

## GEOGLOSSACEAE OF INDIA AND ADJACENT COUNTRIES

R. A. MAAS GEESTERANUS  
*Rijksherbarium, Leiden*

(With 36 Text-figures)

A revision of the genera *Geoglossum*, *Microglossum*, and *Trichoglossum* as represented by collections made in West Pakistan, India, Nepal, Sikkim, and Tibet is given. Several species from this area are recorded for the first time. *Geoglossum glabrum*, albeit not indigenous, is discussed and shown to be a nomen dubium; the name as used in the sense of Nannfeldt is replaced by *G. sphagnophilum*. The name *Geoglossum nigratum* is a misapplication, so that for it *G. umbratile* is re-introduced. *Geoglossum umbratile* var. *heterosporum* is a new combination.

In 1964 two members of the 'Rijksherbarium' collected fungi in the northwestern part of India. This was made possible by a grant from the 'Netherlands Organisation for the Advancement of Pure Research (Z.W.O.).'

The Geoglossaceae, which were found exclusively during the last stage of the trip, comprise comparatively few species, but combined with collections borrowed from various institutes and covering a much wider area they probably give a fair picture of the number of species represented in the lower ranges of the Himalayas.

In the past, collectors did not pay a great deal of attention to Geoglossaceae and records from the Himalayan region were extremely scarce. Berkeley (1854: 209) listed *Geoglossum glabrum* from Yeumtong (Sikkim) and *Geoglossum viride* from Yeumtong and Lachoong (Sikkim). For a long time these were the only data available and they were repeated by Cooke (1875: 7, 9), Saccardo (1889: 44, *G. ophioglossoides*; 38, *Mitrella viridis*), and Butler & Bisby (1931: 11). Gradually the situation improved but not much. Lloyd (1916: 12) recorded *Geoglossum hirsutum* from India and shortly afterwards (1917: 4) mentioned *G. glabrum* in a list for an Indian correspondent. *Geoglossum ophioglossoides* was reported from southeastern Tibet by Mrs. Balfour-Browne (1955: 213). Sultan Ahmad (1956: 37) mentioned *Geoglossum glabrum* and *Trichoglossum velutipes* from West Pakistan. An important contribution was made by Batra & Batra (1963: 149-151) who reported many species distributed over the genera *Geoglossum*, *Gloeoglossum* (which in the present paper is not accepted as a separate taxon), *Microglossum*, and *Trichoglossum*.

A serious defect common to all records mentioned is the lack of descriptions of even passable quality. This is meagre encouragement for a prospective investigator since he cannot know whether his collections match those already reported. Worse still, without access to the material he has no means of verifying whether the species recorded have been correctly identified. As a definite improvement must be regarded

a recently published paper by Thind & Singh (1965) in which the authors deal with a few species only of *Geoglossum* and *Trichoglossum*, but give detailed descriptions. The present paper is offered in the hope that it may incite local mycologists to further interest in this much neglected group.

India and adjacent countries lie in an area that from a plant-geographical point of view cannot fail to yield interesting data. This is borne out by the present paper, however few the collections on which it is based. For example, *Geoglossum affine*, previously known only from the United States, is shown to occur in Nepal and Sikkim; *G. cookeianum*, hitherto known from Europe and the United States, appears in a single collection from India; and so on. More is certainly to be expected from an extended study.

There is also another point that requires comment. In the past several species have been described from a single collection which sometimes consists of a single specimen. It is not at all exceptional to find that collections are being regarded as referable to two independent species if they are found to differ in a single character. While this displays a certain disregard for the variability of the character in question, the distinction tends to be carefully maintained, particularly if the collections have come from places widely remote from one another. However, subsequent finds are likely to bridge the gap between the two 'species' while the Himalayan ranges, because of their enormous and uninterrupted expanse, are a promising place for such finds. The following example serves to illustrate this point. *Geoglossum pumilum*, described from Brazil, and *G. pusillum*, described from China, were once thought to represent two separate species but material collected in India demonstrates that they are the same. It is probable that even *G. pygmaeum* from the United States is another synonym.

Practically nothing is as yet known of the altitudinal distribution of the Geoglossaceae in the Himalayas. It may be expected, however, that at least some species favour a certain altitude and *G. affine* is possibly a case in point.

Attention must be drawn to a few technical points. The descriptions have been made from dried material. This unavoidably affects the size and colour of the fruit-body and, in the case of *Microglossum*, possibly also the spore-measurements. While it is desirable that eventually these parts in the descriptions be replaced by observations of fresh material, neither the size of the fruit-body nor its colour has been used in the key. The key used is basically the same as the one first published by Nannfeldt (1942), but it has been appropriately modified and adapted.

As far as possible duplicates of the material collected by the Dutch party have been deposited in (i) the herbarium of the Botanical Survey of India, Northern Circle, Dehra Dun (BSD), (ii) the Forest Research Institute & Colleges, Dehra Dun (DD), and (iii) the Indian Agricultural Research Institute, Division of Mycology and Plant Pathology, New Delhi (HCIO).

I gratefully acknowledge the loan of valuable collections from The National Fungus Collections, Beltsville (Mycological Herbarium of Lloyd, BPI), Department

of Plant Pathology, Cornell University, Ithaca (CUP), The Herbarium, Royal Botanic Gardens, Kew (K), British Museum (National History), Department of Botany, London (BM), Istituto e Orto Botanico dell'Università, Padova (PAD), and Laboratoire de Cryptogamie, Paris (PC). Thanks are also due to Dr. Sultan Ahmad, Lahore, for generously sending unidentified material, and to Prof. Dr. J. A. Nannfeldt, Uppsala, for the gift of some collections of *Geoglossum starbaeckii*. I am also very much indebted to Mrs. E. van Maanen, Amsterdam, for her advice in linguistic matters; deviations from the English idiom remain my responsibility.

GEOGLOSSACEAE

Fruit-bodies solitary or gregarious to subcespitate, erect, consisting of a fertile portion (clavula) born by a stipe, fleshy to somewhat waxy-fleshy, with or without black setae, dry to viscid. Clavula more or less gradually passing into the stipe, terete or compressed, cylindrical, clavate, ligulate, spatulate, lanceolate, more rarely capitate or flabellate, glabrous to felted or setose, black, black-brown, (when fresh also) purplish brown, olivaceous, green, yellow, orange. Stipe usually well developed, terete, glabrous, pubescent, squamulose, setose, more or less concolorous with the clavula. Asci cylindrical to cylindrical-clavate, inoperculate, (2-)4-8-spored. Spores 1-2-seriate or fasciculate in the ascus, acicular or cylindrical to cylindrical-clavate or ellipsoid to fabiform, straight or curved, 1-16-celled, rarely with more cells, colourless to brown. Paraphyses discrete or agglutinate, septate, more or less branched, straight to variously curved, colourless or brownish above.

Terrestrial or growing on vegetable debris or decaying wood.

Thus far only three genera—*Geoglossum*, *Microglossum*, and *Trichoglossum*—have been found in the area under discussion, which includes West Pakistan, India, Nepal, Sikkim, and Tibet.

*Leotia* Pers. is considered to belong to the Helotiaceae (Maas Geesteranus, 1964: 81) and is not treated in this paper.

KEY TO THE GENERA

- 1. Spores turning brown at maturity (in one species long remaining colourless, but then paraphyses apically abruptly enlarged and stipe slippery-viscid).
  - 2. Hymenium without dark setae. . . . . *Geoglossum*
  - 2. Hymenium with dark setae . . . . . *Trichoglossum*
- 1. Spores permanently colourless; paraphyses not abruptly enlarged apically and stipe not viscid . . . . . *Microglossum*

GEOGLOSSUM Pers. ex Fr.

*Geoglossum* Pers. in Neues Mag. Bot. 1: 116. 1794; ex Fr., Syst. mycol. 1: 487. 1821. — Type species: *G. glabrum* Pers. ex Fr. (Cf. Saccardo, 1884: 214).

*Gloeoglossum* Dur. in Annls mycol. 6: 418. 1908. — Type species: *Geoglossum peckianum* Cooke (cf. Durand).

Fruit-bodies solitary or gregarious to subcespitate. Clavula gradually passing into the stipe, terete or compressed, cylindrical, clavate, ligulate, spatulate or lanceolate, glabrous or felted, dry or viscid, black to dark brown (also when fresh). Stipe terete, glabrous or pubescent to squamulose, dry or viscid, concolorous with the clavula or

darker. Asci cylindrical to cylindrical-clavate, inoperculate, 4–8-spored, the pore blued with iodine. Spores fasciculate in the ascus, acicular, cylindrical, cylindrical-clavate, straight or curved, 1–16-celled, eventually brownish to brown. Paraphyses discrete or agglutinate, septate, more or less branched, straight to variously curved, colourless or brownish above; in some species not confined to the hymenium, but continuing down the stipe to form a dense palisade.

Batra & Batra (1963: 149) mentioned a species called *Geoglossum alveolatum* from various localities in India, referring to Butler & Bisby's check-list as well as to their own collection. However, it turned out that at Cornell University, Ithaca, only slides had been deposited and these had not been sent on loan. The material which seems to be preserved at Panjab University, Chandigarh, was asked on loan, but had not arrived at the time this paper went to press.

From the Kew Herbarium word was received that no Indian material of *G. alveolatum* was either there or at the Commonwealth Institute. Butler, it was said, normally sent his fungi to Sydow so that the place they were most likely to be found was Stockholm. However, the reply from the Natural History Museum at Stockholm was that no material of *G. alveolatum* had been found there either.

Although it may turn out after all that *G. alveolatum* has actually been collected in India, the species is not dealt with here.

#### KEY TO THE SPECIES

1. Paraphyses in the upper part agglutinate by brownish amorphous matter.
  2. Paraphyses continuing down the stipe to form a conspicuous palisade.
    3. Paraphyses enveloped in a sheath of brown matter. Asci 18–25  $\mu$  wide *G. affine*
    3. Paraphyses without adhering brown matter. Asci up to 15  $\mu$  wide *G. glutinosum*
  2. Paraphyses not continuing down the stipe to form a palisade, remotely septate, colourless . . . . . *G. fallax*
1. Paraphyses not agglutinate by brownish matter, discrete.
  4. Spores 8-celled or with fewer cells.
    5. Asci 8-spored.
      6. Paraphyses in the upper part as a rule without side-branches or buds.
        7. Paraphyses closely to moderately septate above.
          8. Paraphyses continuing down the stipe as 'hairs' which form a dense palisade; besides, the paraphyses are characterized by many barrel-shaped pairs of cells . . . . . *G. simile*
          8. Paraphyses not continuing down the stipe to form a dense palisade; barrel-shaped pairs of cells rare or absent.
            9. Paraphyses straight to somewhat curved, the upper part consisting of a chain of symmetrical cells . . . . . *G. cookeianum*
            9. Paraphyses variously curved to coiled, most cells of the upper part unequal-sided . . . . . *G. japonicum*
        7. Paraphyses remotely (rarely moderately) septate *G. umbratile* var. *umbratile*
      6. Paraphyses with many side-branches and buds . . . . . *Geoglossum* sp.
    5. Asci 4–8-spored . . . . . *G. umbratile* var. *heterosporum*
  4. Some or all of the spores more than 8-celled.
    10. At least part of the spores 9–12-celled . . . . . *G. japonicum*
    10. Spores normally 16-celled . . . . . *G. pumilum*

## GEOGLOSSUM AFFINE (Dur.) Sacc. &amp; Trav.—Figs. 1-4

*Geoglossum affine* Dur. in *Annlis mycol.* 6: 420, figs. 73, 74, 165-167. 1908. — *Geoglossum affine* (Dur.) Sacc. & Trav. in *Syll. Fung.* 19: 756. 1910. — *Cibalocoryne affinis* (Dur.) Imai in *Bot. Mag., Tokyo* 56: 526. 1942.

Fruit-body 16-50 mm high. Clavula 10-21 × 1-2 mm, lanceolate or ligulate, with median groove and obtuse apex, dull, black-brown. Stipe 9-31 × 0.5-1.5 mm, terete, apparently smooth and viscid when fresh, dried somewhat shiny, covered with dirt, black-brown. Asci (154-)158-190(-210) × (18-)20-25.5 μ, 8-spored. Spores 52-65(-71) × 6.5-7.5(-10) μ (but sometimes longer, e.g. 73-95 × 5.5-7 μ), cylindrical-clavate to somewhat fusiform, 8-celled, brown. Paraphyses agglutinate by brown amorphous matter (which also partly or wholly envelops the upper cells), 2-5 μ wide and colourless below, 8-12 μ wide and pale brown above, moderately to remotely septate in the upper parts and curved to coiled, rarely straight; continuing down the stipe to form a conspicuous palisade that is viscid when fresh.

