0.15–0.25 mm wide and to 0.5 mm high; soralia whitish 0.2–0.5 mm wide; apothecia 0.5–1.2 mm diam. (including thalline margin to 0.1–0.3 mm wide; ascospores (14–)15.5–25(–30) × (9–)10.5–12.5(–14) μm	<i>Rimularia gibbosa</i>
–	Thallus rimose-areolate; hypothallus not distinct or absent	6
6	Thallus with small soralia to 0.1 mm diam., and isidia (0.05–)0.1(–0.15) mm diam., and to 0.2 mm high, erect or rounded; thalline areoles 0.3–0.7 mm across; apothecia 0.2–0.4 mm diam.; ascospores (11–)12.5–20(–22) × (7–)8–11.5(–13) μm	(<i>Rimularia badioatra</i>)
–	Thallus without soralia and isidia; thalline areoles 0.7–1.3(–1.7) mm diam./across; apothecia 0.4–0.7 mm diam.; ascospores (11–)12.5–20(–22) × (7–)8–11.5(–13) μm; Thallus K+ yellow	<i>Rimularia geumodoensis</i>
7	Medulla I+ blue	<i>Aspicilia umbrinella</i>
–	Medulla I–	8
8	Thallus and/or medulla K+ red, or K+ yellow then red or orange, or K+ yellow; norstictic or stictic acid present	9
–	Thallus K–, while medulla can be K+ weak yellow; no substances detected or stictic acid present	28
9	Thallus and/or medulla K+ red	10
–	Thallus and/or medulla K+ yellow then red, or K+ yellow	14
10	Thallus K+ red	11
–	Medulla K+ red	13
11	Ascospores 8–10 × 3–6 μm; conidia 10–12 × 1 μm	<i>Aspicilia microsporeta</i>
–	Ascospores larger, conidia various	12
12	Conidia 11–16 × 1 μm; ascospores 12–22 × 6–13 μm	<i>Aspicilia cinerea</i>
–	Conidia 15–20 × 0.7–0.9 μm; ascospores 16–20 × 8–12 μm	<i>Aspicilia subepiglypta</i>
13	Ascospores 19–24 × 12–14 μm; conidia 10–12 × 0.5–0.6 μm	<i>Aspicilia fauriana</i>
–	Ascospores narrower, 17–20 × 7–8(–9) μm; conidia unknown	<i>Aspicilia leucera</i>

* Species known only from Japan or other neighbouring territories are given in brackets.



Fig. 7. Phylogenetic tree of aspicilioid lichens based on ITS nr DNA sequences.

14	Thallus and/or medulla K+ yellow then red or orange	15
-	Thallus and/or medulla K+ yellow	24
15	Thallus seem to be placodioid, 0.5–0.6 mm thick; ascospores narrow, 14–24 × 8–9 μm [or 16 × 6–7 μm]; conidia 11–14 × 1 μm	<i>Aspicilia stellata</i>
-	Thallus areolate, various thickness	16
16	Thallus to 0.4–0.8 mm thick	17
-	Thallus to 0.2–0.3 mm thick	21
17	Ascospores broader, 10 μm wide	18
-	Ascospores narrower, 10 μm wide	20
18	Conidia longer, 14 μm long	19
-	Conidia (8–)9–14(–17) × 0.8–1 μm	(<i>Aspicilia pacifica</i>)
19	Conidia 14–16 × 0.6–0.8 μm; ascospores 16–22 × 12–14 μm; thallus <i>ca</i> 0.2–0.4 mm thick	<i>Aspicilia adamanticola</i>
-	Conidia 14–22 × 0.7 μm; ascospores 16–19 × 10–13(–14) μm; thallus <i>ca</i> 0.4–0.6 mm thick ..	<i>Aspicilia verrucigera</i>
20	Apothecia 0.3–0.5 mm diam.; ascospores narrow 16–20 × 6–7 μm	<i>Aspicilia stenospora</i>
-	Apothecia to 1.5 mm diam.; ascospores wider, 15–20 × 9–10 μm	<i>Aspicilia excerta</i>
21	Ascospore wall to 2 μm thick	(<i>Aspicilia inaequata</i>)
-	Ascospore wall narrower, 2 μm thick	22
22	Thallus becoming verruculose [areoles to 1.5–3 mm across] in the centre; ascospores narrow, 16–18 × 7–8 μm; conidia very short 4–5 × 0.5–0.6 μm	<i>Aspicilia dimorphodes</i>
-	Thallus more or less areolate; conidia unknown, ascospores wider	23
23	Thallus dull white; ascospores 16–22 × 8–10 μm	<i>Aspicilia chinampoana</i>
-	Thallus yellowish-brownish to bluish-greyish; ascospores 13–24 × 10–12 μm	<i>Aspicilia tofacea</i>
24	Conidia to 8 μm long	25
-	Conidia longer, 10 μm long	26
25	Conidia 6–7.5 × 1 μm; ascospores narrow, 10–12 × 5–6 μm	<i>Aspicilia geographica</i>
-	Conidia 3.5–5.5 × 0.7–0.8 μm; ascospores much larger, 19–22 × 12–16 μm	<i>Aspicilia subgeographica</i>
26	Ascospores 12–19 × 7–11 μm; conidia 10–12 × 1 μm; thallus brownish grey	<i>Aspicilia tumens</i>
-	Ascospores 18–23 × 11–14 μm; conidia (13–)15–18(–19) × 0.7–1 μm; thallus dark grey ...	27
27	Thallus K–, to 0.5(–0.8) mm thick; hypothallus well developed; apothecia to 0.5(–0.8) mm diam.; apothecium disc greyish; hymenium 140–170 μm high interspersed with oil	<i>Aspicilia subgoettweigensis</i>
-	Thallus K+ yellow, less than 0.4 mm thick; hypothallus absent; apothecia mainly more than 0.8 mm diam.; apothecium disc black; hymenium 110–140 μm high	<i>Aspicilia pseudoabbasiana</i>
28	Thallus straw-yellow-greenish; medulla K+ yellow; ascospore walls to 1.5 μm thick	<i>Aspicilia straminella</i>
-	Thallus white, grey to brownish without yellow colour; ascospore walls various	29
29	Thallus rather thick, to 0.4(–0.8) mm thick in section	30
-	Thallus rather thin, to 0.2(–0.3) mm thick in section	34
30	Ascospores narrower 10 μm wide	31
-	Ascospores broader 10 μm wide	32
31	Conidia 10–15 × 1 μm; ascospores 14–16 × 6–7 μm	(<i>Aspicilia aomoriana</i>)
-	Conidia unknown; ascospores 12–16 × 8–9 μm	(<i>Aspicilia owaniana</i>)

