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ON THE DISTRIBUTION OF *CONOCEPHALUM CONICUM* AND *C. SALEBROSUM* (MARCHANTIOPHYTA) IN RUSSIA

К РАСПРОСТРАНЕНИЮ *CONOCEPHALUM CONICUM* И *C. SALEBROSUM* (MARCHANTIOPHYTA) В РОССИИ

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Abstract

The *Conocephalum conicum*–group is revised in Russia basing on the narrow species concept. A key to species of the genus *Conocephalum*, illustrations, and a comparison of *C. conicum* (L). Dumort. with *C. salebrosum* Szweyk., Buczk. & Odrzyk. are given. On the base of the revision of 243 samples the distribution of both taxa in Russia is given.

Резюме

Проведена ревизия видов, входящих в комплекс *Conocephalum conicum* в соответствии с современным пониманием их объема. На основе изучения образцов (243) с территории России уточнено распространение *C. conicum* (L). Dumort. s.str. и *C. salebrosum* Szweyk., Buczk. & Odrzyk. Приведены основные диагностические признаки, а также рисунки этих видов, дан ключ для определения видов рода *Conocephalum* в России.

KEYWORDS: *Conocephalum conicum, Conocephalum salebrosum,* Hepaticae, Russia, taxonomy

Introduction

Conocephalum salebrosum Szweyk., Buczk. & Odrzyk. was recently described by Szweykowski et al. (2005). Among 324 specimens studied by authors of description, two specimens from Russia were identified as *C. salebrosum* (from Far East and Kaliningrad Province). After this publication *C. salebrosum* was recorded from several provinces of central and northern parts of european Russia (Borovichev & Kokoshnikova, 2008; Borovichev & Konstantinova, 2009; Dulin, 2008; Potemkin & Kotkova, 2008; Potemkin et al., 2008). However, the current distribution of *C. salebrosum* and *C. conicum* (L). Dumort. s. str. in Russia remains poorly known.

We studied specimens of *Conocephalum conicum*–group in KPABG, LE, MHA, PZV, H, TUR and OULU. Altogether 243 specimens were revised, revealing the ecology and distribution as well as morphological variability of two species in their current circumscriptions.

Discussion

As it was stressed by Szweykowski et al. (2005), the distinction of *C. conicum* and *C. salebrosum* is complicated. The best diagnostic feature is the structure of pores of the archegoniophore «head», but the latter are rarely present among revised specimens. The most important characters of sterile plants are: the structure of dorsal thallus surface including limits between particular air chambers and texture of the dorsal surface of the thallus; the number of air

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chambers between costa and margin of the thallus; the number of rows of hyaline cells at the margin of the thallus; the junction of air chamber wall with dorsal epidermis and the shape of hyaline apical cells underlying the pores. However the broad variability of these characters was found by Szweykowski et al. (2005) as well as in the present study (Table 1).

The feature of the thallus that allows to identify samples in the field is the structure of dorsal thallus surface. Microscopically the most useful are the width of hyaline margin of the thallus (in *C. conicum* (2-)3-4(-5) rows of elongated hyaline cells and in *C. salebrosum* 1-2 rows, sometimes lacking) and junction of air chamber wall with dorsal epidermis (in *C. conicum* the highest cell of air chamber wall reaches dorsal epidermal cells but is not inserted between them and in *C. salebrosum* the highest cell of air chamber wall is inserted between dorsal epidermal cells, cf. Figs. 1-5 and 1-11) are most reliable. The number of air chambers between costa and thallus margin (in *C. conicum* (3-)5-7(-9) and in *C. salebrosum* (3-)4-5(-7) and shape of the hyaline apical cells underlying the pores have very low diagnostic significance. Variability of two taxa based on Szweykowski et al. (2005) and our study are shown in more details in the Table 1.

KEY TO SPECIES OF *CONOCEPHALUM* IN RUSSIA

1. Thallus two to three times dichotomically branching, 1-3(-5) cm long and 3-6 mm wide; brown-green to pale brown-yellow, in the autumn becoming yellow-brown and even whitish; pores ellipsoidal; hyaline apical cells of assimilators under stomata finger-shaped; Far East ..... *C. japonicum* (Thunb.) Grolle
1. Thallus dichotomically branched, (1-)2-10(-20) cm long and 5-30 mm wide; pores rounded; yellowish-green or aeruginose to dark; hyaline apical cells of assimilators under stomata flask-shaped or pyriform 2
2. Dorsal surface of thallus indistinctly reticulate; outer epidermal cell walls slightly inflatedflat; highest cells of air chamber walls usually not inserted into epidermal layer; hyaline margin of thallus broad, usually consisting of (2-) 3-4(-5) cell rows *C. conicum*
2. Dorsal surface of thallus distinctly reticulate; outer epidermal cell walls distinctly inflated, giving epidermis verrucose appearance; highest cells of air chamber walls inserted between epidermal cells; hyaline margin of thallus narrow, usually consisting of 1-2 cell rows or sometimes lacking .. *C. salebrosum*

DISTRIBUTION AND ECOLOGY

According to Szweykowsky & al. (2005), *C. salebrosum* is a holarctic species occurring in Europe, East Asia and North America, whereas *C. conicum* is considered to be restricted to Europe only.

