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Stictis s.l. (Ostropales, Ascomycota) in the Russian Far East

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ABSTRACT

This paper summarizes literature data and new information on the geographical distribution and ecology of *Stictis* and closely related genera in Russia. *Stictis sphaeroboloides* is reported as new to Eurasia; *Carestiella socia* and *Stictis populorum* are new to Asia, *S. carnea* is new to Russia, and *S. radiata* is new to the Russian Far East. New data on distribution and ecology of *Carestiella socia* and five *Stictis* species are provided along with a comprehensive key for all species of *Stictis* s.l. sensu Wedin et al. (2006) known in Russia and nearby areas. Our research clearly shows importance of the collaboration between mycologists and lichenologists to study trophically complex taxa and to obtain the most complete knowledge about fungal diversity.

Keywords: lichenized fungi, saprotrophic fungi, Sakhalin, Kamchatka, Primorsky Territory, Kuril Islands

РЕЗЮМЕ

Попов Е.С., Чесноков С.В., Конорева Л.А., Ёжкин А.К., Степанчикова И.С., Кузнецова Е.С., Гимельбрант Д.Е., Галанина И.А., Чабаненко С.И. Род *Stictis* s.l. (Ostropales, Ascomycota) на Российском Дальнем Востоке. Впервые представлен обзор по роду *Stictis* s.l. sensu Wedin et al. (2006) для российского Дальнего Востока. Составлен ключ для видов, известных в России. Представлены новые данные о распространении и экологии *Carestiella socia* и пяти видов из рода *Stictis*. *Stictis sphaeroboloides* впервые приводится для Евразии. *Carestiella socia* и *Stictis populorum* являются новыми видами для Азии; *S. carnea* впервые приводится для России, *S. radiata* приводится здесь как новый вид для российского Дальнего Востока. Наше исследование ясно показывает важность сотрудничества между микологами и лихенологами для изучения трофически сложных таксонов и получения наиболее полных знаний о разнообразии грибов.

Ключевые слова: лихенизированные грибы, сапротрофные грибы, Сахалин, Камчатка, Приморский край, Курильские острова

Stictis s.l. as circumscribed by Wedin et al. (2006) includes taxa from at least three ostropalean genera (*Stictis* s.str., *Carestiella*, and *Schizoxylon* pro parte). Within *Stictis* s.l. some taxa have shown facultative lichenization where the fungus may either persist as saprotroph or be lichenized, apparently depending on its substrate, i. e. bark or wood (Wedin et al. 2004).

Four *Schizoxylon* species, five *Stictis* species and one *Ostropa* species were reported from Russia before. Their distribution by large geographical regions (adopted after Czerepanov 1995) is as follows:

European Part of Russia. Five species of *Stictis* and one species of *Schizoxylon* are known: *Schizoxylon berkeleyanum* (Durieu et Lév.) Fuckel (Jaczewski 1896), *Stictis brunnescens* Gilenstam et al. (Wedin et al. 2006, Notov et al. 2011, Kuznetsova et al. 2012), *S. mollis* Pers. (Jaczewski 1895, Tranzschel 1905, Tranzschel & Serebrianikow 1912, Popov 2012, Muchnik et al. 2019), *S. phragmitis* Lobik (Lobik 1928), *S. populorum* (Gilenstam) Gilenstam (Hermansson et al. 2006, Urbanavichus 2014), *S. radiata* Pers. (Martius 1817, Weinmann 1828, Karsten 1866, Vasil'eva 1939, Sirko 1976, Vaasma et al. 1986, Urbanavichene 2011, Kuznetsova et al. 2012, Popov & Volobuev 2014, Churakov et al. 2015, Huseyin et al. 2016, Himelbrant et al. 2017).

Caucasus. Three species were previously reported: *Schizoxylon alboatrum* (Urbanavichus & Urbanavichene 2017), *Stictis brunnescens* Gilenstam et al. (Urbanavichus & Urbanavichene 2015), and *S. radiata* Pers. (Vaasma et al. 1986, Urbanavichene & Urbanavichus 2014).

Western and Eastern Siberia. Only *Stictis mollis* has been known to occur in Siberia since 1880 (Thümen, as *S. ollaris* Wallr.). Konoreva et al. (2016) summarized data on the distribution and ecology of *Stictis* s.l. in Russia and added *Schizoxylon albescens* Gilenstam et al., *Stictis brunnescens* and *S. radiata* from Altai Mts. and Eastern Siberia.