- 32 Thallus placodioid, conidia $11-14 \times 1 \mu\text{m}$; ascospores wide, $16-20 \times 10-14 \mu\text{m}$ *Aspicilia asteria*
 – Thallus areolate; conidia unknown 33
- 33 Ascospores $20-24 \times 12-14 \mu\text{m}$ (*Aspicilia mamillata*)
 – Ascospores $(15-)18-25(-27) \times (7-)10-13(-14) \mu\text{m}$; apothecia 0.4–1 mm diam., disc seem to be pruinose (but not!); hymenium 120–140 μm high; hypothecium interspersed with oil
 *Aspicilia submamillata*
- 34 Hymenium 100–140 μm high; ascospores narrow 7–12 μm wide 35
 – Hymenium 140–180 μm high; ascospores much wider, $14-20-24 \times 10-12-18 \mu\text{m}$ or to 12 μm diam. if spherical (*Aspicilia nitellina*)
- 35 Ascospores narrow, $(10-)17-20 \times 7-10 \mu\text{m}$; apothecia 0.3–0.4 mm diam. *Aspicilia vulcanica*
 – Ascospores wider, $18-23(-25) \times (9-)10-12(-14) \mu\text{m}$; apothecia 0.5–0.8 mm diam.
 *Aspicilia subvulcanica*

CONCLUSIONS

The first results of the molecular study of *Aspicilia* species from Korea show that we are still very far from understanding species diversity of this genus. Hue's and Nylander's taxa described more than a century ago from this region still need to be confirmed by fresh collections and molecular data.

Molecular study of a number of other floristical novelties for Korea, i.e. *Aspicilia pacifica*, *Circinaria contorta*, *C. leproscens* and others selected hitherto only on the basis of morphological characters is still in progress. Their status will be discussed separately when results of DNA extraction and sequencing are available.

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Összefoglaló: Az *Aspicilia* nemzetség taxonómiai revíziója során összesen 18 faj jelenlétét igazoltuk Korea területéről, ebből hat tudományra új fajt (*Aspicilia pseudoabbasiana*, *A. pseudovulcanica*, *A. subepiglypta*, *A. subgeographica*, *A. subgoettweigensis*, and *A. submamillata*) jelen dolgozatban írtunk le, illetve ismertettünk. Egy a taxonómiai nevezéktan szabályai alapján hibásan elnevezett fajnak (*Aspicilia vulcanica* Ismayil, Abbas et Guo nom. illeg., non *Aspicilia vulcanica* Hue) új nevet adtunk (*Aspicilia abbasiana*), valamint az *Aspicilia geumodoensis* S. Y. Kondr., Lőkös et J.-S. Hur fajt egy másik nemzetségbe soroltuk át *Rimularia geumodoensis* néven. Kimutattuk, hogy az *Aspicilia* cf. *pacifica*, a *Buellia coniops*, a *Circinaria contorta* és a *C. leproscens* zuzmófajok, továbbá a *Lichenostigma bolacinae*, a *Phaeospora peregrina* és a *Rosellinula frustulosae* zuzmólakó mikrogombafajok újak Korea zuzmóflórájára. Elkészítettük a koreai, illetve a kelet-ázsiai *Aspicilia* fajok határozókulcsát, melyet szintén itt közlünk.

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