

# New resinicolous ascomycetes from beaver scars in western North America

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Three new species of resinicolous ascomycetes are described from western North America. These include two species of *Chaenothecopsis* (Mycocaliciaceae) and the new monotypic genus *Brucea*, with the new species *B. castoris*. Deep scars and massive resin flows caused by beaver represent an important habitat type for resinicolous fungi in the Pacific Northwest. All the new fungi grow on scarred *Abies grandis* and *Tsuga heterophylla* in low elevation forests in Oregon. *Chaenothecopsis montana* and *C. oregana* are also common at higher elevations in the Cascade Range. The former species also occurs in northern Europe, where it grows on *Picea abies* resin in moist conifer forests.

Key words: beaver scars, *Brucea*, *Chaenothecopsis*, exudate, resinicolous fungi, taxonomy

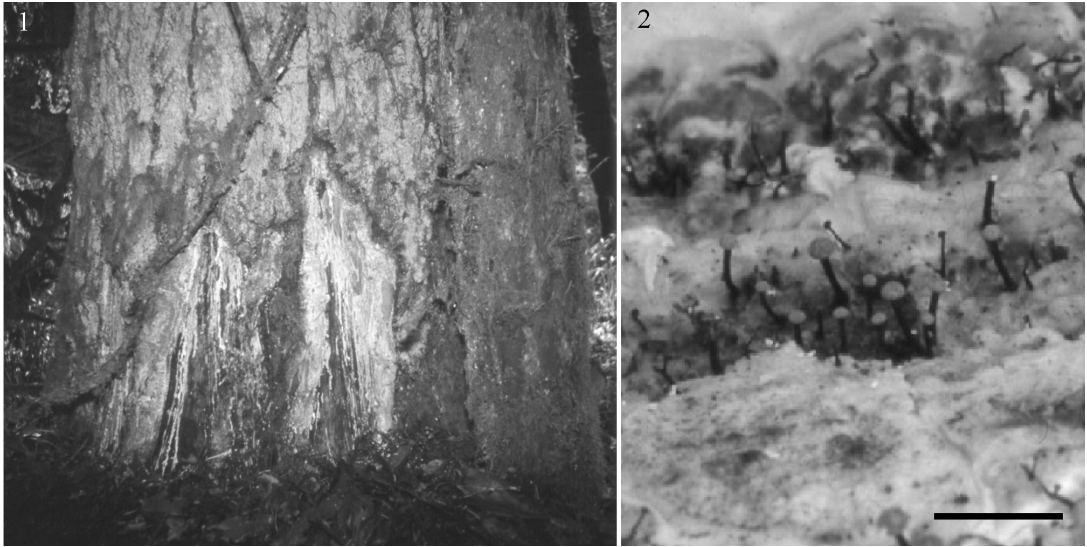
## Introduction

During studies of calicioid fungi in the Pacific Northwest, three previously unknown resinicolous taxa were found growing in beaver scars on basal trunks of conifers. One of the new species cannot be accommodated in established genera, and the new genus *Brucea* is proposed for it. The two other fungi belong to the genus *Chaenothecopsis* (Mycocaliciaceae), which includes many resinicolous species in addition to lichenicolous and saprophytic taxa. The genus is characterized by rather small, non-septate or 1-septate ascospores, usually produced in well-stalked ascomata. Like other members of the Mycocaliciaceae, they have active ascospore dispersal and a well-developed apical apparatus in the ascus. Most resinicolous *Chaenothecopsis* species grow on conifer exu-

dates; they have been collected from species of *Abies*, *Larix*, *Picea*, *Pinus*, *Sequoia*, *Sequoiadendron*, and *Tsuga* (Bonar 1971, Titov & Tibell 1993, Tibell & Titov 1995, Titov 1998, 2001, Rikkinen 1999, 2002, Selva & Tibell 1999). Some resinicolous species are widely distributed, but most seem to be restricted to East Asia or western North America. The group has a long evolutionary history, as exemplified by a fossilized specimen in European amber dating back to 20–40 million years ago (Rikkinen & Poinar 2000).

## Material and methods

Specimens were obtained during extensive field studies of pin-lichens, non-lichenized members of the Mycocaliciaceae and myxomycetes of west-



**Figs. 1–2.** Type locality of *Brucea castoris* (Little Sinks Research Natural Area, Oregon). All the new fungi described in this paper were first found from this site. — 1: Beaver scar at trunk base of *Abies grandis*. — 2: Ascomata of *Brucea castoris* on hardened exudate. Scale bar = 2 mm.

ern Oregon, western Washington and NW California in 1997 and 1998 (Rikkinen 1998, 1999, 2002, Peterson & Rikkinen 1998, 1999, Ukkola & Rikkinen 2000). Some 1400 mixed specimens of calicioid fungi and myxomycetes were collected from different types of forests and woodlands along a complex environmental gradient over the Cascade Range. Over 60 localities were surveyed for site-level species inventories, with a primary goal to maximize species capture in the limited amount of time allotted (1–6 hours per site).

