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CENTRAL AMERICAN PEZIZALES. I. A NEW GENUS OF THE SARCOSCYPHACEAE¹

WILLIAM C. DENISON

(WITH 12 FIGURES)

This is one of a series of papers based upon specimens collected by the author and his students in Central America in the periods June–July, 1962 and August–November, 1964. Among these specimens were four collections of a new cup-fungus from the Province of Guanacaste in Costa Rica. Although this fungus is clearly a member of the tribe Sarcoscyphae of the family Sarcoscyphaceae, it does not seem to belong in any known genus of that family. Unlike other members of the tribe it grows on bare soil. This paper describes the fungus as a new species of a new, monotypic genus, and discusses its relationship with other members of the family.

GEODINA Denison, gen. nov.

Apothecia cupularia, stipitata; stipes angustus; excipulum crassum, subereum vel coriaceum; intus filamentosum, extra membranaceum e cellulis subrectangularibus constans; hymenium pallidum vel coloratum, luteum vel rubrum; extra simile colore et pilosum; pili fasciculati ex hyphis crasse tunicatis et continuis; asci suboperculati, cylindracei, in basim sensim angustati, iodo addito non caerulei, non simul maturescentes; opercula eccentrici; sporae ellipsoideae, amplae, 1–2 guttis adfectae, costis magnopere sculptae; paraphyses tenues cylindraceaeque, septatae, in apice clavatae. Plantae terrestres, clima calido vigentes.

Apothecium goblet-shaped with a slender stem, thick-fleshed, corky to leathery; hymenium light-colored to bright-colored, yellow to red; exterior similarly colored, hairy; hairs fasciculate composed of thick-walled, nonseptate hyphae arising from the ectal excipulum; excipulum composed of two distinct layers, a medullary excipulum of entangled hyphae (*textura intricata*), and a rind-like ectal excipulum composed of more or less rectangular cells (*textura prismatica* to *textura angularis*); asci suboperculate, with eccentric opercula, cylindrical with gradually

¹ A study supported in part by grants from the American Philosophical Society (grant #3664) and the Faculty Research Fund of Swarthmore College.

tapering bases, not turning blue in iodine, not all maturing simultaneously; ascospores ellipsoid, large, long, containing 1–2 large oil drops, heavily sculptured; spore sculpturing not staining readily in cotton blue, consisting of coarse, anastomosing ridges; paraphyses slender, cylindrical, septate, with subclavate apices; growing in the soil in the tropics.

Type species: *Geodina guanacastensis* Denison.

Name: From the Greek, *ge* = earth, and *dinos* = a whirlwind or waterspout, by extension a goblet with a similar form.

***Geodina guanacastensis* Denison, sp. nov.**

Apothecia solitaria vel sparsa, modica, 7–30 mm lata, 10–25 mm alta, cupularia, stipitata; stipes 2–5 mm crassus, 5–20 mm longus; hymenium subaureum, simili colore extra sed pilis hyphisque fuscum; pili 300–800 μ longi, fasciculati ex hyphis fuscis et crasse tunicatis et continuis; asci cylindracei, in basim sensim angustati, 350–400 \times 15–18 μ ; sporae acutae ellipsoideae, polis subangustatae, 1–2 guttis adfectae, costis magnopere sculptae; costae crassae et anastomosans quasi in rara retia; paraphyses tenues cylindraceae, in apice subclavatae, 1–2 μ infra, 2–3 μ supra crassae, raris septis ornatae, infrequenter ramosae. Plantae terrestres in Costaricae provincia Guanacaste vigentes.

Type: *Denison 2278* (holotype at CUP: isotypes at CR, NY, and SWC²).

