

“*Quercirhiza stellata*”

+ *Quercus ilex* L. subsp. *ballota* (Desf.) Samp.

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Short description

The ectomycorrhizae are dark brown to black, monopodial-pyramidal to coralloid. The outer mantle layers are pseudoparenchymatous with angular, star-like arranged cells bearing a hyphal net of angular cells, whereas the inner layers are plectenchymatous with hyphae arranged ring-like. Mantle cell walls often thickened and darkened at the intersection of cells, especially in outer layers. Abundant emanating hyphae bearing clamps, with some highly refractive amyloid zones appearing gelatinized, i. e., as if there were no cell lumen. This ectomycorrhiza probably belongs to the genus *Tomentella*.

Morphological characters (Fig. 1a): *Mycorrhizal systems* up to 3.5 mm long, monopodial-pyramidal to coralloid, 0–2 orders of ramification, solitary or in few numbers. – *Main axes* 0.2–0.3 mm diam. – *Unramified ends* straight to slightly bent, up to 0.6 mm long and 0.1–0.3 mm diam., dark brown to black, colour of very tip and older parts also dark brown to black, not carbonizing. – *Surface of unramified ends* shiny, often covered with soil particles, dots concolorous to mantle, but darker, surface distinct, not transparent, cortical cells not visible; emanating hyphae abundant, not specifically distributed. – *Rhizomorphs* lacking. – *Sclerotia* not observed.

Anatomical characters of mantle in plan views (Figs. 2a–b, 3a–b): *Lacking are*: oily droplets, brownish and needle-like contents, blue granules, drops of exuded pigment, cell wall projections and clamps. – *Outer mantle layers* (Figs. 2a–b) pseudoparenchymatous with angular, star-like arranged cells bearing a hyphal net (mantle type P according to AGERER, 1987–1998), membranaceously brownish, surface of cells with soil particles; cells of pseudoparenchyma (4)7–13 µm diam. and 10–20(27) µm long, 6–12 cells in a square of 20 x 20 µm, walls 0.5–1 µm thick, with frequent pores between cells; cells of hyphal net not specialized, angular, 10–13(15) µm diam.; walls of both pseudoparenchyma and hyphal net cells often thickened and darkened at the intersection of cells. – *Middle mantle layers* (Fig. 3a) pseudoparenchymatous to plectenchymatous, membranaceously brownish, cells (4)6–11 µm diam. and (13)16–21(25) µm long, cell walls 0.5–1 µm thick, less frequently thickened and darkened than in outer mantle layers. – *Inner mantle layers* (Fig. 3b) plectenchymatous with hyphae arranged ring-like, membranaceously brownish, hyphae (2)3–4 µm thick, distance of septa 14–36(40) µm, cell walls less frequently thickened and darkened than in outer mantle layers. – *Very tip* with no structural differences, but cells smaller, 7–14 cells in a 20 x 20 µm square.

Anatomical characters of emanating elements (Figs. 1b–d): *Rhizomorphs* lacking. – *Emanating hyphae* (Figs. 1b–d) wavy, sometimes tortuous, with simple ends, 1.5–2.5(3) µm thick, cells (32)45–75(85) µm long, walls up to 0.5 µm, very slightly membranaceously yellowish,

with clamps and elbow-like protrusions, secondary septa infrequent, surface with soil particles, intrahyphal hyphae and backwards oriented ramifications occurring, backwards oriented clamps not observed, anastomoses both open and closed by a simple septum, always with a short bridge, open anastomoses to a clamp also frequent, anastomoses occurring close to hyphal tips; septal pores with globular thickenings, one Y-shaped branching at septum, one or two hyphal diam. below it; some highly refractive zones occurring within some hyphal cells, appearing gelatinized, as if there were no cell lumen, and being amyloid. – *Cystidia* lacking. – *Chlamydospores* not observed.