The specimens were studied under dissecting and compound microscopes. Ascospore, ascus and hyphal measurements were made from squash mounts of ascomata in water. Ascomata height, capitulum diameter, and stalk width were measured from dry ascomata under incident light. Specimens used for all measurements were chosen arbitrarily but without preconceived bias.

## Taxonomy

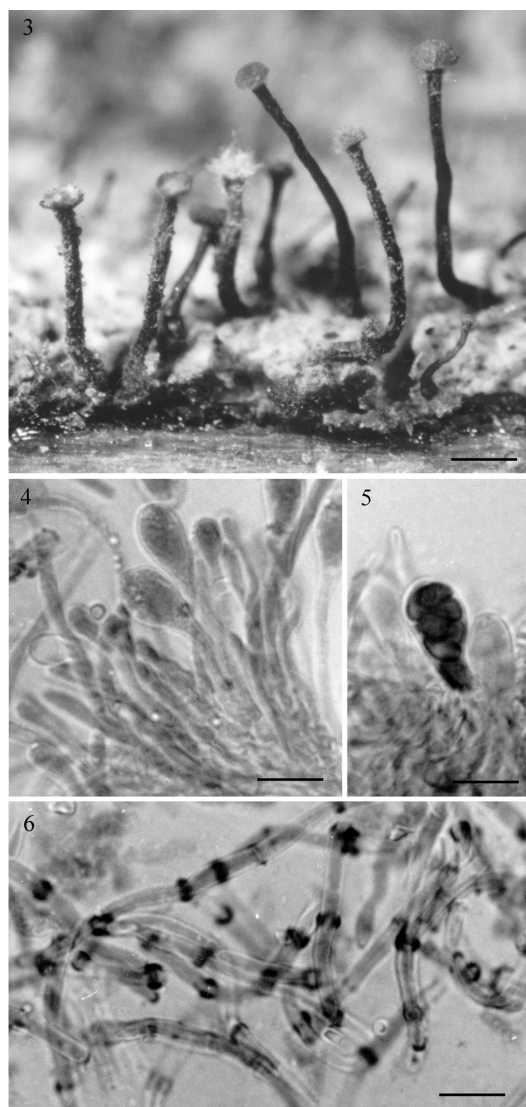
***Brucea castoris* Rikkinen, gen. & sp. nov.**  
(Figs. 1–8)

*Supra exudatum coniferarum. Thallus non lichenisatus. Ascomata dispersa vel gregaria,*

*mediocri vel magna, 0.8–2.5 mm alta. Capitula apotheciorum lenticularia vel hemisphaerica, (0.17)0.20–0.31(0.43) mm diam. Mazaedium bene evolutum, cinerofuscus vel ferruginea. Excipulum parum evolutum ut stipitis strata exteriora continuata, e hyphis periclinalibus constans. Hypothecium pallidum ad fuscum. Stipes rectus vel flexuosus, (75)85–135(200)  $\mu$ m diam., laevis, luce incidenti nitiditer, e hyphis periclinaliter ordinatis ferrugineis constans. In parte superiore stipitis versus pallidior. Omnes partes apotheciorum K–, pigmentum rubrum stipitis N addito leviter plus intense coloratum. Asci octospori, clavati, 15–20  $\times$  7–9  $\mu$ m, stipite 20–25  $\mu$ m longo, apice non incrassato. Ascosporae non septatae, ellipsoideae, pallide brunneae, (6.0)7.0–8.3(9.8)  $\times$  (4.0)4.4–5.1(5.8)  $\mu$ m, longitudinaliter rugosae.*

