

*TUBER SPINORETICULATUM*, A NEW  
TRUFFLE FROM MARYLAND

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In November, 1969, we collected several ascocarps of a truffle from a lawn in Hagerstown, Maryland. All the specimens were completely hypogeous in an open-shaded area of about one-fourth acre enclosed by a fence. Trees present were *Prunus serotina* Ehrh. (black cherry), *Carya* sp. (hickory), *Quercus* sp. (oak), and *Ulmus* sp. (elm). We were unable to determine whether or not the fungus is mycorrhizal with any of the trees present. The only ground cover was a sparse stand of lawn grass. The black soil is shallow because of the rocks just below or jutting through the surface.

The owner of the property possessed two male French poodles that dug up ascocarps of this truffle throughout the spring and summer and into late fall for several years. The older dog ate the ascocarps eagerly.

Names of herbaria are abbreviated according to the *Index Herbariorum* (Holmgren and Keuken, 1974).

*Tuber spinoreticulatum* Uecker & Burdsall, sp. nov.

Ascocarpi 1.4-2.5 cm. diametro, sphaerici vel paulum elongati, plerumque ad latus unum excavati, brunneo-grisei, verrucis humilibus appressis pyramidalibus, basi ad 1 mm lato ornati, intus marmorati et venulosi; venae internae haud discernibiles, externae albae, pubescentes, nec in centrum vergentes nec in superficie aperientes; asci 75-125 × 45-65 μm, pyriformes vel sphaeropedunculati, crasse tunicatae, 1-4-sporei; ascosporae luteo-brunneae (26-) 30-35 (-40) × (20-) 22-25 (-28) μm, ornamento excluso, spinoso-reticulatae, spinulis 2.5-4 μm altis, conicis in formam subangulatan vergentibus, basibus latis in reticulo connectis. Holotypus Uecker 188 (BPI 71862), 24 November 1969 lectus; isotypus in OSC.

Ascocarps leathery, 1.4-2.5 cm broad, spherical or slightly elongate, most specimens with cavity on one side, surface brownish gray, with low, appressed, more or less pyramidal wartys up to 1 mm broad at base;