According to our data *C. conicum* is more widespread. It was found in Urals and in mountains of South Siberia, but eastwards of Baikal area (Khamar-Daban Range) it was not registered yet. All records of this species from the Russian Far East apparently should be referred to *C. salebrosum.* In European Russia *C. conicum* was collected in 8 of 51 administrative units and seems to be less frequent than *C. salebrosum*, which was registered in 26 of 51 provinces of European part of Russia. In spite of quite a large number of specimens studied it is difficult to find out differences in distribution patterns of these species in Europe. According to our data, *C. salebrosum* penetrates to more northern areas, e.g. in Arctic in Nenets Autonomous Distict, whereas the most northern locality of *C. conicum* is restricted to Subarctic (Murmansk Province).

In mountains, *C. conicum* was not found above 1080 m evel., and more often it has been collected below 600 m. At the same time, *C. salebrosum* is known at higher elevations: e.g. in Caucasus it reaches 2100 m, although more frequently occur between 400 and 1500 m. So, *C. salebrosum* can be characterized as an arcto-boreal circumpolar species, whereas *C. conicum* is predominantly a boreo-temperate euro-siberian element.

Ecological preferences of both species are quite similar, moreover, they can grow intermingled (such specimens are marked in the list of specimens by asterisk, *). Both species occur as extensive mats along stream sides, bases on moist rocks and cliffs occupying sometimes several square meters. They grow on different substrates including soil, rocks, fine earth and