HABITAT.—This seems to be a species of somewhat higher altitudes, having been collected among dwarf *Rhododendron* and *Vaccinium* between 3600 and 4000 m.

DISTRIBUTION.—Thus far the species does not seem to have been reported outside the United States (Durand, Mains).

## COLLECTIONS EXAMINED.—

Nepal: S. of Gurjakhani, 17 Aug. 1954, *Stainton, Sykes, & Williams 3879a 3879b* (BM); Annapurna Himal, Leti Khola, 28 July 1954, *Stainton, Sykes, & Williams 6540* (BM).

Sikkim: Yeumtong, 5 Sept. 1849, *Dr. Hooker* (K); [6 Sept. 1849, *Dr. Hooker*] (K).

Tibet: Mira La, Nyang chu, 17 Aug. 1938, *Ludlow, Sherriff, & Taylor 6095* (BM).

Generally, but erroneously, Lloyd (1916: 9) is being regarded as the first author to have transferred the present species to the genus *Geoglossum*.

Durand (l.c.) gave the measurements of the spores of the type only, omitting those of the second collection he cited. The latter was examined by Mains (1954: 594) who found the spores (55-)60-80(-85) μ long. It is clear that the length of the spores has a wider range of variability than can be deduced from Durand's data. The spores in *Stainton, Sykes, & Williams 3879a* were even longer still, measuring 73-95 × 5.5-7 μ.

Mains (1954: 593), comparing the present species with *G. glutinosum*, found the status of *G. affine* very uncertain. This sounds strange, considering that there are enough features to make it possible to tell the species apart. In dried condition the hymenium is dull and black-brown in *G. affine*, shiny and black in *G. glutinosum*. The asci are much stouter in *G. affine* than in *G. glutinosum*. The spores in *G. glutinosum* apparently take their time maturing, hence in the same slide they vary from colourless to brownish and from one-celled to eight-celled, whereas in *G. affine* a large proportion mature at the same time. In their heavy incrustation and the shape of the upper cells, the paraphyses of *G. affine* differ considerably from those of *G. glutinosum*.

Berkeley (1945: 209) reported two species from Yeumtong in Sikkim, *G. viride*

and *G. glabrum*, both collected by Hooker. The former turns out to be *G. affine*, while the latter is partly *G. affine*, partly *G. fallax*.

Part of the collection of *Stainton, Sykes, & Williams* from Nepal (No. 3879c) deviates from Nos. 3879a and 3879b in that the paraphyses are discrete and not encrusted with brown matter. It is not known what significance should be attributed to this phenomenon.

GEOGLOSSUM COOKEIANUM Nannf.—Fig. 5

*Geoglossum cookeianum* Nannf. in *Ark. Bot.* (A) 30 (4): 22 figs. 2d, 3. 1940.

The collection consists of a single specimen which is incomplete, as it lacks the upper half of the clavula. Clavula 1–1.5 mm wide, dull, black-brown. Stipe  $18 \times 1$  mm, somewhat flattened, smooth, somewhat shiny, black. Asci  $170\text{--}177 \times 20\text{--}22$   $\mu$ , 8-spored. Spores  $75\text{--}83 \times 5.5\text{--}7$   $\mu$ , cylindrical-clavate, 8-celled, brown. Paraphyses somewhat adhering in clusters in the upper part, not really agglutinate by brown amorphous matter, 2–3  $\mu$  wide and brownish below, up to 8–10  $\mu$  wide and brownish to darkish brown above, closely septate in the upper parts, straight to somewhat curved.

HABITAT.—No information.

DISTRIBUTION.—Europe (Nannfeldt), India, U.S.A. (Durand, Mains).

COLLECTION EXAMINED.—

India: Uttar Pradesh, Mussoorie, Camel's Back Road, Cemetery, 9 Sept. 1960, *L. R. Batra* (CUP-I. 133).

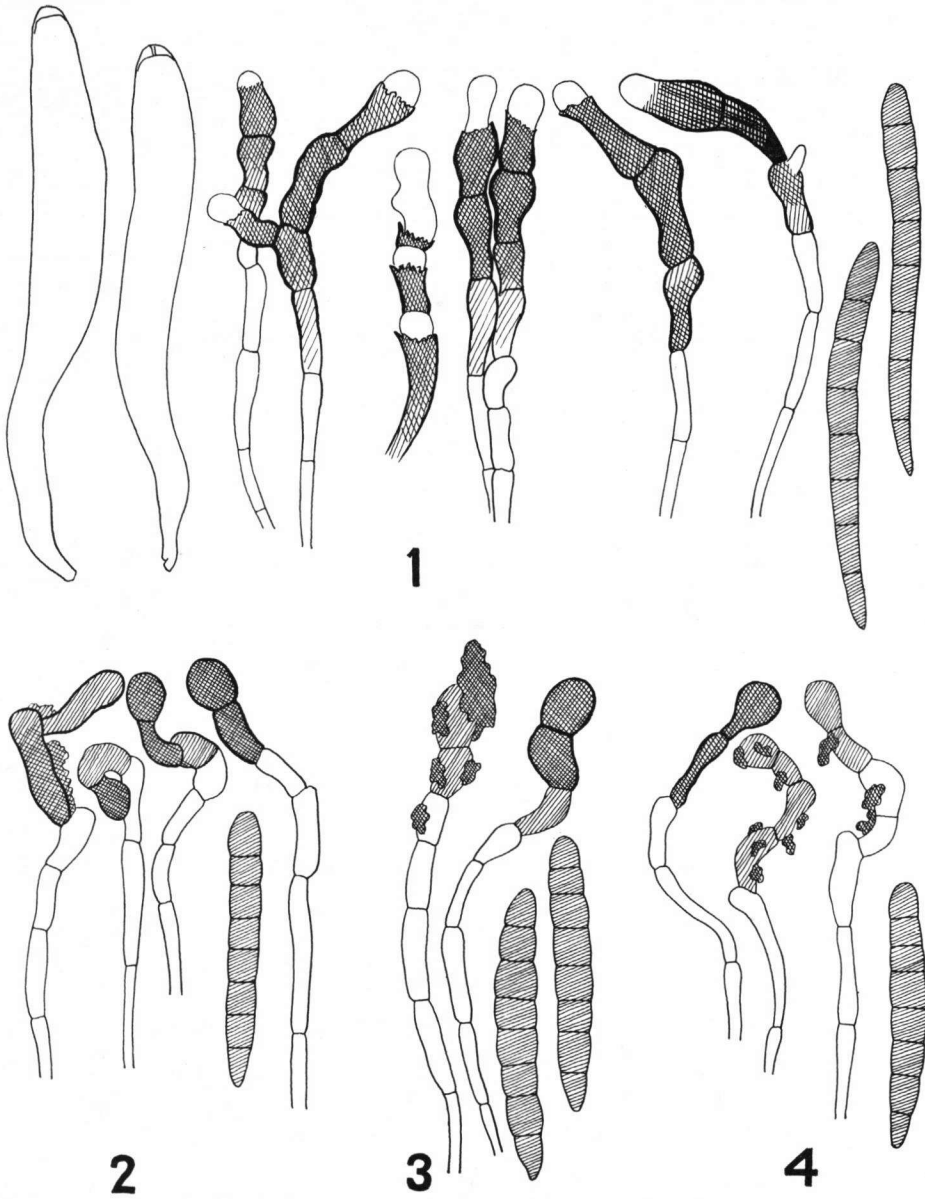
Thind & Singh (1965: pl. 2 fig. 1) published a photograph of *Geoglossum cookeianum*, but failed to give a description and did not indicate whether the material had been collected in India.

Even though much has already been said on the subject, it is unavoidable to discuss *G. glabrum* once again in connection with the present species.

Mains (1954: 601) once said that "there is considerable disagreement concerning the specific limitations of *Geoglossum glabrum*." The situation is worse than that for it is not known what the original *Geoglossum glabrum* looks like. There is, however, some knowledge of (and disagreement about) *G. glabrum* sensu Nannfeldt, a species for which a good epithet is available.

The specific epithet *glabrum* goes back to Persoon (1794: 116) who introduced it as a new name for *Clavaria ophioglossoides* L. Later (1799: 61), having become disgusted with all the different conceptions of what various authors called *C. ophioglossoides*, Persoon supplied a description for what he called "this my fungus," adding that the species occurs among grass in the hills ("in colliculis graminosis"). Unfortunately, this macroscopical description, however detailed, is altogether inadequate for identification of the species. Microscopical examination of the type could have furnished the clue, but the whole point is that there is no type.

The cover in Persoon's herbarium labelled *Geoglossum glabrum* contains the five following sheets. Of none of these can it be proved that it possibly served for the description of the species. In the case of the last sheet there is even definite proof that Persoon did not come into possession of the material until after he had published his *G. glabrum*.



Figs. 1-4. *Geoglossum affine*: asci ( $\times 400$ ), paraphyses and spores ( $\times 600$ ). — 1. Nepal, Stainton, Sykes, & Williams 3879a (BM). — 2. Nepal, Stainton, Sykes, & Williams 3879b (BM). — 3. Sikkim, 6 Sept. 1849, Hooker (K). — 4. Tibet, Ludlow, Sherriff, & Taylor 6095 (BM).

No. 910.261-768: nine specimens glued to a piece of paper and the name written in Persoon's handwriting. Seven specimens belong to *G. fallax*, two to *G. cookeianum*.

No. 910.261-769: two specimens glued to a piece of paper and the name in Persoon's handwriting. Both specimens belong to *Trichoglossum hirsutum*.

No. 910.261-770: one specimen, about which Persoon was in doubt whether it represented a young stage or possibly a small variety of *G. glabrum*. Instead, it is an immature specimen of some species of *Xylosphaera*.

No. 910.261-773: two specimens glued to a piece of paper along with a message which Mougeot had sent to Persoon. Both specimens represent *G. fallax*.

No. 910.262-109: two specimens glued to a piece of paper, to the bottom of which two smaller slips are attached, both written in Mougeot's handwriting. One bears the name *Geoglossum glabrum*, the other a remark to the effect that the specimens were found to be perfectly glabrous and not viscid. These specimens appear to be *Geoglossum glabrum* as understood by Nannfeldt.

It was from this last sheet that fragments of both specimens were sent to Durand who naturally assumed that he had received parts of the type. It is quite certain, however, that these specimens do not represent the type. First, Persoon received Mougeot's material after he had already settled in Paris, that is, long after the publication of the name *G. glabrum*. Secondly, Mougeot's material came from a habitat entirely different from that which Persoon had indicated for his species. The two specimens forwarded by Mougeot have the bases of their stipes attached to tufts of *Sphagnum*. There is no doubt but that these specimens form part of a larger collection distributed by Mougeot & Nestler in their *Stirpes cryptogamae vogeso-rhenanae* under No. 684 as *Geoglossum sphagnum* Pers. (which is a nomen nudum). At any rate, the specimens in the copy at Leiden are also fastened to tufts of *Sphagnum*. The label of this exsiccatum reads: "Inter *Sphagna* in torfaceis circa Gerardmer. Autumnno."

As there is no sense in speculating on the identity of *G. glabrum* and as it would be undesirable to choose a neotype from among the specimens discussed above, the specific epithet is here formally rejected.

Nannfeldt (1942: 29) accepted Durand's choice of the type and very likely during his visit to Leiden he had himself noticed the identity of the alleged type and Mougeot & Nestler's exsiccatum. This, in all probability, is the source from which his conviction grew that *G. glabrum* must be a species of *Sphagnum* bogs. Nannfeldt is perfectly right in maintaining that the species is well characterized and distinct from all others, but its name must be replaced by *Geoglossum sphagnophilum* Ehrenb. ex Wallr.<sup>1</sup>

Notwithstanding the fact that Nannfeldt had clearly demonstrated the difference

<sup>1</sup> *Geoglossum sphagnophilum* Ehrenb., Sylv. mycol. berol. 30. 1818; ex Wallr., Fl. cryptog. Germ. 2: 532. 1833. — *Geoglossum ophioglossoides* var. *sphagnophilum* (Ehrenb. ex Wallr.) Rehm in KryptogFl. Deutschl., Ed. 2, 1 (3): 1156. 1896. — *Geoglossum glabrum* f. *sphagnophilum* (Ehrenb. ex Wallr.) J. Favre in Matér. Fl. cryptog. suisse 10 (3): 21. 1948. — *Geoglossum glabrum* var. *sphagnophilum* (Ehrenb. ex Wallr.) Imai in Trans. mycol. Soc. Japan 3: 52. 1962 ("Fr."). — Lectotype: *Geoglossum sphagnophilum* Ehb. in Herb. Pers. (L 910.261-786).

