

# Two new species in the genus *Cenangiopsis* (Helotiales) with non-lanceolate paraphyses: *C. desae* and *C. rosae* spp. nov.

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**Abstract:** Two new species of the genus *Cenangiopsis* with non-lanceolate paraphyses and inamyloid asci are described: *C. desae* and *C. rosae*. Both develop on periodically dry twigs and branches of *Rosa* spp. in mountainous areas of Montenegro. The two species are easily distinguished from each other by the colour of the apothecial disc and exterior: *C. rosae* has a brownish disc and exterior with a whitish margin similar to all other species of this genus, whereas *C. desae* sharply differs in an orange-red disc and blackish exterior. The cylindrical-ellipsoid ascospores of the two species resemble in size, shape, colour, and oil content those of the other two species with non-lanceolate paraphyses, *C. alpestris* and *C. andreae*, except that the ascospores of *C. desae* have a low lipid content and when overmature they do not become brown but instead septate. All species with lanceolate paraphyses (*C. junipericola*, *C. livida*, *C. raghavanii*, *C. quercicola*, *C. violascens*) have smaller, often heteropolar (cuneate) ascospores with a low lipid content which remain hyaline and non-septate with age. Within the group with non-lanceolate paraphyses, *C. rosae* is similar to *C. alpestris* and *C. andreae*, but *C. andreae* is extraordinary by its amyloid asci, which also occur in all species with lanceolate paraphyses, and *C. alpestris* differs from *C. rosae* mainly by ejecting hyaline instead of brown ascospores. *C. alpestris* and *C. rosae* resemble *Velutaria rufoolivacea* in shape and colour of the apothecia, but have much narrower cylindrical-ellipsoid ascospores and lack both an amyloid ascus apical ring and vesicular elements in the excipulum.

**Keywords:** *Cenangiaceae*, Montenegro, new taxa, *Rosa*, vital taxonomy.

## Introduction

Based mainly on molecular data, the family *Cenangiaceae* Rehm was resurrected by PÄRTEL *et al.* (2017) for taxa previously included in subfamily *Encoelioideae* Nannf. of *Helotiaceae* Rehm on the one hand, and for members of the younger *Hemiphacidiaceae* Korf on the other hand. In a series of recent papers, the closely related genera *Cenangiopsis* and *Velutaria* of *Cenangiaceae* have been investigated (BARAL *et al.*, 2014; PERIĆ *et al.*, 2019a, 2019b). The present paper adds two new species to *Cenangiopsis* which now comprises nine species.

Our search for fungi occurring on dead, periodically xeric twigs of mountain roses (*Rosa* spp.) continued in 2016. After having reported *Godronia rosae* Schläpf.-Bernh. (PERIĆ *et al.*, 2016) and *Cenangiopsis andreae* (PERIĆ *et al.*, 2019a), we found two interesting ascomycetes that we present in this work. They are described as new species in *Cenangiopsis* Rehm based on our experience of the morphology of this genus. Molecular analyses were not successful so far, so we followed the suggestion of KORF (2005), who recommended that it is more important to publish a description of a new species in a possibly inappropriate taxonomic category, than to leave it in the darkness of the drawer, awaiting disclosure of its taxonomic position.

## Materials and methods

The collections were examined in the fresh or rehydrated, living state in tap water (see BARAL, 1992), using a Leica DMLS microscope. Macrophotos were obtained using a Canon 7D and microphotos using a Leica DC 300.

The observations, descriptions and illustrations were made from dead, rehydrated specimens (in water or 2–5% KOH). Cresyl blue (CRB, aqueous) was used for staining VBs (refractive vacuolar bodies) and testing stainability of spore surfaces. The presence of gel in individual layers was tested with Toluidine blue (TB). The iodine reaction was tested with Lugol's solution (IKI) with a concentration of iodine around 0.5–1%, without KOH-pretreatment (if not otherwise stated). Measurements for living (\*) and dead (+) elements are given separately. The oil (lipid) content index (OCI) relative to ascospore volume means: 0= no lipid, 5= maximum possible lipid content. In the description and legends of *C. desae* and *C. rosae* a number in curled brackets refers to the host genus from which the given data were gained, and a number in square brackets refers to the individual collection number ([T] means "from holotype").

Type material was deposited in the herbarium of M (Botanische Staatssammlung München).

## Taxonomy

***Cenangiopsis desae*** B. Perić, *sp. nov.* (Figs. 1–11) – Mycobank: 83817.

**Holotype:** MONTENEGRO, Massif Žijevo, mt. Treskavac, bark of periodically dry branch of *Rosa* sp., 25.XII.2016, *leg.* B. Perić (M-0311987).

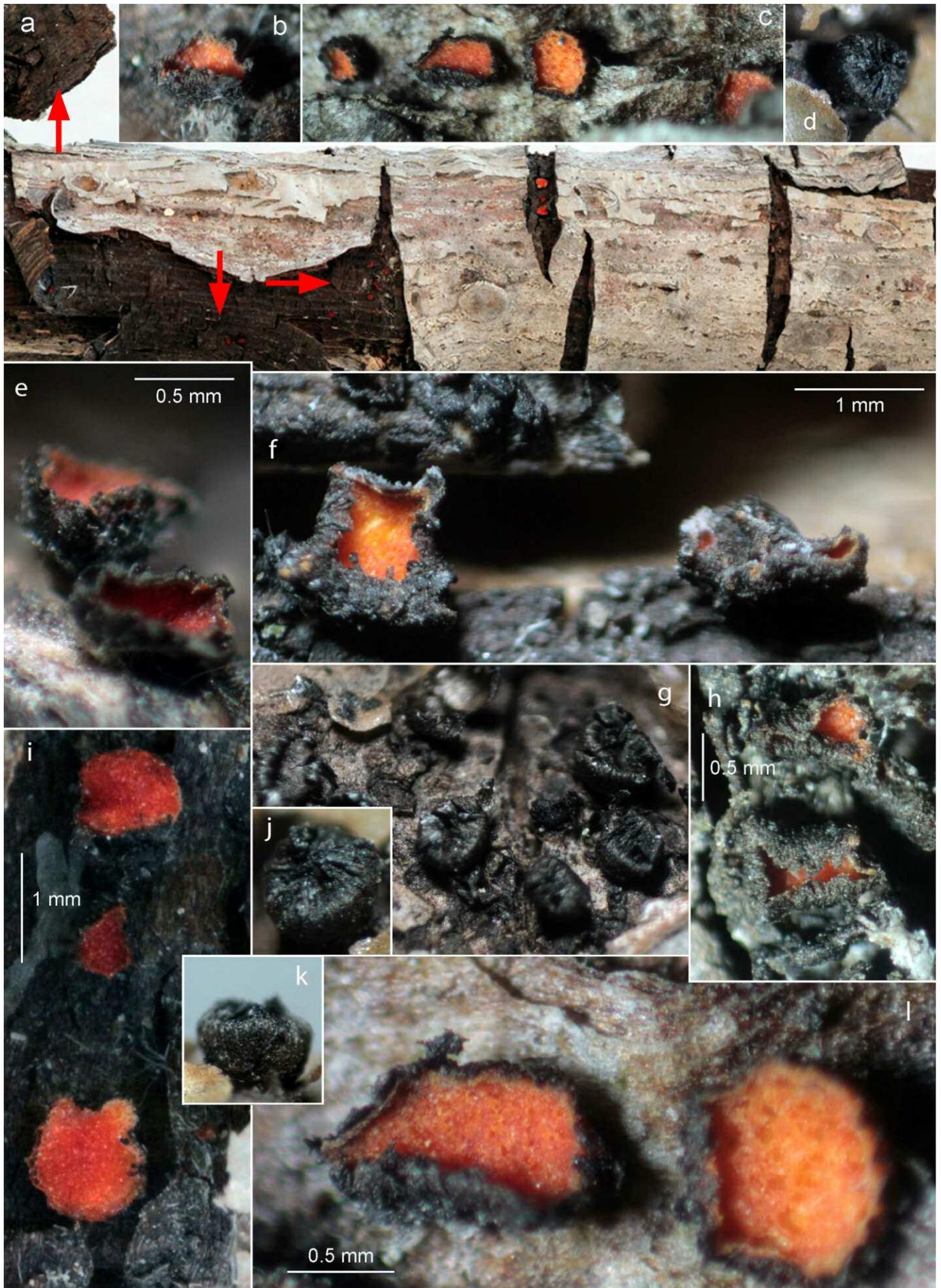
**Diagnosis of teleomorph:** Differs from other species of *Cenangiopsis* by a bright orange- to cinnabar-red disc due to non-refractive, yellowish-orange(-olive) vacuoles in the terminal cells of paraphyses in contrast to a blackish exterior and a slightly ionomitic (yellow) reaction of the apothecia in KOH, from those species with cylindrical paraphyses by the absence of hairs and by ascospores with a low lipid content composed of some small LBs around two glycogen bodies, remaining hyaline but becoming 1(–3)-septate when overmature.

**Etymology:** After the name of the first author's mother, Desa Perić.

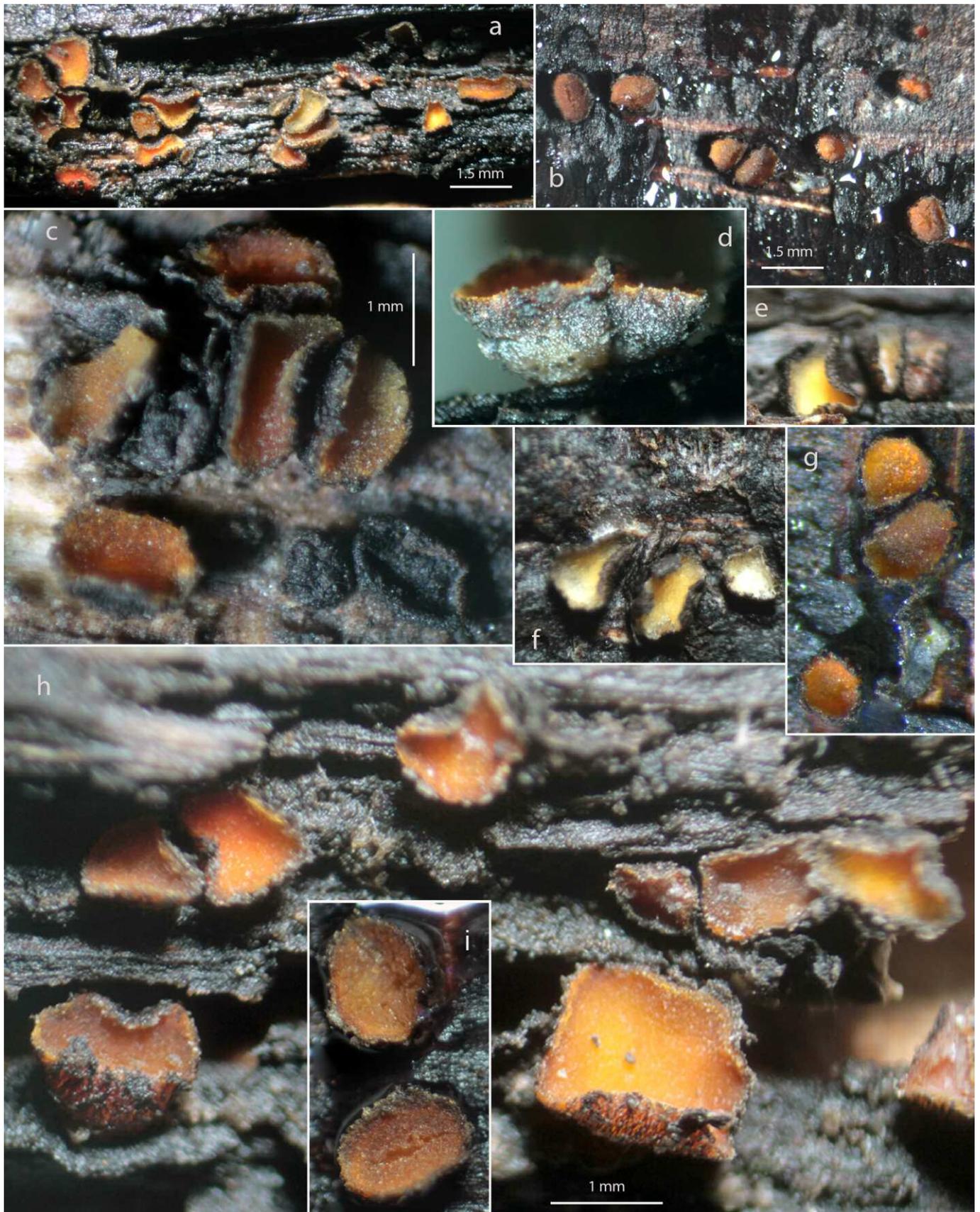
**Habitat:** On corticated, xeric twigs and branches of *Rosa* spp. (often associated with black pycnidia of anamorph).