Apothecia solitary to widely scattered, medium-sized, 7–30 mm broad, 10–25 mm high, goblet-shaped, stipitate; stipe 2–5 mm thick, 5–20 mm long; hymenium pale orange, “Capucine Yellow”³ to “Pale Yellow-Orange”; exterior similarly colored but appearing darker because clothed in dark brown hairs and small tufts of dark brown hyphae; hairs 300–800 μ long, fasciculate composed of 4–5 or more dark brown, thick-walled, nonseptate hyphae; asci cylindrical with gradually tapering bases, 350–400 \times 15–18 μ ; ascospores pointed-ellipsoid, 22–25 \times 11–13 μ , containing 1–2 large oil drops, heavily sculptured; spore sculpturing consisting of coarse, irregular, longitudinal ridges which anastomose to form a partial or irregular reticulum; paraphyses slender with subclavate apices, 1–2 μ broad below, 2–3 μ broad above, sparingly septate, infrequently branched.

Name: From Guanacaste, the province in which the species has been collected.

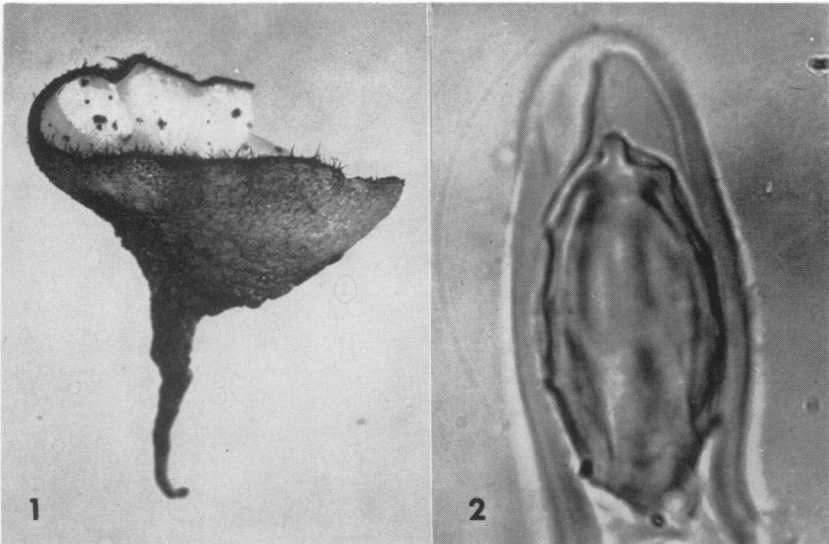
Specimens Examined: Costa Rica: *Denison 2278*, on bare soil, Pan American Highway kilometer 135, Guanacaste, alt. 30 m, 13 Sept. 1964

² The abbreviations of herbaria are those proposed by Lanjouw and Stafleu (1964).

³ Names of colors enclosed in quotation marks refer to the corresponding color chip in Ridgway (1912).

(CUP HOLOTYPE; CR, NY, SWC ISOTYPES-slides and photographs): *Denison 2291, 2294*, on soil, near Caña, Guanacaste, alt. 50 m, 13 Sept. 1964 (CUP, CR, SWC); *Denison 2310*, on soil, hills above Playas del Coco, Guanacaste, alt. 65, 14 Sept. 1964 (CUP, CR, SWC).