Misapplication: *Geoglossum glabrum* Pers. ex Fr. sensu Nannf. in Ark. Bot. (A) 30 (4): 29. 1942.



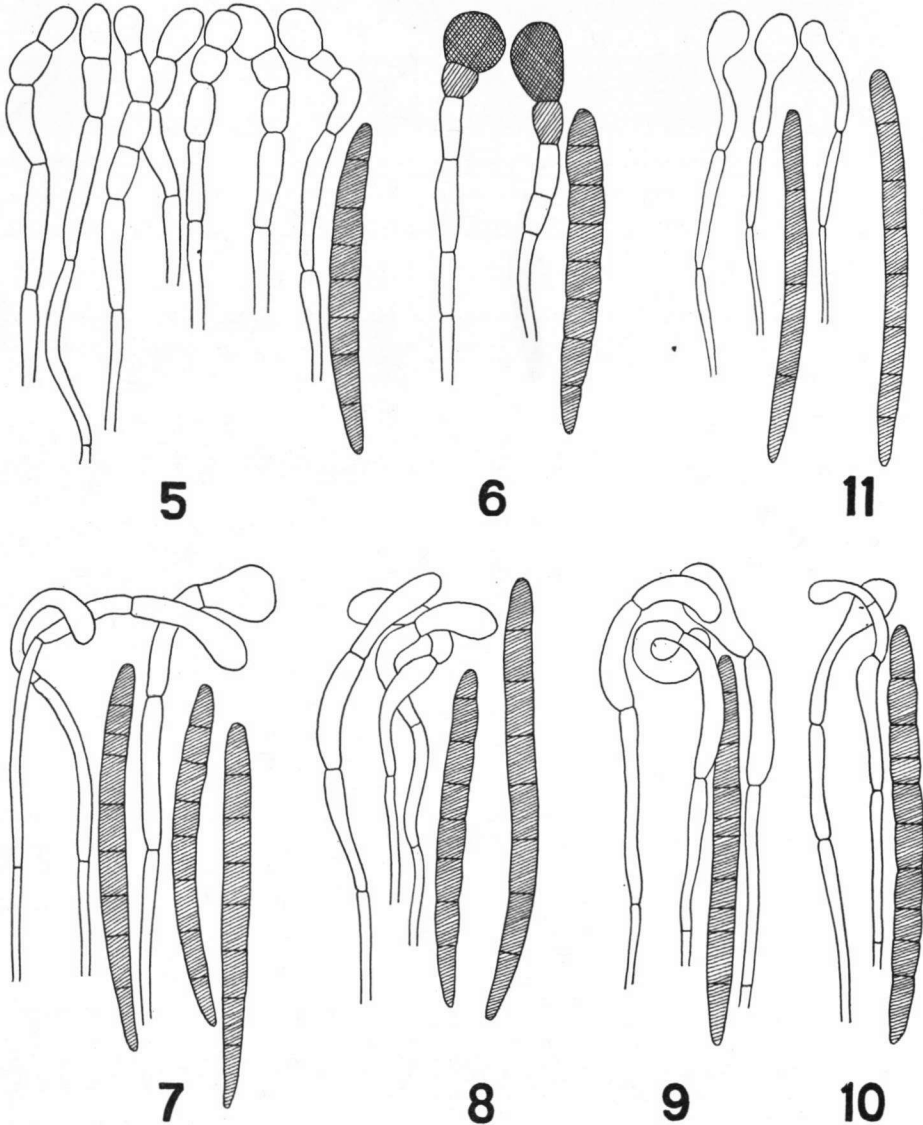


Fig. 5. *Geoglossum cookeianum*: paraphyses and spore ( $\times 600$ ); India, *Batra* (CUP-I. 133).  
 Fig. 6. *Geoglossum sphagnophilum*: paraphyses and spore ( $\times 600$ ); Germany, *Ehrenberg* (lecto-type, L).  
 Figs. 7-10. *Geoglossum fallax*: paraphyses and spores ( $\times 600$ ). — 7. India, *Maas Geesteranus* 14507 (L). — 8. India, *Maas Geesteranus* 14550 (L). — 9. India, *Maas Geesteranus* 14559 (L). — 10. Sikkim, *Hooker* (K).  
 Fig. 11. *Geoglossum glutinosum*: paraphyses and spores ( $\times 600$ ); India, *Thind 202b* (K).

between *G. cookeianum* and *G. sphagnophilum*, Durand's description and figures of what he considered to be *G. glabrum* continued to determine the opinion of later authors, the main trouble being the distinction between the two species so admirably unravelled by Nannfeldt. Mains (1954: 602) said that "usually there is considerable variation in the types of paraphyses within collections and distinctions are based on the predominance of types . . . It seems best to recognize these variants as varieties of *G. glabrum*." To judge from Mains' descriptions and, above all, his photographs, it seems that he never saw a good sample of the true *G. sphagnophilum*. It certainly is by no means superfluous to quote Nannfeldt's observation: "The apical cells [of the paraphyses] are almost invariably globose, very large (often reaching a diameter of 15  $\mu$ ), adhere almost indissolubly to each other and form a continuous dark, almost opaque layer above the asci, which layer is very conspicuous under the microscope, and renders *G. glabrum* recognizable already at first sight."

The Geoglossums in Persoon's herbarium are none too easy to examine microscopically and Durand may not have known that to enable the terminal cells of the paraphyses to resume their original shape the material has to be boiled in a fairly strong solution of KOH. From Durand's drawings it is obvious that he has altogether missed the typical paraphyses. Figures 5 and 6 in this paper show the difference between *G. cookeianum* and *G. sphagnophilum*.

#### GEOGLOSSUM FALLAX Dur.—Figs. 7–10

*Geoglossum fallax* Dur. in *Annls mycol.* 6: 428, figs. 61–64, 133–137. 1908.

Fruit-body 12–47 mm high. Clavula 3–11  $\times$  1–3.5 mm, clavate to ligulate, with median groove and obtuse apex, dull, dark brown to black-brown. Stipe 5–35  $\times$  0.5–1 mm, minutely squamulose, dark brown to black. Asci 132–177  $\times$  16–20  $\mu$ , 8-spored. Spores 76–102  $\times$  (4–)5–6  $\mu$ , cylindrical-clavate to acicular, slowly maturing, finally 8–13-celled and brown. Paraphyses agglutinate by brownish matter and sometimes firmly coherent, 2–4  $\mu$  wide and colourless below, (5–)6–12  $\mu$  wide and colourless to brownish above, remotely septate, not or little constricted at the septa, curved to coiled, the apical cell clavate to abruptly pyriform or hooked.

HABITAT.—On earth or among mosses covering rocks, sometimes in deep shade, but also in exposed positions, up to an altitude of about 4000 m.

DISTRIBUTION.—China (Tai, Teng), Europe (Nannfeldt), India, Japan (Imai), Sikkim, U.S.A. (Durand, Mains).

#### COLLECTIONS EXAMINED.—

I n d i a : Uttar Pradesh, Mussoorie, Jabber Keth, 10 Sept. 1960, *L. R. Batra* (CUP-I. 145); Mussoorie, 15 Sept. 1964, *R. A. Maas Geesteranus* 14538 (L); 17 Sept. 1964, *R. A. Maas Geesteranus* 14559 (L); Mussoorie, Camel's Back Road, 12 Sept. 1964, *R. A. Maas Geesteranus* 14501 (BSD, DD, HCIO, L); Mussoorie, near Charleville, 13 Sept. 1964, *R. A. Maas Geesteranus* 14507 (L); Mussoorie, Oakvilla, 16 Sept. 1964, *R. A. Maas Geesteranus* 14550 (L).

S i k k i m : Yeumtong, 6 Sept. 1849, *Dr. Hooker* (K).

Bille-Hansen (1954: 12) observed that in the colour of the apical part of the paraphyses and the amount of brown, amorphous matter in which they are embedded *Geoglossum fallax* is markedly variable. The difference between the extremes proved

so great that were it not for the intermediate forms he would have found it difficult to believe that the specimens belonged to the same species. A similar variability is seen in the Indian collections.

The collection from Sikkim was identified by Berkeley (1854: 212) as *G. glabrum*.

#### GEOGLOSSUM GLUTINOSUM Pers. ex Fr.—Fig. 11

*Geoglossum glutinosum* Pers., Obs. mycol. 1: 11. 1796; ex Fr., Syst. mycol. 1: 489. 1821. — *Geoglossum glutinosum* (Pers. ex Fr.) Dur. in Annl. mycol. 6: 419, figs. 70–72, 149–155. 1908. — *Cibalocoryne glutinosa* (Pers. ex Fr.) Imai in Bot. Mag., Tokyo 56: 525. 1942.

Fruit-body 22–50 mm high. Clavula 8–18 × 1–2(–4) mm, clavate to ligulate, with median groove and obtuse apex, somewhat shiny (viscid when fresh), black-brown to black. Stipe 10–36 × 1–1.5 mm, glabrous, shiny (viscid when fresh), dark brown to black. Asci 207–265 × 12–16 μ, very slender, 8-spored. Spores 73–95.5 × 4–5.5 μ, acicular-cylindrical, maturing slowly and tardily becoming septate, ultimately 8-celled and brown, but many with fewer cells and brownish or colourless. Paraphyses agglutinate by brownish matter, 2–4 μ wide and colourless below, 4–10 μ wide and brownish above, remotely septate, straight to curved, the terminal cell clavate to pyriform; continuing down the stipe to form a conspicuous palisade.

HABITAT.—On soil in oak forest or among mosses on stony slopes, at an altitude of about 2000 m.

DISTRIBUTION.—China (Tai, Teng), Europe (Nannfeldt), India (Batra & Batra, Thind & Singh), Japan (Imai), U.S.A. (Durand, Mains).

COLLECTIONS EXAMINED.—

I n d i a: Himachal Pradesh, Dalhousie, 22 Sept. 1955, *L. R. Batra* (CUP-I. 54). Uttar Pradesh, Mussoorie, Jabber Khet, 8 Sept. 1960, *L. R. Batra* (CUP-I. 127); Mussoorie, Camel's Back Road, 9 Sept. 1960, *L. R. Batra* (CUP-I. 126); Mussoorie, Jabber Kher Khad, 18 Aug. 1961, *K. S. Thind 215* (K); 9 Sept. 1961, *K. S. Thind 202b* (K); Mussoorie, 17 Sept. 1964, *R. A. Maas Geesteranus 14560* (BSD, DD, HClO, L).

#### GEOGLOSSUM JAPONICUM Imai—Figs. 12–14

*Geoglossum japonicum* Imai in J. Fac. Agric. Hokkaido imp. Univ. 45: 210, pl. 8 fig. 5. 1941. — *Geoglossum glabrum* var. *japonicum* (Imai) Imai in Trans. mycol. Soc. Japan 3: 52. 1952 ("Mains").

Fruit-body 25–42 mm high. Clavula 6–20 × 2–4 mm, ligulate, with median groove and obtuse apex, dull, dark brown to black. Stipe 15–17 × 1–1.5 mm, terete to flattened, minutely squamulose or glabrescent below, dull, black-brown to black. Asci 144–197 × (16–)20–25 μ, 8-spored. Spores 66–89 × 6–7 μ, cylindrical-clavate to somewhat fusiform, 8–12-celled, brown. Paraphyses discrete, 2–4 μ wide and colourless below, 5–9 μ wide and pale to fairly dark brown above, moderately to closely septate in the upper part, usually much constricted at the septa, straight or, more often, variously curved to circinate, the terminal cell generally clavate to pyriform.

HABITAT.—Among moss on stony slopes outside the forest, at an approximate altitude of 2000 m.