### Description of teleomorph and anamorph:

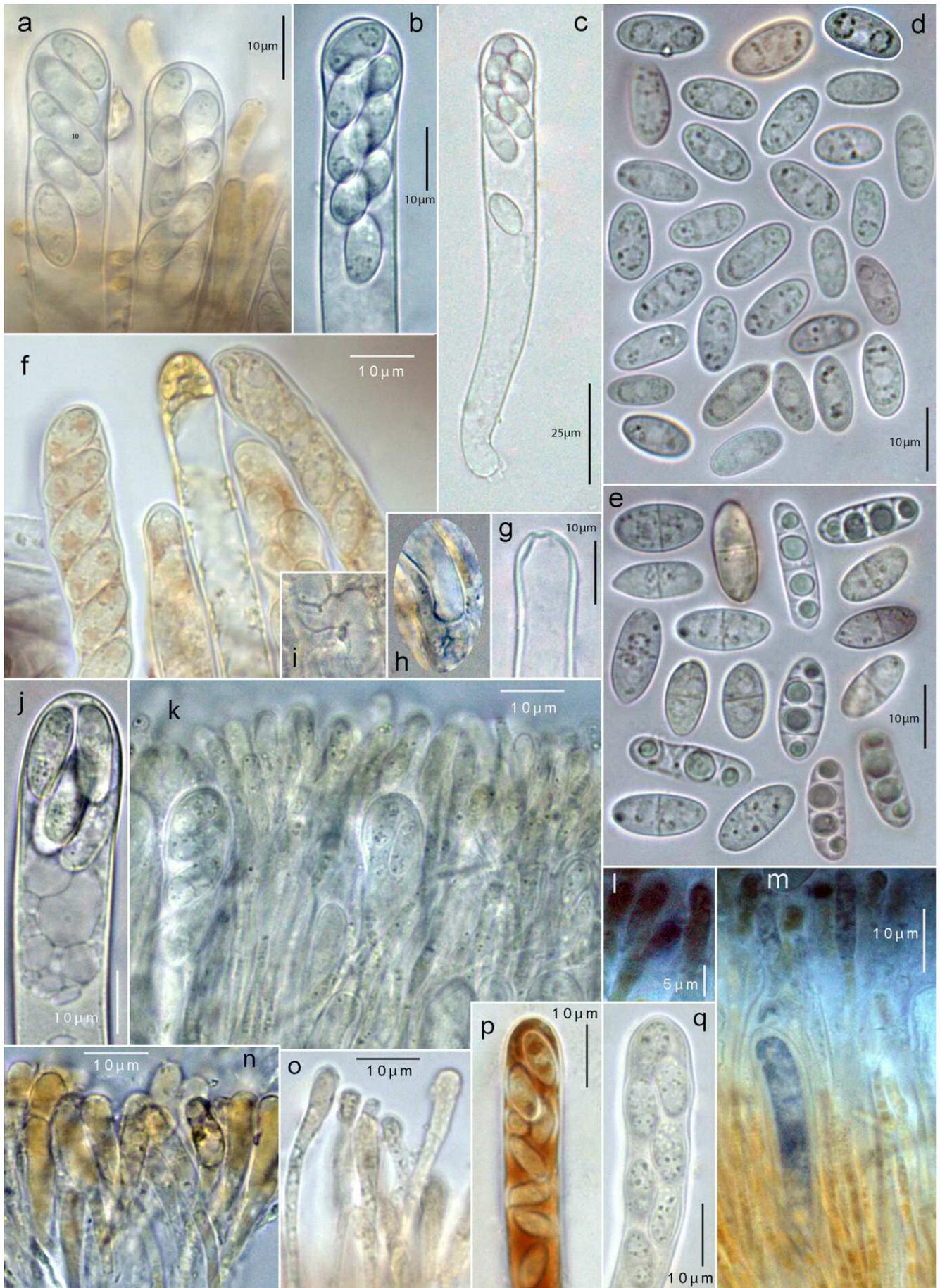
**Apothecia** non-gelatinous, scattered or aggregated in groups of 3–12, sometimes emerging from a common stroma together with anamorph; erumpent from outer and inner layers of bark; dry 0.5–1.3 mm diam., rehydrated 0.7–1.5(–2) mm, initially closed, spheroidal to urceolate, opening in the mesohymenial phase at the top by a pore or as transversal cracks (similar to *Godronia rosae* in PERIĆ *et al.*, 2014: Fig. 1); mature bowl-shaped with inwards-rolled and toothed margin, finally rarely fully expanded. **Hymenium** convex, slightly grainy, bright orange-red to cinnabar-red when dry, rehydrated dirty red, dirty red-orange to pale yellowish-orange, blackish in old dead apothecia. **Margin** excessively cretulated like in *Godronia*, more or less tomentose, black. **Outer surface** tomentose, striate, blackish brown to black, surface completely ribbed. **Asci** \*92–110(–120) × 11–13 µm, (†85–95 × 8–11 µm) [T]; 8-spored, cylindrical, spores (\*) obliquely biseriate to subbiserial (†uniserial), *pars sporifera* \*25–50 µm long (†50–65 µm); \*apex broadly hemispherical, †conical(-truncate), inamyloid (IKI, even if KOH-pretreated), completely lacking apical wall thickening, opening by an apical split; base slightly tapered and sometimes crowned, with short, ± thick stalk arising from croziers (pleurorhynque); ascoplasm of living mature asci transparent, sometimes more or less granulated around large vacuoles, often staining brown-red in IKI. **Ascospores** freshly ejected (mature) \*10.5–13.5 × 5–6.5 µm, (†8–11



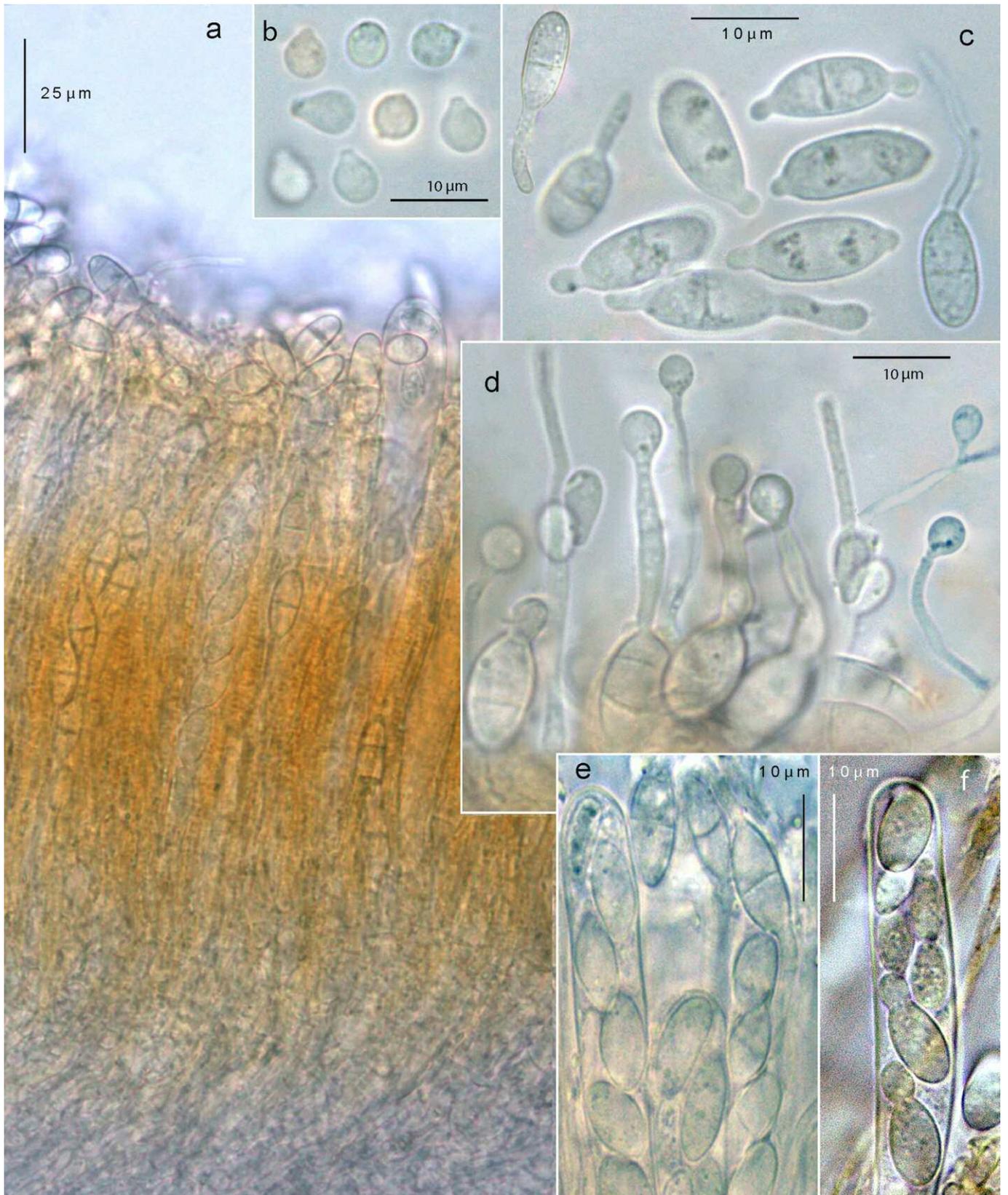
**Fig. 1** – *Cenangiopsis desae*, apothecia in dry state, on partially corticated, xeric twigs and branches of *Rosa* sp.: a. erumpent through longitudinal and transverse cracks of detaching periderm, seated on outer and inner parts of bast; b–c, e–f, h–i, j. \*apothecia; d, g, j, k (†)apothecia. – [T], except for d–e, g, j–k [3]; f [2]. Photos B. Perić.



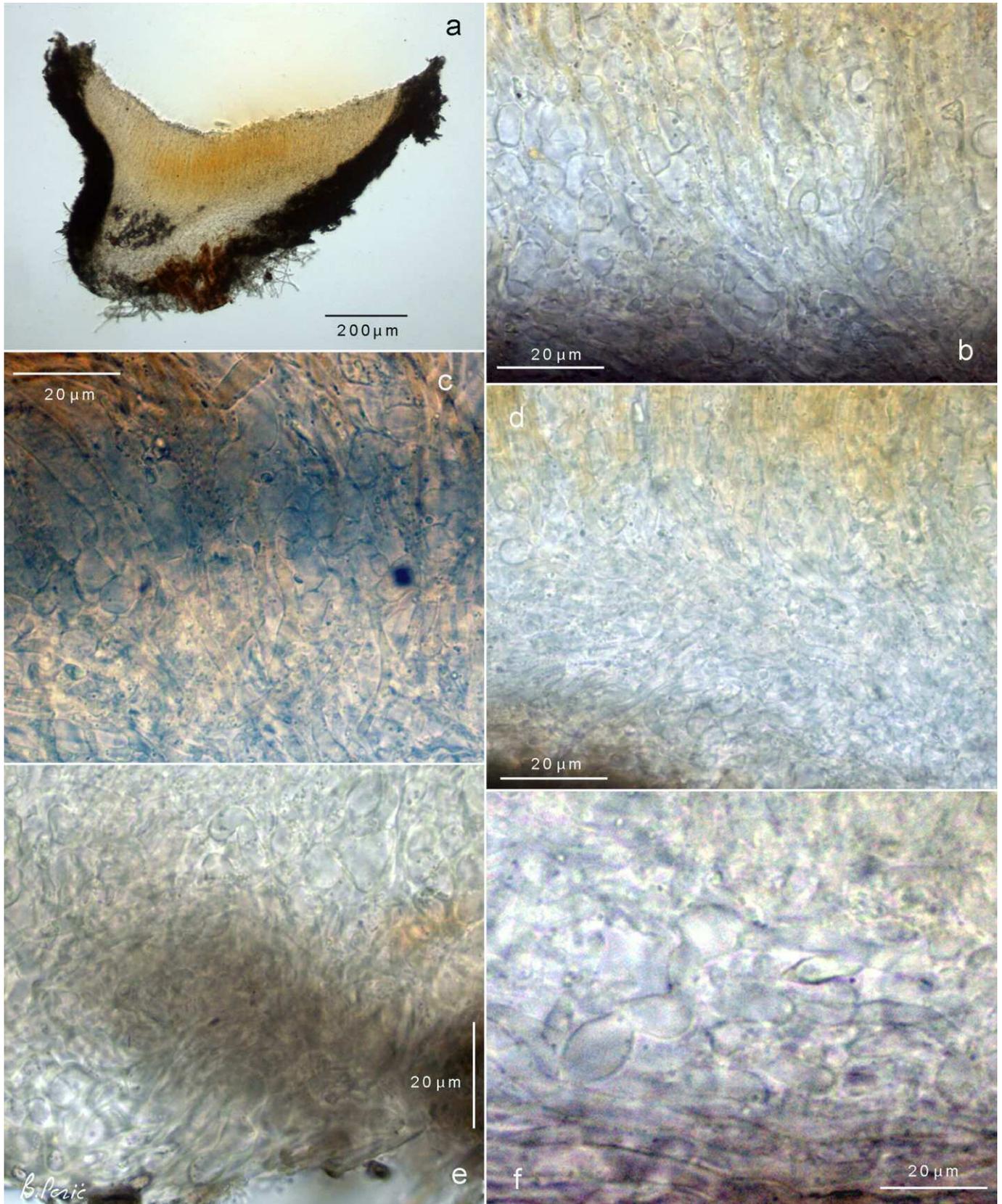
**Fig. 2** – *Cenangiopsis desae*, rehydrated apothecia on partially corticated, xeric twigs of *Rosa* sp.: a–c, g–i. \*apothecia (in c. mature and old, hymenium disappeared); d. \*apothecia in side view, showing margin and exterior; e–f. \*apothecia with yellowish hymenium. – b, g, i [T]; a, d–f, h [2]; c [3]. Photos B. Perić.



