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NOMENCLATURE AND SYSTEMATICS OF *GEOPYXIS* WITH TAXONOMIC NOTES ON ITS HIMALAYAN SPECIES

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Nomenclature and systematics of *Geopyxis* is discussed briefly. *G. grandis* isdescribed as a new species; *G. alpina*, a rare species is reported for the first time from India, *G. vulcanalis* is fully described and is reported to occur throughout North-Western Himalayas., and an annotated note is included for *G. carbonaria*. A key to all the four species is included.

Geopyxis (Pezizales) has been a heterogeneous assemblage of stalked terrestrial species, and Saccardo (1889) mentioned as many as 48 species under this genus. Boudier (1907) emended the genus as it is understood now andwidelyaccepted by modern workers. He selected *Peziza carbonaria* Alb. & Schw. ex Fr. as the lectotype of the genus. This species, and *P. raplum* Bull. ex Fr. (which is also lectotype of *Stromatinia* (Boud.) Boud., 1885, 1907; and *Tarzetta* (Cke.) Rehm, 1894), have often been proposed as lectotypes of an earlier generic name *Tarzetta* (Cke.) Lamb. 1887. Rifai (1968) designated *P. carbonaria* as lectotype of *Peziza* (Dill.) St. Amans (Ser. Aleuria) subgenus *Tarzetta* Cke. 1879. This typification makes *Tarzetta* (Cke.) Rehm, 1894, a later homonym of *Tarzetta* (Cke.) Lamb., 1887, and leaves *Stromatinia* (Bond) Boud. 1885, 1907, as an available name which need not be replaced by *Tarzetta* (Cke.) Rehm as proposed by Dumont and Korf (1971). On the contrary, Rifai's typification of *Tarzetta* (Cke.) Lamb. by *P. carbonaria* obliges us to use this generic name in place of *Geopyxis*. He, therefore, proposed to conserve the much used and universally accepted name *Geopyxis* (Pers. ex Fr.) Sacc., 1889, against *Tarzetta* (Cke.) Lamb., 1887. His proposal was, however; rejected by special committee for fungi and lichens (Petersen, 1974).

The problem was solved by Rogers, Dumont and Korf (1971) who reached a different nomenclatural conclusion in accordance with Art. 22 of the Code. They found that the correct nomenclatural type of *Peziza*, subgenus *Tarzetta* Cke. was *Peziza tarzetta*, a constituent species of that subgenus with identical epithet. It was further concluded by these authors that *P. tarzetta* was a synonym of *P. catinus* Holmskj. per Pers., a species now placed in the genus *Pustulina* Eckbl. (=*Pustularia* Fuck., 1870, emend Boud., 1885, a later homonym of *Pustularia* Bon., 1851, a genus of pyrenomycetes and hence illegitimate). *Tarzetta* thus becomes an earlier available generic name for *Pustulina*, and *Stromatinia* and

Geopyxis remain valid generic names unclouded by *Tarzetta*. Thus there is no need to propose conservation of generic name *Geopyxis*, and it is accepted here in the sense of Boudier (1907).

Eckblad included *Geopyxis* (along with *Sowerbyella* Nannf., *Otidea* (Pers.) Bon., *Pustulina* Eckbl.=*Tarzetta* (Cke.) Lamb. and *Ascoparassis* Kobayasi) in the family Otideaceae. We agree with Korf, add feel that because of 'discoloring of external surface of bruising', *Sowerbyella* (along with *Caloscypha* Boud.) should be placed in the tribe Sowerbyelleae of Pyronemataceae. However, due to the presence of carotenoid pigments and non-discoloring, almost glabrous external surface, *Geopyxis* (treated in the tribe Geopyxideae by Korf, l. c.) is shifted here to the tribe Aleurieae of Pyronemataceae. Diagnostic features of the genus, as understood here, are given below :

Apothecia medium sized, cupulate, acron cup-like or expanding, usually short stipitate to sessile; external surface glabrous or nearly so; margin often fringed with fascicles of septate hyphae; hymenium bright coloured, smooth. Asci 8-spored, cylindrical, apices obtuse, J-. Ascospores ellipsoid, uniseriate, hyaline, smooth, eguttulate. Paraphyses filiform , slightly enlarged apically, straight, septate, simple or branched below, hyaline or subhyaline, containing carotenoid pigments.