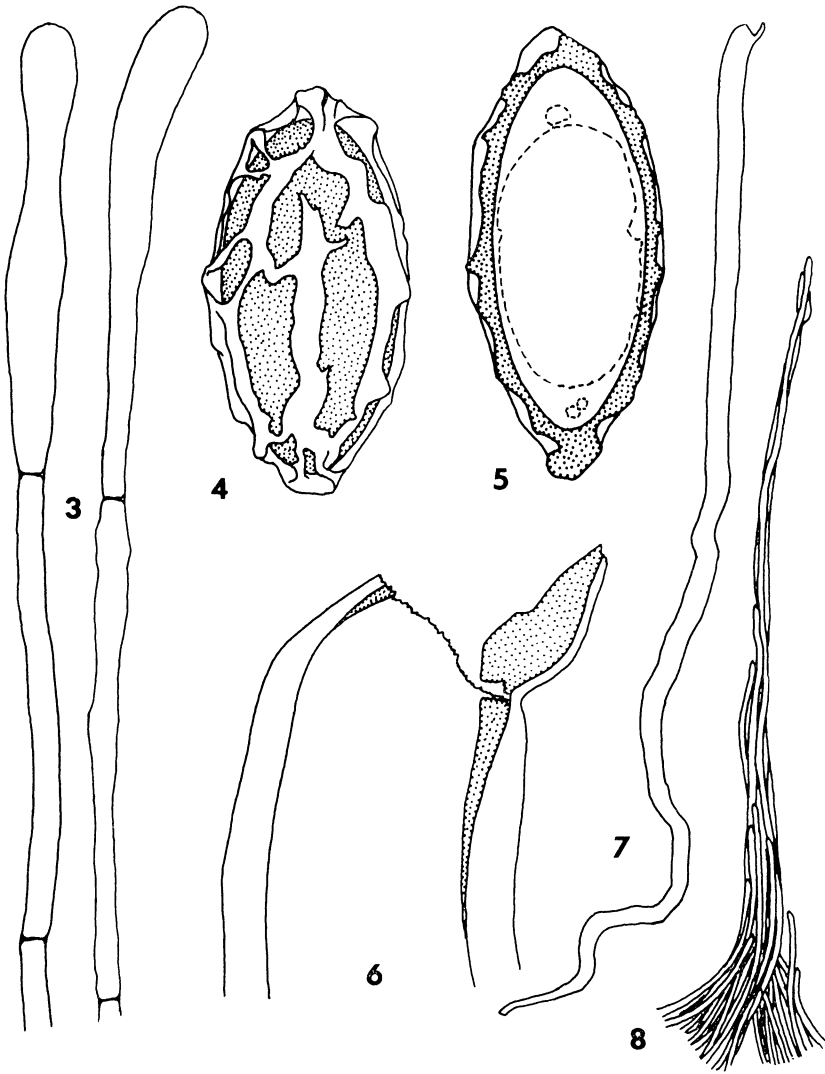
The family Sarcoscyphaceae is characterized by tough, leathery to corky or rubbery apothecia which are often stipitate and usually grow on wood in early stages of decay. The tough, elastic texture of the apothecium derives from the fact that the excipular tissues are mostly filamentous (prosenchymatous) rather than pseudoparenchymatous as in the softer, more brittle apothecia of the Pezizaceae and Ascobolaceae. In the Sarcoscyphaceae the asci are suboperculate (Le Gal 1946) in contrast to