Anatomical characters, longitudinal section: *Mantle* (26)32–48 μm thick, three different pseudoparenchymatous layers discernible; hyphae of outer layer tangentially 10–18 μm , radially 6–12 μm ; middle layer hyphae tangentially (6)9–13(17) μm , radially (4)5–9(10) μm ; hyphae of inner layer tangentially 4–5(6) μm , radially 3–4(5) μm ; caliptra cells visible; mantle of very tip 30–32 μm thick, with no structural differences. – *Tannin cells* lacking. – *Epidermal cells* radially-oval to -elliptic, oriented obliquely; tangentially (13)16–34(37) μm , radially (21)25–43(50) μm , $\text{EC}_t = 24 \mu\text{m}$, $\text{EC}_q = 0.7$. – *Hartig net* in section paraepidermal, with cylindrical hyphal cells in one row, (1.3)2–3.2 μm thick; *Hartig net* in plan view of scarcely lobed palmetti type, lobes (1.5)2.6–3.2 μm broad.

Colour reaction with different reagents: *Mantle and rhizomorph preparations:* cotton blue-lactic acid: bluish, cell walls become brighter; guaiac: n. r. (= no reaction); iron(II)sulfate: greenish grey; KOH 15%: n. r.; lactic acid: brighter cell walls; Melzer's reagent: amyloidity observed in certain zones of some emanating hyphae; sulfo-vanillin: n. r.; toluidine blue: bluish.

Reference specimen for *Quercus ectomycorrhiza*: Spain, Navarra, Nazar, in a *Quercus ilex* subsp. *balota* stand burned in 1993, soil core exc., myc. isol. M. de Román, 17. 11. 2000, ectomycorrhiza MDR 5 (in Department of Botany, Universidad de Navarra, Spain). The epitheton “stellata” refers to the star-like arrangement of the outer mantle cells.

Discussion: The ectomycorrhizae of “*Quercirhiza stellata*” differ significantly from other ectomycorrhizae described up to now.

Except for the hyphal net and the lack of cystidia, the mantle resembles that of the unidentified ectomycorrhiza ITE. 5 (INGLEBY et al. 1990), especially regarding the cell wall thickenings. The mantle of “*Pinirhiza cyaneoviridis*” (GOLLDACK et al. 1998) and “*Q. stellata*” are also very much alike, but the outer mantle cells of the former contain blue granules, and its hyphae lack clamps.

A similar morphology and mantle anatomy have also been recorded for “*Quercirhiza fibulocystidiata*” (JAKUCS et al. 1997), “*Quercirhiza nodulosomorpha*” (AZUL et al. 1999), “*Fagirhiza spinulosa*” (BRAND 1991a, “*Fagirhiza setifera*” (BRAND 1991b), “*Piceirhiza nigra*” (AGERER et al. 1995), “*Pinirhiza dimorpha*” (GOLLDACK et al. 1999), *Tomentella pilosa* (JAKUCS & AGERER 1999) and *Tomentella albomarginata* (AGERER 1996), but the presence of cystidia in the first seven cases and the presence of a gelatinous matrix and rhizomorphs in the last one are significant distinguishing features.

Other similarities have been found with ectomycorrhizae which have not been described in detail, such as the five *Tomentella* types not identified to species level described by DANIELSON et al. (1984), DANIELSON & PRUDEN (1989) and DANIELSON and VISSER (1989). Cystidia are again an important distinguishing feature in four of these types, while a further comparison of “*Q. stellata*” with the fifth type is not possible due to the short description given.

Regarding the emanating hyphae, the most striking characteristic is the presence of highly refractive amyloid zones which appear gelatinized, i. e., as if there were no cell lumen, a feature which has also been recorded for “*Quercirhiza argenteobrunneola*” (FISCHER & AGERER 1996), but in contrast to “*Q. stellata*”, this mycorrhiza has cystidia and a different mantle structure.

Since "*Q. stellata*" shares many characteristics with several *Tomentella* ectomycorrhizae and with other unidentified types which supposedly belong to this genus, it is suggested that "*Q. stellata*" may also be a member of the genus *Tomentella*.