DISTRIBUTION.—India, Japan (Imai).

COLLECTIONS EXAMINED.—

I n d i a: Uttar Pradesh, Mussoorie, 17 Sept. 1964, *R. A. Maas Geesteranus 14557* (BSD, DD, HClO, L), *14646* (L); Mussoorie, Oakvilla, 16 Sept. 1964, *R. A. Maas Geesteranus 14549* (L).

Mains (1954: 602) expressed it as his opinion that "*G. japonicum* should also probably be considered a variety of *G. glabrum*." This led Imai to think that Mains had actually made the transfer. Even if it is borne in mind that Mains' conception of the type variety of *G. glabrum* covers *G. cookeianum*, it is by no means certain that *G. japonicum* is related with *G. cookeianum*, let alone that it should be subordinate to that species at all; too many of the paraphyses of both species are completely dissimilar in appearance.

The septation of the spores appears to be unequal. Imai described the spores of his species as 8-celled; so are most of the spores in *Maas Geesteranus* 14557. Many other spores, however, have fewer cells, although, to judge from their brown colour, they seem mature. In *Maas Geesteranus* 14549 some of the spores are 9-celled, in *Maas Geesteranus* 14646 even 8–12-celled. The steps are so gradual and the paraphyses so similar that it would seem arbitrary to draw any line. The situation is somewhat reminiscent of that in *G. starbaeckii* Nannf., a species that is characterized by slowly maturing, 1–10(–14)-celled spores and discrete, fairly dark, remotely septate, and variously curved paraphyses. There seems, in fact, to be no objection to placing *G. japonicum* (or what is here taken to be that species) proximate to *G. starbaeckii*. To facilitate comparison, Figure 15 is added.

Batra & Batra (1963: 149) mentioned *Geoglossum japonicum* in their publication, but their collection is here referred to *G. simile*.

#### GEOGLOSSUM PUMILUM Wint.—Figs. 16, 17

*Geoglossum pumilum* Wint. in Grevillea 15: 91. 1887.

*Geoglossum pusillum* Tai in Lloydia 7: 150, fig. 23. 1944.

Fruit-body 5–28 mm high. Clavula 2–10 × 1–3.5 mm, lanceolate to ligulate or spatulate, with median groove and obtuse apex, sometimes deformed and globose, dull, dark brown. Stipe 3–19 × 0.3–0.5 mm, terete, minutely squamulose or smooth below, somewhat shiny, black. Asci 175–225 × 20–24 μ, 8-spored. Spores 77–148 × 5–6.5 μ, acicular, (14–)16-celled at maturity, brown. Paraphyses discrete, 2–4 μ wide and colourless below, 5–10(–11.5) μ wide and pale brown above, (moderately to) remotely septate in the upper part, constricted at the septa, straight to curved or coiled, the terminal cell cylindrical to clavate or pyriform.

HABITAT.—On damp soil in forest of *Quercus* and *Rhododendron* or among mosses on exposed stony slopes, at an altitude of about 2000 m.

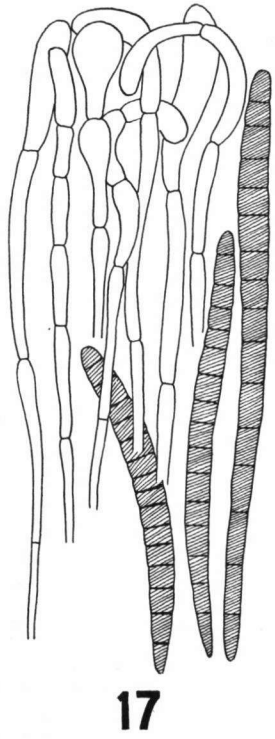
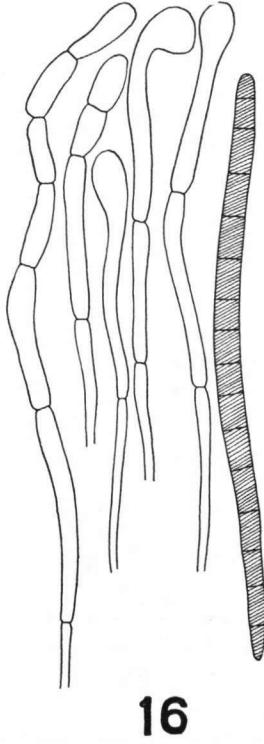
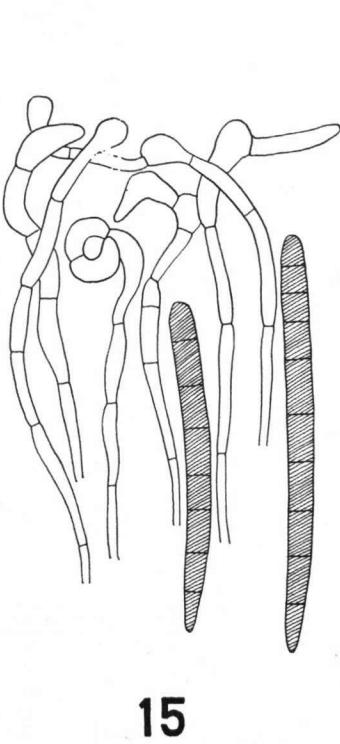
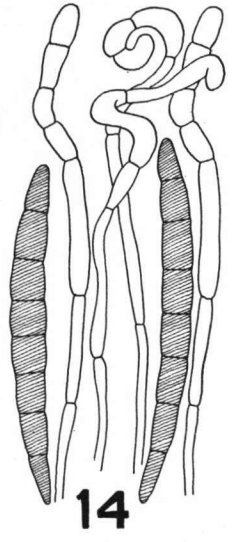
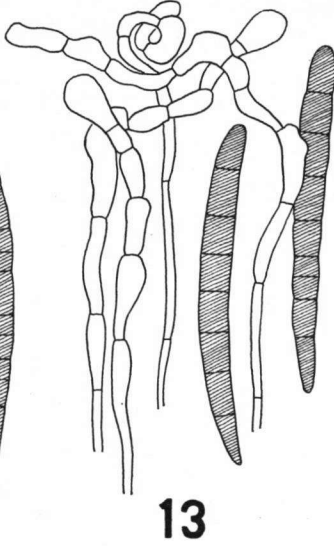
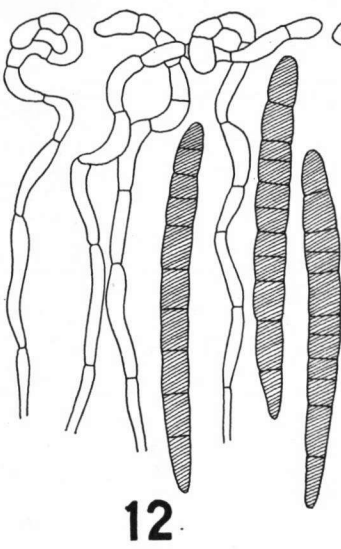
DISTRIBUTION.—Brazil (type locality), Bermuda (Durand), China (as *G. pusillum*, Tai), India (as *G. pygmaeum*, Batra & Batra; Thind & Singh), Japan (Imai), U.S.A. (Durand, Mains).

#### EXPLANATION OF FIGURES 12–17

Figs. 12–14. *Geoglossum japonicum*: paraphyses and spores (× 600). — 12. India, *Maas Geesteranus* 14646 (L). — 13. India, *Maas Geesteranus* 14549 (L). — 14. India, *Maas Geesteranus* 14557 (L).

Fig. 15. *Geoglossum starbaeckii*: paraphyses and spores (× 600); Sweden, Donk, Lundell, & Nannfeldt 4447 (L).

Figs. 16, 17. *Geoglossum pumilum*: paraphyses and spores (× 600). — 16. India, Batra (CUP-I. 131). 17. India, *Maas Geesteranus* 14558 (L).



Figs. 12-17

## COLLECTIONS EXAMINED.—

I n d i a : Himachal Pradesh, Simla, Summer Hill Chakkar, 7 Sept. 1962, *K. S. Thind 207* (K). Uttar Pradesh, Mussoorie, Camel's Back Road, Cemetery, 9 Sept. 1960, *L. R. Batra* (CUP-I. 131); Mussoorie, Jabber Khet, 10 Sept. 1960, *L. R. Batra* (CUP-I. 130); Mussoorie, Camel's Back Road, 19 Aug. 1961, *K. S. Thind 206* (K); Mussoorie, 17 Sept. 1964, *R. A. Maas Geesteranus 14558* (L).

The paraphyses in Winter's description are said to be straight but the Indian material proves that in the same collection they vary from straight to curved or coiled. Similarly, Durand (1921: 184) found the paraphyses in his material "usually nearly straight but sometimes strongly curved. . .," while Mains (1954: fig. 26) published a photograph of *G. pumilum* which also shows the paraphyses both straight and curved. Compare also Thind & Singh (1965: fig. 4).

A closely similar species is *Geoglossum pygmaeum* Gerard ex Dur. (1908: 429, figs. 60, 140, 141), described from a single collection. Durand (1921: 185) thought that *G. pumilum* would be different from *G. pygmaeum* "in its shorter spores, and especially in its more robust, longer, remotely septate paraphyses." With regard to the paraphyses it should be noted that, while the original description of *G. pumilum* gives no information on either the robustness and length or on the septation of the paraphyses, Durand admitted that he had not seen the type. Regarding the length of the spores, a third species, *Geoglossum pusillum*, must now be introduced, since it helps to illustrate that spore-length alone is an unreliable feature for the distinction of species in a genus like *Geoglossum*. The data available are tabulated as follows:—

TABLE I. SPORE-LENGTHS IN THREE SPECIES OF *Geoglossum*

Authors	<i>G. pumilum</i>	<i>G. pusillum</i>	<i>G. pygmaeum</i>
Winter (1887: 91) Ger. ex Dur. (1908: 429) Patouillard (1910: 132) Durand (1921: 184)	95-110 $\mu$  (104-)110- 115(-125) $\mu$ 100-137 $\mu$		122-140 $\mu$ 150 $\mu$
Imai (1941: 217) Tai (1944: 150) Mains (1954: 606)	(85-)90-130 (-145) $\mu$ 100-140 $\mu$	111-144 $\mu$	(120-)125-160 (-180) $\mu$
Thind & Singh (1965: 535)	100-140 $\mu$		

From this table it is obvious that with each successive record the spore-length of *G. pumilum* was found to have greater variability, overlapping that of *G. pygmaeum* to an increasing degree. On the other hand, the spores in *G. pygmaeum* seem to reach greater maximum lengths. If there is any value to be attributed to this difference, then all Indian collections are referable to *G. pumilum*. If the distinction depends on the paraphyses they are equally referable to *G. pumilum*. Since it has not been proved

that the paraphyses of *G. pygmaeum* are in any way different from those of *G. pumilum* there is as yet no reason to use the younger epithet.

If, as is assumed here, the spores with fewer than 16 cells are taken to be deformed or immature, then *Geoglossum pusillum* falls entirely within the limits of variability of *G. pumilum*.

A far more awkward problem is where to draw the line between *G. pumilum* and *G. fallax*. This statement may seem unfounded as the spores are 16-celled in the former, 8-celled in the latter. But there seems to be a gradated transition from one species to the other through *G. pusillum* and *G. fallax* var. *subpumilum* Imai (1941: 215). At present no solution can be offered.

#### GEOGLOSSUM SIMILE PECK—Figs. 18—20

*Geoglossum simile* Peck in Bull. Buffalo Soc. nat. Sci. 1: 70. 1873 (not seen).

Fruit-body 25–60 mm high. Clavula 9–23 × 1–2 mm, cylindrical to ligulate with narrow median groove and obtuse to subacute apex, dull, brown to black-brown. Stipe 15–48 × 0.5–1.5 mm, terete, minutely pubescent or smooth and seemingly glabrous (in that case usually somewhat shiny and covered with dirt), black. Asci (144–)158–226 × (12–)16–20 μ, 8-spored. Spores 63–87(–97) × (3.5–)4–6 μ, cylindrical-clavate, 8-celled, brown. Paraphyses discrete, 2–4(–5) μ wide and colourless below, (4–)6–10(–12) μ wide and pale, rarely darkish, brown above, moderately to closely septate in the upper part, much constricted at the septa to form barrel-shaped (or clavate) cells or 2-celled segments; continuing down the stipe to form a dense, colourless to dark palisade which under certain circumstances may become gelatinized.