Anatomy : Ectal excipulum textura angularis of thick-walled radially arranged cells; medullary excipulum textura intricata, hyphae often vesicular at places.

Habitat : Terrestrial, on damp soil or burnt soil, sometimes on burnt wood.

Type species : *Peziza carbonaria* Alb. & Schw. ex Fr., Syst. Myc. 2 : 62. 1822.

In this paper *Geopyxis grandis* Thind & Kaushal is described as a new species, *G. alpina* Hohn., a rare European species, is described for the first time from India *G. vulcanalis* is fully described and reported to occur throughout the North-Western Himalayas, and an annotated note is included for *G. carbonaria*. *G. catinus* (Holmsk. ex Fr.) Sacc. reported by Thind and Sethi (1957) is to be sought under *Tarzetta*. A key to these four species now recognised from India is given below :

KEY TO THE SPECIES

1. Apothecia up to 2 (-2·5) cm in diameter, external surface pale yellow to dirty yellow; ectal excipulum 25–45, -70 (-80) μm thick.
   2. Apothecia sessile to short stipitate, cupulate to repand, not like acorn cup, on moist and humicolous soil.
      3. External surface usually tubercled; paraphyses simple. ..... *G. vulcanalis*

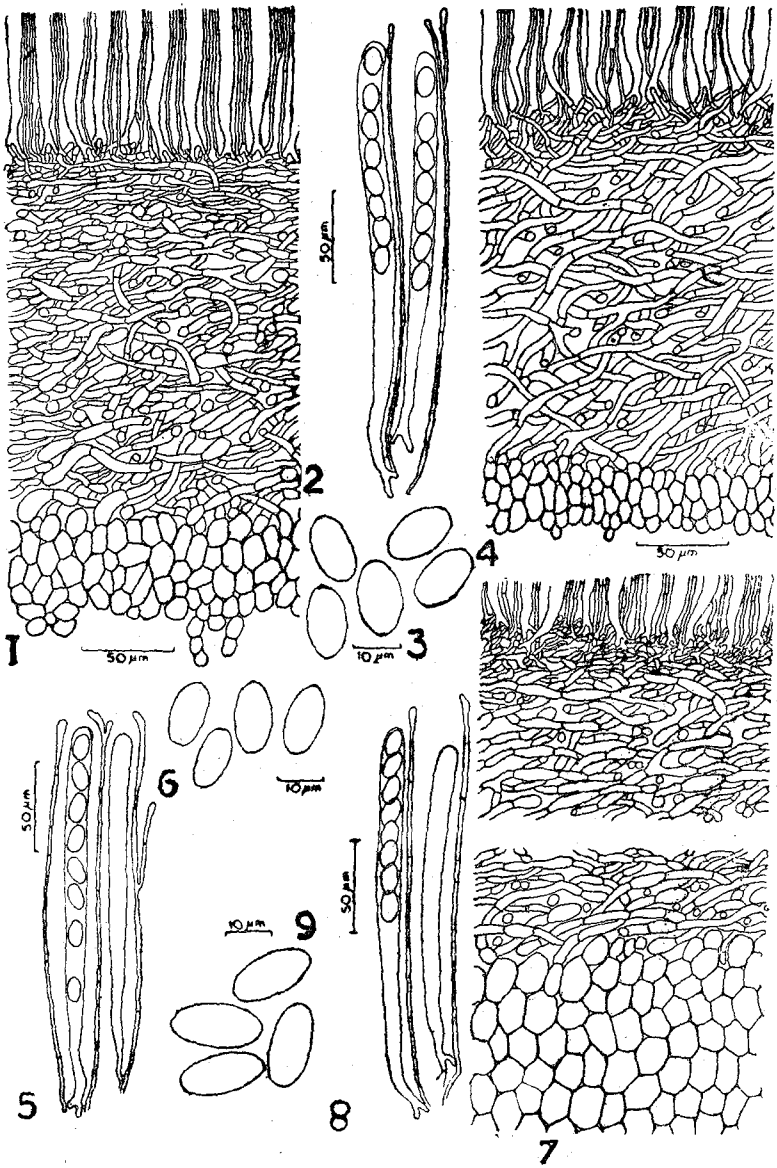

Fig. 1–3. *Geopyxis vulcanalis*. 1. V. S. of the apothecium passing through its middle. 2. Asci and paraphyses. 3. Ascospores. 4–6. *G. alpina*. 4. V. S. of the apothecium passing through its middle. 5. Asci and paraphyses. 6. Ascospores. 7–9. *G. grandis*. 7. V. S. of the apothecium passing through its middle. 8. Asci and paraphyses. 9. Ascospores.

3. External surface glabrous paraphyses lobed at apices. ..... *G. alpina*

2. Apothecia subsessile to distinctly stipitate, usually resembling acorncup, pyrophilous. ..... *G. carbonaria*

1. Apothecia up to 5 cm in diameter, external surface orange brown, ectal excipulum 90–145 μm thick. ..... *G. grandis*

Geopyxis vulcanalis (Peck) Sacc., Syll. Fung. 8 : 65. 1889.

Basionym : *Peziza vulcanalis* Peck, apud Haydin, U. S. Goel. Surv. Terr. 6 : 792. 1873. Figs. 1–3.