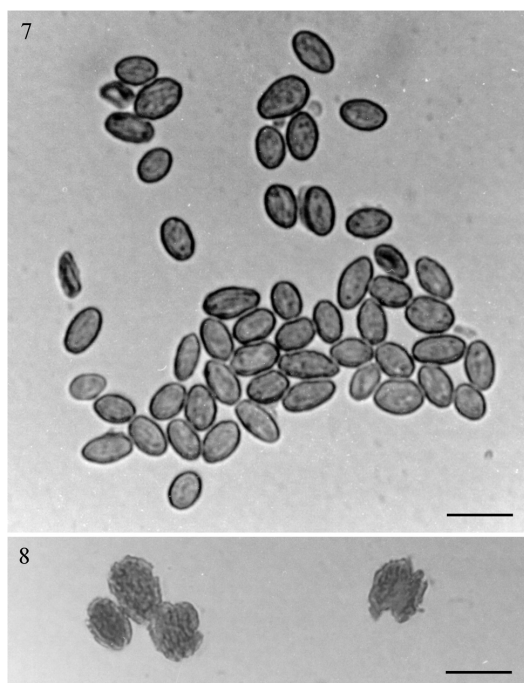
TYPE: USA. Oregon, Polk Co. Little Sinks Research Natural Area, semi-open forest by beaver pond, with mature *Pseudotsuga menziesii*, *Abies grandis*, *Acer macrophyllum*, and *Alnus rubra*, 44°50.3'N, 123°26.4'W, elev. 200 m, on exudate and lignum in beaver scars at trunk bases of living *Abies grandis*, 1998 Rikkinen 98010 (holotype H; isotypes UPS and OSC).

On exudate and resin impregnated lignum of conifers. Thallus non-lichenized. Ascomata



**Figs. 3–6.** *Brucea castoris* (holotype). — 3: Ascomata. — 4: Young asci. — 5: Ascus with spores. — 6: Paraphyses. Scale bars: 3 = 0.5 mm; 4, 5, 6 = 10  $\mu$ m.

dispersed or gregarious, medium-sized to large, 0.8–2.5 mm high. Capitulum lenticular to subhemispheric, (0.17)0.20–0.31(0.43) mm in diam. Mazaedium well developed, pale greyish to reddish brown. Excipulum poorly developed as a continuation of the outer layer of the stalk, consisting of periclinally arranged hyphae. Hypothecium pale to medium brown, containing numerous colourless oil droplets. Stalk straight or flexuous, (75)85–135(200)  $\mu$ m in



**Figs. 7–8.** *Brucea castoris* (holotype). — 7: Ascospores. — 8: Swollen ascospores with ruptured walls. Scale bars = 10  $\mu$ m.

diam., smooth, shining blackish brown in incident light, consisting of periclinally arranged, reddish brown hyphae. Uppermost part of stalk and excipulum paler than the stalk base. All parts of the apothecium K–, reddish colour of stalk slightly intensified with N. Asci eight-spored, clavate, 15–20  $\times$  7–9  $\mu$ m, with 20–25  $\mu$ m long stalks, with relatively thick wall, not differentiated at the apex. Asci formed singly from ascogenous hyphae with croziers. Paraphyses 2.5–3.5  $\mu$ m diam., with thickened septa. Mature ascospores non-septate, ellipsoidal, pale brown, (6.0)7.0–8.3(9.8)  $\times$  (4.0)4.4–5.1(5.8)  $\mu$ m, surface with longitudinal wrinkles visible under the light microscope. The spore walls may rupture as the spores swell after being mounted in water.

**ETYMOLOGY.** The genus is named in the honour of Prof. Bruce McCune for his invaluable contribution to the study of the lichen flora of western North America. The specific epithet refers to beavers, which play an important role in the ecology of resinicolous fungi in the Pacific Northwest. The beaver is also the state animal of Oregon and the Oregon State University mascot.

**TAXONOMIC NOTES.** *Brucea castoris* displays typical calicioid features such as stalked ascomata, a well-developed mazaedium and pigmented, distinctly ornamented spores. Calicioid fungi, as such, represent a diverse assemblage and belong to widely different orders among the ascomycetes (Tibell 1984, 1999, Aptroot & Tibell 1997, Wedin & Tibell 1997). In its gross morphology *Brucea* most closely resembles *Roesleria*, *Roeslerina*, *Sclerophora*, and some species of *Chaenotheca*. All these fungi produce ascomata with slender stalks consisting of periclinally arranged, brownish hyphae and have well developed mazaedia consisting of pale or brown, usually non-septate spores. However, *Brucea* differs from the other genera by a number of anatomical features. *Brucea castoris* resembles *Sclerophora* and some *Chaenotheca* species in having well-stalked asci formed singly from ascogenous hyphae with croziers. However, the asci of the two latter genera are cylindrical, thin-walled and dissolve at early stages. In *B. castoris* the asci are broadly clavate, with 2–3-seriately arranged spores, and the ascus wall is relatively thick and persists until the spores are nearly mature (Figs. 4 and 5). The ascus wall appears to consist of two layers. The asci of *Roeslerina* and *Roesleria* are formed without croziers, they are usually more or less cylindrical, and occasionally formed in short chains. *Brucea* resembles *Roeslerina radicella* in general shape and size of ascospores, but the spores of the latter species are hyaline and smooth, not brownish and distinctly ornamented as in *B. castoris* (Fig. 8). *Roesleria subterranea* has ellipsoidal, brownish spores, but they are septate and have smooth walls. Most species of *Chaenotheca* and *Sclerophora* have globose spores, but the spores of some *Chaenotheca* species, like *C. chlorella*, are broadly ellipsoidal and comparatively large. However, they have thick walls and a different type of surface ornamentation than those of *B. castoris*. Species of *Roesleria* and *Roeslerina* resemble *B. castoris* in having prominent paraphyses, but their septa are not conspicuously thickened (Fig. 6). *Brucea* differs from all similar fungi in its ecology; all species of *Chaenotheca* and *Sclerophora* are lichenized (Tibell 1984, 1999, 2001), while species of *Roesleria* and *Roeslerina* are parasitic on angiosperm and conifer roots, respectively