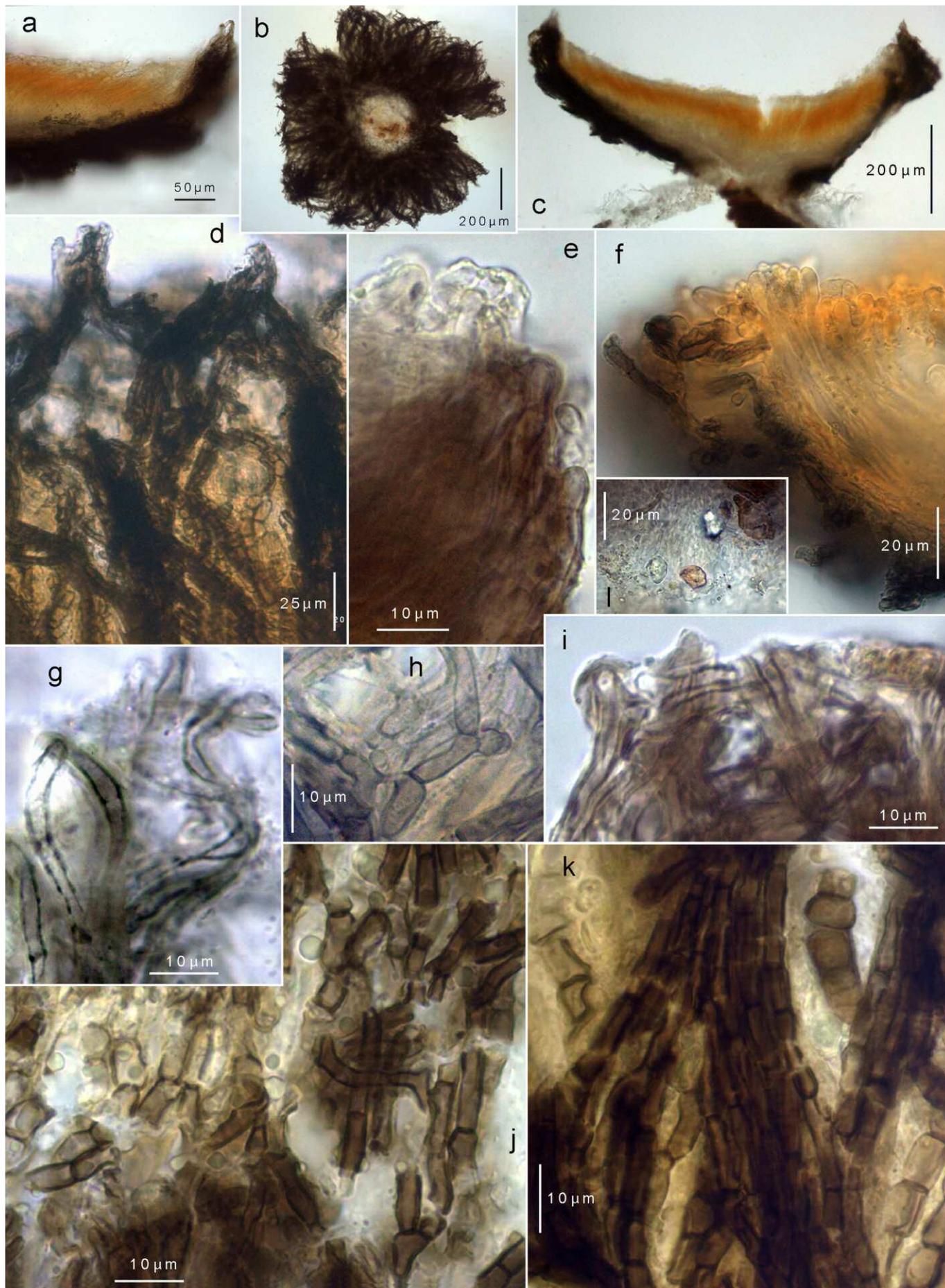
**Fig. 3** – *Cenangiopsis desae*: a–c, j, fully turgescient asci, \*ascospores biseriate and subbiseriate, crowded at the top; d, mature \*ascospores (freshly ejected); e, \*overmature ascospores (with septa and in some spores large LBs); f, p–q, upper part of †asci, showing inamyloidity and lack of apical wall thickening, \*ascospores with glycogen bodies (in f & p); g, ascus apex after discharge; h–i, base with croziers; k, hymenium with mature †asci, †paraphyses exceeding asci; l–o, \*/†paraphyses (\*with yellowish-orange content in m–n). – a–e, g–i, j, n in water; f, p in IKI without KOH-pretreatment; k, o, q in KOH; l–o, (in cresyl blue). d, f–j, p [T]; all rest [2]. Photos B. Perić.



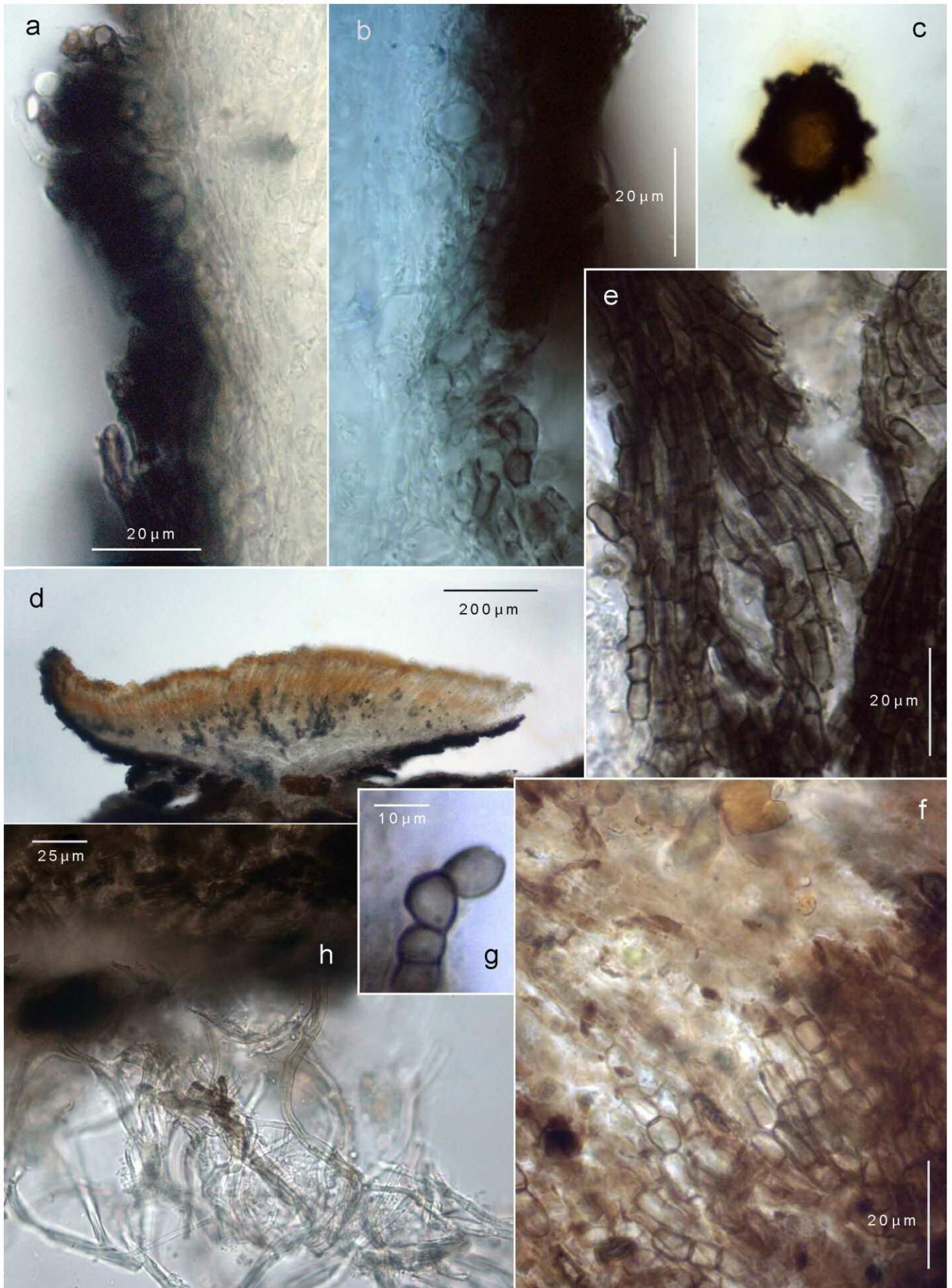
**Fig. 4** – *Cenangiopsis desae*, germination of ascospores: a. overmature hymenium, ascospores in state of gemination; b. detached blastoconidia; c. free germinated ascospores forming germ tubes; d. germinated ascospores with conidiophores forming blastoconidia at the top; e–f. ascospores germinating in dead asci. All in water. All [3], except for e [T] and f [2]. Photos B. Perić.



**Fig. 5** – *Cenangiopsis desae*, \*subhymenium and \*medullary excipulum: a. apothecium in median section, showing anchoring hyphae; b–c. subhymenium, showing ascogenous and paraphysogenous hyphae; d. medullary excipulum at the base; e. do., in middle part; f. vesicular cells with LBs. All in water. – a–b [2], c–f [T]. Photos B. Perić.



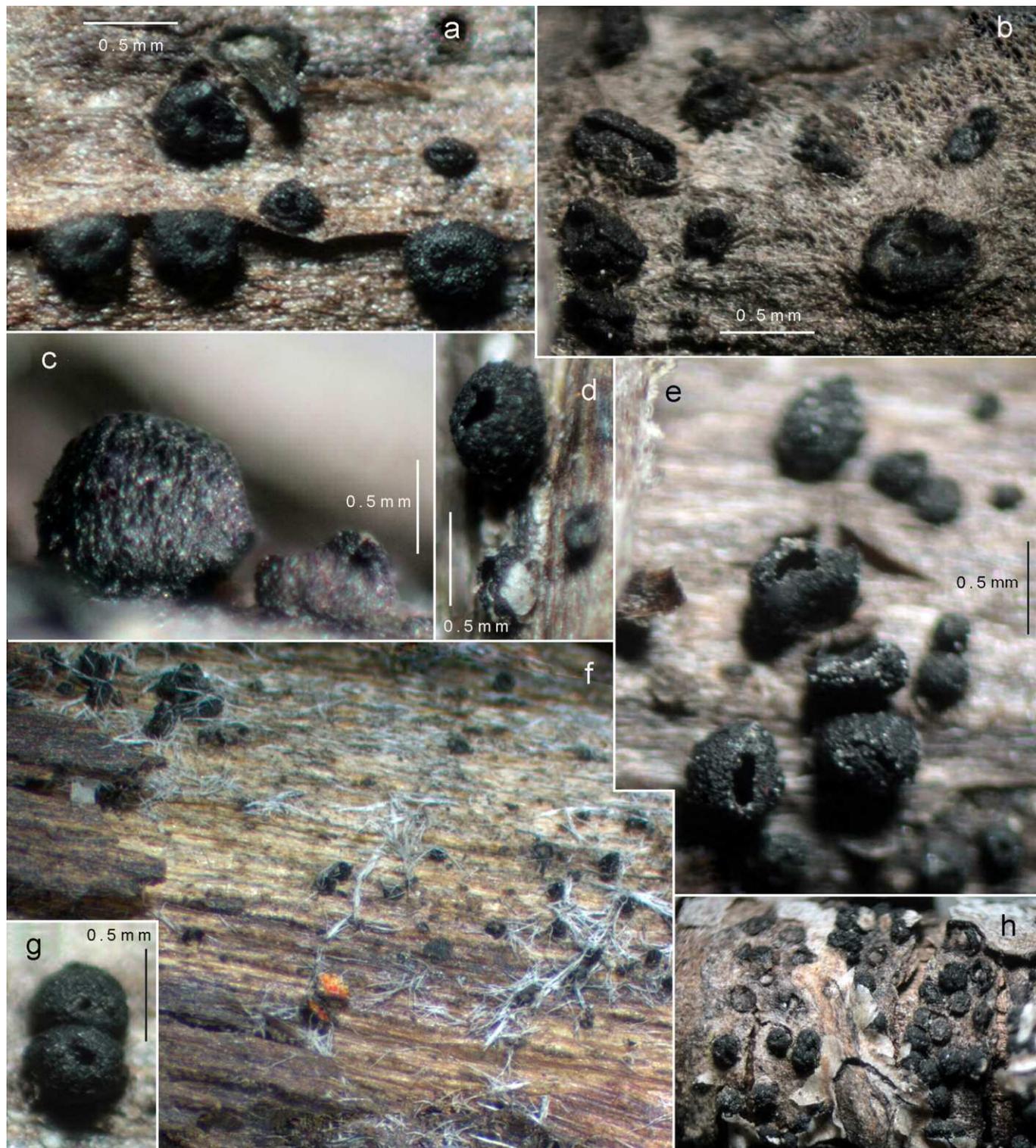
**Fig. 6** – *Cenangiopsis desae*, margin and outer surface of ectal excipulum composed of dark brown cortical hyphae: a, c. apothecia in median section; b. apothecium in median section; d–f, i. hyphoid marginal cortical cells with obtuse apex, immersed in gel matrix; g. incrustated marginal cells; h. cortical cells occasionally branched and anastomosing; j–k. cortical cells immersed in gel matrix; l. crystals in ectal excipulum; All in water except for g–i (in KOH) and k (in IKI without KOH-pretreatment). – a–d, g, i [T]; e–f [2]; h, l [3]. Photos B. Perić.