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Captions: *Fig. 1* – *a*. Habit. – *b*. Hypha emanating from outer mantle layers. – *c*. Hyphae with open anastomoses and amyloid zones. – *d*. Emanating hyphae. – *Fig. 2* – *a*. Plan view of hyphal net. – *b*. Plan view of outer mantle layers. – *Fig. 3* – *a*. Plan view of middle mantle layers. – *b*. Plan view of inner mantle layers. *All figs. from MDR 5.*

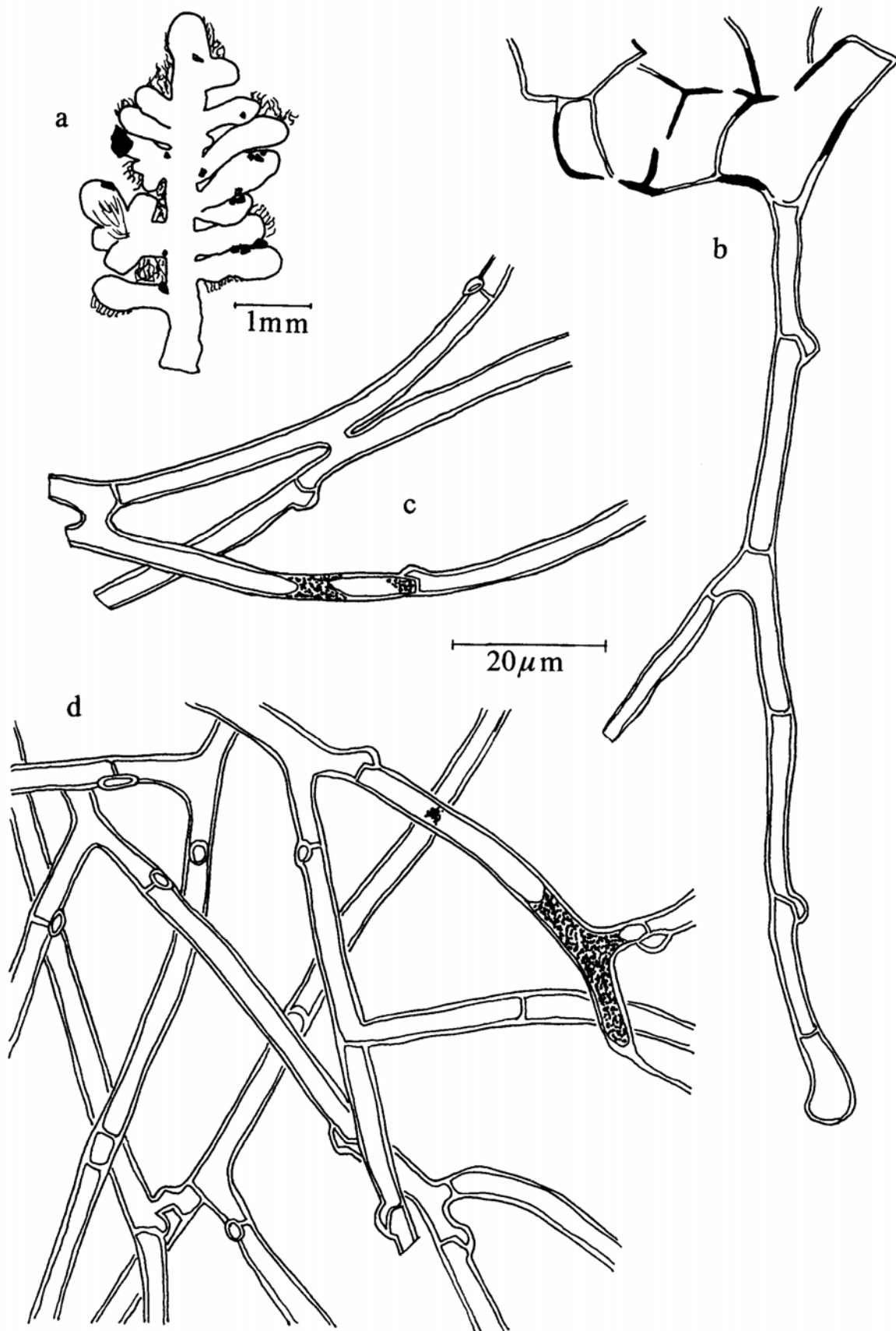


Fig. 1 - "*Quercirhiza stellata*" + *Quercus ilex* subsp. *ballota*