(Redhead 1984). As *B. castoris*, in my opinion, cannot be accommodated in any of the established genera, it is here placed in a new genus.

**ECOLOGY AND DISTRIBUTION.** Only three collections of *Brucea castoris* are presently known, all from low elevation (150–200 m) riparian forests in Oregon. Twice the fungus was found growing on partly solidified exudate and in large beaver scars on basal trunks of mature *Abies grandis* trees (Figs. 1 and 2). Both trees grew in forests adjacent to beaver ponds. The third collection was made from resin in a small beaver scar on the basal trunk of *Tsuga heterophylla* in a moist riparian forest. In all three cases *B. castoris* was accompanied by one or both of the two *Chaenothecopsis* species described in this paper. Considering the poor knowledge of resinicolous fungi in western North America, *B. castoris* may well be a relatively widespread but overlooked species in the Pacific Northwest.

**ADDITIONAL SPECIMENS EXAMINED** (paratypes). **USA.** Oregon: Polk Co. Little Sinks Research Natural Area, semi-open forest by beaver pond, with mature *Pseudotsuga menziesii*, *Abies grandis*, *Acer macrophyllum*, and *Alnus rubra*, 44°50.3'N, 123°26.4'W, elev. 200 m, on exudate and lignum in beaver scars at trunk bases of living *Abies grandis*, 1998 Rikkinen 98008, 98024 (H); Lincoln Co., H. B. Van Duzer Forest Corridor Wayside, mature riparian forest with *Tsuga heterophylla*, *Pseudotsuga menziesii*, *Acer macrophyllum*, *Alnus rubra* and old-growth *Picea sitchensis*, 45°02.2'N, 123°48.6'W, elev. 150 m, on exudate and lignum in beaver scar at trunk base of living *Tsuga heterophylla*, 1998 Rikkinen 98333 (H); Benton Co., McDonald Research Forest, between Sulphur Springs trailhead and Forest Service Road 800, forest edge by beaver pond in moist gully, 44.0°38.47'N, 123°18.79'W, elev. 185 m., 44°38.5'N, 123°18.8'W, elev. 180 m, on exudate and lignum in beaver scar at trunk base of living *Abies grandis*, 1998 Rikkinen 98363 (H).

***Chaenothecopsis montana* Rikkinen, sp. nova** (Figs. 9–12)

*Supra exudatum coniferarum. Ascomata satis variabilia, vulgo mediocri vel magna, (0.3)0.5–1.2(1.7) mm alta. Capitula apotheciorum lenticularia vel hemisphaerica, (125)200–350(575) µm diam. Excipulum bene evolutum, e cellulis subelongatis vel isodiametricis formatum. Stipes rectus, (60)70–110(200) µm crassus, e hyphis periclinalibus constans. Omnes partes apotheciorum K–. Asci cylindrici, 28–35*