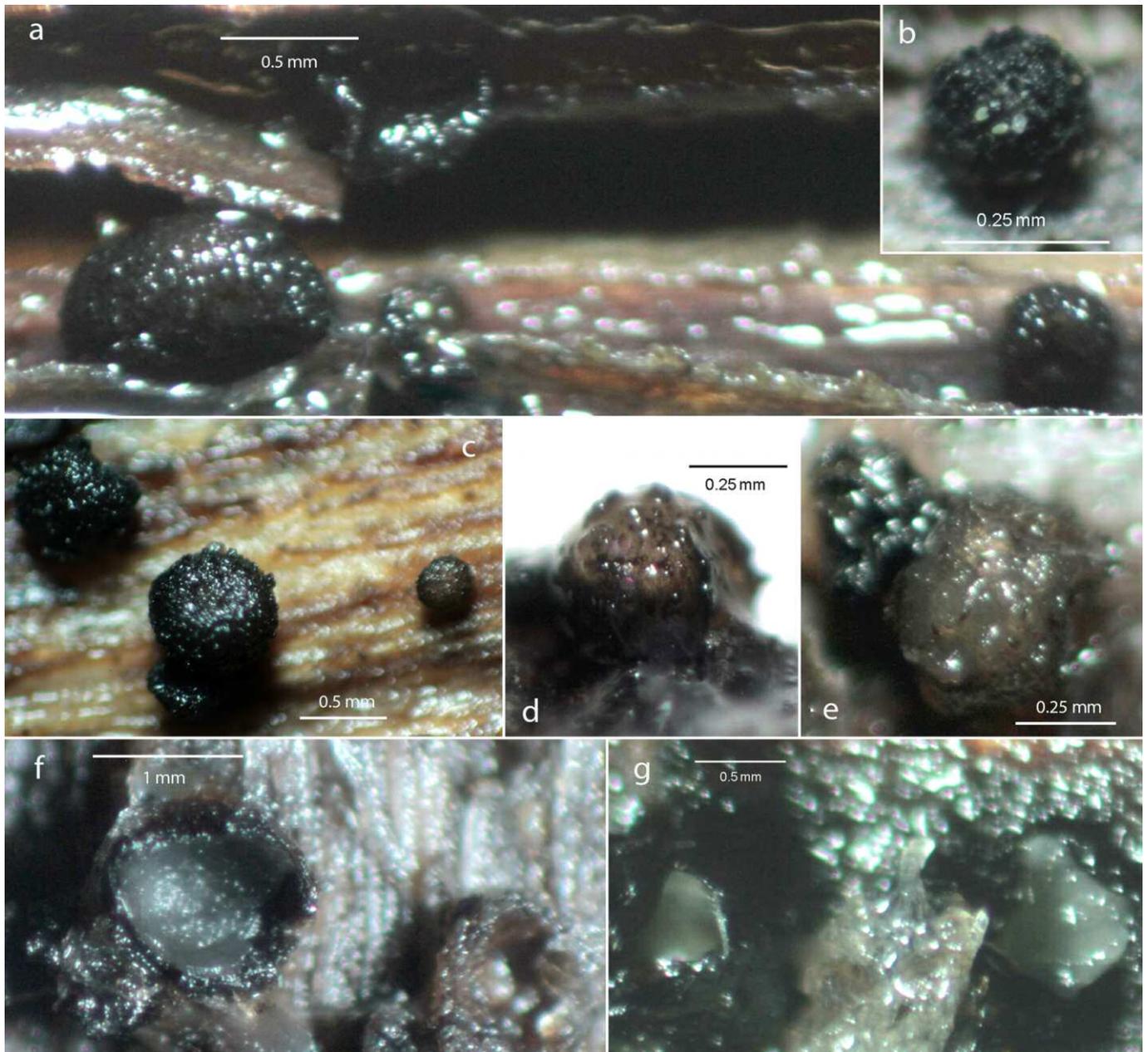
**Fig. 7** – *Cenangiopsis desae*: a, b. ectal excipulum in median section at middle flanks; c. apothecium in KOH, showing slightly ionomidotic reaction; d. apothecium in median section; e, f. brown cortical cells of marginal ectal excipulum in surface view; g. cortical cells of ectal excipulum; h. anchoring hyphae. All [T], in water, except for b (in CRB) and c, e (in KOH). Photos B. Perić.

× 4.5–6 µm) [T], non-septate, ellipsoidal with a tendency to subcylindrical, sometimes subvoid or slightly subcuneate, straight to very slightly inequilateral, smooth, hyaline, ends rounded to obtuse, firm-walled (0.2–0.3 µm thick), containing several small LBs which are usually grouped around two globose glycogen bodies (OCI 1–2), uninucleate; overmature ascospores \*†12–20 × 5–7.5 µm, 1–3 septate, smooth, hyaline, sometimes firm-walled (0.3–0.5 µm thick); containing 2–4 LBs 2.5–4.5 µm diam., rather quickly germinating within the dead asci or when ejected, forming 1–2 germ tubes emerging at the poles or phialides directly on the ascospores. **Paraphyses** ± equalling or slightly exceeding \*asci, strongly exceeding †asci (10–15 µm), apically gradually ± inflated (clavate), sometimes slightly

curved, apex rounded to obtuse, containing a yellowish-orange, reddish-orange to orange-olive pigment in non-refractive vacuoles surrounded by sparse minute droplets, terminal cells, \*15–30 × 3–6(–9) µm (basal septum difficult to see), lower cells \*1.8–2.2 µm wide, unbranched, anastomosing at base. **Subhymenium** not well differentiated from medullary layer, of *textura intricata* with light yellowish-ochraceous encrustation. **Medullary excipulum** 30–200 µm thick, of *textura intricata*, composed of hyphoid cells \*8–38 × 2–4.5 µm, ochre-yellowish towards subhymenium, subhyaline towards excipulum, non-gelatinized but incrustated by pigmented exudate, occasionally forked, densely or loosely interwoven with subglobose, ovoid and pyriform or sausage-like ampullaceous, more or less



**Fig. 8** – *Cenangiopsis desae*, dry \*pycnidia († in b) on partially corticated, xeric twigs of *Rosa* spp.; f. two apothecia (orange) in the foreground surrounded by pycnidia. – a, e, f [T]; b, c [2]; d, g–h [3]. Photos B. Perić.



**Fig. 9** – *Cenangiopsis desae*: a–g. rehydrated, closed and open \*pycnidia [3], on partially corticated xeric twigs of *Rosa* sp. All in water. From [3]. Photos B. Perić.

swollen vesicular cells \*8–18 × 5–10 μm, thin-walled (0.3–0.5 μm), some with hyaline LBs. **Ectal excipulum** at middle flanks 15–20 μm thick, at lower flanks and base 20–40 μm thick; inner zone composed of hyaline to pale brown, spheroidal to ovoid cells \*5–9 μm diam., of *textura globulosa-angularis*, vertically oriented; cortical zone at middle flanks and margin of *textura porrecta* oriented at a 10–30° angle to the outside, composed of elongated rectangular dark brown cells, \*15–15 × 2.5–7 μm, occasionally forked, incrustated (especially visible in KOH), thick-walled (\*0.6–1 μm); base composed of spheroidal to ovoid cells like those near inner zone; margin crenulated to wavy, raised 50–60 μm above disc, hyphae running out in cylindrical to slightly clavate, incrustated, septate, terminal cells \*10–20 × 4–7 μm, with rounded ends, in low amounts of gel, hair-like elements absent; irregular patches of dark brown exudate in areas of mutual contact. **Anchoring hyphae** \*2–6 μm wide, hyaline to brownish. **Crystals** 5–12 × 3–9 μm, occasionally observed in ectal excipulum. **KOH reaction**: KOH added to a water mount provokes a slightly ionomidotic reaction (dissolution of yellowish pigment into the medium).

**Anamorph**: (1) on germinating ascospores: **Conidiophores** \*5–40 × 1–2.5 μm, 0–4-septate, hyaline, holoblastic. **Blastoconidia** glo-

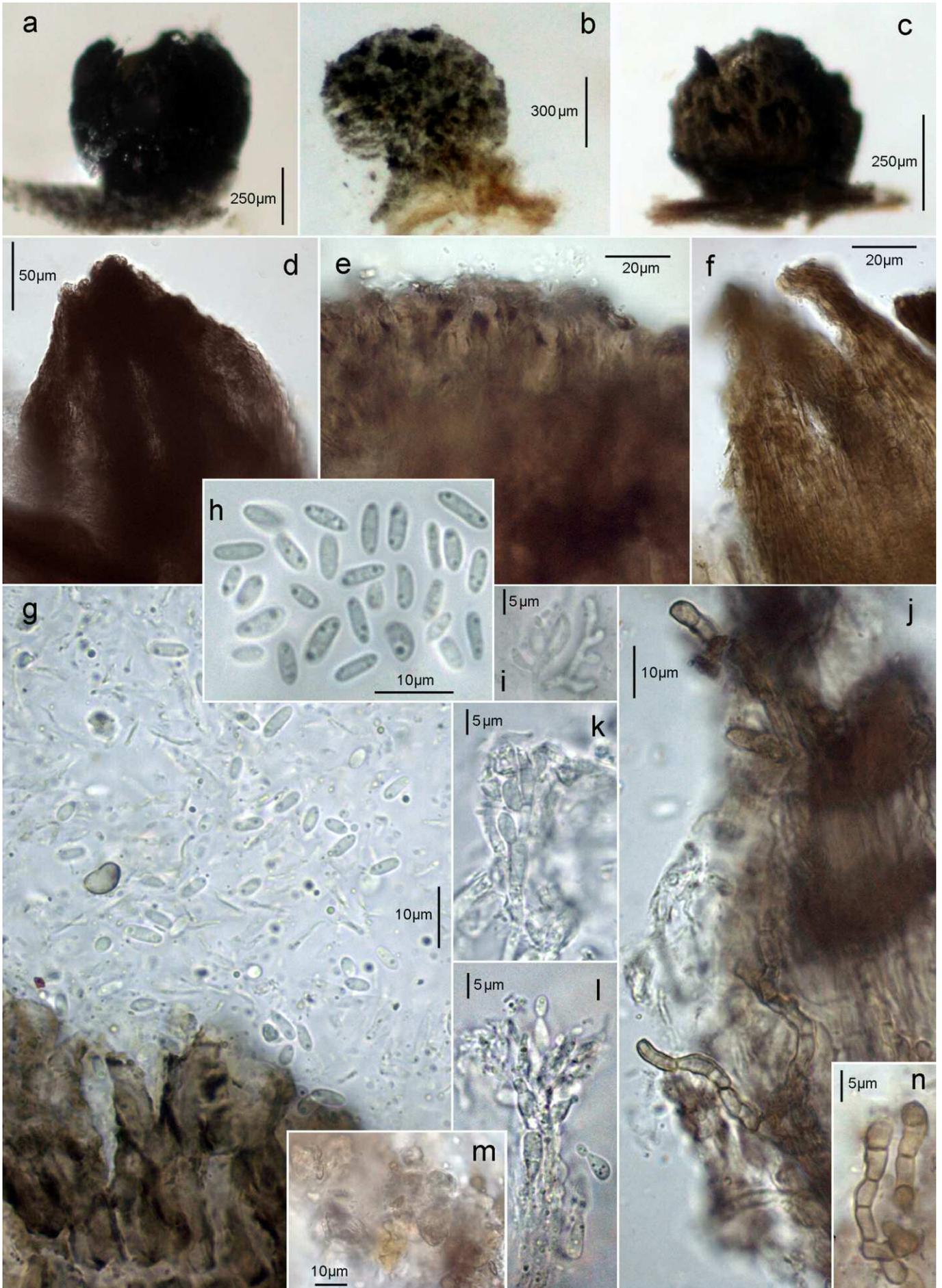
bose to pear-shaped with basal protrusion, \*4–7.8 × 3.2–5 μm, with a few minute LBs. (2) Topospore-like pycnidia sometimes occurring close to mature apothecia: **Pycnidia** dry 0.25–0.7 mm diam., spherical, with granular, black or black-brownish surface; rehydrated 0.5–1 mm diam., smooth, glossy, slightly granulated at base, initially closed, later with a small circular or elongated pore at the top and finally open. **Crystals** \*4–12 × 4.5–10 μm, occasionally observed on peridial wall. **Conidiophores** hyaline, dichotomously branched; conidiogenous cells \*4–7 × 2–4 μm, phialidic, without collarette. **Phialoconidia** \*4–7.5 × 1.6–3 μm ellipsoid to cylindrical, ends rounded or very slightly pointed, containing two LBs 0.5–1 μm diam. mostly situated next to the poles and 1–2 smaller ones.

**Habitat**: On ± corticated, xeric, dead twigs and branches of *Rosa* spp. in vertical position on the bush or horizontally lying on the ground, seated on bast or sometimes on periderm.