HABITAT.—On soil in *Cedrus* or *Quercus* forest or among mosses on exposed slopes, at an altitude of about 2000 m.

DISTRIBUTION.—India (Batra & Batra), Japan (Imai), U.S.A. (Nannfeldt, Mains).

COLLECTIONS EXAMINED.—

I n d i a: Uttar Pradesh, Mussoorie, Camel's Back Road, 9 Sept. 1960, *L. R. Batra* (CUP-I. 128); Mussoorie, Camel's Back Road, Cemetery, 9 Sept. 1960, *L. R. Batra* (CUP-I. 129); Mussoorie, Chakrata Road, 12 Sept. 1960, *L. R. Batra* (CUP-I. 134); Mussoorie, Jabber Kher Khad, 19 Aug. 1961, *K. S. Thind 210* (K); Mussoorie, Dhnauli, 2 Sept. 1961, *K. S. Thind 211b* (K); Mussoorie, 17 Sept. 1964, *R. A. Maas Geesteranus 14648* (L).

As the stipes of each may be equally slippery, in the field *G. simile* can prove indistinguishable from *G. glutinosum*, in close proximity to which it sometimes grows. When dried, however, the macroscopical difference is clear. The clavula in *G. simile* is dull and dark brown, while owing to shrinkage of the hymenium it looks porous; in *G. glutinosum* it is somewhat shiny, black, and continuous. The anatomical explanation is that the hymenial paraphyses are discrete in the former, agglutinate in the latter.

Batra & Batra (1963: 149) mentioned one of the collections (CUP-I. 129) as *G. japonicum*, another (CUP-I. 134) as *G. nigratum*.

## GEOGLOSSUM UMBRATILE SACC.

*Geoglossum umbratile* Sacc. in *Michelia* 1: 444. 1878; *Fungi ital.* fig. 1323. 1882. — *Geoglossum peckianum* f. *umbratile* (Sacc.) Masee in *Ann. Bot.* 11: 251. 1897. — Holotype: *Geoglossum umbratile* S. / Bizz [ozero] / [18] 78. 10 [= October] / [follows an illegible part, the first letters of which appear to be HPa, possibly the abbreviation of Hortus Patavinus] (PAD).

? *Microglossum partitum* Pat. in *Revue mycol.* 12: 135, pl. 107 bis fig. 2. 1890. — *Mitrulea partita* (Pat.) Masee in *Ann. Bot.* 11: 283. 1897.

MISAPPLICATION: *Geoglossum nigratum* (Pers. ex Fr.) Cooke, *Mycogr.* 205, pl. 96 fig. 345. 1878.

Clavula lanceolate to ligulate or cylindrical, with or without median groove and with obtuse to subacute apex, dull, dark brown to black-brown. Stipe terete to somewhat flattened, squamulose to glabrous (in which case somewhat viscid when fresh, shiny when dried), black-brown to black. Asci cylindrical-clavate, consistently 8-spored or 2–8-spored. Spores cylindrical-clavate to acicular, 8-celled, curved, brown. Paraphyses discrete, remotely to moderately septate in the upper part, usually little or not constricted at the septa (but deep constrictions do occur), straight to curved or coiled, colourless or pale brown above, the terminal cell cylindrical, clavate or pyriform, and sometimes much enlarged.

The type variety is the one most commonly encountered; it is characterized by consistently eight-spored asci. Variety *heterosporum* possesses asci which in the same fruit-body may be two- to eight-spored.

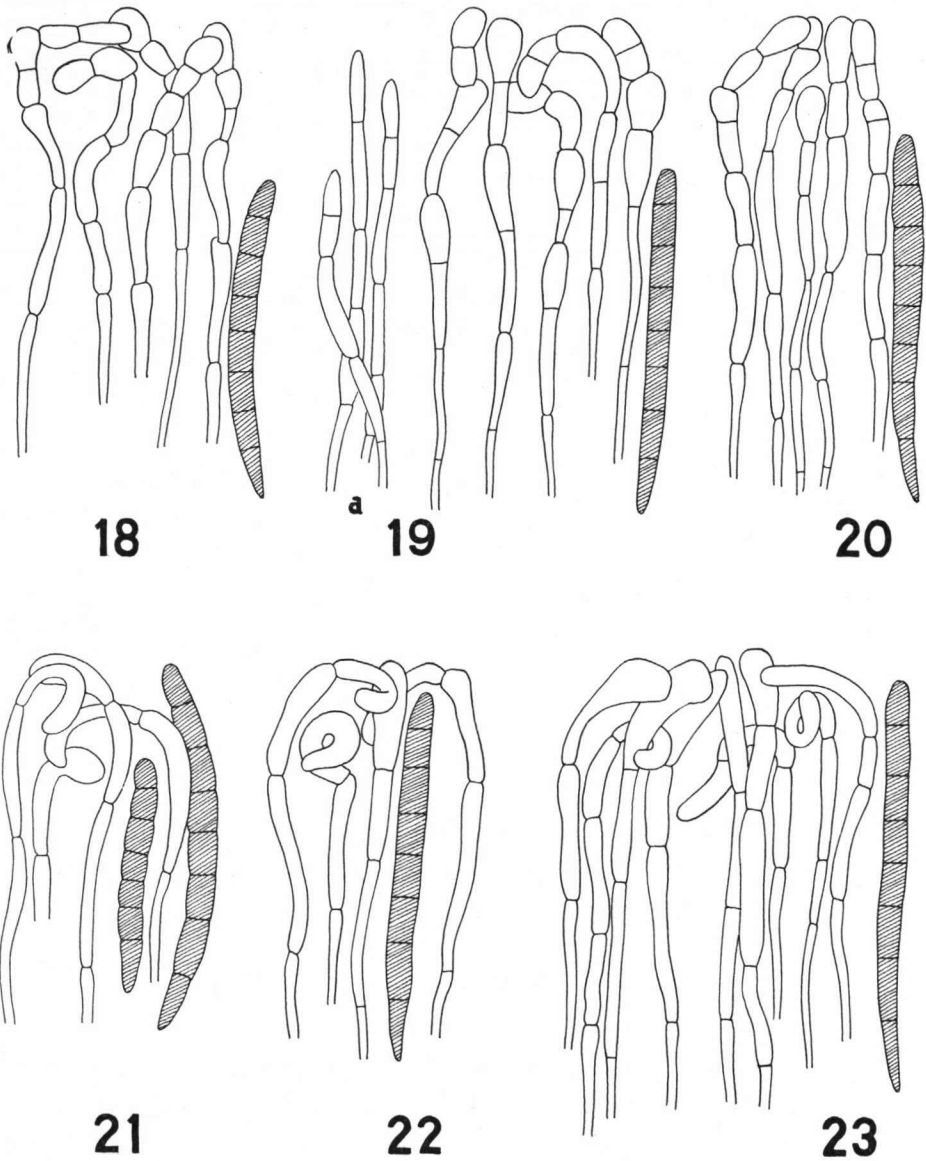
The name currently in use for this species is *Geoglossum nigratum*. Some mycologists (Durand, 1908: 427; Nannfeldt, 1942: 35) were of the opinion that Cooke was the author of the species, while others (Imai, 1941: 211; Mains, 1954: 595) used the citation (Fr.) Cooke. Both citations are erroneous, as is the use of the specific epithet. Only Mains expressed his doubts as to the correctness of the application of the name. A review of the history of the epithet would not seem out of place.

Persoon (1797: 78) introduced a *Clavaria nigrita*, characterized among other things by its "clavulis . . . fistulosis"; in the description this was repeated with the words "Clavulae . . . intus cavae." The species was taken up again a few years later (1801: 604) with the circumscription unchanged. It may be stated at the outset that it is precisely on account of this character that *Clavaria nigrita* is not a *Geoglossum*.

Fries (1821: 483), faithfully repeating the word "fistulosa," referred to Persoon's Synopsis, from which it is obvious that *Clavaria nigrita* Pers. ex Fr. is still not a *Geoglossum*. Much later (1874: 676), however, Fries added the sentence "Species insignis, habitu *Geoglossi*, nuperius ad Halmbyboda prope Upsaliam lecta. (v.v.)." This Swedish material turned out to be a true *Geoglossum*. Part of the collection was sent to Berkeley and from this Cooke prepared his figure. Both Durand and Nannfeldt mistakenly concluded that the material in Berkeley's herbarium represented the type of what they thought to be *Clavaria nigrita* Fr., not realizing (i) that Persoon, not Fries, was the first author of that species, (ii) that if a type were in existence (which it is not), it would necessarily be the type of *Clavaria nigrita* Pers., and (iii) that Fries had misidentified his specimens, for a *Geoglossum* is not hollow.

It is not possible, by leaving *Clavaria nigrita* out of consideration, to attribute the name *Geoglossum nigratum* to Cooke alone, since Cooke, too, referred unambiguously





Figs. 18–20. *Geoglossum simile*: paraphyses, hairs from the stipe (a), and spores ( $\times 600$ ). — 18. India, *Batra* (CUP-I. 129). — 19. India, *Batra* (CUP-I. 128). — 20. India, *Thind 210* (K).  
 Figs. 21–23. *Geoglossum umbratile* var. *umbratile*: paraphyses and spores ( $\times 600$ ). — 21. Italy, *Bizzozero* (holotype; PAD). — 22. India, *Batra* (CUP-I. 139). — 23. India, *Thind 208* (K).

to *Clavaria nigrata* Pers. and even went so far as to describe the species as "fistulosum." Clearly *Geoglossum nigratum* (Pers. ex Fr.) Cooke is a misapplication.

Bourdot & Galzin (1928: 119) and Bresadola (1884: pl. 67 fig. 4; 1932: pl. 1105 fig. 2) are among the few authors who have recognized the true nature of *Clavaria nigrata*.

GEOGLOSSUM UMBRATILE Sacc. var. UMBRATILE—Figs. 21–23

? *Microglossum partitum* Pat., l.c.

Fruit-body 14–31 mm high. Clavula 2–10 × 1–3 mm, lanceolate to ligulate, with narrow median groove and obtuse to subacute apex, dull, dark brown to black-brown. Stipe 9–23 × 0.2–0.6 mm, terete, minutely squamulose to glabrous (in which case somewhat shiny), dark brown to black-brown. Asci 148–197 × (14–) 16–20  $\mu$ , 8-spored. Spores 59.5–100 × 4.5–6  $\mu$ , acicular to somewhat fusiform, 8-celled, brown. Paraphyses discrete, 1–4  $\mu$  wide and colourless below, 3–10  $\mu$  wide and colourless to pale brown above, remotely to moderately septate in the upper part, more or less constricted at the septa, straight to curved or coiled to hooked, the terminal cell sometimes abruptly enlarged.

HABITAT.—On soil or among mosses in *Cedrus* or *Quercus* forest, at altitudes between 2000 and 2100 m.

DISTRIBUTION.—China (Tai, Teng), Europe (Nannfeldt), India (Batra & Batra), Japan (Imai), U.S.A. (Durand, Mains), West Pakistan.

COLLECTIONS EXAMINED.—

India: ? Uttar Pradesh, Mussoorie, 23 Sept 1955, *L. R. Batra* (CUP-I. 53; locality not indicated); Uttar Pradesh, Mussoorie, Sept. 1960, *L. R. Batra* (CUP-I. 146); Mussoorie, Landour, 8 Sept. 1960, *L. R. Batra* (CUP-I. 139–141); Mussoorie, Camel's Back Road, Cemetery, 9 Sept. 1960, *L. R. Batra* (CUP-I. 136, 137, 142, 143); Mussoorie, The Park, 11 Sept. 1960, *L. R. Batra* (CUP-I. 138); Mussoorie, Chakrata Road, 11 Sept. 1960, *L. R. Batra* (CUP-I. 135); Mussoorie, Chakrata Road, 12 Sept. 1960, *L. R. Batra* (CUP-I. 144); Mussoorie, road Subakholi-Maghra, 31 Aug. 1961, *K. S. Thind 208* (K); Mussoorie, road Maghra-Dhnaulti, 1 Sept. 1961, *K. S. Thind 214* (K); Mussoorie, Dhnaulti, 2 Sept. 1961, *K. S. Thind 211a* (K).

West Pakistan: Lahore, no date, *S. R. Kashyap* (Lloyd 30240 in BPI); Murree, 20 Aug. 1948, *S. Ahmad 2709b* (L); Aug. 1949, *S. Ahmad 4050* (L).