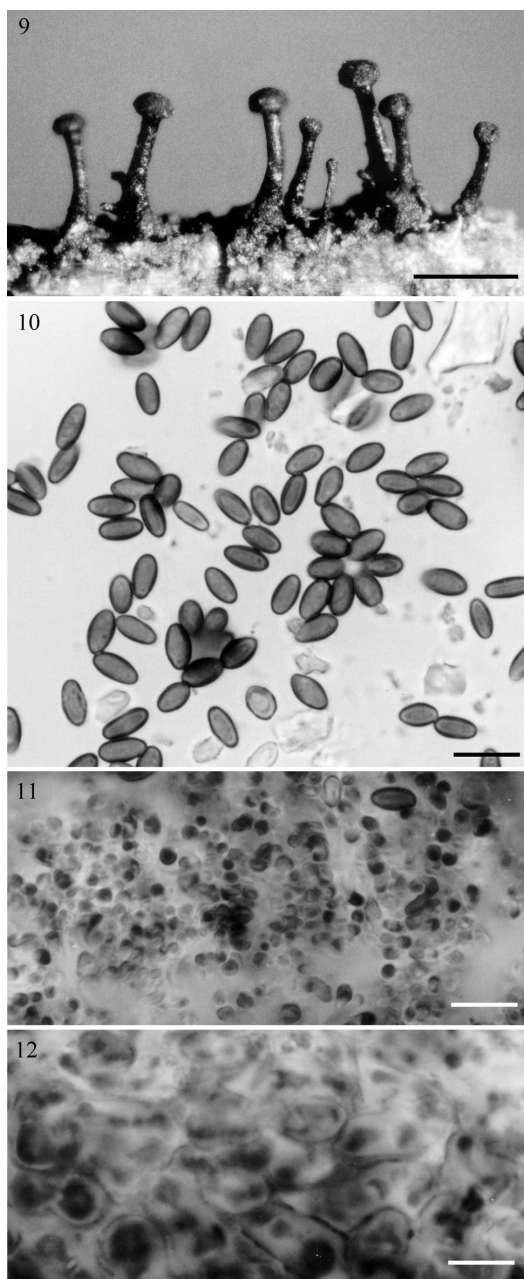


$\times 4\text{--}5\ \mu\text{m}$ , *ascosporae* in asco valde oblique, interdum anticlinaliter directae. *Ascosporae* non septatae, ellipsoideae, utrinque rotundatae,  $(6.0)6.7\text{--}7.5(8.3) \times (3.5)3.6\text{--}4.0(4.7)\ \mu\text{m}$ , laeves.

TYPE: USA. Oregon: Polk Co., Little Sinks Research Natural Area, semi-open forest around beaver pond, with mature *Pseudotsuga menziesii*, *Abies grandis*, *Acer macrophyllum*, and *Alnus rubra*,  $44^{\circ}50.3'\text{N}$ ,  $123^{\circ}26.4'\text{W}$ , elev. 200 m, on exudate and lignum in beaver scars at trunk bases of living *Abies grandis*, 1998 Rikkinen 98008 (holotype H; isotypes UPS and OSC).

On exudate of conifers. Ascomata quite variable in size, usually medium-sized to large,  $(0.3)0.5\text{--}1.2(1.7)\ \text{mm}$  high. Capitulum lenticular to subhemispheric,  $(125)200\text{--}350(575)\ \mu\text{m}$  in diam., dark greenish brown, sometimes with a thin white pruina on surface. Epithecium well developed, greenish brown, consisting of swollen, pigment-capped tips of paraphyses, tips  $1.5\text{--}2.5\ \mu\text{m}$  in diam. Excipulum well developed, several cell layers thick, consisting of up to  $20\ \mu\text{m}$  wide, cylindrical or almost isodiametric cells, with strongly swollen walls and small lumina. Hypothecium pale, containing numerous colourless oil droplets. Stalk straight or curved, rarely branched,  $(60)70\text{--}110(200)\ \mu\text{m}$  in diam., epruinose, dull brownish black in incident light, consisting of mainly periclinaly arranged, swollen hyphae, with thick walls and small lumina. All parts of the apothecium K $^-$ ; the tissues do not swell appreciably in K. Asci cylindric,  $28\text{--}35 \times 4\text{--}5\ \mu\text{m}$ , with very strongly thickened apex penetrated by fine canal. Spores uniseriately arranged in the asci, often obliquely and irregularly orientated in semi-mature asci. Ascospores non-septate, ellipsoidal with rounded ends, greenish gray,  $(6.0)6.7\text{--}7.5(8.3) \times (3.5)3.6\text{--}4.0(4.7)\ \mu\text{m}$ , smooth under the light microscope.

TAXONOMIC NOTES. *Chaenothecopsis montana* is characterized by the cylindrical to isodiametric, thick-walled cells of the stalk and excipulum, the swollen, pigment-capped paraphysis tips, the often reddish brown stalk and greenish capitulum, the K $^-$  reaction, and the non-septate, broadly ellipsoidal spores that are densely, obliquely and, in part, irregularly arranged in the relatively short asci. Most North American specimens have short, rather stout apothecia, with dull reddish or yellowish brown stalks.



**Figs. 9–12.** *Chaenothecopsis montana* (holotype). — 9: Ascomata. — 10: Ascospores. — 11: Epithecium. — 12: Excipulum. — Scale bars: 9 = 0.5 mm; 10, 11, 12 = 10  $\mu\text{m}$ .

The Finnish specimens have narrower, distinctly reddish stalks. However, the two populations are quite similar in anatomical respects and thus seem to represent to the same species.