Apothecia up to 2 cm in diameter, densely gregarious to crowded together, solitary, sessile to subsessile, cupulate to repand, regular to irregular, soft, fleshy; external surface light yellow, glabrous or slightly pruinose, pruinose hairs up to 35 μm long, formed of chains of 2–4 cells, hyaline, thin-walled, simple, sometimes aggregating to form small tubercles; margin crenate, sometimes split for a short distance; hymenium pale orange to orange-yellow, smooth; stipe absent or very small (up to 3 × 1 mm) paler or concolorous with external surface. Asci 200–260 × (8–) 10–14 μm, 8-spored, cylindrical, apices obtuse, J–. Ascospores 12·5–16·5 × 8–9·5 (–10 5) μm, broadly ellipsoid, uniseriate, hyaline, smooth, eguttulate. Paraphyses up to 1·75 μm wide below, not or slightly enlarged above up to 2·5 (–3) μm at their apices, filiform, septate, straight, simple or branched, hyaline to pale yellow-orange.

Anatomy : Ectal excipulum up to 65 μm thick, textura angularis, cells up to 25 × 14 μm, slightly thick-walled, externally minutely pruinose; medullary excipulum up to 200 μm thick, textura intricata, hyphae vesicular at places, up to 4·25 μm wide (up to 9 μm at vesiculate places); hypothecium indistinct.

Substratum : On damp soil.

Collections examined : S. Chander 2373 (PAN), on soil, Kufri, Simla, H.P., August 1, 1971; S. Chander 2386 (PAN), on damp soil. Kufri, Simla, H.P., August 10, 1971; S. Chander 2406 (PAN), on damp soil, Narkanda, Simla, H.P., August 17, 1971; S. Chander 2502 (PAN), on damp soil among mosses, Kalatope, Dalhousie, H.P., September 15, 1972; S. Chander 2542 (PAN), on soil, Cheena Peak, Nainital, U.P.; August 16, 1973; S. Chander 2598 (PAN), on damp soil, Gulmarg, J. & K., August 18, 1974; S. Chander 2600 (PAN), on damp soil, Gulmarg, J. & K., August 8, 1974; S. Chander 2605, 2606 (PAN), on damp soil, Kalatope, Dalhousie, H P., August 24, 1974; Waraitch 2089 (PAN), on soil amid mosses, Lakkar Mandi, Dalhousie, H.P., July 21, 1966; Waraitch 2240 (PAN), on moist soil, Bhadarwah, J. & K., August 18, 1967.