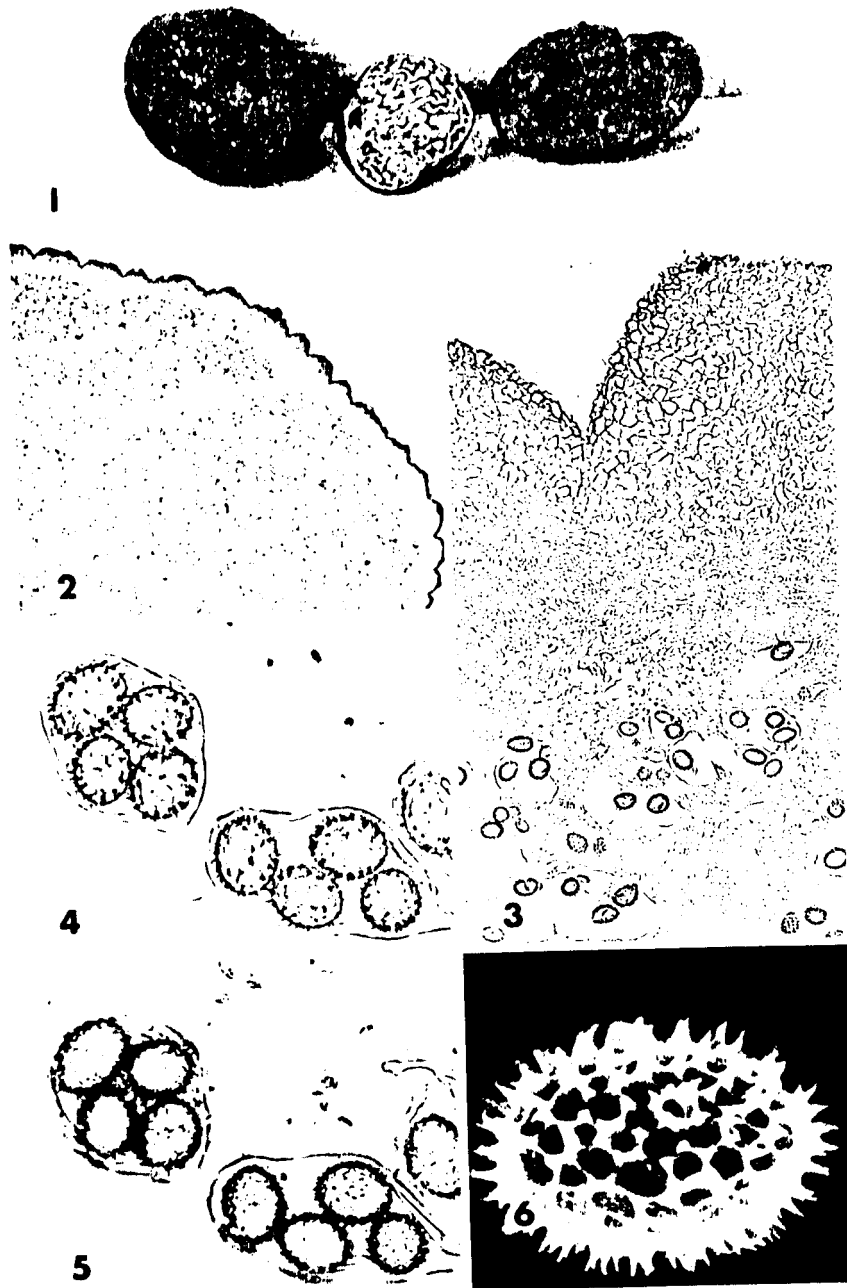
interior marbled and veined; venae internae not distinguishable; venae externae white, pubescent, no apparent convergence or opening to exterior of ascocarp; outer excipulum 150-600  $\mu\text{m}$  thick, irregularly warted; warts usually flattened, composed of textura angularis few to many cells thick, cells 5-25(-30) $\mu\text{m}$  broad, thick walled (up to 1  $\mu\text{m}$  thick), pale yellow to yellowish brown, outer cells darkest and with thickest walls, inner cells nearly hyaline, rather abruptly changing into inner excipulum; inner excipulum 30-125  $\mu\text{m}$  thick, a textura intricata of hyaline hyphae (2-)2.5-6(-10) $\mu\text{m}$  broad, irregularly swollen, walls thin or up to 0.5  $\mu\text{m}$  thick, continuing into area between asci, septa simple; venae externae 100-180 $\mu\text{m}$  wide, composed of textura intricata-textura porrecta, hyphae 2-5(-7) $\mu\text{m}$  broad, hyaline, walls thin or up to 0.5  $\mu\text{m}$  thick, hyaline, septa simple: asci irregularly arranged, 7-125 (apex to crozier)  $\times$  45-65  $\mu\text{m}$ , pyriform to sphaeropedunculate, thick walled (2-3 pin thick), two or more layered, arising from croziers, 1-4-spored; ascospores yellow brown, (26-) 30-35 (-40)  $\times$  (20-)22-25 (-28) $\mu\text{m}$  plus ornamentation, broadly ellipsoid, uni- to multiguttulate, spinose reticulate; spines 2.54  $\mu\text{m}$  high, conical to subangular with broad bases connecting to form a reticulum, walls 1-2 $\mu\text{m}$  thick; one or two spored asci usually with larger ascospores than three or four spored asci. Odor of rotting cabbage.

*Habitat.*—In lawn under various deciduous trees.

*Type locality.*—Fahnestock property, 725 Fountainhead Road, Hagerstown, Maryland. USA.

The distinctive features of this fungus are the small but distinct cavity at one side of most ascocarps (FIG. 1), the peridium covered with small warts (FIGS. 2, 3), the absence of venae internae (FIG. 2), and the spinose-reticulate ascospores (FIGS. 4-6).

Knapp (1950) divided the species of *Tuber* into five groups, represented by *T. excavatum* Vitt., *T. rufum* Pico ex Fr., *T. puberulum* Berk. & Br., *T. dryophilum* Tul., and *T. aestivum* Vitt., respectively. A distinct cavity in the hard, almost woody ascocarp, and coarsely reticulate ascospores characterize the *T. excavatum* group. The peridium is composed of a tightly packed tough inner layer and a looser outer layer that has a peculiar clayey or sandy feel and often can be rubbed off. In the spiny-spored *T. rufum* group the fleshy ascocarp usually has a shallow depression rather than a cavity. The peridium is two layered but the outer one is solidly packed and may form small warts. In the *T. puberulum* and *T. dryophilum* groups the ascocarp is soft and lacks a cavity, and the spores are reticulate. In the *T. aestivum* group



the peridium is composed of large polygonal or pyramidal warts. Spores are variously reticulate in some species, spiny in others. Within this group, *T. mesentericum* Vitt. and its segregates have a distinct cavity.