Russian Far East. Three species were previously reported: *Stictis mollis*, *Schizoxylon berkeleyanum* and *Ostropa barbara* (Koval' 1972) from the Primorye Territory, and *Schizoxylon hemisphaericum* (Fr.) DiCosmo et al. known only from the type locality in Kamchatka (Fries 1823, DiCosmo et al. 1984).

Thus, most of known records originate from European part of Russia, while the diversity and distribution of Stictidaceae. in Asian part remain poorly understood, and only four species were known from the Russian Far East before our research.

MATERIAL AND METHODS

The present study is based on the specimens collected by the authors between 2005 and 2018 in various regions of the Russian Far East. The data from the Pskov Region and Karachayevo-Circassian Republic were used to clarify the distribution of the species in Russia. The specimens are deposited in the lichen and fungal subdivisions of the herbarium of the Komarov Botanical Institute RAS, St. Petersburg, Russia (LE), also in the herbaria of St. Petersburg State University, St. Petersburg, Russia (LECB), Polar-Alpine Botanical Garden-Institute of the KSC RAS, Kirovsk, Russia (KPABG), University of Helsinki, Helsinki, Finland (H), Institute of Marine Geology and Geophysics FEB RAS, Yuzhno-Sakhalinsk, Russia (SAK) and Sakhalin Branch of Botanical Garden-Institute FEB RAS, Yuzhno-Sakhalinsk, Russia (SAKH).

The material was examined at The Core Facility Center "Cell and Molecular Technologies in Plant Science" at the Komarov Botanical Institute using standard microscopic techniques (Smith et al. 2009). Photographs of the species were made using AxioCam MRc5 digital camera mounted on Stemi-2000 CS light microscope. The distribution map was prepared using MapInfo GIS software. Geographical coordinates are given in spatial reference system WGS 1984.

Abbreviations of authors in text: EP = Eugene S. Popov, SCh = Sergey V. Chesnokov, LK = Liudmila A. Konoreva, AE = Alexander K. Ezhkin, IS = Irina S. Stepanchikova, EK = Ekaterina S. Kuznetsova, DH = Dmitry E. Himelbrant, IG = Irina A. Galanina.

RESULTS

Altogether 21 specimens were studied, and 7 species of *Stictis* s.l. were revealed in the Russian Far East. *Carestiella socia*, *Stictis populorum*, and *S. sphaeroboloides* are new to Asia, *S. carnea* is new to Russia, and *S. radiata* is new to the Russian Far East.

To facilitate the progress in the studies of diversity and distribution of Stictidaceae in Russia we provide an identification key for the filiform-spored epixylic and epiphytic species of *Stictis* and morphologically similar genera known to occur in the country. Short descriptions, differences from the related species, notes on ecology and distribution are given for species found in the Far East.

Key to the epixylic and epiphytic filiform-spored species of Stictidaceae in Russia

All species mentioned in the key are known from Russia; for the species which are not yet reported from Russian Far East but expected to be found there the notes on distribution are given in brackets.

1. Apothecia opening at maturity by a rounded pore or irregular fissures **2**

– Apothecia opening at maturity by a transverse slit **13**

2. Periphysoids ± distinct; apothecial margin with distinct crystalline inclusions; ascospores not disarticulating into part-spores (genus *Stictis*) **3**

– Periphysoids absent or indistinct; apothecial margin usually without crystalline inclusions (but see *Schizoxylon alboatrum*), sometimes with crystalline pruina on outer surface; ascospores disarticulating or not **9**

3. Hymenium remaining covered by crystalline layer for a long time after eruption trough the host tissues ..... ***Stictis sphaeroboloides***

– Hymenium soon opening by a pore **4**

4. Disc ochraceous, glossy, never pruinose **5**

– Disc brown, or grey to black, ± dull, often pruinose **7**

5. Margin partly brown in section ..... ***Stictis brunnescens***

– Margin colourless in section **6**

6. Ascospores 3–3.5 μm broad, distinctly tapered below; individual cells 3–4 μm long ..... ***Stictis carnea***

– Ascospores 2–2.5 μm broad, not or slightly tapered; individual cells 4–7 μm long ..... ***Stictis radiata***

7. Ascospores more than 3 μm broad ..... ***Stictis populorum***

– Ascospores less than 3 μm broad **8**

8. Ascospores longer than 100 μm; on wood and bark ..... ***Stictis mollis***

– Ascospores shorter than 100 μm; on stems of *Phragmites* ..... ***Stictis phragmitis***