Comments : The fungus was first recorded from India by Batra and Batra (1962) who remarked it to be an uncommon species. Thind and Waraitch (1970) described it on the basis of a single collection made from Simla hills. However, we have found it to be very common and widely distributed species in North-Western Himalayas. Waraitch (1969) and subsequently we have made its many collections during the last decade. The species is characterised by its cupulate to repand apothecia and its non-pyrophilous habitat. Rifai (1968) pointed out that

G. vulcanalis is probably a luxuriant form of *G. carbonaria* (Alb. & Schw. ex Fr.) Sacc. However, it is described here as a distinct species (see under *G. carbonaria*).

Geopyxis alpina Hohnel, Ann. Myc. III : 555. 1905. Figs. 4–6

Apothecia up to 1·2 cm in diameter, densely gregarious, solitary, sessile, shallow cupulate to repand, regular, soft, fleshy; external surface pale orange, glabrous to minutely pruinose due to a few protruding out cells; margin entire to crenate; hymenium orange to orange-yellow, smooth. Asci 190–215 (–250) × 10·25-13 (–14) μm, 8–spored, cylindrical, apices obtuse, base long and tapering below, J–. Ascospores 14–16 (–17) × 7–9 μm; ellipsoid, uniseriate, subhyaline, smooth, eguttulate. Paraphyses up to 2 μm wide below, expanding above up to 3·5 (–5) μm at their apices, filiform, septate, straight or slightly bent, simple or branched below, apex simple or irregularly lobed, pale orange.

Anatomy : Ectal excipulum up to 42 μm thick, textura angularis, cells up to 19 × 10·5 μm; thick-walled, more or less radially arranged; medullary excipulum up to 163 μm thick, textura intricata, hyphae up to 3 μm wide, vesicular at places (up to 6·5 μm); hypothecium narrow, up to 20 (–25) μm thick, textura densely intricata, hyphae up to 3 μm wide.

Substratum : On damp soil.

Collections examined : S. Chander 2370 (PAN), on damp soil, Glen, Simla, H. P., July 31, 1971; S. Chander 2444 (PAN), on damp soil, Gojra, Kulu, H. P., September 27, 1971.

Comments : This is a rare species and is described here for the first time from India. Jiri Moravec, who has studied this species from Europe has very kindly informed me that its sessile to subsessile to substipitate to stipitate form is also common in Czechoslovakia (personal communication). The Indian collections are all sessile, more or less smooth externally, and the cells are not aggregated to form any short of tubercles on the outside. The species is very close to *G. vulcanalis* from which it differs only doubtfully.

Geopyxis grandis Thind et Kaushal sp. nov. Figs. 7–9

Apothecia ad 5 cm diam, dense gregaria ad congesta ie unum, subsessilia ad parum stipitata, alte cupulata (ad 2 cm alta), regularia, mollia, carnosa; superficies exterior brunneoaurantiaca, minute tuberculata, tuberculis ad 35 μm transverse, constantibus cellulis globosis ad subglobosa, margine crenato; hymenium flavo-aurantiacum; stipite ad 7·5 × 2 mm, concolori cum superficie externa, solidum, extendens supra in apothecia. Asci 175–215 × 7·5–11 μm, octosporidei, cylindrici, apices obtusi, J–. Ascosporae 14·25–18 (–21) × 7·25–9 μm, ellipsoideae, uniseriatae, subhyalinae, molles, eguttulatae. Paraphyses ad 3 μm diam latae infra, supra vel non ampliatae vel ampliatae exigue ad 4 μm in apicibus; apices aliquando irregulariter lobulati, filiformes, septati, recti, simplices vel ramosi infra.