ECOLOGY AND DISTRIBUTION. *Chaenothecopsis*

*montana* is common in the Oregon Cascades, where it grows on resin and resin impregnated lignum of *Abies* and *Tsuga* in mature conifer forests. It has also been collected from Washington and California and probably also occurs in other parts of western North America as well. Additional collections are known from Northern Europe, where the fungus grows on the resin of *Picea abies*. Thus, the species has a wide, probably circumboreal distribution. In central Finland *C. montana* prefers humid, mature forests and tends to grow in crevices under slabs of dead bark at the edges of deep wounds. Though probably overlooked, it is definitely not as common in central Finland as it is in western North America.

ADDITIONAL SPECIMENS EXAMINED (paratypes). **USA.** Oregon: Polk Co., Little Sinks Research Natural Area, semi-open forest around beaver pond, with mature *Pseudotsuga menziesii*, *Abies grandis*, *Acer macrophyllum*, and *Alnus rubra*, 44°50.3'N, 123°26.4'W, elev. 200 m, on exudate and lignum in beaver scars at trunk bases of living *Abies grandis*, 1998 Rikkinen 98010 (H); Benton Co., McDonald Research Forest, between Sulphur Springs trailhead and Forest Service Road 800, forest edge by beaver pond in moist stream gully, 44°38.47'N, 123°18.79'W, elev. 185 m, 44°38.5'N, 123°18.8'W, elev. 180 m, on exudate and lignum in beaver scar at trunk base of living *Abies grandis*, 1998 Rikkinen 98363 (H); Benton Co., McDonald Research Forest, Oak Creek, herb-rich riparian forest with *Alnus rubra*, *Acer macrophyllum*, *Fraxinus latifolia*, *Pseudotsuga menziesii*, and *Abies grandis*, 44°36.2'N, 123°20.1'W, elev. 150 m, on exudate and lignum in beaver scar at trunk base of living *Abies grandis*, 1998 Rikkinen 98417 (H); Deschutes Co., Elliot R. Corbett II Memorial State Park, between Cub Lake and Cache Mt., semi-open mature mixed forest with *Abies grandis*, *A. amabilis*, *A. lasiocarpa*, *Tsuga mertensiana*, *Pseudotsuga menziesii* and *Picea engelmannii*, 44°23.1'N, 121°47.9'W, elev. 1300 m, on exudate and lignum in trunk cavities of *Abies* sp. and *Tsuga mertensiana*, 1998 Rikkinen 98508, 98509, 98516, 98517, 98518, 98525, 98526 (H); Jefferson Co., Elliot R. Corbett II Memorial State Park, near Island Lake, mature conifer forest with *Abies* spp., *Pseudotsuga menziesii*, *Pinus monticola* and *Picea engelmannii*. Also *Populus* and *Alnus* near lake shore, 44°24.3'N, 121°48.3'W, elev. 1200 m, on exudate and lignum in trunk cavities of *Abies* sp., 1998, Rikkinen 98530, 98531, 98541 (H); Black Butte, semi-open *Pinus ponderosa* dominated conifer forest with grassy understory on moderate W-facing slope, 44°24.1'N, 121°38.8'W, elev. 1680 m, on exudate and lignum in trunk cavity of living *Abies grandis*, 1998 Rikkinen 98589 (H); Hayrick Butte, dense *Tsuga mertensiana*-*Abies* forest on steep N-facing slope, 44°24.3'N, 121°51.9'W, elev. 1550 m, on exudate and lignum in trunk cavity of mature living *Abies* sp., 1998 Rikkinen 98548 (H); Between Candle

Creek and Parker/Jefferson Creek, riparian, mature stand of *Pinus ponderosa*-*Pseudotsuga menziesii*-*Larix occidentalis*-*Abies* forest by open lava flow, 44°34.5'N, 121°39.7'W, elev. 900 m, on exudate and lignum in beaver scar on trunk base of young *Abies* sp., 1998 Rikkinen 98576 (H); Linn Co., Hackleman Grove, mature riparian *Pseudotsuga menziesii*-*Tsuga heterophylla*-*Abies amabilis* forest with understory of deciduous shrubs, 44°23.9'N, 122°05.6'W, elev. 1100 m, on exudate and lignum in beaver scars at trunk bases of large living *Abies amabilis*, 1998 Rikkinen 98670, 98671, 98679 (H). California: Trinity Co., Scott Mountain, semi-open forest on moderate rocky slope with mature *Abies* sp., *Calocedrus decurrens*, *Pseudotsuga menziesii*, and *Pinus ponderosa*, 41°15.4'N, 122°62.1'W, elev. 1000 m, on exudate and lignum in trunk base cavity of living *Abies* sp., 1997 Rikkinen 97052 (H). Washington: Skamania Co., Thorton T. Munger Research Natural Area, Whistle Punk Trail, moist *Tsuga heterophylla* dominated forest bordering seasonally flooded *Fraxinus latifolia* swamp, 45°49'N, 121°58'W, elev. ca. 350 m, on exudate and lignum in beaver scar at trunk base of large living *Tsuga heterophylla*, 1998 Rikkinen 98499 (H). **Finland.** Juupajoki: Kuivajärvi forest reserve, ca 1 km N of Hyytiälä Forest Station, mature *Myrtillus* type (MT) fresh heath forest, 61°51'N, 24°17'E, elev. 150 m, on semisolid resin in deep wound on basal trunk of living *Picea abies*, 1999 Rikkinen 201500 (H). Saarijärvi: Kulha forest reserve, Syväojarrotko, mature, paludified fresh heath forest in moist ravine, 62°35'N, 24°58'E, elev. 200 m, on semisolid resin in deep wound on basal trunk of living *Picea abies*, 1999 Rikkinen 201501 (H); Pyhäähäkki National Park, old-growth *Myrtillus* type (MT) fresh heath forest, 62°51'N, 25°29'E, elev. 165 m, on semisolid resin in deep wound on basal trunk of living *Picea abies*, 1999 Rikkinen 201502 (H).