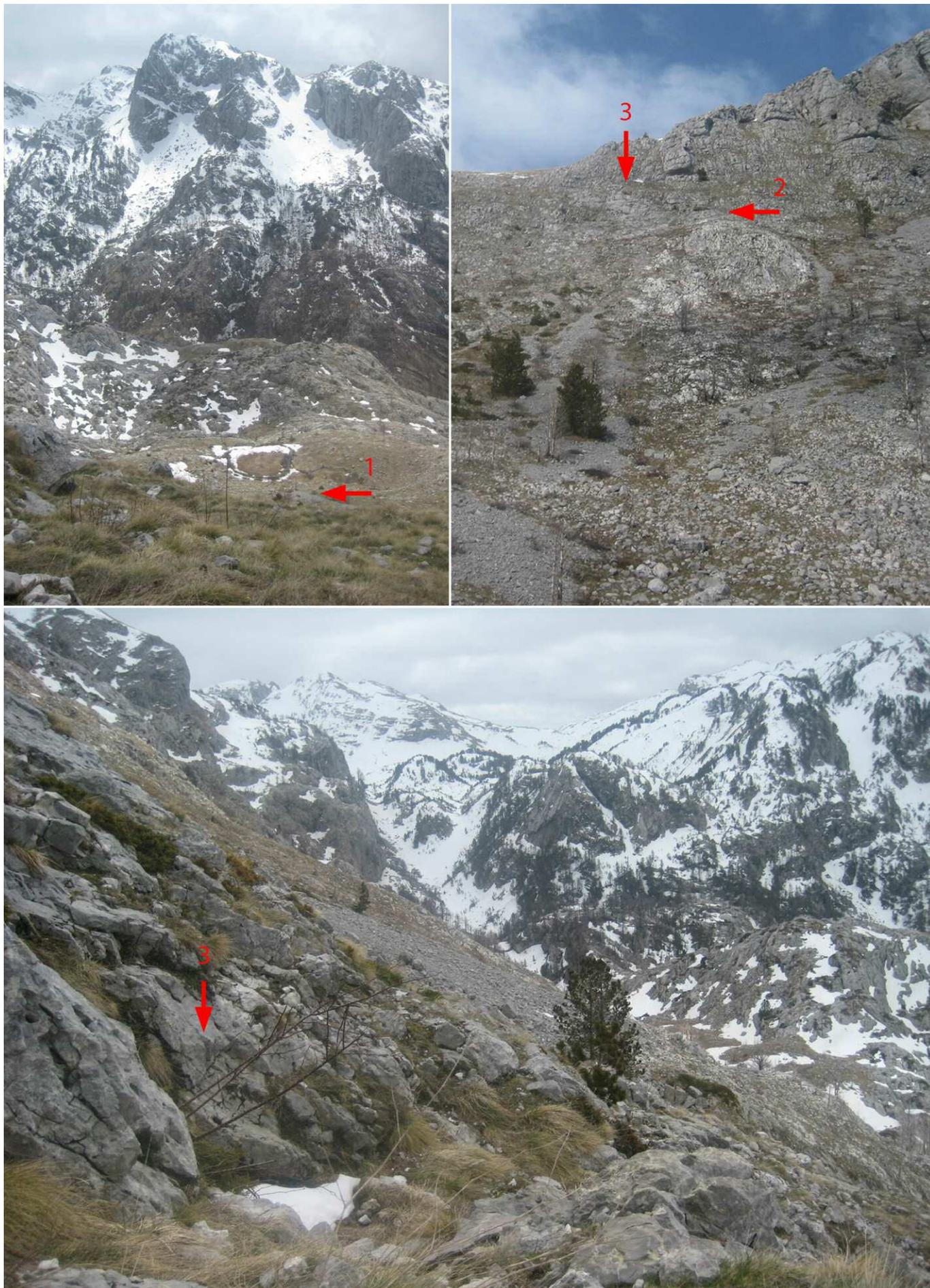
**Desiccation tolerance**: after 11 months and ten days some ascospores still alive [2].

**Associated fungi**: *Calycina languida* (P. Karst) Baral, R. Galán & Platas, *C. vulgaris* (Fr.) Baral, *Mollisia rosae* (Pers.) P. Karst.

**Specimens examined**: (All material on partially to entirely corticated, xeric twigs and branches of *Rosa* spp.): MONTENEGRO: Massif Ži-



**Fig. 10** – *Cenangiopsis desae*, \*pycnidia, conidiophores and conidia: a–c. \*mature pycnidia; d–f. surface view on exterior of pycnidial margin; g. margin of pycnidium (squash mount), with phialoconidia and phialides; h, phialoconidia; i, k–l. phialides; m. crystals in/on peridial wall; j, n. celles of pycnidial margin. All in water. From [T], except for a, d–e, g–h [3]. Photos B. Perić.



**Fig. 11** – Sites of *Cenangiopsis desae* on the SSW-exposed slope of Treskavac massif at 1715–1838 m (summit at 2000 m); showing the locations of the three collections described in this work. Photos B. Perić.

jevo, Treskavac, 42°35'4.08" N, 19°31'39.06" E, 1715 m, 2–20 mm thick, vertical, 25.XII.2016, *leg.* B. Perić (Dgf /7CD-25-12-16a, M-0311987, holotype); B.P., Dgf/C7D-25-XII-16a [T]). *Ibid.*, 42°35'6.21" N, 19°31'43.89" E, 1790 m, 3–12 mm thick, horizontal, 25.XII.2016, *leg.* B. Perić (B.P., Dgf/C7D-25-12-16b [2]). *Ibid.*, 42°35'8.61" N, 19°31'44.57" E, 1838 m, 5–28 mm thick, vertical, 25.XII.2016, *leg.* B. Perić (B.P., Dgf/C7D-25-XII-16c [3], M-0311988, paratype).

***Cenangiosis rosae*** B. Perić, *sp. nov.* (Figs. 12–21) – Mycobank: 83818.

**Holotype:** MONTENEGRO, Massif Žijevo, mt. Treskavac, bark of periodically dry branch of *Rosa* sp., 15.XI.1016, *leg.* B. Perić (M-0311989).

**Diagnosis of teleomorph:** Differs from *C. alpestris* by slightly narrower, predominantly subcylindrical(-ellipsoid) ascospores which often turn light ochre-brown already in living mature asci, hyaline, irregularly curved marginal hairs, and shorter terminal cells of paraphyses.

**Etymology:** Named after the host, *Rosa* sp.

**Habitat:** On ± corticated, xeric twigs of *Rosa* sp.

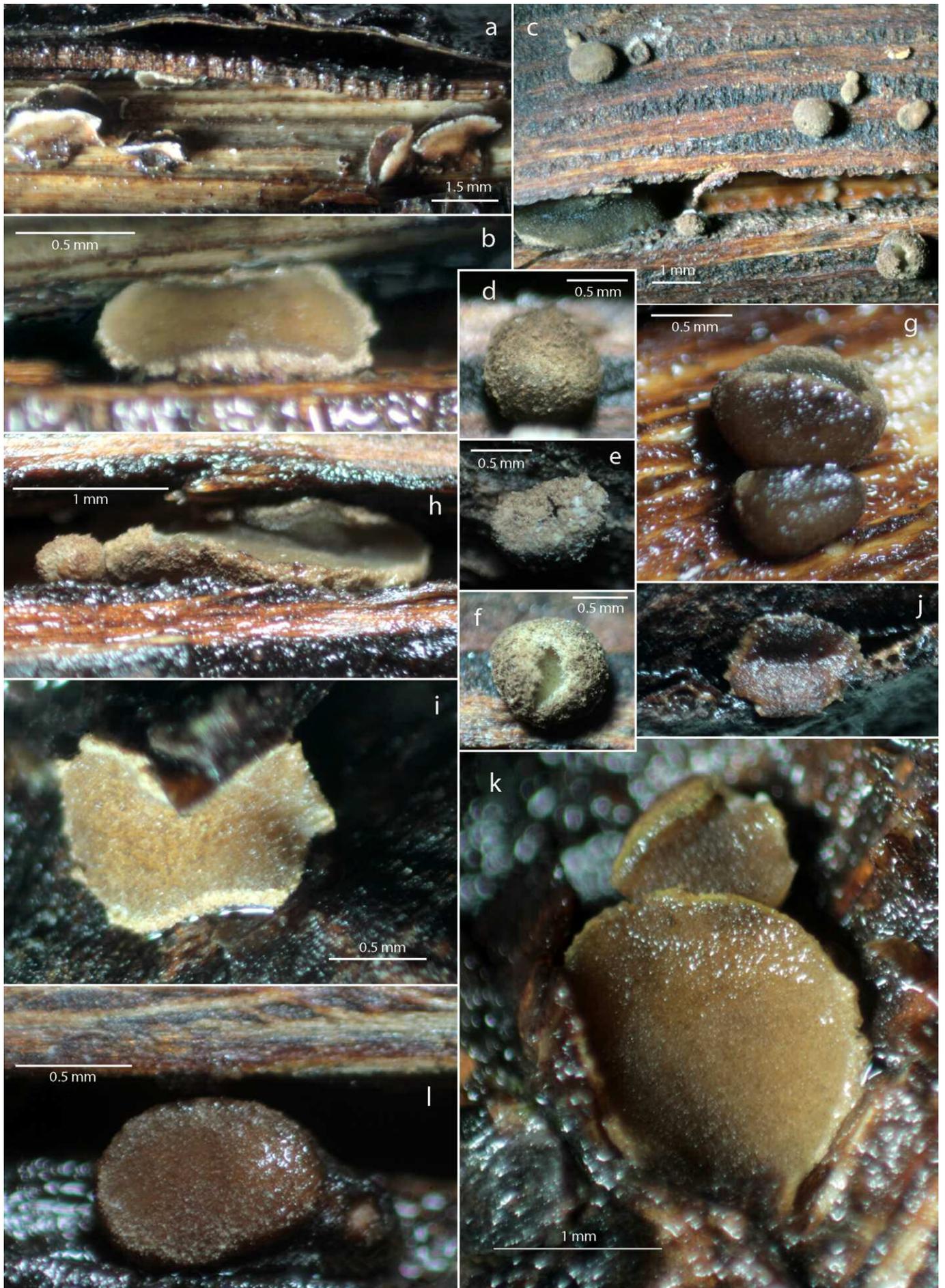
**Description of teleomorph and anamorph:**

**Apothecia** non-gelatinous, singly or aggregated in groups of 2–5; dry 0.5–1.8(–2) mm in diam., rehydrated 0.8–2.5 (–3) mm diam.,

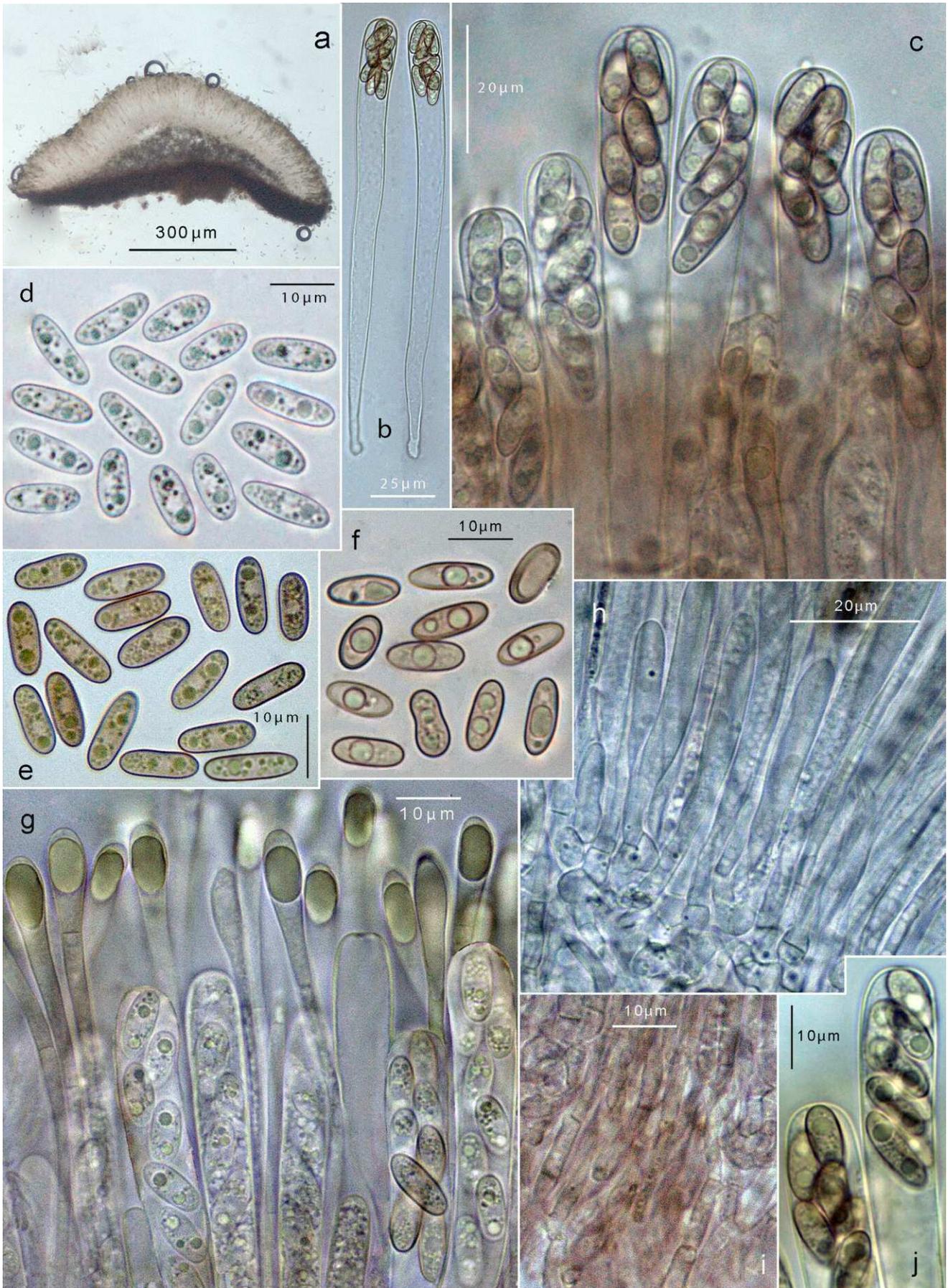
0.5–1.4 mm high in centre (receptacle 0.7–1 mm), spheroidal to elongated, sessile or shortly stipitate (stipe 0.2–0.7 mm high); erumpent from inner layers of bark, initially closed (cleistohymenial), rupturing at the top in the mesohymenial phase by a small pore or often transversal split or often almost radially ± star-like (Fig. 13e), later becoming more or less regularly disc- or shallowly bowl-shaped. On rehydration the apothecium initially repels water, then slowly absorbs it and opens. During dehydration the disk slowly closes, in younger apothecia completely, partially in the elderly, leaving a small crack at the top. **Hymenium** slightly convex to flat, sometimes shallow concave, smooth, brilliant when moist, only finely grained at higher magnification, cream, sometimes yellowish with ± olive reflex, later darker to tan-cinnamon brownish or olive-to reddish-brown, with age chestnut-brownish (due to colour changes of VBs and formation of brown ascospores), ashen black when dry. **Margin** ± regularly circular and slightly wavy, raised 30–50 µm above disc. **Outer surface** whitish-cream, tan or cinnamon-brownish to reddish-brownish-grey, or finally dark chestnut-brown, pruinose-tomentose, with smaller floccules or granules (in hydrated state darker, sometimes nearly chocolate-brown). **Pseudostipe** 200–700 × 700–950 µm, obconical, brownish-maroon, smooth or finely grained. **Asci** \*100–180 × 9–12 µm (†105–120 × 7–9 µm), 8-spored, spores (\*) obliquely biseriate to subbiserial (†uniseriate), *pars sporifera* \*25–48 µm long (†60–80 µm); \*apex broadly hemi-