[so far known only from the type locality in Kalmykia]

9. Ascospores with average length less than 100 μm, 3- to 7-septate; asci less than 150 μm long, multispored ..... ***Carestiella socia***

– Ascospores and asci longer on average; ascospores with more than 10 septa; asci initially 8-spored, when mature filled with numerous part-spores **10**

10. Ascospores 100–130 × 5–6 μm, part-spores 1-celled, globose to discoid, 3–7 × 5–6 μm; apothecia black ..... ***Schizoxylon hemisphaericum***

– Ascospores more than 150 μm long and up to 2.5 μm broad, part-spores, if present, 1- to multiseptate, oblong; apothecia with grayish, white or yellowish pruina **11**

11. Excipular pigment dissolving in KOH and staining the medium bright yellow; ascospores regularly disarticulating into two-celled part-spores; predominantly on large herbaceous stems ..... ***Schizoxylon berkeleyanum***

– Excipular pigment not reacting with KOH; ascospores disarticulating or not; on wood and bark **12**

12. Ascospores ca 150–270 × 1.5–2.5 μm, disarticulating into 2–15-septate part-spores; asci ca 200–280 μm; margin without crystalline inclusions ..... ***Schizoxylon albescens*** [Palearctic taxon]

– Ascospores longer, not regularly disarticulating into part-spores; asci longer than 300 μm; margin with crystals ..... ***Schizoxylon alboatrum*** [Holarctic taxon]

13. Apothecia deep immersed, hockey stick-shaped in longitudinal section, with longer axis subparallel to substrate surface ..... ***Robergea cubicularis*** [Holarctic taxon]

– Apothecia erumpent, ± rounded in longitudinal section, oriented perpendicular to substrate surface ..... ***Ostropa barbara***

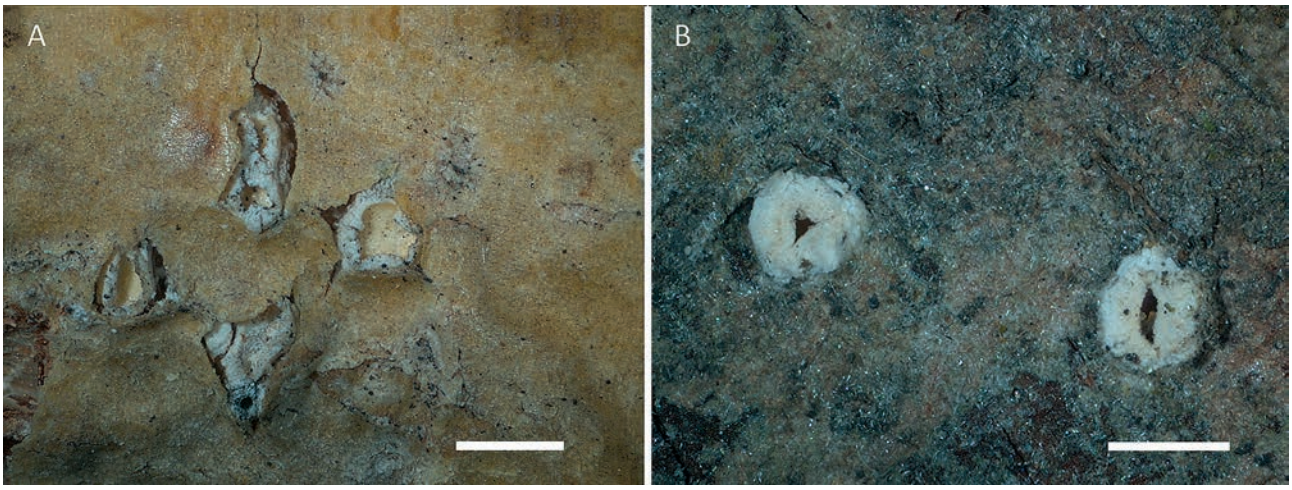

Figure 1 A – *Carestiella socia* Bres.; B – *Stictis carnea* Seaver & Waterston. Scale bar A, B = 1 mm

Carestiella socia Bres., Malpighia 11(6–8): 274. 1897 (Fig. 1A, 2)

This species is easily recognized by its multispored asci, relatively short, often falcate or sigmoid ascospores with 3–7 transverse septa, and peculiar structure of the excipular margin, which is composed of loosely interwoven brown thick-walled hyphae without crystalline inclusions. The only known specimen of *C. socia* in Russia was collected during Ryabushinsky's Kamchatka Expedition (1908–1909), but remained unidentified and was not mentioned in the expedition report (Tranzschel 1914). It fits well the detailed description of the species given by Wedin et al. (2006). In the material studied asci were predominately 16-spored, ca 80–90 × 10–15 μm. Ascospores 38–50 × 2–2.5 μm, with 3–7 septa.