***Chaenothecopsis oregana* Rikkinen, sp. nova** (Figs. 13 and 14)

*Supra exudatum coniferarum. Ascomata satis variabilia, vulgo mediocri vel magna, (0.3)0.5–1.0(2.5) mm alta, nigra. Capitula apotheciorum lenticularia vel subsphaerica, (100)135–215(250) µm diam., epruinosa. Excipulum evolutum ut stipitis strata exteriora continuata, e hyphis periclinalibus constans. Hypothecium pallidum. Stipes rectus vel flexuosus, interdum ramosus, (38)75–90(150) µm diam., atribitida, e hyphis periclinaliter ordinatis constans. Asci cylindrici, 28–35 × 2.5–3 µm. Ascosporae non septatae, ellipsoidales, extremis rotundatis, pallide brunneae, (4.9)5.7–6.5(7.7) × (2.5)2.6–2.8(3.0) µm, laeves.*

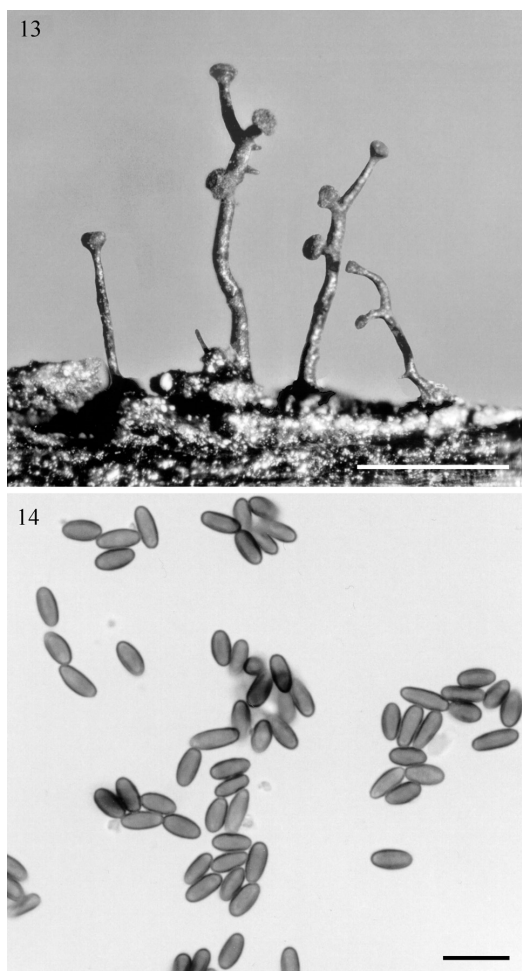
TYPE: USA. Oregon: Benton Co., McDonald Research Forest, between Sulphur Springs trailhead and Forest Service Road 800, forest edge by beaver pond in moist stream

gully, 44°38.47'N, 123°18.79'W, elev. 185 m; 44°38.5'N, 123°18.8'W, elev. 180 m, on exudate and lignum in beaver scar at trunk base of living *Abies grandis*, 1998 Rikkinen 98363 (holotype H).

On exudate of conifers. Ascomata quite variable in size, usually medium-sized to large, (0.3)0.5–1.0(2.5) mm high, black. Capitulum obovoid to lenticular, later subspheric, (100)135–215(250)  $\mu\text{m}$  in diam., epruinose. Excipulum developed as a continuation of the outer layer of the stalk, consisting of periclinally arranged hyphae. Hypothecium pale. Stalks straight or flexuous, sometimes branched, (38)75–90(150)  $\mu\text{m}$  in diam., shiny black in incident light, consisting of mainly periclinally arranged, dark reddish hyphae. All parts of the apothecium containing the red pigment turn purplish with K. Asci cylindric, 28–35  $\times$  2.5–3  $\mu\text{m}$ , with thickened apex; spores uniseriately arranged in the asci. Ascospores non-septate, ellipsoidal with rounded ends, pale brown, (4.9)5.7–6.5(7.7)  $\times$  (2.5)2.6–2.8(3.0)  $\mu\text{m}$ , smooth under the light microscope.