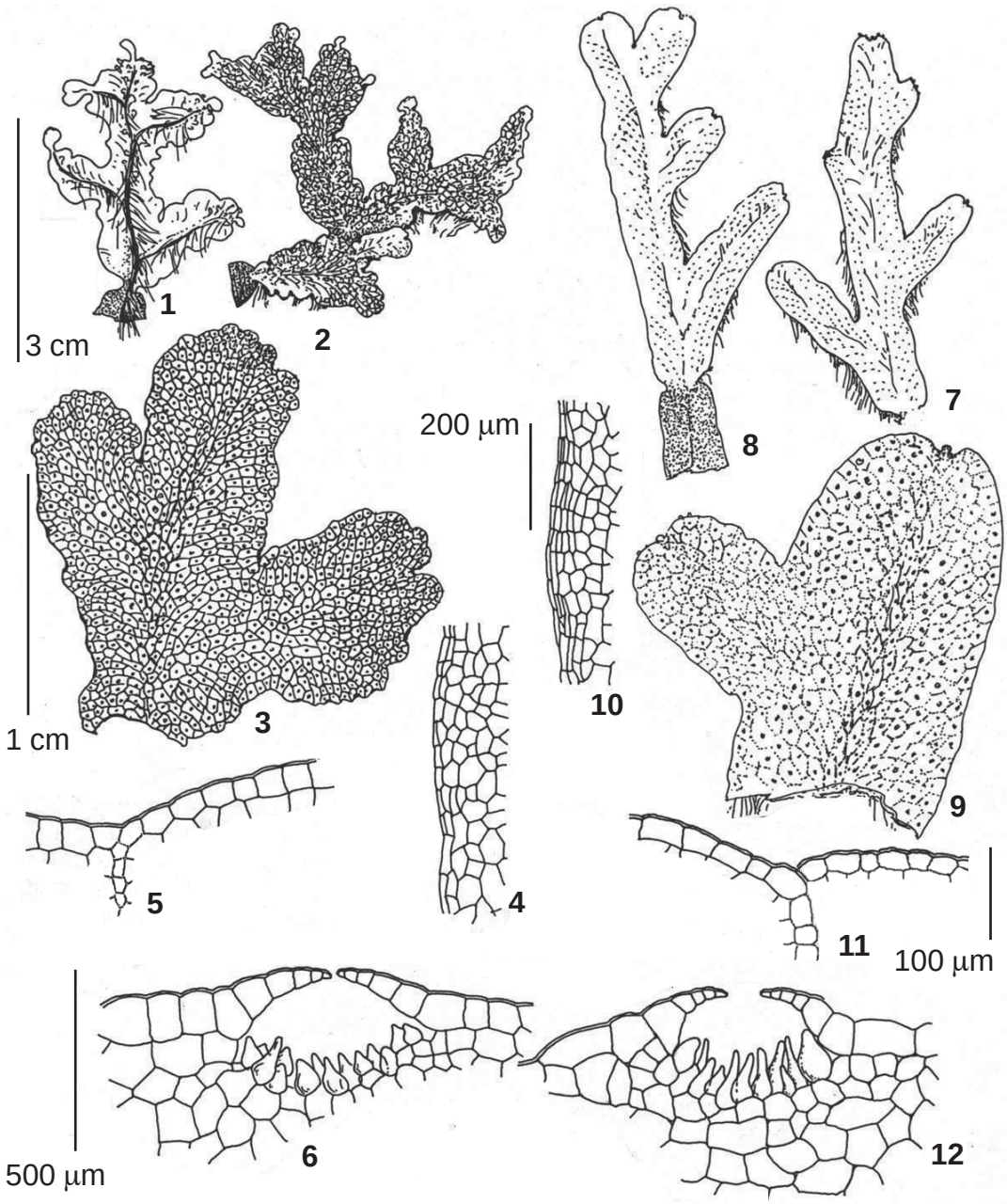

Fig. 1. Diagnostic characters of sterile thallus of *Conocephalum salebrosum* Szweyk., Buczk. & Odrzyk. (1-6) and *C. conicum* (L.) Dumort. (7-12). 1,2,6,7 – habit; 3, 8 – texture of thallus dorsal surface; 4, 9 – hyaline margin of thallus; 5, 10 – junction of air chamber wall with epidermis; 6, 12 – shape of the hyaline apical cells underlying the pores. Scale bars: 3 cm for 1, 2, 6, 7; 1 cm for 3, 8; 500 μm for 6,12; 200 μm for 4, 10; 100 μm for 5, 11.

decaying wood. Both species prefer soils rich in humus and high pH, but *C. conicum* seems to be more strongly restricted to calcareous substrates. It occupies large areas on cliffs in deep canyons, especially near waterfalls, whereas *C. salebrosum* grows in less shaded habitats and often occurs near springs and streams. Szweykowski et al. (2005) indicated that *C. salebrosum* is more tolerant to desiccation than *C. conicum*.

Selected specimens examined: * – mixed collections of both species; S+ – specimens with archegoniophores.

Conocephalum conicum

EUROPEAN RUSSIA: NW Murmansk Prov.: Pechenga River, 6.VIII.1936 *Häyren E.* (H); Ponoy, 3.VIII.1972 *Schlyakov R.N.* (KPABG 5632); Lapland State Reserve, Sal'nye Mnts., 28.VII.2007 *Borovichev* (KPABG 18154); Kutsa Sanctuary, VIII.1986 *Konstantinova* (KPABG 5635, 5636*); Republic of Karelia: Louchskij Disct., Paanajarvi National Park, 26.VII.1998 *Bakalin V.A.* (KPABG 109387); Suojarvi Disct., 16.VIII.1939 *Tuomikoski R.* (H); Pudozhskij Disct., 27.IV.2002 *Bakalin* (KPABG 102569*); Petrozavodsk, 12.V.1998 *Bakalin V.A.*, *Bakalina L.N.* [Bryophyta Karelica Exsiccata, 1998, # 3] (KPABG 112316); NE Arkhangelsk Prov.: Pinega State Reserve, 7.VIII.1988 *Ignatov M.S.* (MHA); C Moscow Prov., Zagorskij Disct., 25.VII.1985 *Ignatov* (MHA); Ruzskij Disct., 16.V.1984 *Ignatov* (MHA*); Serpukhovskij Disct., Priokscko-Terrasnyj State Reserve, 22.IX.1987 *Ignatov* (MHA); Republic of Mari-El: Bol'shay Kokshaga State Reserve, 16.IX.2004 *Konstantinova* (KPABG 108097); N-Ur Republic of Komi: Troitsko-Pecherskij Disct., 18.VI.1985 *Zheleznova* (KPABG 100729); Perm's Prov.: Basegi State Reserve, IX.2004 *Konstantinova* (KPABG 108401); **CAUCASUS**: Krasnodar Territory: Tuapse Disct., Tuapse 12.IX.1995 *Kostyleva N.V.* (MHA*); Caucasian State Reserve, IX.2008 *Konstantinova* (KPABG 100885*, 112838, 112768); 19.09.2009 *Konstantinova, Savchenko* (KPABG K-116-09*), 4.10.2009 *Konstantinova, Savchenko* (KPABG K-177-2-09^{s+}); **SIBERIA**: SIB-S Republic of Altai: Kayra River, 18.VII.1993 *Ignatov* (MHA 35-55); Republic of Tuva: Todzha Valley, VII.1999 *Bakalin* (KPABG 100885, 100841); Republic of Buryatya: Khamar-Daban Ridge, Baikalskij State Reserve, 8.VIII.2001 *Konstantinova* (KPABG 102448, 109897*).