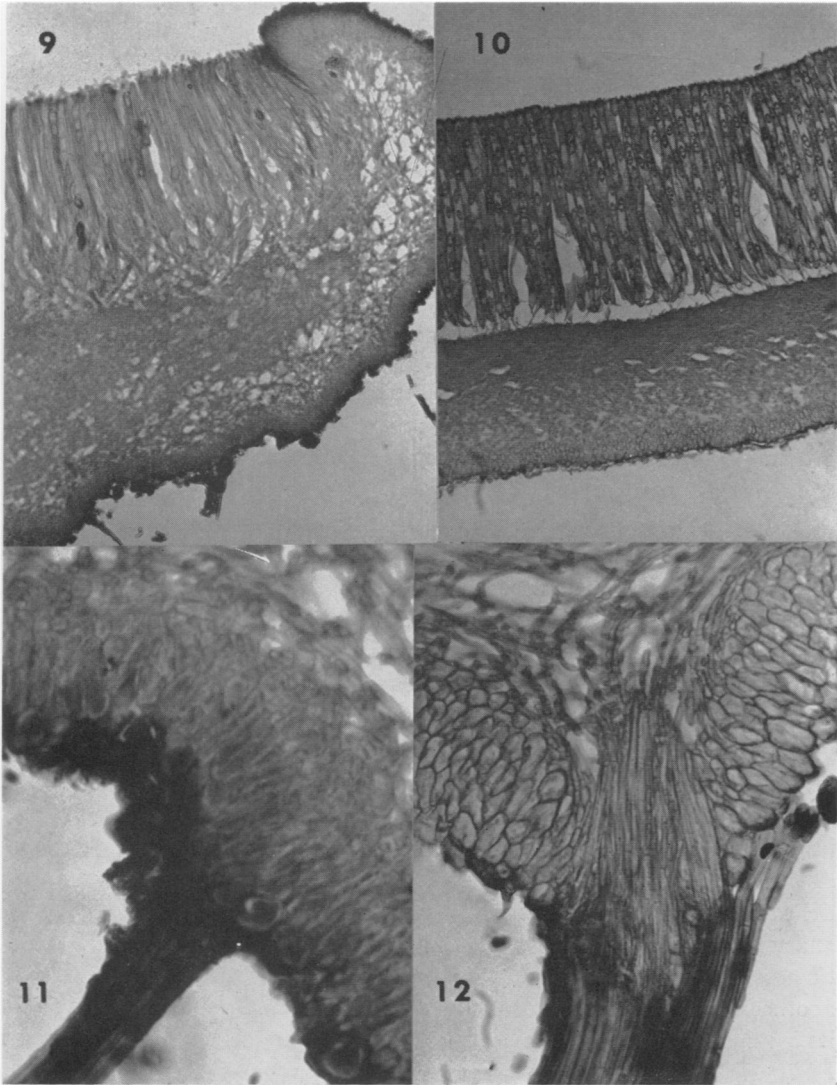
FIGS. 1-2. *Geodina guanacastensis*, HOLOTYPE. 1. Apothecium, dried specimen partly revived by soaking in water. $\times 25$. 2. Tip of ascus with ascospore. $\times 2,000$.

the operculate asci of the Pezizaceae and Ascobolaceae. The walls of a suboperculate ascus are thicker than those of an operculate ascus; there is an inward swelling of the ascus wall at the operculum to form an apical pad (coussinet apical), and the operculum is typically eccentric.

Geodina guanacastensis has a tough, leathery to corky apothecium with a long, slender, central stipe (FIG. 1). The apothecia cited above were collected on bare soil, their stipes extending into the ground, but it is possible that they were growing from buried wood or roots as does *Microstoma protracta* (Fr.) Kanouse. The excipular tissues of *G.*



FIGS. 3-8. *Geodina guanacastensis*, from HOLOTYPE. 3. Paraphyses. $\times 2,700$. 4. Ascospore, surface view. $\times 2,000$. 5. Ascospore, optical section. $\times 2,000$. 6. Tip of discharged ascus with operculum. $\times 2,700$. 7. Ascus. $\times 350$. 8. Fasciculate hair. $\times 150$.



Figs. 9–12. 9. *Geodina guanacastensis*, vertical section of apothecium, from holotype. $\times 75$. 10. *Cookeina tricholoma*, vertical section of apothecium. $\times 75$. 11. *G. guanacastensis*, section of excipulum showing origin of hair, from holotype. $\times 550$. 12. *C. tricholoma*, section of excipulum showing origin of hair. $\times 550$.

guanacastensis are chiefly prosenchymatous (FIGS. 9, 11), resembling, except for their thickness, those of the closely related genus *Cookeina*. The asci of *G. guanacastensis* are suboperculate (FIGS. 2, 6, 7); the heavy walls, apical pad, and eccentric operculum are easily seen both before and after spore discharge. From this evidence the writer concludes that *G. guanacastensis* belongs in the family Sarcoscyphaceae.

Le Gal (1946) divides the Sarcoscyphaceae into two tribes: the tribe Urnuleae in which the exterior of the apothecium is black or blackish, and the tribe Sarcoscyphaeae in which the exterior is bright-colored or light-colored. *G. guanacastensis* belongs in the tribe Sarcoscyphaeae.