Ecology. Saprotrophic on wood and bark of *Populus* and *Salix* spp., facultatively lichenized according to Wedin et al. (2006).

Distribution. This is the first report of *Carestiella socia* from Russia and Asia. Previously the species was reported from Europe (Italy, Sweden, Norway), and North America (Wedin et al. 2006).

Specimens examined: KAMCHATKA TERRITORY, Yelizovo District, between Malka and Ganaly, near the Shestaya River, on bark of *Salix* sp. [according to the label on 'vetla', a Russian name for some species of *Salix* subgen. *Salix*], VI.1909, V. P. Savicz s. n. (LE 172078).

Schizoxylon hemisphaericum (Fr.) DiCosmo, Nag Raj & W.B. Kendr., Can. J. Bot. 61(1): 44. 1983

Schizoxylon hemisphaericum was described by Fries (1823) as *Phacidium hemisphaericum* Fr. based on single collection made by Wormskjold in Kamchatka. DiCosmo et al. (1984) studied the holotype which is kept now in Fries's Herbarium in Uppsala (UPS) and argued that this species should be placed in *Schizoxylon*. They also provided a full description and illustrations of the type material.

Ecology. Saprotrophic on bark and wood of *Betula*.

Distribution: Known only from the type locality.

Stictis carnea Seaver & Waterston, Mycologia 33(3): 311. 1941 (Fig. 1B, 2)

Stictis carnea has apothecia with a general appearance similar to those of *S. radiata*, but differs in definitely broader ascospores

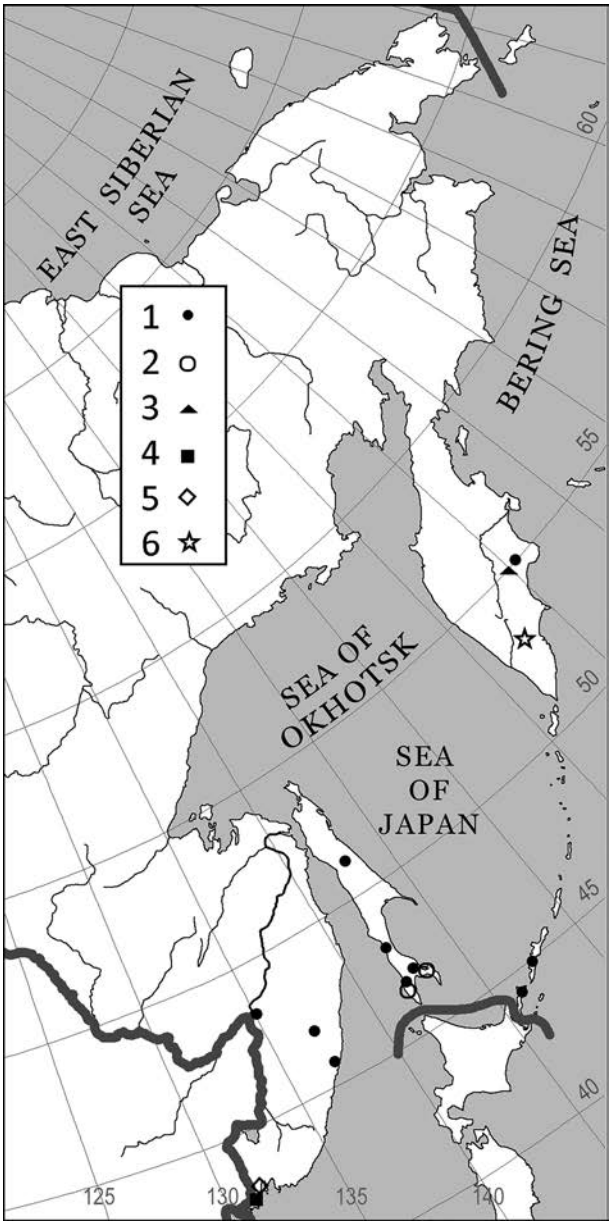

Figure 2 The distribution of genera *Stictis* and *Carestiella* in the Russian Far East: 1 – *Stictis radiata* Pers., 2 – *S. mollis* Pers., 3 – *S. populorum* (Gilenstam) Gilenstam, 4 – *S. carnea* Seaver & Waterston, 5 – *S. sphaeroboloides* (Schwein.) Ellis, 6 – *Carestiella socia* Bres.

with short, isodiametric to discoid individual cells. For a full description and illustrations, refer to Sherwood (1977).

