Literature

• references

Müller WR, Rauscher T, Agerer R, Chevalier G (1996) *Tuber aestivum* Vitt. + *Corylus avellana* L.Descr Ectomyc 1: 167-172.
Rauscher T, Müller WR, Chevalier G, Agerer R (1996) *Tuber aestivum*. In Agerer R (ed) Colour Atlas of Ectomycorrhizae, plate 112, Einhorn-Verlag, Schwäbisch Gmünd.
Zambonelli A, Branzanti MB (1984) Prove do micorrizazione del nocciolo con *Tuber aestivum* e *Tuber albidum*. Micol Ital 13(1): 47-52.

Morphology

Morphology of the mycorrhizal system

• length

0 mm	Lower value of unspecified range (could be µ-s.d., but not known)
4.4 mm	Upper value of unspecified range (could be µ+s.d., but not known)

• ramification presence-type

absent
or monopodial-pyramidal

• ramification orders

0	Lower value of unspecified range (could be µ-s.d., but not known)
1	Upper value of unspecified range (could be µ+s.d., but not known)

• abundance

solitary or in small numbers

• main axis diameter

0.3 mm	Lower value of unspecified range (could be µ-s.d., but not known)
0.39 mm	Upper value of unspecified range (could be µ+s.d., but not known)

• rhizomorphs as stout, short, conical structures presence-abundance

absent

• rhizomorphs as short mycorrhiza-like outgrowths with blunt tips presence

absent

• rhizomorphs presence

absent

• exploration type

short distance

Morphology of the unramified ends

• shape

straight

• shape {of distal end}

not inflated, cylindric

• length

0 mm Lower value of unspecified range (could be μ-s.d., but not known)
2.6 mm Upper value of unspecified range (could be μ+s.d., but not known)
3.7 mm Maximum value

• diameter
0.3 mm Lower value of unspecified range (could be μ-s.d., but not known)
0.34 mm Upper value of unspecified range (could be μ+s.d., but not known)

• colour
brown
or red

• very tip colour
brown
or ochre, yellowish brown

• older parts colour
dark brown

• mantle cortical cells visibility
not visible

• mantle {distinct} surface visibility
present

• mantle transparency
not transparent

• mantle laticifers visibility
absent

• mantle dots presence-colour
absent

• mantle carbonizing presence
absent

• mantle surface {in general} habit
smooth
or not smooth

• mantle surface {in detail} kind
densely grainy or warty

• emanating hyphae presence
absent
or present

• emanating hyphae abundance
infrequent
or abundant

Morphology of sclerotia

• presence
absent

Anatomy

Anatomical features of the entire mycorrhiza

- emanating elements presence-type
  cystidia

- emanating elements cystidia location
  on outer mantle layer

Anatomy of laticifers

- presence
  absent

Anatomical features of the mantle

- matrix presence
  absent

Anatomy of the outer mantle layer apart from the ectormycorrhizal tip

- organisation
  pseudoparenchymatous

- organisation {if pseudoparenchymatous} cell shape
  angular

- mantle type
  angular cells (type L)

- pores between cells presence
  absent

- septa clamps presence
  absent

- cell pigment location-colour
  membranaceously brownish

- cell contents presence-kind
  absent

- cell diameter
  - 3 µm Minimum value
  - 5 µm Lower value of unspecified range (could be µ-s.d., but not known)
  - 8 µm Upper value of unspecified range (could be µ+s.d., but not known)
  - 10 µm Maximum value

- cell length
  - 6 µm Minimum value
  - 8 µm Lower value of unspecified range (could be µ-s.d., but not known)
  - 13 µm Upper value of unspecified range (could be µ+s.d., but not known)
  - 15 µm Maximum value

- cell density
  - 10 Lower value of unspecified range (could be µ-s.d., but not known)
  - 12 Upper value of unspecified range (could be µ+s.d., but not known)

- cell wall thickness
  - 0.5 µm Lower value of unspecified range (could be µ-s.d., but not known)

2 µm Upper value of unspecified range (could be µ+s.d., but not known)

• cell wall with globular thickenings
absent

• cell wall surface habit
smooth

• cell wall projections presence
present

• cell wall projections abundance
infrequent

• cell wall projections shape
even in thickness

• drops of exuded pigment presence
absent

Anatomy of the middle mantle layer

• organisation
pseudoparenchymatous

• cell pigment location-colour
membranaceously brownish

• cell diameter
4 µm Lower value of unspecified range (could be µ-s.d., but not known)
10 µm Upper value of unspecified range (could be µ+s.d., but not known)
13 µm Maximum value

• cell length
6 µm Minimum value
8 µm Lower value of unspecified range (could be µ-s.d., but not known)
15 µm Upper value of unspecified range (could be µ+s.d., but not known)
18 µm Maximum value

• cell density
6 Minimum value
9 Lower value of unspecified range (could be µ-s.d., but not known)
11 Upper value of unspecified range (could be µ+s.d., but not known)