**Fig. 12** – *Cenangiosis rosae*: a–e. apothecia in dry state, on partially corticated, xeric twigs and branches of *Rosa* sp. Photos B. Perić.

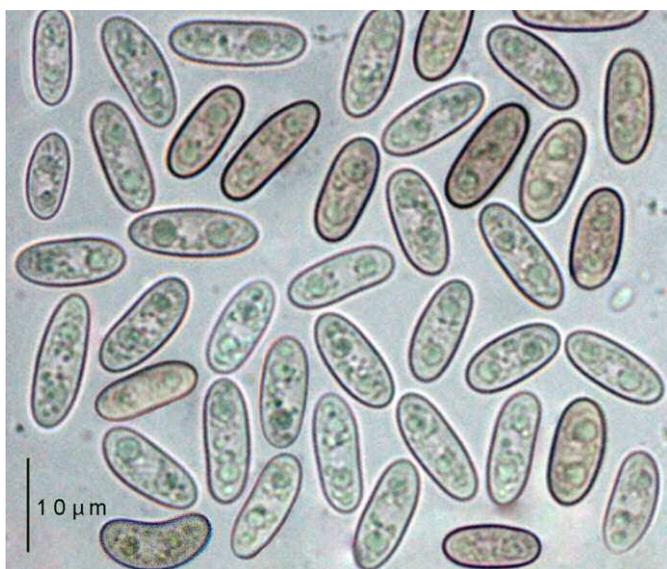


**Fig. 13** – *Cenangiopsis rosae*, rehydrated apothecia on bark of *Rosa* sp.: a–l. rehydrated apothecia, showing rupturing at the top in early stages by a small transversal split or radially ± star-like (d–f). Photos B. Perić.



**Fig. 14** – *Cenangiopsis rosae*: a. apothecium in median section; b. mature \*asci, biseriate arrangement of \*ascospores; c. \*asci at normal turgescence (left) with hyaline, subbiseriately arranged \*ascospores, and at full turgescence (right) with brown biseriately arranged \*ascospores; d. hyaline mature \*ascospores; e. brown mature \*ascospores; f. do., †ascospores; g. paraphyses with refractive olive-yellowish VBs in terminal cells, \*asci with mainly hyaline \*ascospores and one discharged ascus; h. young asci arising from croziers and paraphyses emerging from subhymenium; i. paraphyses at base bifurcate and sometimes anastomosing in subhymenium; j. inamyloid apex of \*asci at full turgescence. – All in water except for j (in IKI). Photos B. Perić.

spherical to subtruncate (†truncate), inamyloid (IKI, even if KOH-pre-treated), completely lacking apical wall thickening, opening by an apical split; base with short, ± thick stalk arising from croziers (pleurorhynque); ascoplasm of living mature asci transparent, sometimes more or less granulated around large vacuoles, often staining brown-red in IKI. **Ascospores** \*9.5–15 × 4.5–5.5 μm when hyaline, non-septate, homopolar, subcylindrical, cylindrical-ellipsoid, elongated-ellipsoid, slightly inequilateral, smooth, ends obtuse, firm-walled (wall 0.2–0.3 μm thick); containing two oil drops (LBs) 1.5–2.5 μm diam., more or less close to the central to lateral nuclear region (apparently uninucleate), surrounded by many small drops up to 1 μm diam. (OCI 4–5), no sheath observed; often turning light ochre-brown at full ascus turgescence, \*11–15 × 4–5.5 μm, cylindrical, cylindrical-ellipsoid, elongated-ellipsoid, rarely reniform (Fig. 15), light ochre, light brownish to olive-brown, firm-walled (wall 0.2–0.3 μm), non-septate, smooth, with two large and many small LBs 1.5–2.5 μm; †9–13.5 × 4.5–6 μm, cylindrical-ellipsoid to ellipsoid-fusoid, sometimes slightly inflated, with 1–2 large lipid bodies due to fusion; rather quickly germinating when ejected, forming germ tubes emerging laterally near the poles, sometimes at the very poles, also forming phialides directly on the ascospores. **Paraphyses** exceeding immature \*asci by 15–25 μm but much shorter than fully turgescence asci, apically gradually slightly ± inflated (clavate), apex obtuse, terminal cell \*15–36 × 2.5–6 μm (†12–20 × 2–4 μm), containing refractive ovoid or elongated, olive-yellowish vacuolar body (VBs) of \*7–12 × 4–5 μm, not stained in IKI, lower cells \*10–22 × 1.5–2.5 μm, containing numerous small LBs; occasionally branched in middle part, sometimes anastomosing near base. **Subhymenium** difficult to differentiate from medullary layer, 20–30 μm thick, hyaline, light grey to light olive, *textura (sub)intricata*, parallel with hymenium, composed of hyaline, trapezoid (slightly inflated) ascogenous cells \*/†5–9 × 3–4.5 μm diam., thin-walled, and paraphysogenous hyphoid cells, \*/†5–10 × 2–2.5 μm. **Medullary excipulum** up to 50 μm thick near margin, up to 350 μm at base, of *textura intricata*, composed of hyaline, hyphoid cells \*15–30 × 3–7 μm, occasionally forked, often with indistinctly swollen vesicular cells \*/† 4–9(–10) μm wide, sometimes with thickened walls, some containing hyaline, \*/† 4–8(–9) μm wide VBs. **Ectal excipulum** at middle flanks \*25–50 μm thick, of *textura globulosa*, at lower flanks and base \*50–100 μm thick, of *textura globulosa*, vertically oriented, inner zone composed of spheroidal to ovoid, sometimes ± elongated (angular when dead), hyaline or light brown cells \*/† 7–13 × 5–9 μm, thick-walled (\*0.5–0.7 μm diam.), some with greenish-amber VBs (\*† 4–8 μm in diam.); outer zone of spherical, ovoid to pear-shaped, brown cells \*5–20 × 7–12(–14) μm, thick-walled (\*0.5–1 μm, in KOH 1.2–2 μm, with light greenish-amber to yellowish-olive



**Fig. 15** – *Cenangiopsis rosae*: hyaline and light brownish mature \*ascospores (freshly ejected). Photos B. Perić.

VBs (\*† 5–10 μm.); irregular patches of dark brown exudate in areas of mutual contact; margin 50–70 μm thick, of *textura globulosa* to *prismatica*, oriented at an angle of 10–25° to the outside; marginal cells running out in cylindrical to ± clavate, smooth, hyaline to light brown, 3(–4)-septate, ~50–70 μm long hair-like elements which are sometimes branched in the middle part; terminal cells \*10–20 × 5–9 μm, containing large, yellowish-olive, elongate, greenish-amber to yellowish-olive VBs \*4.5–8.5 μm diam.; lower cells \*7–17 × 3.5–4.5 μm. Vesicular cells \*15–30 × 7–12 μm, interspersed throughout medullary excipulum, especially towards ectal excipulum (sometimes in cortical region of ectal excipulum), borne on lateral branches of hyphae, subglobose to ovoid or pyriform, thin-walled, containing large globose greenish-amber vacuoles (VBs). **Anchoring hyphae** not observed. Octahedral **crystals** scattered to abundant in medullary and ectal excipulum, 4–10 μm diam., sometimes aggregated as druses. **KOH-reaction**: apothecia do not show any ionomidotic reaction; VBs in paraphyses and in marginal cells disappear, exudate in ectal excipulum not changing colour.

**Anamorph**: phialidic, only observed during ascospore germination; phialides lageniform hyaline, \*4–12 × 1.5–4 μm, with 3–5 × 2–5 μm large tubular collarette; phialoconidia \*2–4.5 × 1.5–3 μm, hyaline, subellipsoid to subcylindrical or ovoid, often slightly inequilateral, broadly or narrowly rounded near ends, containing one or two small LBs.

**Habitat**: On partially corticated, xeric, dead, 8–12 mm thick twigs of *Rosa* sp., on outer and inner layers of bast (not observed on the periderm).

**Desiccation tolerance**: was preserved in the dry state during 4 months and 4 days, after which it was rehydrated for study, showing all elements alive.

**Associated fungi**: *Dermea* sp.

**Specimens examined**: MONTENEGRO: Massif Žijevo, mountain village Guzovalja, 1558 m alt, 42°34'59" N, 19°31'20" E, xeric twigs and branches of *Rosa* sp., horizontal, 5–10 mm thick, 15.XI.2016, *leg.* B. Perić (B.P., Dgf/C7D-15-11-16g, M-0311989, holotype).

## Discussion

The genus *Cenangiopsis* in the present circumscription comprises nine species. Two morphological groups can easily be distinguished: four species (*C. alpestris* (Baral & B. Perić) Baral, B. Perić & Pärtel, *C. andreae* B. Perić, *C. desae*, and *C. rosae*) have cylindrical-clavate paraphyses, often inamyloid asci (amyloid in *C. andreae*), and comparatively large, ± homopolar ascospores that are often rich in lipids and finally brown, whereas the core group of the genus (*C. junipericola* B. Perić, *C. livida* B. Perić, *C. raghavani* B. Perić, *C. quercicola* (Romell) Rehm, and *C. violascens* B. Perić) has strongly protruding lanceolate paraphyses, amyloid asci, and smaller, mostly heteropolar ascospores that are poor in lipids and remain hyaline when overmature.

With its predominantly subcylindrical ascospores which are also cylindrical-ellipsoid, elongated-ellipsoid, rarely subreniform, *Cenangiopsis rosae* differs from the other three species of the group which have ellipsoid-ovoid(-fusoid) spores. *C. rosae* appears to be closest to *C. alpestris*. Their asci are inamyloid and their paraphyses and marginal hairs are similar because they contain refractive vacuoles (VBs) in the terminal cells, which tend to be distinctly longer in *C. alpestris*. In both species the spores turn brown with age, but in *C. rosae* they are already light brown when ejected, whereas those of *C. alpestris* are consistently hyaline when ejected. In addition, *C. alpestris* was found on *Salix*, *Fagus*, and *Crataegus* but so far not observed on *Rosa*. For the similarities and differences of microelements of species that belong to the group with cylindrical-clavate paraphyses, see Tab. 1.