Ecology. Saprotrophic on various woody substrates.

Distribution. Widely distributed in tropical areas. Known from Asia (Hong Kong, Philippines, Sri Lanka), Africa, South America, New Zealand (Sherwood 1977, Johnston 1983, Whitton et al. 1999). The record from this survey is the most northern known occurrence of the species (Fig. 2). This, however, is in good agreement with the relatively high diversity of taxa with tropical and subtropical biogeographic affinities in the flora of the southern Primorye Region of the Russian Far East (Kozhevnikov & Kozhevnikova 2014).

Specimens examined: PRIMORYE TERRITORY, Khasansky District, Kedrovaya Pad Nature Reserve, the Kedrovaya River valley, 43°06'00.5"N 131°33'32.3"E, on bark of *Acer* sp. 19.VIII.2005, EP (LE 323496).

Stictis mollis Pers., Mycol. eur. (Erlanga) 1: 337. 1822 (Fig. 2)

Stictis mollis is one of the three *Stictis* species (together with *S. confusum* and *S. populorum*), shown to occur on wood as a saprotroph, and on bark when lichenized (Wedin et al. 2006).

Stictis mollis is easily distinguished from the two other *Stictis* species with distinctly brown margins (*S. confusum* and *S. populorum*) by the comparatively narrow spores and the olivaceous, amorphous pigmentation of the uppermost part of the paraphyses (Wedin et al. 2006).

Ecology. According to Wedin et al. (2006) the saprotrophic form of the species inhabits decorticated thin dead branches or twigs of *Populus tremula* L. and *Salix caprea* L. in Sweden, Norway and Germany, while the lichenized form is usually developed on young, thin smooth-barked *Populus*-trunks in Sweden and Norway. The specimen reported by Muchnik et al. (2019) belongs to the lichenized form and grows on bark of young *Acer* sp. The two specimens examined as part of this study were collected on old, coarse bark of *Populus maximowiczii* Henry in mixed forests, and were not lichenized.

Distribution. The species is known from Greenland (Rostrup 1891), Norway, Sweden, Germany (Wedin et al. 2006), Spain (Malençon & Bertault 1972), Greece (Zervakis et al. 1999), Ukraine (Dudka et al. 2009), and North Africa (Malençon & Bertault 1969). In Russia it is known from the Ryazan Region (Muchnik et al. 2019), Novgorod Region (Popov 2012), Smolensk Region (Jaczewski 1895), Yaroslavl Region (Tranzschel & Serebrianikow 1912), Republic of Crimea (Tranzschel 1905), Krasnoyarsk Territory (Thümen 1880), Primorye Territory (Koval' 1972), Pskov Region, Karachayevo-Circassian Republic (this paper).

Specimens examined: SAKHALIN REGION, Sakhalin Island, Korsakov District, Tunaicha Lake surroundings, 46°48'07.4"N 143°06'15.7"E, mixed forest, on bark of *Populus maximowiczii*, 26.X.2017, AE (SAK 1675, LE); ibid., Nevelskiy District, Shebunino village surroundings, 46°26'09.2"N 141°54'12.5"E, alt. 13 m, mixed forest, on bark of *Populus maximowiczii*, 17.V.2016, AE (SAK 1676, LE).

Additional specimens examined: PSKOV REGION, Loknyanskiy District, Bashovo, 56°39'31.0"N 30°10'15.7"E, on bark of *Ulmus laevis* Pall., 17.VIII.2011, EP (LE 247491); ibid., Skokovo, 56°39'45.9"N 30°08'50.5"E, on wood of *Populus longifolia* Fisch. ex Loudon, 28.VII.2011, EP (LE 247555); Ivantsevo, 56°38'47.4"N 29°54'38.7"E, on wood of *Salix caprea* L., 13.VIII.2011, EP (LE 247493); ibid., Polistovsky Nature Reserve, Korolyova Borina 9 km N of Gogolevo, 57°04'40.5"N 30°32'52.0"E, on wood of *Populus tremula* L., 19.IX.2018, EP (LE 323495). KARACHAYEVO-CIRCASSIAN REPUBLIC, Karachayevsky District, Teberdinsky Nature Reserve, environs of Dombay, Amnauz valley, 43°18'26.6"N 41°38'04.1"E, on bark of *Salix caprea* L., 14.VIII.2012, EP (LE 247819).