Five genera are presently recognized in the tribe Sarcoscyphaeae: *Cookeina* Kuntze, *Microstoma* Bernstein, *Phillipsia* Berkeley, *Pithya* Fuckel, and *Sarcoscypha* (Fries) Boudier. Of these, *Pithya* is a small, cosmopolitan genus containing species with small, sessile apothecia growing on the leaves and fine twigs of conifers. The ascospores are smooth and spherical.

Microstoma and *Sarcoscypha* are predominantly temperate to boreal in distribution. Their apothecia are goblet-shaped, as are those of *G. guanacastensis*, but their ascospores are smooth. Their apothecial hairs are light-colored, flexuous, and generally consist of individual hyphae rather than fascicles of hyphae. *G. guanacastensis*, on the other hand, is tropical, has sculptured ascospores, and has dark-colored, bristle-like, fasciculate apothecial hairs.

The tropical genus *Phillipsia* has apothecia which vary from shallowly cup-shaped to discoid or repand. The stipe, when present, is usually stout and often eccentric. The exterior of the apothecium may be glabrescent or tomentulose, but not conspicuously hairy or bristly. Although the ascospores are sculptured, the sculpturing consists of a few delicate, widely-spaced striations running from pole to pole without anastomoses. In most instances the ascospores are unequal-sided, sometimes almost crescent-shaped. *G. guanacastensis* with its goblet-shaped apothecia; its long, slender, central stipes; its dark, bristle-like hairs; and its symmetrical, reticulate spores does not appear to belong to the genus *Phillipsia*.

G. guanacastensis seems to be more closely related to the species of *Cookeina* than to those of other genera of the tribe. A predominantly tropical genus with goblet-shaped apothecia, *Cookeina* has fasciculate hairs and symmetrical spores which are sculptured in some species. Although the shape of the apothecium is similar in both genera, *Geodina* is thicker-fleshed and less flexible. Except for their thicknesses, the excipular tissues of *Geodina* (FIGS. 9, 11) and *Cookeina* (FIGS. 10, 12)

are very similar, with a thin ectal excipulum enclosing a filamentous medullary excipulum. The excipular hairs of *Geodina* resemble those of *Cookeina* in that they are fasciculate, but they differ in that in *Geodina* the hairs arise from ectal excipulum (FIGS. 8, 11) whereas in *Cookeina* they arise from hyphae in the medullary excipulum (FIG. 12). Probably the most fundamental distinctions between *Geodina* and *Cookeina* are those having to do with the asci. In *Cookeina* the asci all mature simultaneously so that in a vertical section of the hymenium (FIG. 10) they all appear at the same stage of development. In *Geodina*, and in most of the other genera of the order Pezizales, they mature a few at a time, so that a section of a mature apothecium (FIG. 9) reveals asci at different stages of development from extremely young ones to empty asci. The asci in *Cookeina* are cylindrical, resembling long sausages, and their blunt bases are connected to the subhymenium by very slender, crooked connections. In *Geodina* the base of each ascus tapers gradually (FIG. 7) and is intertwined with the bases of adjacent asci. Ascospore sculpturing, where present in the genus *Cookeina*, consists of delicate, longitudinal striae or wrinkles which are much closer together than those in *Phillipsia*, and which occasionally anastomose. In *Geodina* the spore sculpturing (FIGS. 4, 5) consists of a few coarse, irregular ridges which anastomose to form an irregular reticulum. The paraphyses of *Cookeina* branch and anastomose freely, so that they are knit together into a loose, net-like tissue. The paraphyses of *G. guanacastensis*, on the other hand, branch only near the base and anastomose rarely if at all.

In my opinion *Geodina guanacastensis* belongs in the family Sarcoscyphaceae, tribe Sarcoscyphaeae, but is not sufficiently like any known species to be grouped in the same genus with it. It has a number of characters which it shares with other members of the tribe, but in a combination found in no existing genus. In addition, its spores sculpturing is unlike that of any member of the tribe, or for that matter any member of the order Pezizales. Therefore the author proposes that it be placed in the new genus described above.

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