





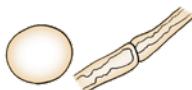

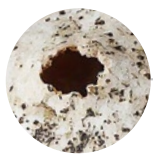







Key to *Tulostoma*

All spore measurements are without ornament.

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|---|--|---|
|  | 1. Opening on par with the surface, ± fluffy and never with a coloured opening zone 2 | |
|  | Opening raised like a chimney, sharply defined and sometimes with a darker or coloured opening zone 8 | |
|  | 2. With a thick, membranose outer layer and a white inner layer. Spore-ball up to 15 mm wide; with a well defined opening zone around a fluffy opening; spores spherical, 4-6 µm, with low warts, that can merge to small crests; capillitium with a few septae, hardly expanded around these; southern <i>Tulostoma pulchellum</i> |  |
| | Outer layer thin and soon disappearing or left as a collar at the base of the spore-ball; inner layer mostly darker 3 | |
|  | 3. Spores absolutely smooth 4 | |
|  | Spores ± ornamented 6 | |
| | 4. Spores 5,5-7 µm. Spore-ball 3-8 mm wide; stem very pale, with a conspicuous hyphal cord below; in steppe-like vegetation; south-eastern <i>Tulostoma grandisporum</i> |  |
| | Spores smaller 5 | |
| | 5. Spore-ball ± reddish brown (■ ■). Spore-ball 9-13 mm wide; stem fibrous-scaly, at first dark, later pale and with furrows, with a bulbose with base of hyphal cords; spores broadly ellipsoid, 3,5-4,5 x 3-3,5 µm; on calcareous, degraded brickwork, etc., often in shady, humus-rich habitats; southern <i>Tulostoma fulvellum</i> | |
| | Spore-ball buff with pinkish (■ ■) shade. Spore-ball 6-10 mm wide; stem with a dark outer layer, mostly with an volva-like structure at the base; spores almost spherical, 3,5-5 x 3,5-4,5 µm; found in very different habitats, including forests and gardens, but also more open and dry places; southern <i>Tulostoma lloydii</i> |  |
|  | 6. Spores in different sizes, 5-10 µm. Spore-ball 10-15 mm wide; stem with quite saturated colours; spores densely warty-spiny; capillitium without crystals, not or only slightly expanded at the septae; on sandy, ± calcareous ground; very rare, eastern <i>Tulostoma winterhoffii</i> |  |
| | Spores 4-6 µm large, not so variable 7 | |
|  | 7. Spores 4-6 x 4-5 µm, with confluent warts. Spore-ball 10-15 mm wide, ofte with a collar below from remnants of the outer layer infused with sand; stem yellow- to greyish brown, robust, with some longitudinal furrows; capillitium without crystals, not or only slightly expanded at the septae; spores densely warty; on sandy, ± calcareous soil in industrial habitats, along the coast, etc.; rare <i>Tulostoma fimbriatum</i> |  |
| | Spores 4-5 x 4-4,5 µm, coarsly ornamented but without confluent warts. Spore-ball up to 12 mm wide; i sandy, ± steppe-like vegetation; southern <i>Tulostoma punctatum</i> | |
|  | 8. The brown, peeling outer layer leaves a reticulate pattern (with sphaerocysts); stem scaly. Spores 5-7 µm; capillitium rather expanded at the septae; on soil i steppe-like vegetation; southern <i>Tulostoma squamosum</i> |  |
| | Without such a pattern; stem smooth to somewhat scaly 9 | |



9. The whole outer surface of the spore-ball with the same colour . 10
 The opening surrounded by a darker, contrasting area 11

10. Spores 4-6 μm , with moderately large warts; capillitium with many small crystals. The whole the fruitbody cream to whitish, or rarely slightly coloured around the opening; spore-ball 3-7 mm wide, egg- to onion-shaped; opening \pm conical, surrounded by a skin-like, soon disappearing outer layer; stem smooth or somewhat scaly; spores 4-6 μm , with moderately large warts; capillitium not or only somewhat expanded at the septae; in moss on limestone; (northern) *Tulostoma niveum*



Spores 3,5-4,5 μm , with low warts; capillitium without crystals. The whole the fruitbody greyish white; spore-ball 5-10 mm wide; opening chimney-like; outer layer soon disappearing; capillitium somewhat expanded at the septae, sometimes asymmetrical; in calcareous sand among mosses; very rare *Tulostoma kotlabae*



11. Opening surrounded by a yellow- to orange-brown (■ ■ ■ ■ ■) zone; capillitium usually clearly expanded at the septae 12

Opening surrounded by a darker \pm greyish brown (■ ■ ■ ■ ■) zone; capillitium not or only slightly expanded at the septae . . . 13



12. With a skin-like outer layer; capillitium with scattered oblong or plate-like crystals and very expanded at the septae. Spore-ball 5-10 mm wide; stem pale brown, with longitudinal fibres; spores 3,5-4,5 (-5) μm ; mostly among mosses, especially *Syntrichia*, in dunes and industrial habitats, dykes, etc.; scattered *Tulostoma brumale*



With a thread-like outer layer; capillitium without obvious crystals, moderately expanded at the septae. Spore-ball 8-15 mm; spores 4-6 μm ; on calcareous soil in steppe-like environments; southern/eastern *Tulostoma simulans*



13. Spore-ball at first \pm orange-brown (■ ■ ■ ■ ■), later pale pinkish buff (■ ■ ■ ■ ■); with a dark brown to almost black zone around the opening; stem at age very dark brown (■ ■ ■ ■ ■); spores on average 5,2-5,4 μm . Spore-ball 5-10 mm wide, outer layer thread-like and very quickly disappearing; stem smooth or with longitudinal fibres; capillitium without crystals, at most a bit expanded at the septae; spores 4,5-6 μm , conspicuously warty-spiny; i calcareous dunes; very rare *Tulostoma melanocyclum*



Spore-ball first brown (■ ■ ■ ■ ■), later almost white; with a less contrasting ring around the opening; stem \pm orange-brown (■ ■ ■ ■ ■); spores on average 4,7-5 μm . Spore-ball 5-12 mm wide, with a quickly disappearing outer layer, that may remain as small particles at the base of the spore ball; capillitium without crystals and without expansions at the septae; spores 4-6 μm ; on calcareous soil in steppe-like vegetation; southern/eastern *Tulostoma calcareum*