• cell contents presence-kind
absent

• cell wall thickness
0.5 µm Lower value of unspecified range (could be µ-s.d., but not known)
1.5 µm Upper value of unspecified range (could be µ+s.d., but not known)

• cell wall surface habit
smooth

Anatomy of the inner mantle layer

• organisation
pseudoparenchymatous

• cell pigment location-colour
membranaceously brownish

• cell diameter
3 µm Minimum value
5 µm Lower value of unspecified range (could be µ-s.d., but not known)
8 µm Upper value of unspecified range (could be µ+s.d., but not known)
10 µm Maximum value

• cell length
7 µm Minimum value
10 µm Lower value of unspecified range (could be µ-s.d., but not known)
14 µm Upper value of unspecified range (could be µ+s.d., but not known)
16 µm Maximum value

• cell contents presence-kind
absent

Anatomy of the outer mantle layer of the ectormycorrhizal tip

• anatomy mantle outer mantle layer {of ectomycorrhizal tip} organisation
pseudoparenchymatous

• anatomy mantle outer mantle layer {of ectomycorrhizal tip} hyphae diameter
2 µm Minimum value
3 µm Lower value of unspecified range (could be µ-s.d., but not known)
6 µm Upper value of unspecified range (could be µ+s.d., but not known)
7 µm Maximum value

• anatomy mantle outer mantle layer {of ectomycorrhizal tip} cell density
14 Lower value of unspecified range (could be µ-s.d., but not known)
16 Upper value of unspecified range (could be µ+s.d., but not known)

Anatomy of the mantle in longitudinal section

• mantle thickness {apart from tip}
15 µm Minimum value
20 µm Lower value of unspecified range (could be µ-s.d., but not known)
30 µm Upper value of unspecified range (could be µ+s.d., but not known)
40 µm Maximum value

• mantle thickness {at ectomycorrhizal tip}
5 µm Minimum value
10 µm Lower value of unspecified range (could be µ-s.d., but not known)
15 µm Upper value of unspecified range (could be µ+s.d., but not known)
20 µm Maximum value

• middle mantle layer hyphae tangentially length
5 µm Minimum value
8 µm Lower value of unspecified range (could be µ-s.d., but not known)
15 µm Upper value of unspecified range (could be µ+s.d., but not known)
20 µm Maximum value

Anatomy of the tannin cells in longitudinal section

• presence
absent

Anatomy of the cortical cells in longitudinal section

• anatomy mantle longitudinal section cortical (epidermal) cells shape
radially-oval to -elliptic, oriented obliquely

• anatomy mantle longitudinal section cortical (epidermal) cells tangentially length
6 µm Lower value of unspecified range (could be µ-s.d., but not known)
17 µm Upper value of unspecified range (could be µ+s.d., but not known)

• anatomy mantle longitudinal section cortical (epidermal) cells radially diameter
23 µm Minimum value
28 µm Lower value of unspecified range (could be µ-s.d., but not known)
53 µm Upper value of unspecified range (could be µ+s.d., but not known)
60 µm Maximum value

Anatomy of the Hartig net in longitudinal section

• presence
present

• kind
paraepidermal

• structure {in plan view}
of palmetti type

• lobes width
1 µm Minimum value
1.5 µm Lower value of unspecified range (could be µ-s.d., but not known)
2.5 µm Upper value of unspecified range (could be µ+s.d., but not known)
3 µm Maximum value

Anatomy of the mantle in cross-section

• mantle different layers presence
discernible

• outer mantle layer organisation
pseudoparenchymatous

• outer mantle layer hyphae tangentially length
5 µm Lower value of unspecified range (could be µ-s.d., but not known)
10 µm Upper value of unspecified range (could be µ+s.d., but not known)
15 µm Maximum value

• outer mantle layer hyphae radially diameter
2 µm Lower value of unspecified range (could be µ-s.d., but not known)
3 µm Upper value of unspecified range (could be µ+s.d., but not known)
4 µm Maximum value

• middle mantle layer organisation

pseudoparenchymatous

- middle mantle layer hyphae tangentially length
  - 3 µm Minimum value
  - 5 µm Lower value of unspecified range (could be µ-s.d., but not known)
  - 12 µm Upper value of unspecified range (could be µ+s.d., but not known)

- middle mantle layer hyphae radially diameter
  - 3 µm Lower value of unspecified range (could be µ-s.d., but not known)
  - 5 µm Upper value of unspecified range (could be µ+s.d., but not known)
  - 7 µm Maximum value

- inner mantle layer organisation
  - pseudoparenchymatous

- inner mantle layer hyphae tangentially length
  - 3 µm Lower value of unspecified range (could be µ-s.d., but not known)
  - 5 µm Upper value of unspecified range (could be µ+s.d., but not known)
  - 10 µm Maximum value

Anatomy of the tannin cells in cross-section

- presence
  - absent

Anatomy of the cortical cells in cross-section

- anatomy mantle cross-section cortical (epidermal) cells shape
  - radially-oval to -elliptic

