Nephromopsis ornata (Parmeliaceae, lichenized Ascomycota) — a new species to Siberia

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Abstract. The discovery of a new for Siberia suboceanic nemoral lichen *Nephromopsis ornata* is reported. All collected specimens fully correspond to the morphological description of the species and differ from other representatives of the genus in the light-yellow color of the medulla. The new locality is more than 1500 km away from the previously known ones. The habitat conditions and associated species are described. Within the surveyed area, there are also other East Asian lichens with disjunctive ranges — *Dolichousnea diffracta* and *Parmelia shinanoana*. At present, this is the extreme northwestern locality of *Nephromopsis ornata*.

Keywords: biodiversity, biogeography, lichens, new records, Russia.

Nephromopsis ornata (Parmeliaceae, лихенизированные Ascomycota) — новый вид для Сибири

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Резюме. Сообщается о находке нового для Сибири субокеанического неморального лишайника *Nephromopsis ornata*. Все собранные образцы полностью соответствуют морфологическому описанию вида и отличаются от других представителей рода светло-желтой окраской сердцевины. Новое местонахождение находится более чем в 1500 км от ранее известных. Описаны условия местообитания и сопутствующие виды. В пределах обследованной территории, кроме указанного вида, встречаются и другие восточноазиатские лишайники с дизъюнктивными ареалами — *Dolichousnea diffracta* и *Parmelia shinanoana*. В настоящее время это крайняя северо-западная точка ареала *Nephromopsis ornata*.

Ключевые слова: биогеография, биоразнообразие, лишайники, новые находки, Россия.

The lichen genus *Nephromopsis* Müll. Arg. is a genetically isolated phylum of cetrarioid lichens from the family Parmeliaceae Zenker (Divakar *et al.*, 2017). Recent studies of the genus *Nephromopsis* in the Eastern Asia including China, Japan, Russia, and South Korea have made a great progress in our understanding of the diversity of this genus in the region and in the world. The genus comprises 19 species worldwide, 10 of which occur in Russia (Thell *et al.*, 2005; Randlane, Saag, 2022). In Southern Siberia, two species were known before our study: *N. komarovii* (Elenkin) J. C. Wei and *N. laureri* (Kremp.) Kurok. In addition, the only locality of *N. rugosa* Asahina in Mongolia is known from collection made in 1968 (Golubkova, 1981).

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Nephromopsis ornata (Müll. Arg.) Hue is a rare nemoral suboceanic foliose lichen that forms a distinct monophyletic group within the genus (Randlane, Saag, 1998). The general distribution of the species (Fig. 1) is limited to East Asia — China, provinces of Hunan, Guizhou, the Guangxi Juan Autonomous Region (Wei, 1991), Taiwan (Lai, 1981), South Korea (Park, 1990), and Japan, Honshu and Hokkaido (Kurokawa, 1980). In Russia, the species is located on the northern border of its range, and until now it was known in the Far East only: Primorye Territory, Sikhote-Alin Range (Skirina, 1995, 1998; Tchabanenko, 2002); the Sakhalin Region, Shikotan (Chesnokov, Konoreva, 2022), Iturup, Kunashir (Tchabanenko, 2002), Sakhalin (Tchabanenko, 2014) islands; the Jewish Autonomous Region, Maly Khingan, Sutarsky, and Bureinsky ranges (Skirina, 2003); southern part of the Khabarovsk Territory (Skirina *et al*., 2007); the Amur Region, Tukuringra Range (Makry, Stetsura, 1987). The distribution of the species suggests that it prefers to grow in wet forest areas in the floodplains at low elevations. The species inhabits coniferous, mixed coniferous-broadleaved, occasionally deciduous forests, where it grows on the bark of pines, birches, and also on mossy boulders. Outside oceanic areas, this species is mainly an epiphyte of conifers in humid conditions. *Nephromopsis ornata* is rare throughout its area, found in individual thalli, sometimes in small populations. The species is protected in many nature reserves of the Far East and is included in the Red Data Books of the Jewish Autonomous Region (Krasnaya..., 2019a), Khabarovsk Territory (Krasnaya..., 2008a), Primorye Territory (Krasnaya..., 2008b), and the Sakhalin Region (Krasnaya..., 2019b).

Our study area lies within the Vitimsky State Reserve (Irkutsk Region) along the southern shore of Lake Oron and the northern foothills of the Kodar Range. The climate is characterized by frequent changes in air masses, sharply continental with a short frost-free period. The annual rainfall does not exceed 350 mm. However, the large area of the water surface of the tectonic lake (length 24 km, width 5–6 km) and its great depth (184 m) are the cause of special microclimatic conditions. Old-growth (over 200-year-old) dark coniferous forest has no traces of logging or fires. Forest stand is formed by *Picea obovata* Ledeb., *Betula platyphylla* Sukaczev, and *Sorbus aucuparia* L. subsp. *sibirica* (Hedl.) Krylov. The ground vegetation is dominated by *Pinus pumila* (Pall.) Regel and *Ledum palustre* L., as well as a variety of mosses, liverworts, and lichens.