Conocephalum salebrosum

EUROPEAN RUSSIA: ARC Nenets Autonomous Area: North Timan, 18.VIII.2008 *Dulin* (KPABG 112315); NW Murmansk Prov.: Rybachij Peninsula, 17.VII.1978 *Konstantinova* (KPABG 5630); Pechenga River 3.VII.1938 *Alava R.* (H; TUR 031459); Lapland State Reserve, Sal'nye Mts., VIII.2007 *Borovichev* (KPABG 18380); Kutsa Sanctuary, Pyhukuru, *Konstantinova* (KPABG 5636*); Republic of Karelia: Louchskij Disct. Paanajarvi National Park, 23.VIII.1933 *Kotilainen M.* (H); Kaleval'skij Disct., 16.VII.1998 *Bakalin* (PTZ); Pudozhskij Disct. 27.IV.2002 *Bakalin V.A.* (KPABG 102569*); Petrosavodsk, 16.X.2005 *Maksimova, Maksimov* (PTZ 05-11); Leningrad Prov.: St. Petersburg, conservatory of Botanical Institute RAS, 29.V.1932 *Ladyzhenskaja K.I.* (LE); Podporozhskij Disct., 23.IV.1943 *Ruotsalo R.* (H^{s+}); Luzhskij Disct.,11.VIII.1926 *Ganeshin S.S.* (LE); Volosovskij Disct., 14.V.1985 *Ignatov* (MHA); NE Arkhangelsk Prov.: Holmogorskij Disct., 28.V.1917 *Savich L.I., Savich V.P.* (LE); Pinegskij State Reserve, 30.VII.1988 *Ignatov* (MHA); KLN Kaliningrad Prov.: 24.VII.1907 *Mikutowicz J.* (H); C Vologda Prov.: Belozerskij Disct., 14.VII.1956 *Metelkova T.A.* (H 3169756, LE); Sokol Disct., 22.IX.1990 *Ignatov* (MHA); Novgorod Prov.: Perevozskij Disct., 15.VIII.1937 *Smirnova A.* (LE); Valdajskij Disct., 4.V.1980 *Morozova O.V.* (MHA); Pskov Prov.: Dnovskij Disct., 3.V.1940 *Abramov I.I.* (LE), 31.V.1940 *Abramova A.A.* (LE); Tver Prov.: 26.VI.1923 *Andreev V.N.* (LE); Nizhnij Novgorod Prov.: Lubitinskij Disct., 13.IX.1957 *Kil'dushevskij I.D.* (LE); Vladimir Prov.: Gorochoveckij Disct., VI.2007 *Kokoshnikova Y.S.* (KPABG 112312); Melenkovskij Disct., 8.V.2008 *Kokoshnikova* (KPABG 112313); Voronezh Prov.: Semilukskij Disct., 18.IX.1989 *Popova N.N.* (LE); Moscow Prov.: Park Filevskij, 2.V.1985 *Ignatov* (MHA^{s+}); Dmitrovskij Disct., 14.V.1986 *Ignatov* (MHA); Ruzskij Disct., 16.V.1984*, 25.IV.1985 *Ignatov* (MHA^{s+}); Serpukhovskij Disct., Priokscko-Terrasnyj State Reserve, 18.VI.1996 *Ignatov* (MHA); Kursk Prov.: Oboyan Disct., Centralno-Czernozemnyj State Reserve, 20.V.1999 *Ignatov* (MHA); Kirov Prov.: Nolingskij Disct., 22.VII.1925 *Razumin M.* (LE); Republic of Tatarstan: Kazan', 4.VIII.1882 *Krylov P.N.* (LE); Volzhsko-Kamskij State Reserve, 4.X.2004 *Ignatov, Ignatova* (MHA 05-2242); N-UR Republic of Komi: Vorkutinskij Disct., 1.VII.2008 *Dulin (*112055); Troitsko-Pecherskij Disct. 10.VI.1985, *Zheleznova* (KPABG 100529); Perm's Prov.: Kudymkarskij Disct., 1932 Vasil'eva (LE); Vishera State Reserve, 11.VII.2004 *Konstantinova* (KPABG 108114); Basegi State Reserve, IX.2004 *Konstantinova* (KPABG 108294); S-UR Republic of Bashkortostan: Byrzyan Disct., 10.IX.1990 *Ignatova* (MHA 11-78); SE Samara Prov.: Volzhskij Disct., 21.VII.1926 *Stunkenberg E.Yu.*, Zhigulevskij State Reserve, 27.V.1928 *Sprigin I.* (LE); **CAUCASUS:** Republic of Kabardino-Balkaria: Belaya River, 25.VIII.2005 *Ignatov, Ignatova*, *Kharzinov.* (MHA 05-1790); Dumala River, 21.VIII.1987 *Portenier N.N., Portinier E.B.* (MHA); Republic of Karachaevo-Cherkessia: Teberda State Reserve, IX.2005 *Konstantinova* (KPABG 109729); Krasnodar Territory: Anapa Disct., Malyj Utrish Surroundings, 4.V.2005 *Ignatov, Ignatova* (KPABG 109429); Tuapse Disct., Tuapse, 12.IX.1995 *Kostyleva* (MHA*); Caucasian State Reserve, Chosta Branch, 12.VIII.2002 *Ignatov, Ignatova.* (KPABG