**TAXONOMIC NOTES.** *Chaenothecopsis oregana* is characterized by its slender apothecia with lenticular, relatively narrow capitula, distinctly reddish stalks composed of mainly periclinally arranged hyphae, smooth and pale brown, narrowly ellipsoidal spores with rounded apices, and the non-dissolving K+ purplish color reaction of the stalk and excipulum. *Chaenothecopsis oregana* may grow intermixed with *C. montana*, but in such cases the two species can usually be easily distinguished on the basis of habit alone. Some specimens, including the type specimen, have produced large, richly branched ascomata in which new apothecia have developed through branching of old stalks and as proliferations through old hymenia. Such ascomata have only been found from low elevation riparian forests in Oregon, growing in beaver scars on *Abies grandis*. In anatomical details the branched specimens are similar to smaller, non-branched specimens from higher elevations, and both morphotypes are thus considered to belong to the same species.

**ECOLOGY AND DISTRIBUTION.** The species is common in the Oregon Cascades, where it grows on resin and resin impregnated lignum of *Abies* and *Tsuga* in mature conifer forests. Like *C.*



**Figs. 13–14.** *Chaenothecopsis oregana* (holotype). — 13. Branched ascomata. — 14: Ascospores. Scale bars: 13 = 1.0 mm; 14 = 10  $\mu\text{m}$ .

*montana*, it may well be a widely distributed species in western North America. The two species often grow together and, in such cases, *C. montana* seems to be more dominant on semi-solid resin while *C. oregana* seems to prefer well hardened resin and resin-impregnated wood.

**ADDITIONAL SPECIMENS EXAMINED (paratypes). USA.** Oregon: McDonald Research Forest, Oak Creek, herb-rich riparian forest with *Alnus rubra*, *Acer macrophyllum*, *Fraxinus latifolia*, *Pseudotsuga menziesii*, and *Abies grandis*, 44°36.2'N, 123°20.1'W, elev. 150 m, on exudate and lignum in beaver scar at trunk base of living *Abies grandis*, 1998 Rikkinen 98418 (H); Polk Co., Little Sinks Research Natural Area, semi-open riparian forest around beaver pond, with mature *Pseudotsuga menziesii*, *Abies grandis*, *Acer mac-*



*rophyllum*, and *Alnus rubra*, 44°50.3'N, 123°26.4'W, elev. 200 m, on exudate and lignum in beaver scars at trunk bases of living *Abies grandis*, 1998 Rikkinen 98010 (H); Lincoln Co., H. B. Van Duzer Forest Corridor Wayside, mature riparian forest with *Tsuga heterophylla*, *Pseudotsuga menziesii*, *Acer macrophyllum*, *Alnus rubra* and old-growth *Picea sitchensis*, 45°02.2'N, 123°48.6'W, elev. 150 m, on exudate and lignum in beaver scar at trunk base of living *Tsuga heterophylla*, 1998 Rikkinen 98333 (H); Deschutes Co., Elliot R. Corbett II Memorial State Park, between Cub Lake and Cache Mt., semi-open mature mixed forest with *Abies grandis*, *A. amabilis*, *A. lasiocarpa*, *Tsuga mertensiana*, *Pseudotsuga menziesii* and *Picea engelmannii*, 44°23.1'N, 121°47.9'W, elev. 1300 m, on exudate and lignum in trunk cavities of *Abies* sp., 1998 Rikkinen 98506, 98526 (H); Jefferson Co. Elliot R. Corbett II Memorial State Park, near Island Lake, mature conifer forest with *Abies* spp., *Pseudotsuga menziesii*, *Pinus monticola* and *Picea engelmannii*, also *Populus* and *Alnus* near lake shore, 44°24.3'N, 121°48.3'W, elev. 1200 m, on exudate and lignum in trunk cavity of *Abies* sp., 1998 Rikkinen 98530 (H); Linn Co., Hackleman Grove, mature riparian conifer forest with *Pseudotsuga menziesii*, *Tsuga heterophylla* and *Abies amabilis*, understory of deciduous shrubs, 44°23.9'N, 122°05.6'W, elev. 1100 m, on exudate and lignum in beaver scars at trunk bases of large living *Abies amabilis*, 1998 Rikkinen 98671, 98679 (H).

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