Anatomia : Ectal excipulum ad 145 μm crassum, textura angularis, cellulae ad 26 × 17·5 μm, exigue tenuitunicatae, minute tuberculatae extrinsecus; excipulum medullare ad 495 μm crassum, textura intricata, hyphae vesiculares in locis, ad 5 μm latae, (ad 9 μm in locis vesiculatis); hypothecium non bene differentiatum, ad 25 μm crassum, textura dense intricata, hyphae ad 3 (–4) μm latae. Holotypus : In usto humo in densa sylva conifora, Gulmarg, J. & K., India, August 28, 1972, Leg. S. Chander 2475 (PAN).

Apothecia up to 5 cm in diameter, densely gregarious to crowded together, subsessile to short stipitate, deep cupulate (up to 2 cm deep), regular, soft, fleshy; external surface orange-brown, minutely tubercled, tubercles up to 35 μm across, made up of globose to subglobose cells; margin crenate; hymenium orange-yellow, smooth; stipe bp to 7·5 × 2 mm, concolorous with external surface, solid, expanding above into apothecia. Asci 175–215 × 7·5–11 μm, 8-spored, cylindrical, apex obtuse, J–. Ascospores 14·25–18 (–21) × 7·25–9 μm ellipsoid, uniseriate, subhyaline, smooth, eguttulate. Paraphyses up to 3 μm wide below, not or slightly enlarged above up to 4 μm at their apices, apices occasionally irregularly lobed, filiform, septate, straight, simple or branched below.

Anatomy : Ectal excipulum up to 145 μm thick, textura angularis, cells up to 26 × 17·5 μm, slightly thick-walled, externally minutely tubercled; medullary excipulum up to 495 μm thick, textura intricata, hyphae vesicular at places, up to 5 μm wide (up to 9 μm at vesiculate places) ; hypothecium not well differentiated, up to 25 μm thick, densely textura intricata. hyphae up to 3 (–4) μm wide.

Comments : *G. grandis* was found growing luxuriantly on burnt soil in dense coniferous forest under very humid conditions. It is closely related to *G. carbonaria* which also has a pyrophilous habit but differs from the latter in having much larger apothecia, very thick ectal excipulum and slightly bigger ascospores.

Geopyxis carbonaria (Alb. and Schw. ex Fr.) Sacc., Syll. Fung. 8 : 71. 1889.

Basionym : *Peziza carbonaria* Alb. & Schw. ex Fr., Syst. Myc. 2 : 62. 1822.

This pyrophilous fungus was first reported from India by Thind and Waraitch (1970) from widely separated localities, occurring usually under coniferous forests. The size of the apothecia (up to 2·5 cm), ascospores (11·5–16×6–9 μm) and the thickness of the ectal excipulum (60–112 μm) and the medullary excipulum (125–225 μm) in the Indian collections are larger than those reported by Rifai (1968) for the American, Japanese and European collections. These features are suggestive of close affinities of the Indian collections with *G. vulcanalis*. Rifai (1968) has suggested, "It is probable that the type specimen of *Peziza vulcanalis* Peck apud Haydin, on (burnt ?) ground among conifer needles in the crater of an extinct volcano in Colorado, U.S.A., s. date, J. M. Coulter, is only a luxuriant form of *G. carbonaria* ". However, he hesitated to list the former as a synonym of the latter because of uncertainty concerning its habitat.

Since all the Indian collections mentioned below are collected from burnt soil and have acorn-cup like apothecia with crenulate margin, these are referred here to *G. carbonaria*. *Collections examined*; Waraitch 2033 (PAN), on burnt soil in open place in coniferous forest, Narkanda, Simla, H. P., August 14. 1965; Waraitch 2055 (PAN), on burnt soil in coniferous, Soja, Kulu, H. P., September 19, 1965; Waraitch 2144 (PAN), on burnt soil in coniferous forest, Saran, Chamba, H. P., August 27, 1966; Waraitch 2207 (PAN), on burnt soil, over-run by mosses in Abies forest, Gulmarg, Srinagar, J. & K., July 18, 1967.

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