Table 1. Comparison of *Conocephalum conicum* and *C. salebrosum (*# – after Szweykowski et al., 2005)

Character	*C. conicum*	*C. salebrosum*
	Dorsal surface of thallus	
Colour purplish	yellowish-green, sometimes aeruginosus	yellowish-green to dark-green, sometimes
Shine	glossy	dull
Borders between air chambers	inconspicuous	conspicuous
Junctions of air chambers	on the same levels with thallus surface	in shallow depressions in thallus
Reticulation	not clear	clear
Outer epidermal cell walls	slightly inflated	distinctly inflated, giving to epidermis warted appearance
Junction of air chamber wall with dorsal epidermis	highest cell of air chamber wall reaches dorsal epidermal cells but is not inserted between them	highest cell of air chamber wall is inserted between dorsal epidermal cells
Number of rows of hyaline cells at margin of thallus	(2-)3-4(-5) / [3-4]#	1-2, sometimes lacking / [1-2]#
Margin of thallus	plane or rarely recurved	undulate or recurved
Number of air chambers between costa and margin	5–7(-9) / [6–8, rarely less]#	(3-)4-5(-7) / [4-5, rarely more]#
	Ventral surface of thallus	
Colour of ventral surface	lightly reddish	purplish
Colour of ventral scales	rose to reddish-brown, rarely colourless	more or less reddish-brown
Colour of rhizoids	whitish to reddish	frequently milky-white
	Archegoniophore#	
Stomata of «head», μm	66–121 x 33-77	99–165 x 44–88
Lowest cells of stomata of «head»	relatively short and variously oriented	elongate and arranged parallelly to long axis of stomatal apparatus, forming rather distinct fascicle
Epidermis of air chamber	bistratose	unistratose

112839*, 112840); Guzeripl, X.2007 *Konstantinova* (KPABG 111734); **SIBERIA**: SIB-S Republic of Altai: Teletzkoe Lake, Koldor, Bolschoj Istube River, 26.IV.1977 *Zolotukhin N.I.* (MHA^{s+}); Samysch River, 26.IV.1977 *Zolotukhin* (MHA^{s+}); Bolschoj Schaltan River, 7.VI.1989 *Zolotukhin* (MHA^{s+}); Republic of Tuva: Todzha Valley, 13.VII.1999 *Bakalin* (KPABG 100890, 100885*); Republic of Buryatia: Khamar-Daban Ridge, Baikalskij State Reserve, VIII.1999 *Bakalin* (KPABG 109897*, 102856); **FAR EAST**: KAM Kamchatka Prov.: northern Kamchatka, 14.VII.2003 *Bakalin* (KPABG 105408); central Kamchatka, 28.VIII.2001 *Bakalin* (KPABG 103901); southern Kamchatka, 22.VIII.2001 Bakalin (KPABG 103787); Eastern of Kamchatka, 23.V.2004 *Bakalin* (KPABG 107806^{s+}, 107811^{s+}); Commander Archipelago: Mednij Islands, 1.VII.2004 *Bakalin* (KPABG 106678); Northern Kurils: Paramushir Islands, VII.2004 *Bakalin* (KPABG 107433); AMU Khabarovsk Territory: Ul'chskij Disct., 3.IX.1976 *Alanko P.* (H), Khabarovskij Disct., 11.IX.1976 *Alanko* (H); SAKH Sakhalin Prov.: South Sakhalin, VII.2001 *Harpel J.A.,*

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