*Cenangiopsis desae* differs from all other species of this genus by its yellowish- to orange-red hymenium (bright cinnabar-red when dry) and blackish exterior. At first glance it resembles a species of the genus *Godronia* Moug. & Lév. In addition, some apothecia de-

**Tab. 1** – Comparison of selected features of species of *Cenangiopsis* with non-lanceolate paraphyses.

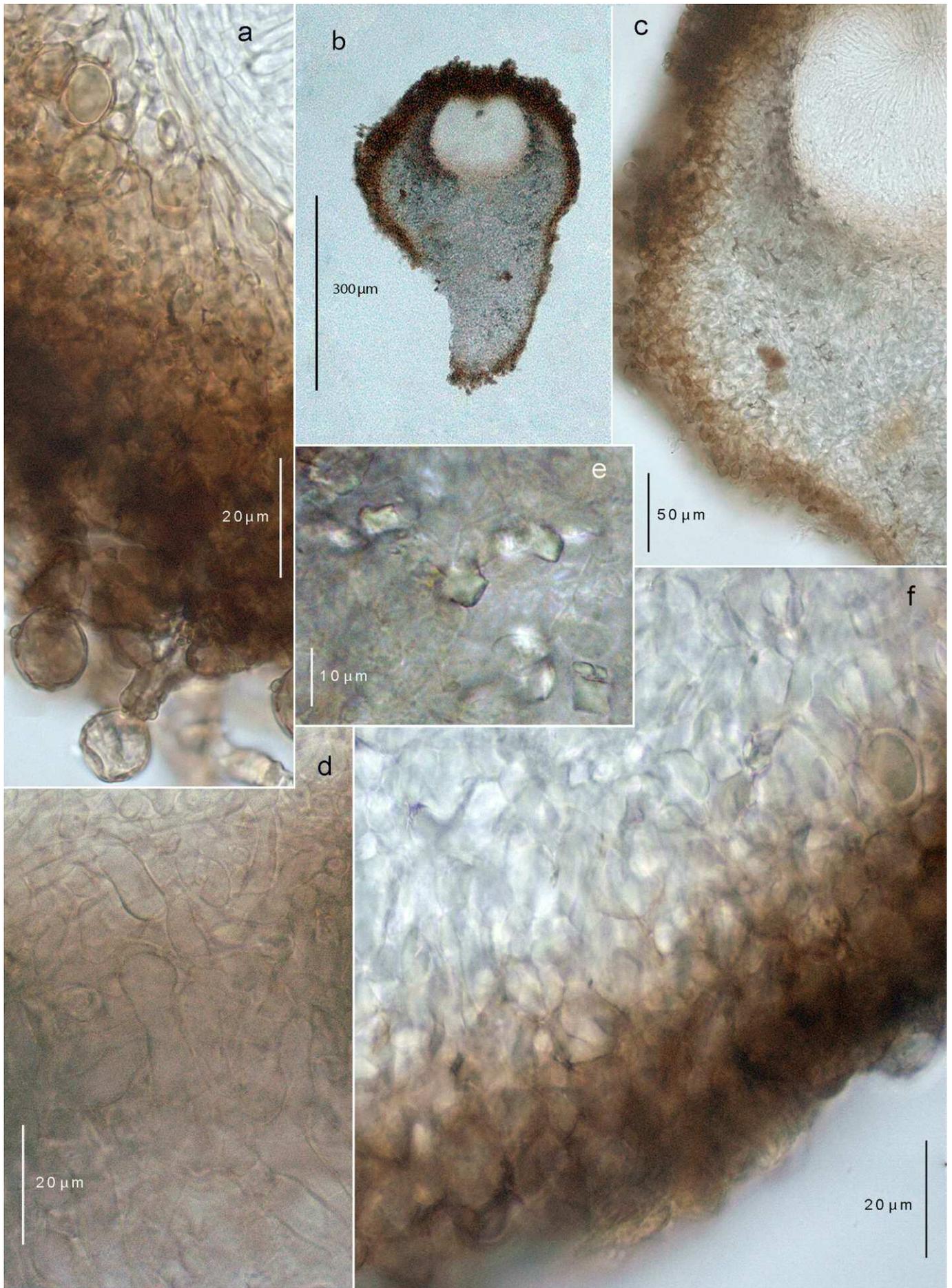
	<i>C. alpestris</i>	<i>C. andreae</i>	<i>C. desae</i>	<i>C. rosae</i>
Apothecia diam. (rehyd.)	0.45–2.5 mm	0.5–3 mm	0.7–1.5(–2) mm	0.8–2.5(–3) mm
Hymenium	yellowish-ochre → chestnut-brown	ochre, ochre-olive, sometimes yellowish-olive → chestnut-brown later bluish-black to sooty	cinnabar-red when dry, rehydrated dirty red, dirty red-orange → pale yellowish-orange; blackish in old dead	yellowish with ± olive reflex, later darker to tannicinnamon brownish, or olive- to reddish-brown, with age chestnut-brownish
Margin; exterior	30–70 µm raised, rough/pustulate; indistinctly hairy light brownish	70–110 µm raised, rough/pustulate; indistinctly to pronouncedly hairy whitish or light cinnamon to cinnamon-brown	50–60 µm raised, excessively crenulated black	30–50 µm raised, whitish-cream to chestnut-brown
Stipe height × width	0.05 × 0.2 mm	0.2–1 × 0.2–0.8 mm	–	0.2–0.7 × 0.7–1 mm
Mature asci	*90–110 × 11–11.7 µm subbiseriate to biseriate	*115–190 × 9.5–11.5 µm subbiseriate to uniseriate	*92–110(–120) × 11–13 µm, obliquely biseriate to subbiseriate	*100–180 × 9–12 µm, obliquely biseriate to subbiseriate
Ascus apex IKI	–	strongly blue (rB)	–	–
Crozier	+	+	+	+
Ascospores	*10–13.5 × 5–6.5 µm	*10–15(–18.5) × (5–)6–7 (–8) µm	*10.5–13.5 × 5–6.5 µm	*9.5–15 × 4.5–5.5 µm
Spore shape	ellipsoid-ovoid (-fusoid)	ellipsoid-ovoid (-fusoid)	ellipsoidal (subcylindrical) subovoid or slightly subcuneate	subcylindrical, cylindrical-ellipsoid, elongated-ellipsoid, rarely subreniform
Spore apex	rounded to obtuse	rounded to obtuse	rounded to obtuse	rounded to obtuse
Lipid content (OCI)	5	4–5	1–2	4–5
Mature spores (colour)	hyaline	hyaline to dark brown	hyaline	light ochre-brown
Overmature spores (colour & septation)	light brown, non-septate	light to dark brown, non-septate	hyaline, 1(–3)-septate	light ochre, brownish to olive-brown, non-septate
Paraphyses terminal cells	*25–54 × (3–)4–5.5 (–6.5)((7.5)) µm	*28–55.5 × 3–7 µm	*15–30 × 3–6(–9) µm	*15–30 × 2.5–6 µm
Paraphyses lower cells	*12–26 × 2.5–4 µm	*12–25 × 3–4 µm	*1.8–2.2 µm	*10–22 × 1.5–2.5 µm
VBs in paraphyses	*11–29 × 3.5–5 µm	*18–42 × 4–6 µm	–	*7–12 × 4–5 µm
Marginal hairs	*†40–70 × 3.5–6.5 µm (terminal cells (10–)20–35(–40) µm, long, ± smooth)	~50–100 × 4–7.5 µm, (terminal cells 12–30 µm long, smooth to incrustated)	absent (cortical cells *10–20 × 4–7 µm long, incrustated)	*50–70 × 5–9 µm (terminal cells 10–20 µm long, smooth)
VBs in marginal hairs	*7–16 × 3.5–6 µm	*7–22 × 3.5–7 µm	–	*4.5–8.5 µm
VBs in medul. excipulum	not observed	sometimes seen	not observed	*† 4–8(–9) µm
Ionomidotic reaction	negative	negative	yellow	negative
Host	<i>Salix, Fagus, Crataegus</i>	<i>Rosa, Erica</i>	<i>Rosa</i>	<i>Rosa</i>
Climate	altimontane to subalpine	altimontane to subalpine	altimontane to subalpine	altimontane to subalpine

velop from a common stroma as is typical in this genus. Like in *Goderonia*, mature apothecia can often be found to be distantly surrounded by a group of anamorphs (Fig. 9f). However, ascospores in these two genera are very different. Interestingly, asci and ascospores of *C. desae* are closest to *C. alpestris*, primarily by size but also by the arrangement of ascospores within the asci (Tab. 1). However, the *pars sporifera* in *C. desae* is shorter (\*25–50 µm) than in *C. alpestris* (\*45–75 µm). Remarkably, overmature ascospores of *C. desae* remain hyaline and become septate unlike all previously studied species of *Cenangiopsis* with non-lanceolate paraphyses (*C. alpestris*, *C. andreae*) in which the spores turn brown and remain non-septate (species with lanceolate paraphyses have smaller ascospores which remain hyaline and usually non-septate). Also the lipid content of the spores is low, unlike in the species with non-

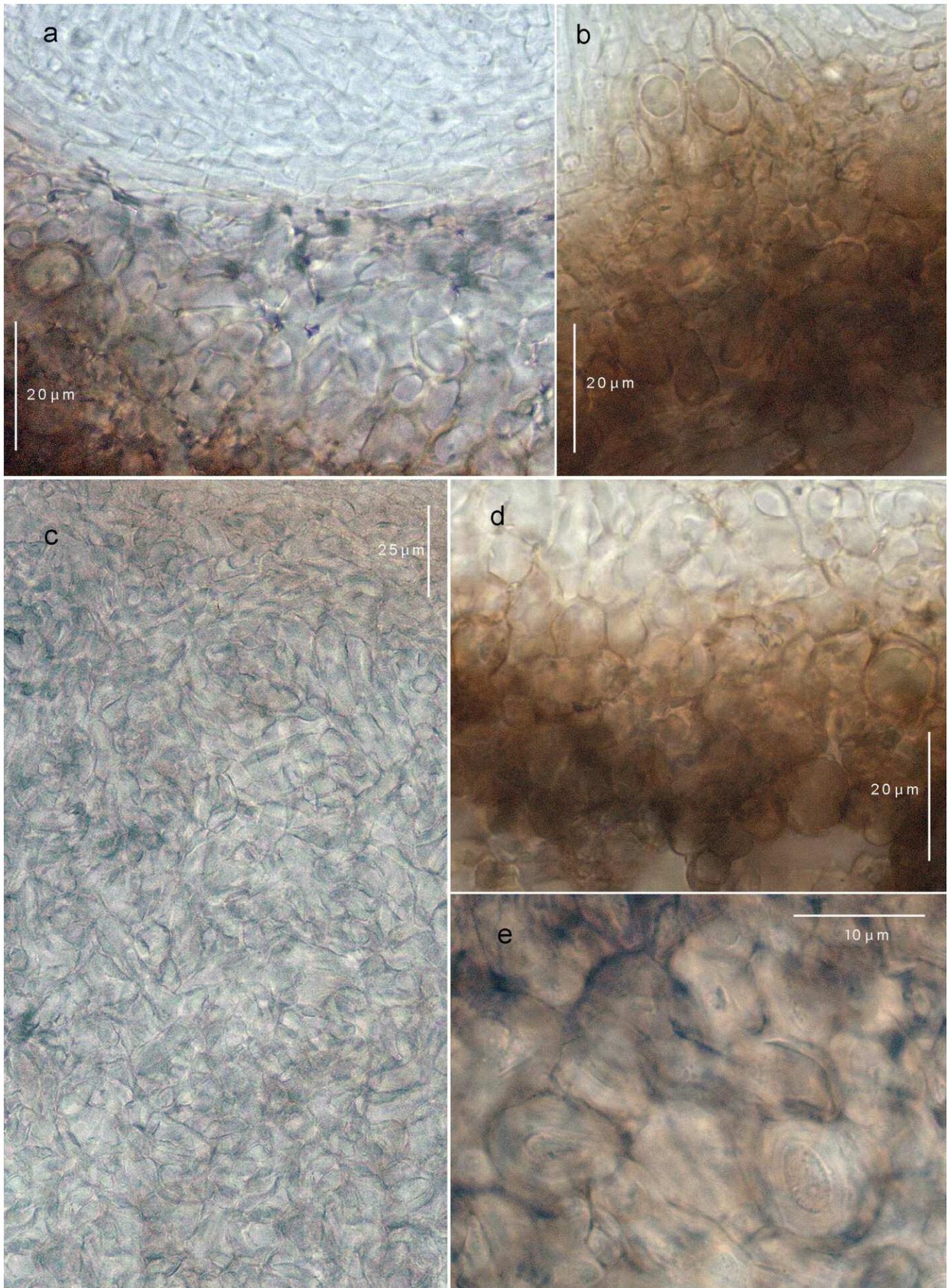
lanceolate paraphyses, but it may become high when the spores become septate. Coupled with this low lipid content is the presence of glycogen bodies. Paraphyses of *C. desae* differ from those of the other species with non-lanceolate paraphyses (*C. alpestris*, *C. andreae*, *C. rosae*) in lacking refractive vacuoles (VBs) in the terminal cells. Instead, they contain elongated, yellowish-orange, reddish-orange to orange-olive, non-refractive vacuoles surrounded by a few oil drops.