Lloyd (1917: 4), replying to a correspondent who had sent in a collection from Lahore, referred the material to *Geoglossum glabrum* but the note accompanying the packet in his herbarium reads thus: "The paraphyses rather tend toward *nigratum*, but I feel that it is really same as *glabrum*."

Tai (1944: 149, 150), in his enumeration of Chinese Geoglossaceae, mentioned *G. nigratum* and *G. umbratile*. A description is given of the latter only and from this ("spores . . . 3–9-, mostly 7-septate") it is rather uncertain to which of the two species he was referring.

Ahmad (1956: 37) placed the collections from Murree under *G. glabrum*.

Batra & Batra (1963: 149) identified one of the collections from Mussoorie (CUP-I. 142) as *G. cohaerens*, and another (CUP-I. 53) as *G. glabrum*.

It has been customary to regard *Microglossum partitum* as a synonym of *Thuemenidium* (or *Corynetes*) *atropurpureum*, no doubt because Patouillard himself compared

his species with one that later turned out to be identical with *T. atropurpureum*. To judge from the description there is nothing to be said against this assumption. However, the material borrowed from the cryptogamic herbarium in Paris, which in Patouillard's handwriting bears the annotation "*Microglossum partitum* / Yunnan / Leg. Delavay," belongs to a different species. Macroscopically it agrees with the original description in that the apical portion of the clavula is split downwards for some length. From this the conclusion seems permissible that the material actually represents the type, for splitting of the clavula is a most unusual phenomenon. From the following description it is evident that this material, at any rate, belongs to *Geoglossum umbratile* var. *umbratile*:—

The material consists of two specimens. The large specimen is young and in bad condition, with practically all asci and paraphyses collapsed and agglutinated, while the very few mature spores trapped in mucilaginous masses are difficult to discern. Very immature spores—1-celled, often as short as  $40\ \mu$ , colourless—are unexpectedly numerous, having doubtless been squeezed out by tapping on the cover-glass. The smaller specimen is in excellent condition but even younger than the preceding one. Asci c.  $160 \times 14-16\ \mu$ , 8-spored. Spores  $63-87 \times 4.5-6\ \mu$ , cylindrical-clavate, 8-celled, somewhat curved, finally brown. Paraphyses discrete, colourless or pale brown above, moderately to remotely septate, not or little constricted at the septa, straight to curved or coiled, the terminal cell cylindrical to clavate.

**G. UMBRATILE** var. **heterosporum** (Mains) Maas G., *comb. nov.*—Fig. 24

*Geoglossum nigratum* var. *heterosporum* Mains in *Mycologia* 46: 596, figs. 16–19. 1954 (basionym).

The following description is based on two collections which are referred to the present variety, though not without some doubt.

Fruit-body 14–22 mm high. Clavula 4–9  $\times$  1–1.5 mm, cylindrical to ligulate, dull, black-brown. Stipe 10–12.5  $\times$  0.2–0.5 mm, terete, squamulose, black-brown. Asci 132–165  $\times$  17–20  $\mu$ , (5–)6–8-spored in *Thind* 212, consistently 4-spored in one of the specimens of *Thind* 213. Spores (69–)77–89(–102)  $\times$  5–6  $\mu$ , cylindrical-clavate to acicular, 8-celled, brown. Paraphyses discrete, 2–4  $\mu$  wide and colourless below, 6–14  $\mu$  wide and colourless to pale brown above, remotely to moderately septate in the upper part, little constricted at the septa, straight to curved, the terminal cell clavate to pyriform and sometimes sharply hooked.

**HABITAT.**—On damp, mossy soil in *Quercus* forest.

**COLLECTIONS EXAMINED:**—

**I n d i a:** Uttar Pradesh, Mussoorie, Jabber Kher Khad, 19 Aug. 1961, *K. S. Thind* 212, 213 (K).

Mains described one variety only but it is probable that *G. umbratile* is far more variable than is generally assumed. Nannfeldt (1942: 36) stressed the variability in the spore length but great differences are also to be seen in the general appearance of the paraphyses and the shape of the terminal cell. The usual form of the terminal cell is a more or less strongly curved cylinder or slender club, as can be seen in the paraphyses of the type (Fig. 21). Sometimes, however, the terminal cell is apically abruptly enlarged (Fig. 23), or else deformed (not shown). Or again, it is short and

inflated, separated from the penultimate cell by a deep constriction (not shown). It is only a gradual step to such paraphyses as occur in *Thind 213* (not shown) and *212* (Fig. 24). If these collections are acceptable as forms or varieties of *G. umbratile*, there seems to be no really adequate reason for preventing *G. barlae* Boud. (1888: 76, pl. 16 fig. 1) and *G. montanum* Nannf. (1942: 34, fig. 1 d-e, pl. 3 fig. 6) from being included in the sphere of *G. umbratile*. The paraphyses of *G. barlae* have been depicted by Boudier, Nannfeldt (1942: fig. 1c), and Maas Geesteranus (1955: fig. 1). Their diversity acquires a new significance in the light of a possible relationship between this species and *G. umbratile*. The same is true of the paraphyses in *G. montanum*, a 'species' which closely approaches variety *heterosporum* on account of its 3-6-spored asci (2-7-spored according to Eckblad, 1963: 148).

#### GEOGLOSSUM sp.—Fig. 25

There is only a fragment, representing the central portion of a clavula, 1.5 mm wide, surface conspicuously felted, somewhat shiny, black. Asci 158-217 × 20-22 μ, 8-spored. Spores 75-95 × 6-7.5 μ, cylindrical-clavate, 8-celled, brown. Paraphyses discrete, 2-3 μ wide and colourless below, 6-8 μ wide and pale brown above, moderately to closely septate in the upper part, little or not constricted at the septa, terminal cell clavate to pyriform.

HABITAT.—No information.

COLLECTION EXAMINED:—

I n d i a: Uttar Pradesh, Mussoorie, Camel's Back Road, Cemetery, 9 Sept. 1960, *L. R. Batra* (CUP-I. 132).

Batra & Batra (1963: 149) listed this collection under *Geoglossum glabrum* but it is neither that nor *G. cookeianum*. Were it not for the numerous side-branches and buds of the paraphyses the collection could be referred to *G. japonicum*. Occasional side-branches of the paraphyses do occur in other species of *Geoglossum* but in the present case they are probably too frequent to be dismissed as a mere freak.

#### MICROGLOSSUM Gill.

*Microglossum* Gill., Champ. France, Discomyc. 25. 1879. — Type species: *Geoglossum viride* Pers. ex Fr. (cf. Durand).

Fruit-bodies solitary or gregarious to cespitose. Clavula gradually passing into the stipe, terete or compressed, cylindrical, clavate, ligulate, spatulate or lanceolate, glabrous, drab to blackish when dried (brownish green, blue-green, green or yellow

#### EXPLANATION OF FIGURES 24-28

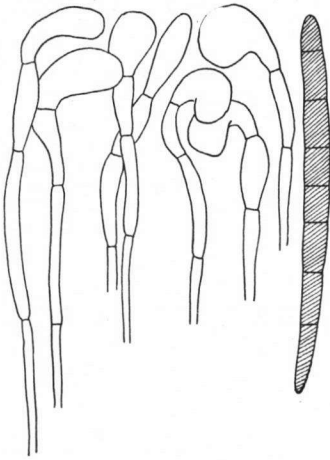
Fig. 24. *Geoglossum umbratile* var. *heterosporum*: paraphyses and spore (× 600); India, *Thind 212* (K).

Fig. 25. *Geoglossum* sp.: paraphyses and spore (× 600); India, *Batra* (CUP-I. 132).

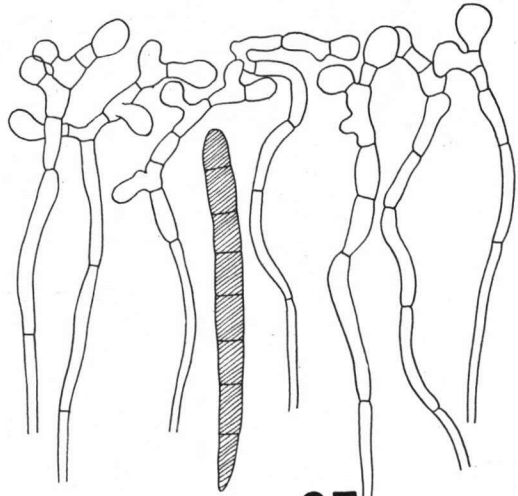
Fig. 26. *Microglossum olivaceum*: asci and paraphysis (× 600), spores (× 1400); India, *Thind 217* (K).

Fig. 27. *Microglossum rufum*: ascus and paraphyses (× 600), spore (× 1400); India, *Thind 216* (K).

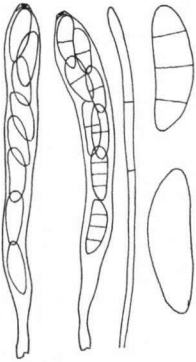
Fig. 28. *Microglossum viride*: ascus, paraphyses and spore (× 600); Sikkim, *Hooker* (K).



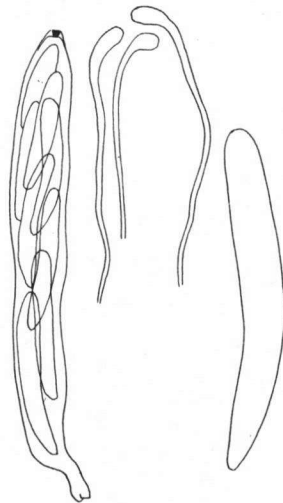
24



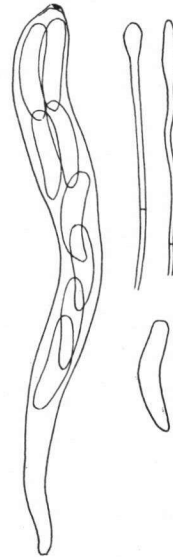
25



26



27



28

Figs. 24-28

when fresh). Stipe terete or somewhat flattened, glabrous or squamulose, dry or somewhat viscid, more or less concolorous with the clavula. Asci cylindrical-clavate, inoperculate, 8-spored, the pore blued with iodine. Spores 1-seriate, then 2-seriate, ellipsoid, fabiform or cylindrical to fusiform, straight to curved, 1-16-celled, colourless. Paraphyses discrete, septate, simple or branched, straight to strongly curved, colourless or apically somewhat coloured.

The spores in all species of *Microglossum* become septate at maturity but in some they seem to take a long time maturing. In general, the septation is not used for the distinction of species.

#### KEY TO THE SPECIES

1. Paraphyses straight or slightly curved to flexuous, apically not or little enlarged.
  2. Stipe smooth. . . . . *M. olivaceum*
  2. Stipe squamulose. . . . . *M. viride*
1. Paraphyses more or less strongly curved, distinctly enlarged at the apices *M. rufum*

#### MICROGLOSSUM OLIVACEUM (Pers. ex Fr.) Gill.—Fig. 26

*Geoglossum olivaceum* Pers., Obs. mycol. 1: 40, pl. 5 fig. 7. 1796; ex Fr., Syst. mycol. 1: 489. 1821. — *Microglossum olivaceum* (Pers. ex Fr.) Gill., Champ. France, Discomyc. 25. 1879.

Fruit-body 31-33 mm high. Clavula 10-14 × 1-2 mm, ligulate, with median groove and obtuse apex, dull, black-brown. Stipe 10-23 × 0.5-1.5 mm, terete, glabrous, somewhat shiny, black-brown. Asci 67-102 × 7-8.5 μ. Spores 12-14 × 4-5 μ, ellipsoid-fusiform to fabiform, 1-celled, multiguttulate, becoming 4-celled, colourless. Paraphyses 1-1.5 μ wide below, gradually widened to 1.5-2.5 μ above, colourless, straight or slightly curved.

HABITAT.—On damp soil amongst decaying leaves in *Quercus* forest, at an approximate altitude of 2000 m.

DISTRIBUTION.—China (Tai), Europe (Nannfeldt), India (Batra & Batra), Japan (Imai), U.S.A. (Durand, Mains).

COLLECTIONS EXAMINED:—

I n d i a: Uttar Pradesh, Mussoorie, Municipal Gardens, 5 Aug. 1960, *L. R. Batra* (CUP-I. 114); Mussoorie, Mossy Fall, 6 Sept. 1961, *K. S. Thind* 217 (K).