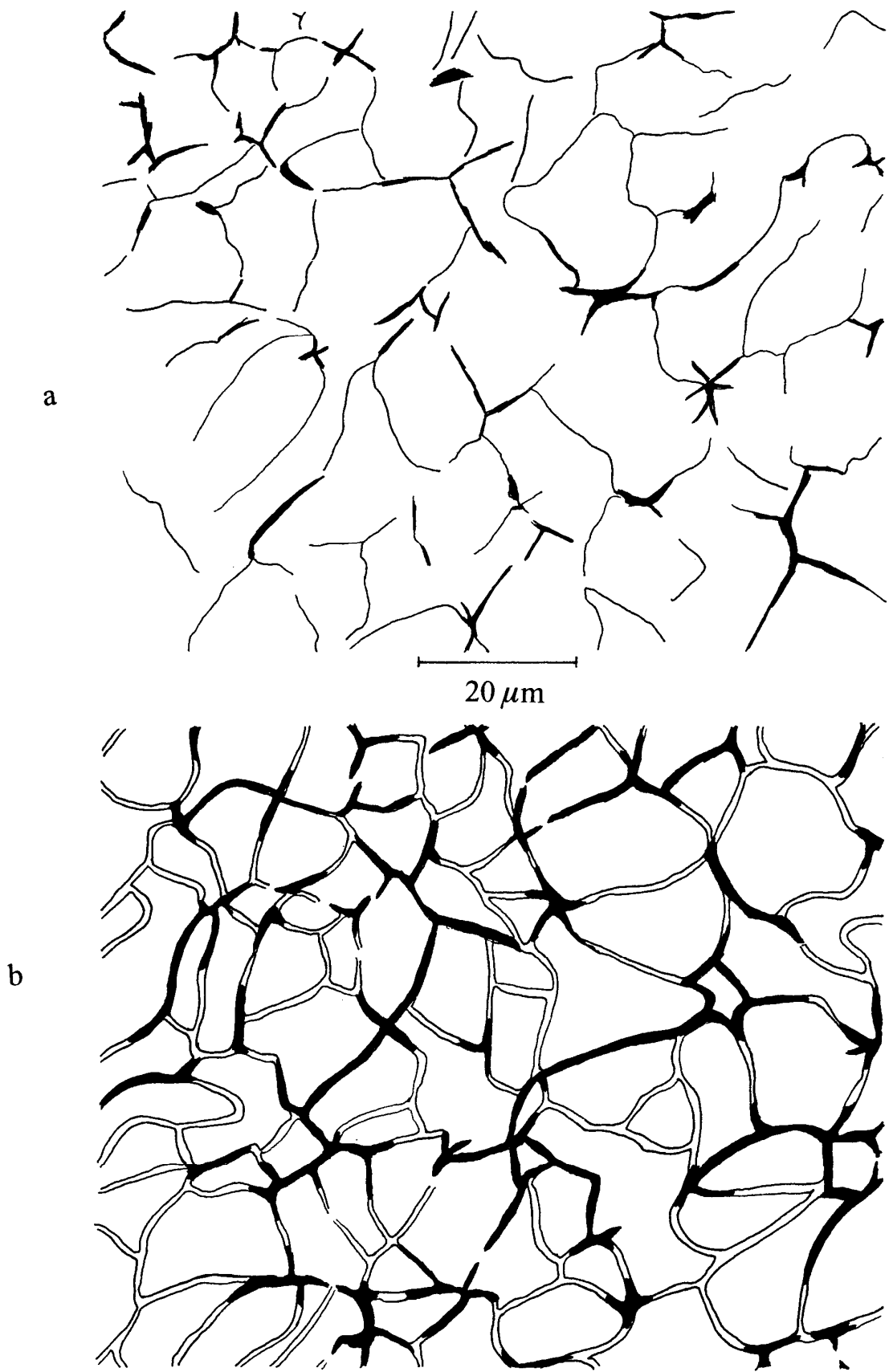


Fig. 3 – “*Quercirhiza stellata*” + *Quercus ilex* subsp. *ballota*

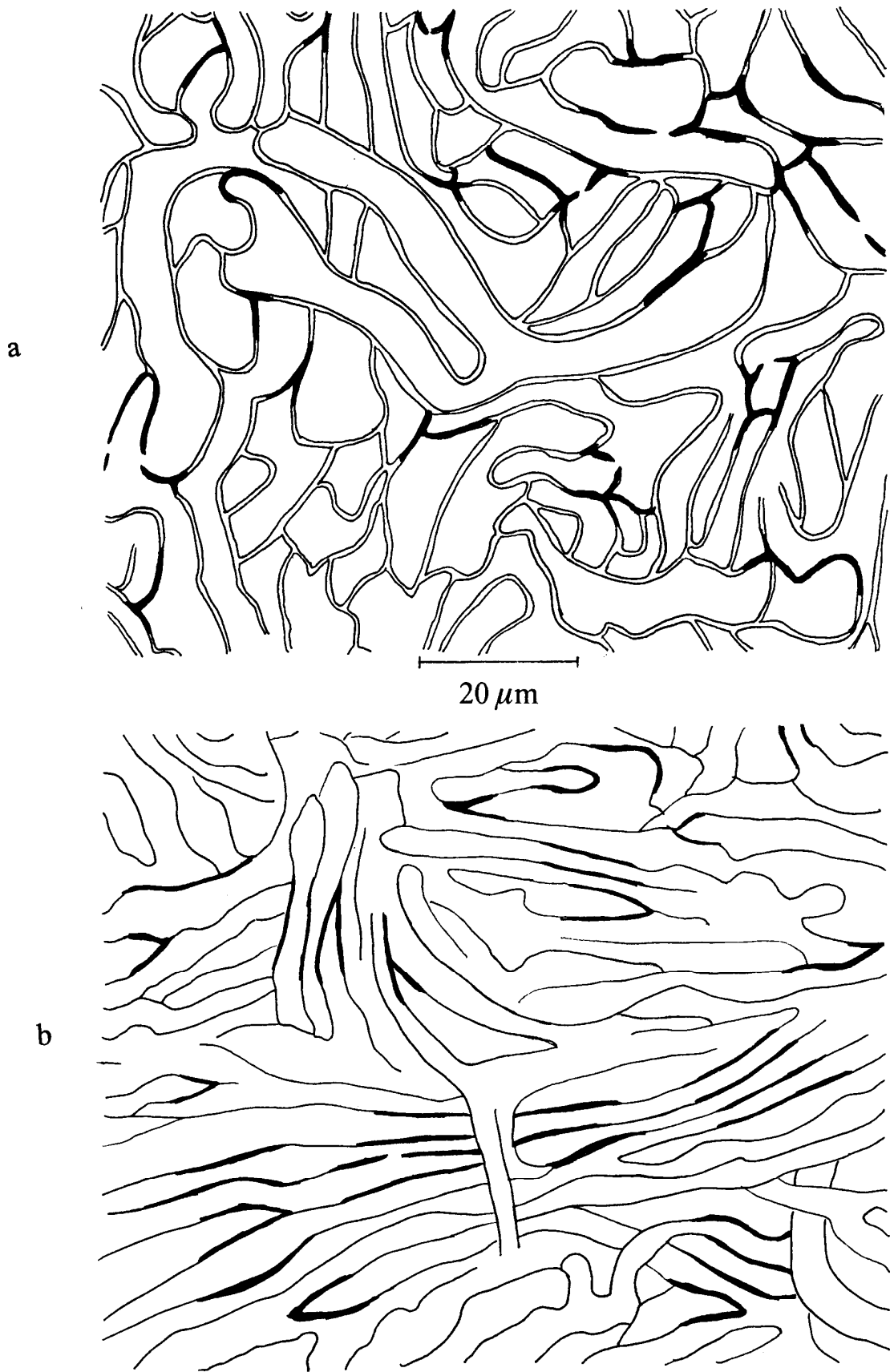


Fig. 2 - "Quercirhiza stellata" + Quercus ilex subsp. ballota