## Acknowledgements

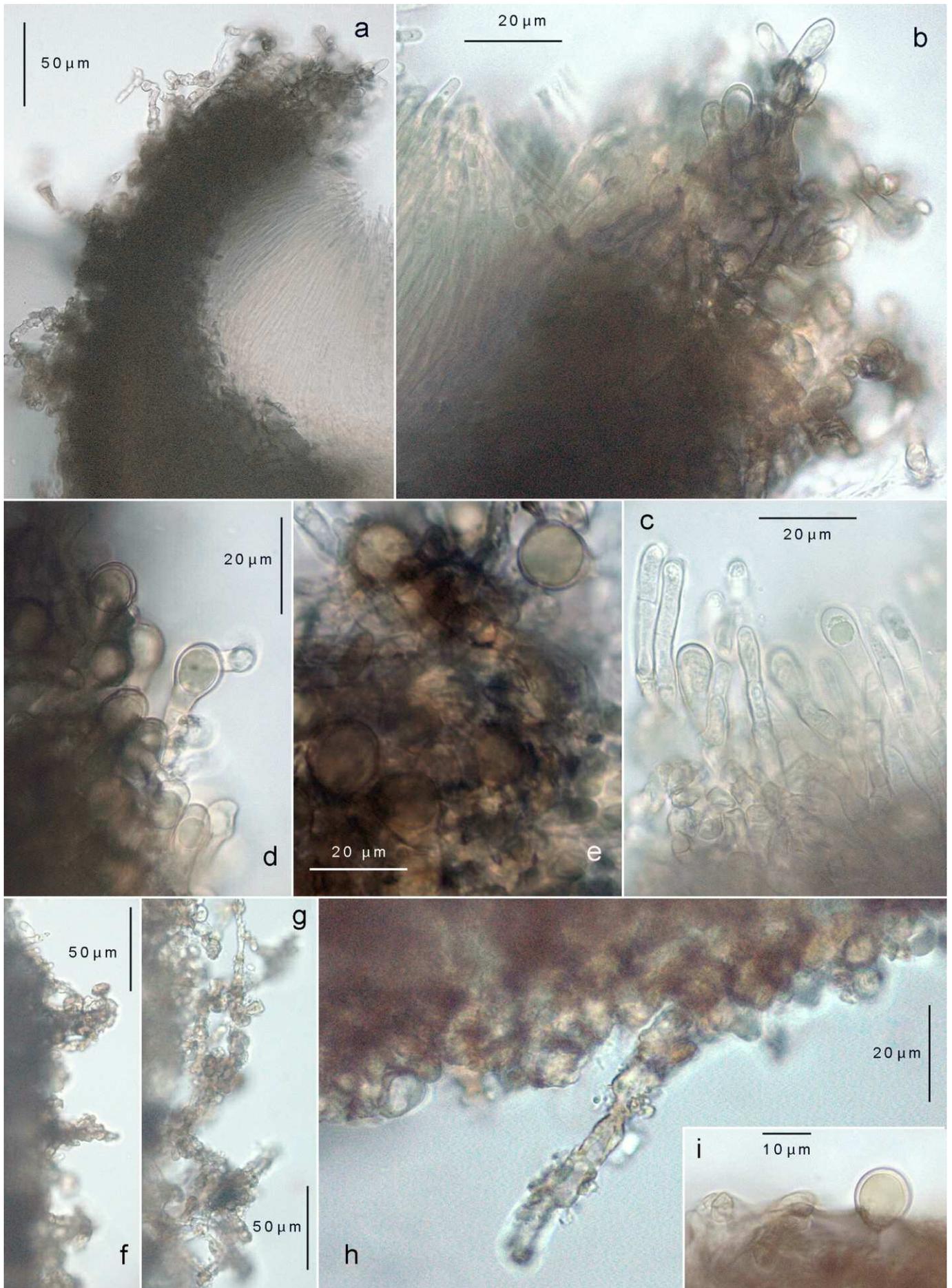
We are greatly indebted to Martin Bemann for proof-reading the manuscript.



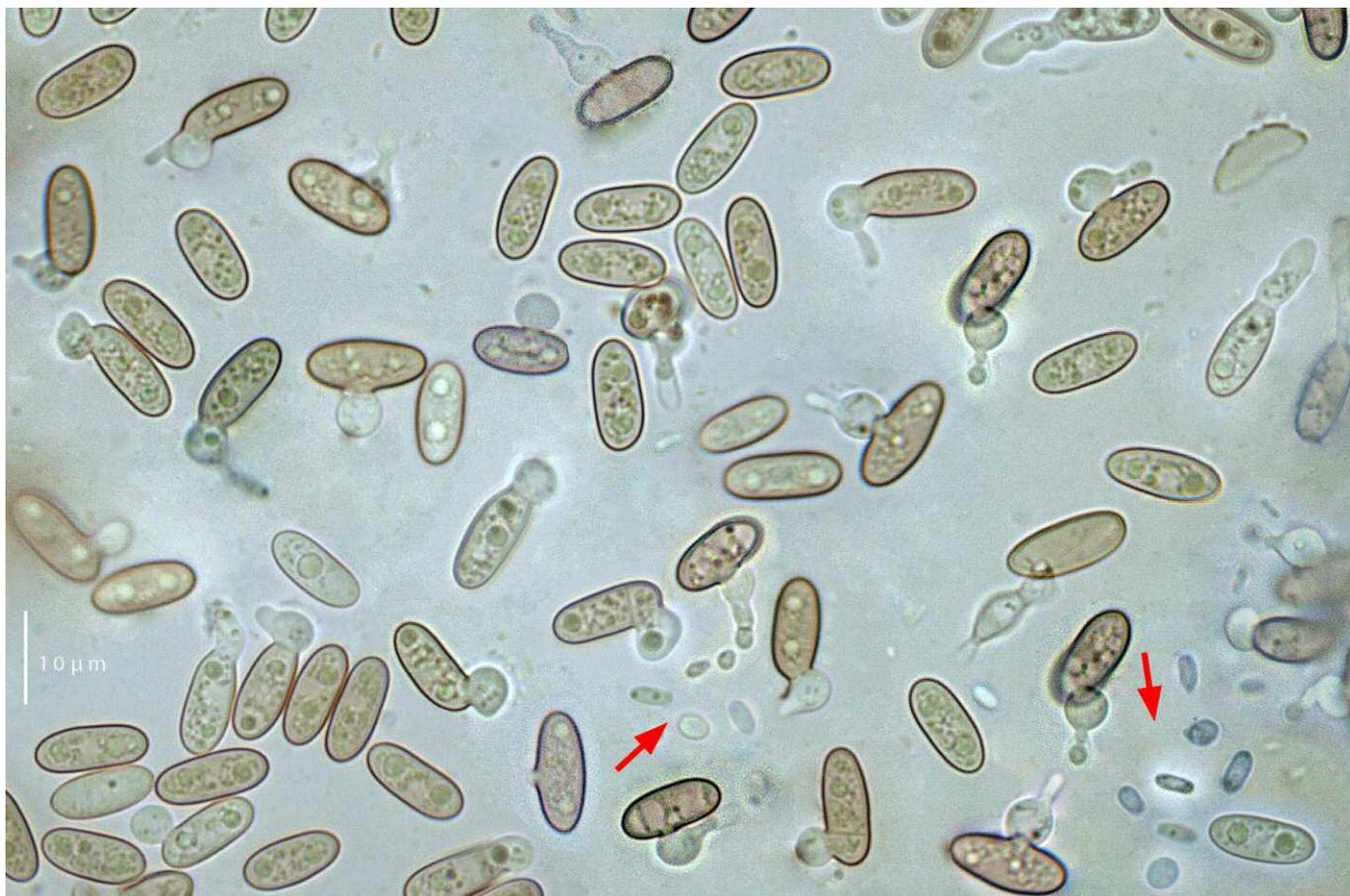
**Fig. 16** – *Cenangiopsis rosae*: a. medullary and ectal excipulum at lower flanks (showing inflated t-cells with VBs); b. apothecium in median section, initially closed (cleistothymenial); c. medullary and ectal excipulum at upper flank in median section; d. cells of medullary excipulum; e. crystals in medullary excipulum; f. cells of ectal excipulum (showing hyaline VBs). All in water. Photos B. Perić.



**Fig. 17** – *Cenangiopsis rosae*: a–b. hyaline \*medullary excipulum (showing inner cells) and brownish \*ectal excipulum, vesicular cells with VBs (in b); c. medullary excipulum of *textura intricata* with indistinct vesicular cells; d. \*cells of ectal excipulum with VBs; e. †cells of ectal excipulum with strongly thickened walls. All from immature apothecium in water, except e (in KOH). Photos B. Perić.



**Fig. 18** – *Cenangiopsis rosae*: a, b. apothecial margin in median section; c. marginal paraphyses (living ones containing VBs); d. marginal hair-like cells containing VBs; e, i. cells of ectal excipulum at margin with greenish-amber VBs; f–h. hairs of ectal excipulum at middle flank and base. All in water. Photos B. Perić.



**Fig. 19** – *Cenangiopsis rosae*: free germinated ascospores with phialides with collarettes and phialoconidia (red arrows). Photo B. Perić.



**Fig. 20** – Site of *Cenangiopsis rosae* on a temporary pastoral settlement at the base of the SSW-exposed slope of Treskavac massif at 1558 m (summit at 2000 m). Photo B. Perić.

## Key to recognized species (emendation of the key in PERIĆ *et al.*, 2019b)

1. Paraphyses ± cylindrical, not exceeding the living mature asci; ascospores \*4–6(–8) µm wide, with a low to high lipid content (OCI 1–5), remaining hyaline or finally turning brown; asci arising from croziers, with IKI deep blue apical ring or IKI– ..... **2**
1. Paraphyses distinctly lanceolate, exceeding the living mature asci by (5–)10–20(–25) µm; ascospores \*(1.6–)2–3(–3.8) µm wide, with low lipid content (OCI 1–2), never turning brown with age; asci arising from croziers or simple septa, in IKI with deep blue apical ring ..... **5**
2. Disc orange- to cinnabar-red due to non-refractive, yellowish-orange(-olive) vacuoles in terminal cells of paraphyses; exterior blackish; apothecia in KOH slightly ionomidotic (yellow); asci IKI–; ascospores with low lipid content (OCI 1–2) composed of some small LBs around two glycogen bodies, \*10.5–13.5 × 5–6.5 µm, ± ellipsoid, overmature remaining hyaline, 1(–3)-septate; on bark of *Rosa* ..... **C. desae**
2. Disc ± brownish due to refractive, pale yellowish- to olive-brown vacuoles (VBS) in terminal cells of paraphyses; exterior whitish-cream to chestnut-brown; apothecia in KOH non-ionomidotic; asci IKI– or +; ascospores with high lipid content (OCI 4–5) composed of two large and some small LBs, without glycogen, wall turning light brown already in living mature asci or only when overmature, remaining non-septate ..... **3**
3. Ascus apex IKI+ blue (faintly red-violet at high concentration); ascospores \*10–13.4 × 5–8 µm, ellipsoid(–ovoid), both hyaline and brown spores occur in living mature asci; on bark of *Rosa* and *Erica* ..... **C. andreae**
3. Ascus apex IKI– ..... **4**
4. Ascospores ellipsoid(–ovoid), hyaline in living mature asci, later turning light brown, \*10–13.5 × 5–6.5 µm; marginal hairs pale to light brown, straight; paraphysis terminal cells \*25–54 µm long; on bark of *Salix*, *Fagus* and *Crataegus* ..... **C. alpestris**
4. Ascospores predominantly subcylindrical(-ellipsoid), often light ochre-brown already in living mature asci, \*9.5–13(–15) × 4.5–5.5(–6) µm; marginal hairs hyaline, irregular; paraphysis terminal cells \*15–36 µm long; on bark of *Rosa* ..... **C. rosae**
5. Ascospores \*1.6–2.6 µm wide; excipulum faintly ionomidotic; marginal hairs 40–70 µm long; apothecial disc greyish-brownish to yellowish; asci arising from croziers or simple septa; on bark of *Juniperus* ..... **6**
5. Ascospores \*2.2–3.8 µm wide; excipulum non-ionomidotic; marginal hairs 60–100 µm long; disc cream-ochraceous to greyish-violaceous; asci arising from croziers; on bark of *Quercus* ..... **7**
6. Asci arising from simple septa; apothecia 0.5–2.5 mm diam., with short stipe; ascospores \*5–6.3 × 1.6–2.2 µm, cuneate; marginal hairs smooth, \*3.7–5.5 µm wide ..... **C. junipericola**
6. Asci arising from croziers; apothecia 0.5–1.5 mm diam., sessile; ascospores \*6.3–8(–9) × 1.8–2.6 µm, cylindrical to cuneate; marginal hairs coarsely incrustated, \*5.5–7.5 µm wide ..... **C. raghavanii**
7. Apothecia with cream-ochraceous hymenium, stipe up to 0.5 mm high; marginal hairs smooth, not swollen at apex, \*4–5.5 µm wide, terminally gradually narrower (†2.8–3.5 µm); ascospores \*(7–)7.5–9(–9.5) × 2.2–2.8 µm ..... **C. quercicola**
7. Apothecia with greyish-violaceous hymenium, stipe absent or 0.2–0.3 mm high; marginal hairs smooth or incrustated, swollen at apex to \*6–9(–15) µm ..... **8**
8. Apothecia shortly stipitate; marginal hairs roughly incrustated, \*6–9 µm wide; ascospores \*6.5–9 × 2.3–3 µm, cuneate, often with delicate detaching basal sheath ..... **C. livida**
8. Apothecia sessile; marginal hairs smooth, \*6–15 µm wide; ascospores \*8–15 × 2.5–3.8 µm, cylindrical-ellipsoid, without sheath ..... **C. violascens**

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