#### MICROGLOSSUM RUFUM (Schw.) Underw.—Fig. 27

*Geoglossum rufum* Schw. in Trans. Amer. phil. Soc. 4: 181. 1834. — *Microglossum rufum* (Schw.) Underw. in Minn. bot. Stud. 1: 496. 1896.

Fruit-body 10-12 mm high. Clavula 4-6 × 1-1.5 mm, cylindrical to ligulate, with narrow median groove and subacute to obtuse apex, orange-brownish. Stipe 6-16 × 0.4-0.8 mm, terete, floccose-squamulose, brownish. Asci 100-114 × 12-14 μ. Spores 22.5-40 × 4-4.5 μ, cylindrical-clavate, 1-celled, colourless. Paraphyses 1.5-2 μ wide below, 4-4.5 μ wide above, colourless, curved apically.

HABITAT.—On damp soil under ferns in forest of *Quercus*, *Rhododendron*, *Pinus*, at c. 2100 m altitude.

DISTRIBUTION.—China (Teng), India, Japan (Imai), U.S.A. (Durand, Mains).

COLLECTION EXAMINED.—

I n d i a: Himachal Pradesh, Simla, The Glen, 25 Sept. 1962, *K. S. Thind* 216 (K).

MICROGLOSSUM VIRIDE (Pers. ex Fr.) Gill.—Fig. 28

[? *Clavaria viridis* Schrad. *apud* Gmel., Syst. Veget. 2: 1443. 1791. —] *Geoglossum viride* Pers. in Neues Mag. Bot. 1: 117. 1794; *ex Fr.*, Syst. mycol. 1: 489. 1821. — *Leotia viridis* (Pers. ex Fr.) Fuck. in Jb. Nassau. Ver. Naturk. 23-24: 284. 1870. — *Mitrula viridis* (Pers. ex Fr.) P. Karst. in Bidr. Känn. Finl. Nat. Folk 19: 29. 1871. — *Microglossum viride* (Pers. ex Fr.) Gill., Champ. France, Discomyc. 25. 1879. — *Leptoglossum viride* (Pers. ex Fr.) Phill., Brit. Discomyc. 32, pl. 2 fig. 8. 1887.

Fruit-body 24-37 mm high. Clavula 12-15 × 3 mm, ligulate, with obtuse apex, black. Stipe 12-22 × 1.5-2 mm, terete, squamulose, blackened. Asci 124-138 × 10 μ. Spores 18-23.5 × 5-6 μ, clavate to subfusiform, 1-celled, colourless. Paraphyses 1-2 μ wide below, not or gradually widened upwards, clavate, up to 4 μ, the apices somewhat agglutinated to form a greenish epithecium.

HABITAT.—No information except that the two localities mentioned below are situated at altitudes of 2400 and 4000 m.

DISTRIBUTION.—Europe (Nannfeldt), India (Batra & Batra), Japan (Imai), Sikkim (Berkeley), U.S.A. (Durand, Mains).

COLLECTIONS EXAMINED:—

Sikkim: Lachoong, date ?, *Dr. Hooker* (K); Yeumtong, 5 Sept. 1849, *Dr. Hooker* (K).

TRICHOGLOSSUM Boud.

*Trichoglossum* Boud. in Bull. Soc. mycol. France 1: 110. 1885. — Type species: *Geoglossum hirsutum* Pers. ex Fr. (cf. Boudier).

Fruit-bodies solitary or gregarious to cespitose. Clavula gradually or abruptly passing into the stipe, compressed or not, subglobose, clavate, lanceolate, ligulate or spatulate, black-brown to black, beset with thick-walled, black setae. Stipe terete to somewhat flattened, black, densely setose from black setae. Asci cylindrical-clavate, inoperculate, 4-8-spored, the pore blued with iodine. Spores fasciculate in the ascus, acicular to subfusiform, straight to curved, up to 16-celled (irregularities excepted), brown. Paraphyses discrete, straight or, more often, curved to coiled or circinate, moderately to remotely septate, colourless below, brownish above.

KEY TO THE SPECIES

- 1. Asci normally 8-spored.
  - 2. Mature spores 16-celled. . . . . *T. hirsutum*
  - 2. Mature spores with fewer cells.
    - 3. Spores 8-12-celled.
      - 4. Spores 8-12-celled, acicular. . . . . *T. variabile*
      - 4. Spores 8-10-celled, more fusiform. . . . . *T. rasum*
    - 3. Spores 1-8-celled.
      - 5. Spores 80-140 μ long, fusiform-acicular . . . . . *T. octopartitum*
      - 5. Spores (50-)75-108 μ long, acicular. . . . . *T. walteri*
- 1. Asci consistently 4-spored . . . . . *T. velutipes*

TRICHOGLOSSUM HIRSUTUM (Pers. ex Fr.) Boud.—Fig. 29

*Geoglossum hirsutum* Pers. in Neues Mag. Bot. 1: 117. 1794; *ex Fr.*, Syst. mycol. 1: 488. 1821. — *Trichoglossum hirsutum* (Pers. ex Fr.) Boud. in Bull. Soc. mycol. France 1: 110. 1885.

Fruit-body 10-48 mm high. Clavula 2-11 × 2-4.5 mm, ligulate to lanceolate or cordate, with or without median groove, with obtuse to subacute apex, densely setose,

dull, black-brown. Stipe 10–41 × 0.6–1.5 mm, terete or flattened, densely setose, black. Asci 190–217 × 20–26 μ, 8-spored. Spores 112–167 × (4.5–)5–6.5 μ, acicular, 16-celled, brown. Paraphyses 2–3 μ wide and colourless below, 4–6 μ wide and colourless or pale brown above, straight or coiled to circinate, remotely septate. Hymenial setae 50–315 × 4–14 μ, thick-walled, black-brown.

**HABITAT.**—On earth or among leaf litter in forests of *Quercus incana* and *Rhododendron arborea* or among mosses on stony slopes outside the forest, 1800–2100 m.

**DISTRIBUTION.**—China (Tai, Teng), Europe (Nannfeldt), India (Batra & Batra, Thind & Singh), Japan (Imai), Java (Rifai), U.S.A. (Durand, Mains).

**COLLECTIONS EXAMINED:**—

**I n d i a:** Uttar Pradesh, Mussoorie, Cemetery, 9 Sept. 1960, *L. R. Batra* (CUP-I. 117–119, 121, and possibly also 120); Mussoorie, Jabber Khet, 11 Sept. 1960, *L. R. Batra* (CUP-I. 122); Mussoorie, road Maghra-Dhnaulti, 1 Sept. 1961, *K. S. Thind 200* (K); Mussoorie, near Charleville, 13 Sept. 1964, *R. A. Maas Geesteranus 14508* (L); Mussoorie, 15 Sept. 1964, *R. A. Maas Geesteranus 14537* (BSD, DD, HCIO, L); Mussoorie, Oakvilla, 16 Sept. 1964, *R. A. Maas Geesteranus 14551* (L); Mussoorie, Balansar, 18 Sept. 1964, *R. A. Maas Geesteranus 14578* (L); Mussoorie, near Charleville, 20 Sept. 1964, *R. A. Maas Geesteranus 14603* (L); Naini Tal, Lands End, 3 Sept. 1961, *K. S. Thind 209b* (K); Saharanpur, date ?, *W. Gollan* (Lloyd 25422 in BPI).

#### TRICHOGLOSSUM OCTOPARTITUM Mains—Figs. 30–32

*Trichoglossum octopartitum* Mains in *Am. J. Bot.* 27: 325, fig. 10. 1940.

Fruit-body 10–45 mm high. Clavula 2–13 × 1–6 mm, lanceolate to ligulate, with median groove and obtuse apex, densely setose, dull, black. Stipe 5–34 × 0.5–1.5 mm, terete or flattened, densely setose, black. Asci 177–225 × 18–24 μ, 8-spored. Spores (83–)91–140 × 6–7 μ, fusiform-acicular, usually 8-celled (but often with fewer cells and sometimes up to 10-celled), brown. Paraphyses 2–3 μ wide and colourless below, up to 4 μ wide and pale brown above, curved to coiled, remotely septate. Hymenial setae 75–256 × 5–10 μ, thick-walled, black.

**HABITAT.**—Growing at widely varying altitudes, the Indian material having been collected at an approximate altitude of 2000 m, the collection from West Pakistan coming “from the plains, about 500 ft. above sea level. The climate is extreme, very hot during summer and very cold during winter” (Ahmad, in litt.).

**DISTRIBUTION.**—British Honduras (type locality), India (Batra & Batra, Thind & Singh), U.S.A. (Mains), West Pakistan.

**COLLECTIONS EXAMINED.**—

**I n d i a:** Uttar Pradesh, Mussoorie, Cemetery, 9 Sept. 1960, *L. R. Batra* (CUP-I. 123, 124); Mussoorie, Chakrata road, 12 Sept. 1960, *L. R. Batra* (CUP-I. 125).

**W e s t P a k i s t a n:** Sheikhpura Distr., Ladhar, 27 Dec. 1952, *S. Ahmad 7980* (L).

#### EXPLANATION OF FIGURES 29–36

Fig. 29. *Trichoglossum hirsutum*: paraphyses and spore (× 600); India, *Maas Geesteranus 14578* (L).

Figs. 30–32. *Trichoglossum octopartitum*: paraphyses and spores (× 600). — 30. India, *Batra* (CUP-I, 123). — 31. India, *Batra* (CUP-I. 125). — West Pakistan, *Ahmad 7980* (L).

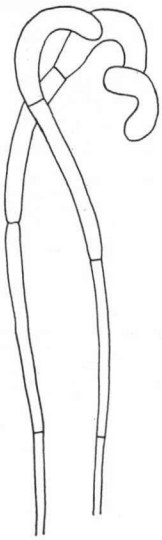
Fig. 33. *Trichoglossum rasum*: paraphyses and spores (× 600); India, *Thind 205b* (K).

Fig. 34. *Trichoglossum velutipes*: paraphyses and spore (× 600); West Pakistan, *Ahmad 2709a* (L).

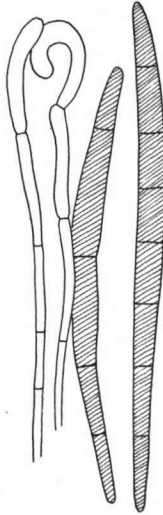
Fig. 35. *Trichoglossum variabile*: paraphyses and spores (× 600); India, *Thind 201* (K).

Fig. 36. *Trichoglossum walteri*: paraphyses and spores (× 600); India, *Thind 204* (K).

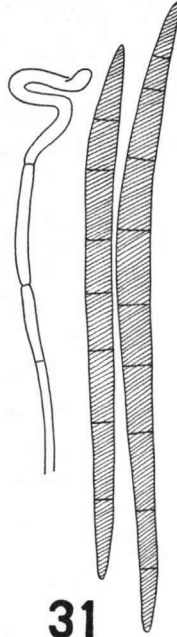




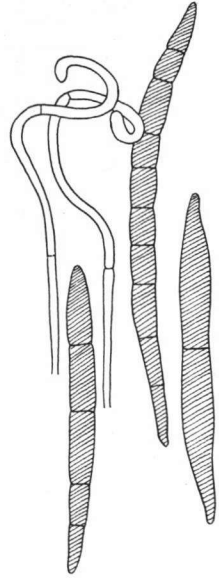
29



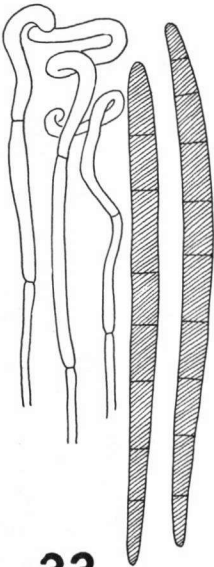
30



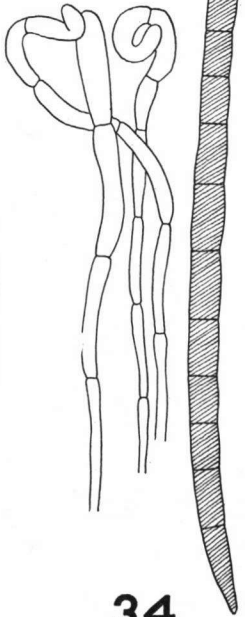
31



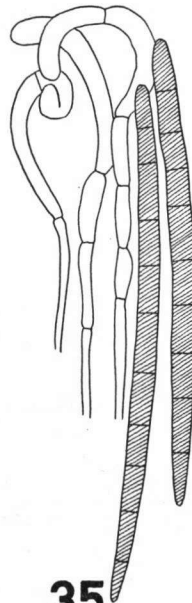
32



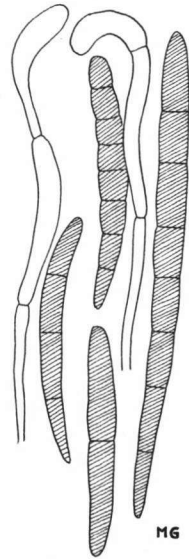
33



34



35



36

MG

Figs. 29-36

Ahmad (1956: 37) listed the collection from Ladhur under *T. velutipes*.