Stictis populorum (Gilenstam) Gilenstam, Lichenologist 37(1): 74. 2005 (Fig. 2)

A detailed description of this species and differences from the closely related species was given by Wedin et al. (2006).

Ecology. A saprotroph on *Populus* wood, particularly on decorticated branches still remaining on the living trunks, or as a lichen in and around cracks in the bark of *Populus* spp. in northern Scandinavia (Wedin et al. 2006). Kamchatian specimen were found on twigs of *P. tremula* in the young spruce forest.

Distribution. In Russia this species was reported from the Murmansk Region (Urbanavichus 2014) and Republic of Komi (Hermansson et al. 2006). Originally known from Sweden (Wedin et al. 2006).

Specimen examined: KAMCHATKA TERRITORY, Eastern Kamchatka, Mil'kovo District, Kronotsky Nature Reserve, Levaya Shchapina River basin, right bank of the Levaya Shchapina River opposite to the mouth of the Ipuin River, on the hill, 55°07'04"N 159°57'41"E, 280 m, young spruce (*Picea jezoensis* Carrière subsp. *ajanensis* (Fisch. ex Carrière) Silba) forest with sparse grass and traces of burn, on dead twig of *Populus tremula*, 14.VIII.2009, DH, IS, K-15-09 (H).

Stictis radiata Pers., Observ. mycol. (Lipsiae) 2: 73. 1800 (Fig. 2)

A detailed description of the species and differences from the closely related taxa was provided by Wedin et al. (2006).

Ecology. The species has wide ecological niche (Wedin et al. 2006). In the Far East it is distributed in different types of forests, mainly near the water (along rivers, creeks and lakes), on bark or wood of *Picea*, *Pinus*, *Populus*, *Ulmus*, *Salix* and *Sorbus* spp.

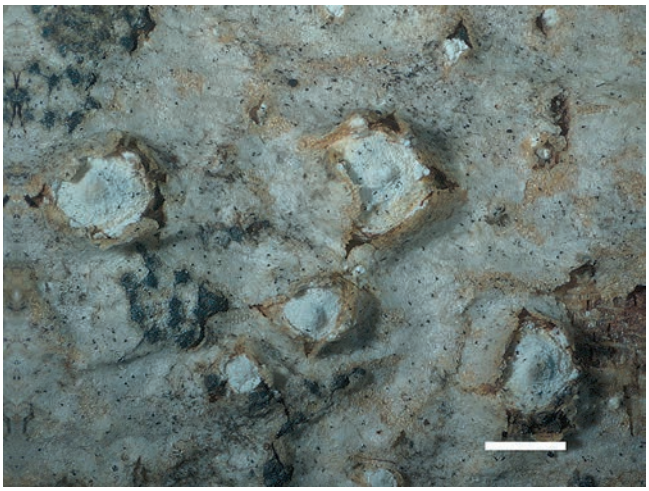

Figure 3 The apothecia of *Stictis sphaeroboloides* (Schwein.) Ellis. Scale bar = 1 mm.

Distribution. A rather common species in Russia, *S. radiata* was reported from Murmansk Region (Karsten 1866, Konoreva et al. 2016), Leningrad Region (Kuznetsova et al. 2012, Himelbrant et al. 2017), St. Petersburg (Weinmann 1828), Moscow (Martius 1817), Ulyanovsk Region (Churakov et al. 2015, Huseyin et al. 2016), Kaluga Region (Popov & Volobuev 2014), Chelyabinsk Region (Urbanavichene 2011), Sverdlovsk Region (Sirko 1976), Krasnodar Territory (Vasil'eva 1939, Urbanavichene & Urbanavichus 2014), Republic of Adygea (Vaasma et al. 1986), Krasnoyarsk Territory, Trans-Baikal Territory and Yakutia (Konoreva et al. 2016), Karachayevo-Circassian Republic (this paper). Cosmopolitan species widely distributed in Eurasia, Africa, North and South America Australia, and New Zealand (Rodway 1924, Sherwood 1977, Johnston 1983, Gamundí et al. 2004).