Material and Methods

Field work was carried out in July 2022 by the author using the standard route method with detailed study of selected localities (Flora..., 2014). The size of the studied locality is about 1 km^2. Associated species were collected on all substrates where *Nephromopsis ornata* was found.

The morphological and anatomical features of the specimens were examined by standard methods of light microscopy (Flora..., 2014). The investigation of lichen substances was not necessary because all the studied species can be easily

distinguished by anatomy and morphology as well as by standard spot tests with KOH and $C_6H_4(NH_2)_2$.

Investigated specimens are stored in the herbarium of Irkutsk State University (IRKU). The nomenclature of taxa follows Esslinger (2021) and Flora... (2022).

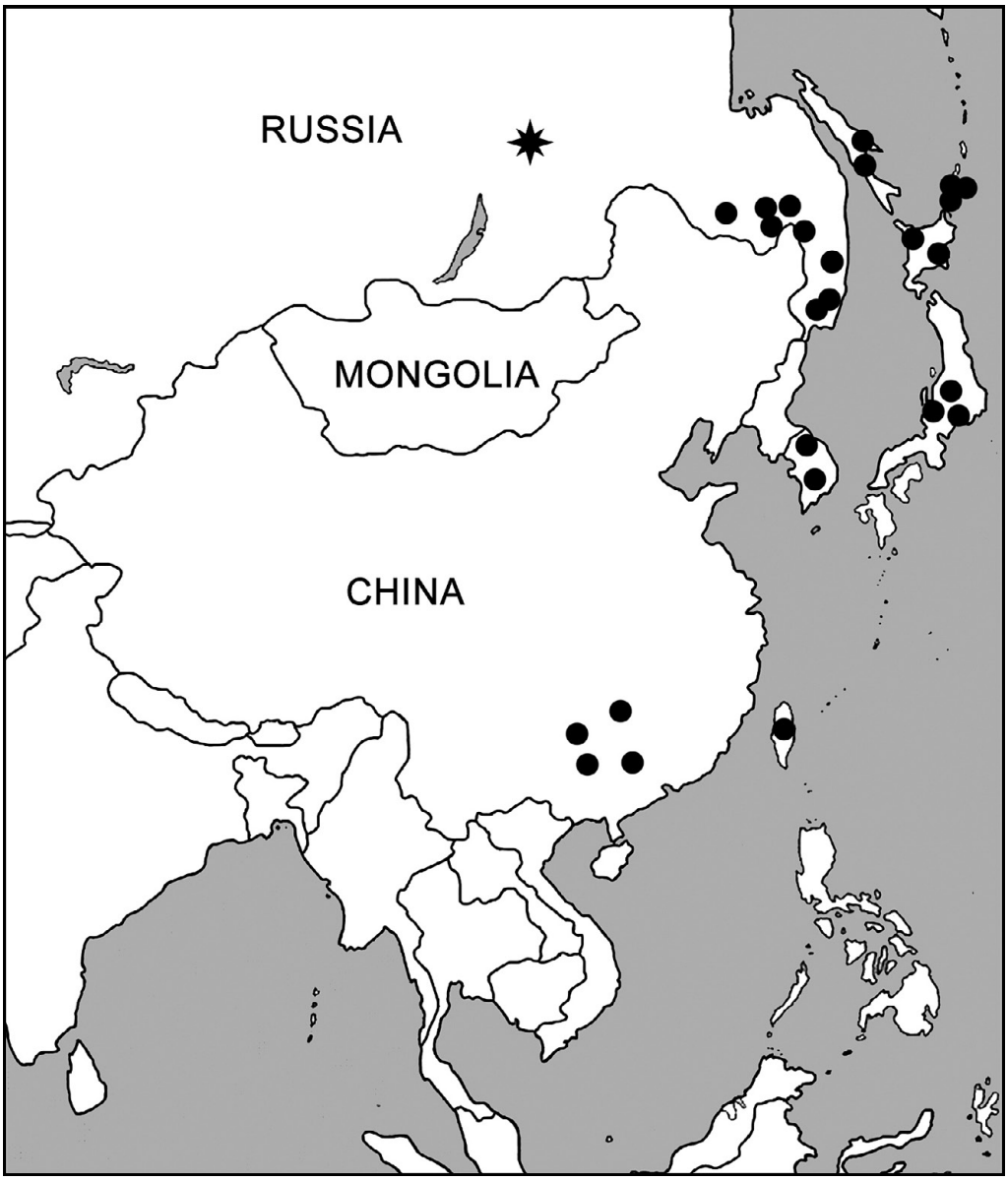

Fig. 1. World distribution of *Nephromopsis ornata*. Literature records are indicated by circles and our record is indicated by asterisk.

Results

During a detailed study of the habitat, more than 200 thalli of *Nephromopsis ornata* (Fig. 2) were identified and investigated in the field. The discovered population fully corresponds to the morphological description of the species (Randlane, Saag, 2022).