Perhaps the collections enumerated here could better have been placed under *T. rasum*. Considering the great variability even in a single specimen, it must seriously be questioned whether with so few characteristics available more distinctions have not already been made in *Trichoglossum* than there are species.

TRICHOGLOSSUM RASUM Pat.—Fig. 33

*Trichoglossum rasum* Pat. in Bull. Soc. mycol. France 25: 130. 1909.

*Trichoglossum hirsutum* f. *wrightii* Dur. in Anns mycol. 6: 438, figs. 83, 174. 1908. — *Trichoglossum wrightii* (Dur.) Dur. in Mycologia 13: 187. 1921.

One small specimen only, 8 mm high. Clavula 4 × 1 mm, ligulate, with obtuse apex, finely setose, dull, black. Stipe 4 × 0.8 mm, terete, setose, black. Asci 20–22 μ broad, 8-spored. Spores 101–114 × 5–6 μ, acicular-fusiform, 8–10-celled, brown. Paraphyses 2–3 μ wide and colourless below, 3–4 μ wide and fairly dark brown above, curved to coiled, remotely septate. Hymenial setae circa 180 × 6–8 μ, thick-walled, black-brown.

HABITAT.—On damp, mossy soil in *Quercus* forest, at c. 2000 m altitude.

DISTRIBUTION.—Bermuda (Durand), China (Teng), Cuba (type locality of *T. hirsutum* f. *wrightii*), India, Java (Rifai), New Caledonia (type locality of *T. rasum*), Panama (Nannfeldt).

COLLECTION EXAMINED.—

I n d i a: Uttar Pradesh, Mussoorie, Subakholi-Maghra road, 31 Aug. 1961, K. S. Thind 205b (K).

Batra & Batra (1963: 151) indicated the present species (as *T. wrightii*) as common around Mussoorie, but except for a collection apparently preserved in the Herbarium of the Panjab University, Chandigarh (not seen), there is no material to corroborate their statement.

TRICHOGLOSSUM VARIABILE (Dur.) Nannf.—Fig. 35

*Trichoglossum hirsutum* f. *variabile* Dur. in Anns mycol. 6: 437, figs. 84, 85, 182–184. 1908. — *Trichoglossum variabile* (Dur.) Nannf. in Ark. Bot. (A) 30 (4): 64, fig. 6a. 1942.

Fruit-body 15–32 mm high. Clavula 3–7 × 1.5–7 mm, ellipsoid to cordate, with obtuse apex, conspicuously setose to nearly glabrous, dull, black-brown. Stipe 11–24 × 0.5–1 mm, terete, densely setose, black. Asci 161–226 × 20–24 μ, 8-spored. Spores 74–124 × 5.5–6 μ, acicular, 8–12-celled, brown. Paraphyses 2–4 μ wide and colourless below, 6–8 μ wide and colourless to fairly dark brown above, curved to coiled, remotely septate. Hymenial setae 73–177 × 5–8 μ, thick-walled, black brown.

HABITAT.—On soil or among mosses in forest of *Quercus* and *Rhododendron* at c. 2000 m altitude.

DISTRIBUTION.—China (Tai), Europe (Nannfeldt), India, Japan (Imai), U.S.A. (Durand, Mains).

COLLECTIONS EXAMINED.—

I n d i a: Uttar Pradesh, Mussoorie, 15 Sept. 1965, R. A. Maas *Gaeasteranus* 14647 (L); Naini Tal, Cheena Peak, 30 Sept. 1961, K. S. Thind 201 (K).

TRICHOGLOSSUM VELUTIPES (Peck) Dur.—Fig. 34

*Geoglossum velutipes* Peck in Rep. N.Y. State Mus. 28: 65. 1876. — *Trichoglossum velutipes* (Peck) Dur. in Anns mycol. 6: 434, figs. 86–88, 169–173. 1908.

Fruit-body 29–57 mm high. Clavula 4–14 × 1.5–6 mm, lanceolate to ligulate, with median groove and obtuse apex, densely setose, dull, black-brown. Stipe 19–43 × 1–2 mm, terete or flattened in places, densely setose, black. Asci 158–225 × (18–)20–26  $\mu$ , 4-spored. Spores 130–163 × 6–8  $\mu$ , acicular, (8–)11–13-celled, brown. Paraphyses 2–6  $\mu$  wide and colourless below, 4.5–8  $\mu$  wide and pale brown above, straight or curved to coiled, remotely septate. Hymenial setae 79–276 × 6–8  $\mu$ , thick-walled, black-brown.

HABITAT.—On damp soil in *Quercus* forest at an approximate altitude of 2000 m.

DISTRIBUTION.—China (Tai), India (Thind & Singh), U.S.A. (Durand, Mains), West Pakistan (Ahmad).

COLLECTIONS EXAMINED.—

I n d i a: Uttar Pradesh, Mussoorie, Maghra-Dhnaulti road, 1 Sept. 1961, *K. S. Thind 203* (K); Mussoorie, Jabber Kher Khad, 9 Sept. 1961, *K. S. Thind 202a* (K).

W e s t P a k i s t a n: Murree, 20 Aug. 1948, *S. Ahmad 2709a* (L).

#### TRICHOGLOSSUM WALTERI (Berk.) Dur.—Fig. 36

*Geoglossum walteri* Berk. *apud* Cooke in *Hedwigia* 14: 39. 1875. — *Trichoglossum walteri* (Berk.) Dur. in *Annls mycol.* 6: 440, figs. 94–97, 190–193. 1908.

Fruit-body up to 34 mm high. Clavula about 10 × 2.5 mm, ligulate, with median groove and obtuse apex, densely setose, dull, black-brown. Stipe 24 × 1 mm, terete, setose, black. Asci 120–217 × 18–24  $\mu$ , 8-spored. Spores 49–108 × 5–8  $\mu$ , cylindrical-clavate to acicular, 1–8-celled, brown. Paraphyses 2–3  $\mu$  wide and colourless below, 4–6  $\mu$  wide and fairly dark brown above, curved to coiled, remotely septate. Hymenial setae 78–200 × 6–10  $\mu$ , thick-walled, black-brown.

HABITAT.—On damp, mossy soil in *Quercus* forest or in mixed forest of *Quercus*, *Rhododendron*, and *Pinus*, at about 2000 m altitude.

DISTRIBUTION.—Australia (type locality), Brazil (Nannfeldt), Europe (Nannfeldt), India, Japan (Imai), U.S.A. (Durand, Mains).

COLLECTIONS EXAMINED.—

I n d i a: Himachal Pradesh, Simla, The Glen, 25 June 1962, *K. S. Thind 204* (K); Uttar Pradesh, Mussoorie, Subakholi-Maghra road, 31 Aug. 1961, *K. S. Thind 205a* (K).

Judging from the spores (73–104 × 6–8  $\mu$ , 4–8-celled), there is no doubt but that the collection from Mussoorie belongs to the present species. The position is less clear in the case of the collection from Simla. The over all dimensions of the spores (1–8-celled) were found to be 49–108 × 5–5.5  $\mu$ , but spores longer than 80  $\mu$  proved rare. That would bring the collection very near *T. confusum* Dur., of which Mains (1954: 618) reported the spores as (45–)55–66(–75) × 5–6  $\mu$ . This raises the question whether specific distinction in *Trichoglossum*, if based on spore-length alone, is sound.

#### REFERENCES

- BALFOUR-BROWNE, F. L. (1955). Some Himalayan fungi. *In* *Bull. Brit. Mus. nat. Hist (Bot.)* 1: 189–218.  
 BATRA, L. R. & BATRA, S. W. T. (1963). Indian Discomycetes. *In* *Univ. Kansas Sci. Bull.* No. 44.  
 BERKELEY, M. J. (1854). Decades of fungi. Decade XLVII, XLVIII. Indian fungi. *In* *J. Bot. & Kew Gdn Misc.* 6: 204–212.

- BILLE-HANSEN, E. (1954). The Danish species of *Geoglossum* and related genera. *In* Bot. Tidsskr. **51**: 7-18.
- BOUDIER, E. (1888). Nouvelles espèces de Discomycètes inoperculés de France. *In* Bull. Soc. mycol. France **4**: 79-86.
- BOURDOT, H. & GALZIN, A. (1928). Hyménomycètes de France.
- BRESADOLA, J. (1881-87). Fungi tridentini **1**. Tridenti.  
— (1932). *Iconographia mycologica* **23**.
- BUTLER, E. J. & BISBY, G. R. (1931). Fungi of India. (Not seen.)
- COOKE, M. C. (1875-1879). *Mycographia*. London.
- DURAND, E. J. (1908). The Geoglossaceae of North America. *In* *Annls mycol.* **6**: 387-477.  
— (1921). New or noteworthy Geoglossaceae. *In* *Mycologia* **13**: 184-187.
- ECKBLAD, F. E. (1963). Contributions to the Geoglossaceae of Norway. *In* *Nytt Mag. Bot.* **10**: 137-158.
- FRIES, E. M. (1821). *Systema mycologicum* **1**. Lundae.  
— (1874). *Hymenomycetes europaei*. Upsaliae.
- IMAI, S. (1941). Geoglossaceae Japoniae. *In* J. Fac. Agric. Hokkaido imp. Univ. **45**: 155-264.
- LLOYD, C. G. (1916). *Mycological Writings* **5** (The Geoglossaceae).  
— (1917). *Mycological Writings* **5** (Letter No. 65).
- MAAS GEESTERANUS, R. A. (1955). Notes on Dutch fungi—II. *In* *Fungus* **25**: 44-52.  
— (1964). On some white-spored Geoglossaceae. *In* *Persoonia* **2**: 81-96.
- MAINS, E. B. (1954). North American species of *Geoglossum* and *Trichoglossum*. *In* *Mycologia* **46**: 586-631.  
— (1956). North American hyaline-spored species of the Geoglossaceae. *In* *Mycologia* **46**: 846-877.
- NANNFELDT, J. A. (1942). The Geoglossaceae of Sweden. (With regard also to the surrounding countries.) *In* *Ark. Bot. (A)* **30** (4).
- PATOUILLARD, N. (1910). Champignons de la Nouvelle Calédonie (suite). *In* Bull. Soc. mycol. France **25**: 129-134.
- PERSOON, C. H. (1794). Tentamen . . . Fungorum . . . *In* *Neues Mag. Bot.* **1**: 81-128.  
— (1797). *De Fungis claviformibus*. Lipsiae.  
— (1799). *Observationes mycologicae. Pars secunda*. Lipsiae et Lucernae.  
— (1801). *Synopsis methodica Fungorum*. Gottingae.
- RIFAI, M. A. (1965). Discomycete flora of Asia, Precursor III: Observations on Javanese species of *Trichoglossum*. *In* *Lloydia* **28**: 113-119.
- SACCARDO, P. A. (1884). *Conspectus generum Discomycetum hucusque cognitorum*. *In* Bot. Zbl. **18**: 213-220.
- TAI, F. L. (1944). Studies in the Geoglossaceae of Yunnan. *In* *Lloydia* **7**: 146-162.
- TENG, S. C. (1934). Notes on Discomycetes from China. *In* *Sinensia* **5**: 431-465.
- THIND, K. S. & SING, H. (1965). The Helotiales of India—III. *In* J. Ind. bot. Soc. **43**: 529-542.
- VASUDEVA, R. S. (1960). The fungi of India. [The revised edition of the work of Butler & Bisby.]