Specimens examined: KAMCHATKA TERRITORY, Eastern Kamchatka, Mil'kovo District, Kronotsky Nature Reserve, Levaya Shchapina River basin, 2.3 km SE to the mouth of the Ipuin River, right bank of the Ipuin River, 55°06'05"N 159°59'22"E, 280 m, *Populus suaveolens* Fisch. and graminoid dominated flood-plain forest near the river, on branch of *Picea jezoensis* subsp. *ajanensis*, 10.VIII.2009, DH, IS, K-10-09 (H); ibid., SW part of Askhachny Ridge, 2.2 km N to the mouth of the Ipuin River, SSE slope, 55°08'07"N 159°57'23"E, 300 m, spruce (*Picea jezoensis* subsp. *ajanensis*) forest with green mosses, on branch of *Picea jezoensis* subsp. *ajanensis*, 11.VIII.2009, DH, IS, K-11-09 (H). PRIMORYE TERRITORY, Terney District, Sikhote-Alin, valley of the Taratay creek, 45°42'00.4"N 136°39'48.6"E, *Pinus koraiensis* Siebold et Zucc. dominated forest mixed with broadleaved trees, on wood, 13.08.2010, EK, Prim-22 (LECB); ibid., Krasnoarmeysky District, neighborhood of the Tayozhny village, 45°41'22.6"N 136°13'12.5"E, cedar-spruce forest on the northern slope, on bark of *Picea* sp., 06.VII.2011, IG, T. 412 (KRABG); KHABAROVSK TERRITORY, Khabarovsk District, Bolshekhekhtsirsky Reserve, Bykov River, neighborhood of the cordon Bychikha, 48°14'17.3"N 134°48'49.8"E, 283 m, coniferous-deciduous forest, on branch of *Picea* sp., 29.IX.2018, SCh (LE); ibid., neighborhood of the cordon Sosninsky, Sosninsky creek, 48°14'16.8"N 134°46'41.7"E, 408 m, *Ulmus* sp.–*Betula* sp. forest with *Picea* sp., on branch of *Picea* sp., 01.X.2018, SCh (LE). SAKHALIN REGION, Sakhalin Island, Dolinsky District, neighborhood of the Sokol settlement, Belaya River, 47°15'14.5"N 142°48'21.9"E, 99 m, *Salix* sp. flood-plain forest, on bark of *Salix* sp., 08.V.2017, LK (LE); ibid., 47°15'13.0"N 142°48'12.0"E, 87 m, on wood of *Salix* sp., 08.V.2017, SCh (LE); ibid., 47°15'00.3"N 142°47'33.3" E, alt. 56 m, riparian forest, bark of *Salix udensis* Trautv., 08.V.2016, AE (SAK 1301, 1303, 1304, 1305); ibid., Yuzhno-Sakhalinsk city surroundings, Mitsul' Mountain, 47°03'02.3"N 142°30'39.5"E, alt. 536 m, dark coniferous forest with *Betula ermanii* Cham., on bark of *Sorbus commixta* Hedl., 26.V.2012, AE (SAK 1296); ibid., Tomarinsk District, near Ainskoe Lake, 48°27'03.7"N 142°04'01.6"E, alt. 4 m, mixed forest, on bark of *Picea jezoensis* (Siebold & Zucc.) Carrière, 15.IX.1997, ST (SAKH); ibid., Tymovskiy District, Pilenga River, 51°04'52.4"N 142°44'14.5"E, alt. 119 m, riparian forest, bark of *Populus maximowiczii*, 04.VI.2017, AE (SAK 1297, 1298, 1299); ibid., 51°01'45.7"N 142°50'33.7"E, alt. 154 m, riparian forest, on bark of *Ulmus laciniata* Trautv., 05.VI.2017, AE (SAK 1302); Iturup Island, Ostrovnoy Reserve, Odessky Bay, 44°47'58.7"N 147°13'46.5"E, 17 m, *Abies* sp. forest with *Sasa kurilensis* (Rupr.) Makino & Shibata, on decayed wood of *Sorbus* sp., 13.VIII.2017, LK (LE); Kunashir Island, proximity of Lagunnoe Lake, 44°02'50.2"N 145°46'01.6"E, alt. 79 m, old-growth mixed coniferous/broadleaved forest, on bark of *Ulmus laciniata*, 08.I.2017, AE (SAK 1300).