Specimens studied. **Russia, Irkutsk Region,** Vitimsky State Nature Reserve, S shore of Lake Oron, Pervy Kultushny waterfall, 57°07′10″N, 116°61′08″E, 377 m a. s. l., birch-spruce forest with mosses, on bark of rowan trunk (IRKU 2034), birch (IRKU 2035), standing deadwood (IRKU 2036), and a mossy boulder (IRKU 2037), 5 VII 2022, *Lishtva*.

All representatives of the genus *Nephromopsis* known in Southern Siberia have a yellowish coloration of the upper surface of the thallus (Table 1), but it can vary from grayish to greenish depending on the wetness of the thallus. The lower surface is usually brownish, only *N. laureri* may be whitish. In addition, this species is distinguished from all others by the presence of whitish marginal soredia. Precisely the presence of vegetative propagules seems to be one of the reasons for the rare development of apothecia in *N. laureri*, while they are common in other species. *Nephromopsis ornata* habitually differs well from other representatives of the genus, but its most reliable distinguishing feature is the light yellow medulla, while in *N. rugosa* it is white. Morphologically, *N. ornata* is similar to *N. endocrocea* Asahina, but *N. endocrocea* has a dark yellow to orange medulla and is still known only from the oceanic regions of East Asia.

Table 1

Diagnostic features of representatives of the genus *Nephromopsis* in Southern Siberia

Species	Upper surface	Lower surface	Medulla	Apothecia	Soredia
N. komarovii	yellowish green, wrinkled	light brown, smooth	white	almost always	absent
N. laureri	light yellow, smooth	white, light brown, generally smooth	white	very rarely	present
N. rugosa	yellowish or olive, reticulated	yellowish, light brown, distinctly reticulated	white	often	absent
N. ornata	yellowish green, smooth or reticulated	light or dark brown, smooth	light yellow	often	absent

The species was recorded on bark in the lower parts of rowan and birch trunks, on a standing deadwood and on mossy boulders; the thalli of *Nephromopsis ornata* occupy the largest areas (up to 65 × 27 cm) on rowan bark. Other 34 lichen species were recorded on the same trees and other substrates: *Amandinea punctata* (Hoffm.) Coppins et Scheid., *Bryoria simplicior* (Vain.) Brodo et D. Hawksw., *Cetrelia cetrarioides* (Delise) W. L. Culb. et C. F. Culb., *Evernia esorediosa* (Müll. Arg.) Du Rietz,

Fig. 2. *Nephromopsis ornata* on bark of rowan trunk. Scale bar: 5 cm.

Graphis scripta (L.) Ach., *Heterodermia speciosa* (Wulfen) Trevis., *Hypogymnia austerodes* (Nyl.) Räsänen, *H. bitteri* (Lynge) Ahti, *H. physodes* (L.) Nyl., *H. vittata* (Ach.) Parrique, *Imshaugia aleurites* (Ach.) S. F. Meyer, *Lecidella euphorea* (Flörke) Hertel, *Leptogium saturninum* (Dicks.) Nyl., *Lobaria retigera* (Bory) Trevis., *Melanohalea olivacea* (L.) O. Blanco et al., *Mycoblastus sanguinarius* (L.) Norman, *Myelochroa aurulenta* (Tuck.) Elix et Hale, *Nephroma helveticum* Ach., *Nephromopsis laureri* (Kremp.) Kurok., *Parmelia discordans* Nyl., *P. saxatilis* (L.) Ach., *P. squarrosa* Hale, *P. sulcata* Taylor, *Parmeliopsis ambigua* (Wulfen) Nyl., *P. hyperopta* (Ach.) Vain., *Peltigera aphthosa* (L.) Willd., *P. didactyla* (With.) J. R. Laundon, *P. horizontalis* (Huds.) Baumg., *P. neopolydactyla* (Gyeln.) Gyeln., *Pyxine sorediata* (Ach.) Mont., *Ramalina dilacerata* (Hoffm.) Hoffm., *Tuckermannopsis chlorophylla* (Willd.) Hale, *T. gilva* (Asahina) M. J. Lai, *Vulpicida pinastri* (Scop.) J.-E. Mattsson et M. J. Lai.

Some of the identified species are quite rare not in Siberia only, but throughout Russia. The presence of rare and vulnerable species, such as *Heterodermia speciosa*, *Lobaria retigera*, *Myelochroa aurulenta*, *Nephromopsis laureri*, and *Pyxine sorediata*, show a high conservation value of biodiversity of the discovered locality. It should be noted that in addition to these species, other East Asian lichens with similar disjunctive ranges were found in the vicinity of Lake Oron — *Dolichousnea diffracta* (Vain.) Articus (Makryi, Lishtva, 2005) and *Parmelia shinanoana* Zahlbr. (Lishtva, 1998). The presence of nemoral lichens in this locality makes possible to consider it as a refugium of species which prefer warm and humid conditions, and to assume a relict character of their local populations.

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