

The Occurrence of *Tuber texense* in Georgia

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Abstract:

A hypogeous fungus found among roots in a pecan orchard represents the first report of a truffle from Georgia. It is identified as *Tuber texense* Heimsch. An illustrated description of the Georgia material is presented.

Introduction:

Records of ascomycetes reported from Georgia have been maintained for over 70 years (Miller, 1941; Hanlin, 1963), and during that time *Elaphomyces* has been the only genus of hypogeous ascomycetes recorded from the state. In September, 1987, during a visit to a pecan orchard near Albany, Georgia, numerous ascomata were observed among roots of several large pecan trees [*Carya illinoensis* (Wang.) K. Koch] that had been exposed by soil erosion caused by a recent rain. Several ascomata were taken to the laboratory and examined, and were subsequently identified as *Tuber texense*. As this is apparently the first report of a tuberaceous species from Georgia and since it differs slightly from previous descriptions, an illustrated description of the Georgia material is presented here.

Materials and Methods:

General observations and measurements of asci and internal tissues were made on fresh material mounted in water. Material to be sectioned was cut into 5mm² blocks, fixed in formalin-propionic acid-alcohol, dehydrated through a tertiary butyl alcohol series, embedded in paraplast, sectioned at 6 or 10 µm and stained in iron hematoxylin. Sections to be examined under the scanning electron microscope were mounted on an 18 mm round cover glass, deparaffined in xylene, then the cover glass was mounted on a stub and sputter-coated with gold-palladium in a Hummer sputter coater (Gaudet and Kokko, 1984). Light micrographs were taken with a Nikon Optiphot on Kodak Technical Pan film 2415; scanning micrographs were taken on a Philips 505 SEM with Polaroid Type 55 P/N film. These procedures have been previously described in greater detail (Hanlin & Tortolero, 1988).

Observations and Discussion:

Tuber texense Heimsch

Ascomata hypogeous, up to 5.5 cm across, oval to nearly globose, light brown to

dark reddish-brown, surface smooth, often lobed, especially on one side (Fig. 1). Interior consisting of a gleba with light and dark veins surrounded by a cortex (= medullary excipulum) and an exterior layer (= ectal excipulum) of pigmented cells (Fig. 2). Cortex 240-280 μm thick, composed of three regions (Fig. 4, 8). Outermost 2-3 rows of cells angular (textura angularis), with somewhat thickened, pigmented walls (Fig. 5). These surface cells integrate into a region ca. 125 μm thick of small, compactly arranged pseudoparenchymatous cells with thin walls that vary in shape from globose to angular or short hyphal; the latter are oriented perpendicularly to the margin of the ascoma. Inner half of cortex (subcortex) composed of small, thin-walled, globose cells among tightly interwoven hyphae oriented parallel to periphery of ascoma; this region extends into gleba as sterile veins. Gleba composed of white, convoluted sterile veins (venae externae) bordered by brown fertile veins (venae internae) (Fig. 3). Sterile veins variable in width, branched, composed of hyaline, interwoven hyphae (textura intricata) (Fig. 10), becoming compressed by developing asci (Fig. 6, 9). Fertile veins brown, cells crowded, often indistinct and appearing as surrounded by mucus at maturity, enveloping numerous asci (Fig. 7, 11). Ascigerous areas in immature ascomata often separated by small veins of hyaline hyphae that form a loose, open network that is crushed as the asci develop. Asci unitunicate, thick-walled (Fig. 16), persistent, variable in size, (70)-88-(122) X (34)-48-(58) μm (including stipe), subglobose to ovoid, short- or long-stipitate [stipe (8)-22-(58) μm], containing 1-6 (usually 4) spores (Fig. 14-15). Ascospores unicellular, oval to occasionally subglobose, golden-brown at maturity, (22)-28-(36) X (16)-19-(24) μm , containing oil droplets, densely covered with spines that vary from minute to long and distinct (Fig. 17-18), up to 2 μm in length. The bases of the spines interconnect to form a reticulate pattern (Fig. 18).

Collected among roots of *Carya illinoensis* (Wang.) K. Koch, Dougherty County, Georgia, September 18, 1987, T.B. Brenneman and P.F. Bertrand. Specimens deposited in GAM (#12742).

The material collected contained asci in all stages of maturity, permitting observation of ascus development. Asci arise from croziers formed from ascogenous hyphae (Fig. 12). The ascus mother cell expands to form a clavate ascus (Fig. 13), which then develops into a mature ascus with ascospores. Developing asci often have a clump-like structure at the base that results from the fusion of the tip and basal cells of the crozier; this apparently forms the basis for the erroneous reports in the literature that tuberaceous asci possess clamp connections (Alexopoulos and Mims, 1979).

The structure of our material agrees well with that described for *T. melanosporum* Vitt. (Parguey-Leduc et al., 1987), except for the large pyramidal scales that cover the surface of *T. melanosporum*.

Gilkey (1939) recognized a single species of *Tuber* in North America with spinose ascospores, *T. candidum* Harkness, to which she later added *T.*

harknessii Gilkey (1954). A third species, *T. texense*, was described from Texas by Heimsch (1958); this species differs from *T. candidum* and *T. harknessii* in the formation of a reticulum on the spore surface that is associated with the spines. On the basis of these characteristics, our material is considered to be *T. texense*. In addition to Texas and Georgia, this species has also been found near Gainesville, Florida (James Kimbrough, personal communication).

Like our material, *T. texense* was found among roots at the base of a pecan tree. The occurrence of numerous ascomata in close association with roots of pecan suggests the possibility of a mycorrhizal association, but no direct evidence was found to support this. *Tuber melanosporum* has been demonstrated to form mycorrhizae with *Corylus avellana* L., *Quercus* spp., and other hardwood species (Delmas, 1976).

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