Only two previously described species of *Tuber* have spinose-reticulate spores. *Tuber texense* Heimsch is discussed in detail below. Except for its spinose-reticulate spores, *T. texense* fits comfortably within the *T. rufum* group. In *T. malacodermum* Fischer (1923) bases of the spines are sometimes connected and the spines are irregularly placed. Furthermore, the single-layered peridium is unique in that it is composed of thin-walled, inflated vesicular cells. The relationship of *T. malacodermum* to other members of the *T. rufum* group is obscure.

On the basis of peridial characters, consistency of the ascocarp, and arrangement of the asci, *T. spinoreticulatum* appears related to the *T. rufum* group. Because of its cavity and spinose-reticulate spores, *T. spinoreticulatum* is distinct from any member of that group. It is closely related to *T. texense* but differs most obviously in peridial structure and in ascospore characters. In *T. texense* the ascocarp surface is light brown, smooth, and lacks a distinct cavity. According to Heimsch (1958), the pseudoparenchymatous outer cortical layer changes gradually to compact prosenchyma and finally to compact masses and strands of sterile hyphae which continue into the gleba to form the irregularly widened and narrowed venae internae. We regard the outer excipulum as a textura angularis-textura epidermoidea, the inner one a textura intricata. Ascospores in *T. texense* are 22-40 × 14-26 μm, and are spinose or more or less spinose reticulate. In a BPI specimen from Tulsa, Oklahoma, the asci nearly always contain only one or two spores. But in Gilkey's specimen (HMG 823, in OSC) from Butler, Tennessee, three or four spores are most commonly found. *Tuber spinoreticulatum* has a gray-brown peridium with small warts. The outer layer, including the warts, is a texture angularis whereas the inner one is a textura intricata. The ascospores are always spinose reticulate and are usually 30-35 × 22-25 μm, more broadly ellipsoid than those of *T. texense*.

Trappe (1969) reported that the ascus walls of members of the *Tuber rufum* and *T. excavatum* groups are composed of three layers: a thin inner wall, a thicker central stratum, and a thin, separable outer wall. The basal portion of the outer layer sometimes persists loosely

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FIGS. 1-6. *Tuber spinoreticulatum*. 1. Ascocarps, × 1.2. 2. Section through ascocarp, × 9. 3. Section of ascocarp showing details of peridium and gleba, × 120. 4, 5. Asci with spores, shown at two focal levels, × 360. 6. Scanning electron micrograph of a spore, × 1,450.

attached or tightly appressed to the stalk of the ascus. Whether the persistent basal outer layer is formed by rupture of the outer wall at an earlier stage of ascus development or by breaking away of the distal portion of the outer layer or by dissolution of the distal portion has not been determined. The persistent basal outer layer is present in *T. spinoreticulatum*, although not so conspicuously as in *T. texense*. One of us (FAU) observed this layer not only in the *T. excavatum* and *T. rufum* groups, but also in specimens labeled as *T. magnatum* Pico ex Vitt. (H. M. Gilkey 861) of the *T. dryophilum* group, and *T. aestivum* (HMG 1011), *T. melanosporum* Vitt. (HMG 502), and *T. bituminatum* Berk. & Br. (HMG 1008) of the *T. aestivum* group. All specimens listed are in OSC. In any single ascocarp only a small percentage of the asci may show this character. It appears that the persistent basal outer layer is present in at least four of Knapp's (1950) five groups and may prove to be a universal feature of asci of *Tuber* species. Further studies are needed before the taxonomic value of this character can be properly evaluated.

We thank D. P. Rogers for preparing the Latin description, and Mrs. Patricia Millner for providing the scanning electron micrograph of a spore. We are grateful to Dr. J. M. Trappe for his views concerning the relationships of this fungus and for his critical review of the manuscript. We also thank Mr. and Mrs. L. Fahnestock for allowing us to dig in their yard for specimens.

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