- anatomy mantle cross-section cortical (epidermal) cells tangentially length
  - 8 µm Minimum value
  - 10 µm Lower value of unspecified range (could be µ-s.d., but not known)
  - 22 µm Upper value of unspecified range (could be µ+s.d., but not known)
  - 25 µm Maximum value

- anatomy mantle cross-section cortical (epidermal) cells radially diameter
  - 11 µm Minimum value
  - 14 µm Lower value of unspecified range (could be µ-s.d., but not known)
  - 40 µm Upper value of unspecified range (could be µ+s.d., but not known)
  - 45 µm Maximum value

Anatomy of the Hartig net in cross-section

- presence
  - present

- kind
  - apparently two rows deep
  - or one or half a row of cortical cells adjoining endodermis free of Hartig net

- anatomy mantle cross-section hyphal cells around cortical (epidermal) cells shape
  - roundish

or cylindrical

• anatomy mantle cross-section hyphal cells around cortical (epidermal) cells thickness
1 µm Minimum value
1.5 µm Lower value of unspecified range (could be µ-s.d., but not known)
2.5 µm Upper value of unspecified range (could be µ+s.d., but not known)
3 µm Maximum value

• anatomy mantle cross-section hyphal rows around cortical (epidermal) cells number
one

Anatomy of the emanating elements in general

Anatomy of cystidia

Anatomy of cystidia (type 1)

• type
awl-shaped, bristle-like (type A)

• ramification presence-position
absent

• septa presence
present

• septa kind
simple

• diameter {proximal}
4 µm Lower value of unspecified range (could be µ-s.d., but not known)
5 µm Upper value of unspecified range (could be µ+s.d., but not known)

• diameter {distal}
2 µm Lower value of unspecified range (could be µ-s.d., but not known)
3 µm Upper value of unspecified range (could be µ+s.d., but not known)

• length
300 µm Minimum value
450 µm Lower value of unspecified range (could be µ-s.d., but not known)
800 µm Upper value of unspecified range (could be µ+s.d., but not known)
900 µm Maximum value

• cell wall colour
brownish

• cell wall colour {relative to mantle cells}
similar

• cell wall thickness
1 µm Lower value of unspecified range (could be µ-s.d., but not known)
1.5 µm Upper value of unspecified range (could be µ+s.d., but not known)

• cell wall thickness {relative to mantle cells}

similar in thickness

• cell wall evenness
even in thickness

• surface habit
smooth
or warty

• contents presence
absent

• contents type
absent

Anatomy of emanating hyphae

• pigment presence-distribution
only distal

Anatomy of the cells of emanating hyphae

• anatomy emanating elements emanating hyphae cell diameter
5 µm Lower value of unspecified range (could be µ-s.d., but not known)
6 µm Upper value of unspecified range (could be µ+s.d., but not known)

Anatomy of rhizomorphs

Anatomy of hyphae in rhizomorphs

Anatomy of chlamydospores

• presence
absent

Anatomy of haustoria

• {of ectomycorrhiza former} presence
present

• {of ectomycorrhiza former} abundance
occasionally present

- {of foreign origin} presence
  absent

Anatomy of nuclei

- number {per cell}
  1 Lower value of unspecified range (could be µ-s.d., but not known)
  2 Upper value of unspecified range (could be µ+s.d., but not known)

Autofluorescence

- whole mycorrhizae UV 254 nm colour-presence
  absent

- whole mycorrhizae UV 366 nm colour-presence
  absent

- mantle in section UV-filter 340-380 nm presence
  present

- mantle in section blue-filter, 450-490 nm presence
  present

- mantle in section green-filter, 530-560 nm presence
  present

Chemical reactions

- reaction with cotton-blue-lactic-acid presence
  present

- reaction with ethanol 70% presence
  absent

- reaction with FeSO4 presence
  present

- reaction with formol 40% presence
  absent

- reaction with guaiac presence
  absent

- reaction with KOH 10% presence
  present

- reaction with lactic acid presence
  absent

- reaction with Melzer's reagent presence
  absent

- reaction with phenole presence
  absent

- reaction with sulpho-vanillin presence
  absent

Ecology

- geographic occurrence continent

  Europe

- knowledge about association with foreign fruitbodies presence

  unknown

Tree

- plant family

  Betulaceae

- plant genus

  Corylus

- plant habitat kind

  nursery

Fungus

- family

  Tuberaceae

- fruitbodies growth habit

  hypogeous

Remarks

- public notes

  Mycorrhizal ends reddish brown to brown; autofluorescence of mantle in section with UV-filter showing outer mantle layer light brown and partly orange brown and middle layers dark brown and inner layers pale brown to grey-brown and cystidia bright brown, with blue-filter cystidia and outer as well as inner layers yellowish brown and middle layers dark brown, with green-filter outer and inner layers deep bright red and middle layers red; mantle in KOH with brown to dark brown cell walls, in FeSO4 cell walls greyish brown to dark brown, in cotton-blue irregularly blue.