Additional specimens examined: KARACHAYEVO-CIRCASSIAN REPUBLIC, Karachayevsky District, Teberdinsky Nature Reserve, environs of Dombay, Amnauz Valley, 43°18'26.6"N 41°38'04.1"E, on coniferous wood, 14.VIII.2012, EP (LE 247817); ibid., on wood of *Picea orientalis* (L.) Peterm., 14.VIII.2012, EP (LE 247818).

Stictis sphaeroboloidea (Schwein.) Ellis, N. Amer. Fung., Ser. 1: no. 463. 1881 (Fig. 2, 3)

This species is well characterized by erumpent apothecia that remain closed by crystalline layer of ascomatal wall for a long time, and paraphyses with inflated brown apices.

Ecology. Saprotrophic on wood and bark of deciduous trees and shrubs, typically on *Quercus* (Sherwood 1977).

Distribution. The species was previously known from eastern North America, where it is quite common (Sherwood 1977). The record in Russian Far East thus is another example of a 'Grayan disjunction' between eastern Asia and eastern North America, which is well known in plants (Li 1952, Graham 1972, Davidse 1983, Wen 1999), and not uncommon in fungi (Culberson 1972, Wu & Mueller 1997, Kovacs et al. 2008, Vasilyeva & Stephenson 2010).

Specimens examined: PRIMORYE TERRITORY, Khasansky District, Kedrovaya Pad' Nature Reserve, the Kedrovaya River valley, near the mouth of the 1st Zolotoy creek, 43°06'31.9"N 131°31'59.3"E, on bark of *Fraxinus mandshurica* Rupr., 20.VIII.2005, EP (LE 323498).

DISCUSSION

Symbiotic associations with photosynthetic partners most probably were established and lost independently multiple times in different clades of Ascomycota (Hawksworth 2015), thus many ascomycete taxa include both lichenized and nonlichenized species. The family Stictidaceae is one of the textbook examples of this complexity. It accommodates 54 lichenized species from 13 genera (Lücking et al. 2016) and a number of nonlichenized (Wedin et al. 2005). The level of lichenization in the family varies widely not only at the genus level, but also at the species level, i. e. lichenized and non-lichenized individuals can be found even within one fungal species. This results in lack of attention or neglecting the whole family or certain genera either by lichenologists or by mycologists. In traditional scientific practice the collections of lichenized and nonlichenized species from the same families or even genera are kept in different herbarium compartments (lichenological and mycological, respectively), many specialists poorly know 'alien taxa', 'alien herbaria', and 'alien literature' or even are not interested in 'mixed taxa'. Predictable result of this 'independence' is the producing of 'new records', already successfully published before, as well as lack of our knowledge on such groups.

Our present paper summarizes data on known diversity of the closely related (Wedin et al. 2005) genera *Carestiella*, *Schizoxylon*, and *Stictis* in Russian Far East. Some data are based on recent collections of the authors (*Stictis carnea*, *S. mollis*, *S. populorum*, *S. radiata*, *S. sphaeroboloides*), others are received from the revision of the herbarium samples (*Carestiella socia*), or previously published in mycological papers, like *Schizoxylon hemisphaericum* (DiCosmo et al. 1984). However, Russian Far East is a huge territory, which still remains underexplored, so far we expect that other species can be found there in course of further research. Therefore, our key includes all the species known in Russia at present time, and hopefully can be used in wider territory than Far East only.

The species discussed here are known to have different level of lichenization: saprotrophic – *Schizoxylon hemisphaericum* (DiCosmo et al. 1984), *Stictis carnea* (Sherwood 1977), *S. radiata* (Wedin et al. 2006), and *S. sphaeroboloides* (Sherwood 1977); saprotrophic, but possibly facultatively lichenized depending on a substrate – *Carestiella socia* (Wedin et al. 2006); saprotrophic and clearly lichenized depending on a substrate – *Stictis mollis* (Wedin et al. 2006) and *S. populorum* (Wedin et al. 2006). However, there are still a lot of questions to the trophical strategies of these taxa to be solved using special methods. For instance, it is not clear yet, if the lichenized Stictidaceae, use photobiont as the only source of nutrients, or they get organic compounds also from the substrate (e. g. bark of tree).

Our research clearly shows importance of the collaboration between mycologists and lichenologists to study trophically complex taxa and to gain a better understanding of fungal diversity.

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