

First records of the entomopathogenic fungus *Ophiocordyceps gracilis* (Ascomycota, Hypocreales) from Siberia

Энтомопатогенный гриб *Ophiocordyceps gracilis* (Ascomycota, Hypocreales), первая находка в Сибири

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Ключевые слова: энтомопатогенный аскомицет, *Ophiocordyceps gracilis*, Сибирь, Саяны.

Abstract. The entomopathogenic ascomycete *Ophiocordyceps gracilis* (Grev.) G.H. Sung, J.M. Sung, Hywel-Jones et Spatafora was registered in Siberia for the first time. Fungi were found on lepidoptera larvae in the subalpine tall grasses on the territory of Krasnoyarsk Krai, in Kuraginsk region, on the edge of Kryzhin range (East Sayan Mountains) and in Ermakovsk region, within the «Ergaki» nature park (West Sayan Mountains) in 2009–2010.

Резюме. Впервые в Сибири зарегистрирован энтомопатогенный аскомицет *Ophiocordyceps gracilis* (Grev.) G.H. Sung, J.M. Sung, Hywel-Jones et Spatafora. Грибы обнаружены в 2009–2010 гг. на территории Красноярского края, в Курагинском районе, в окрестностях хр. Крыжина (Восточный Саян) и в Ермаковском районе, на территории Природного парка «Ергаки» (Западный Саян) среди субальпийского высокоотравья на гусеницах чешуекрылых.

Entomopathogenic ascomycetes have a significant biocoenosis value: they induce epizootic reaction in insect populations, particularly in phytophagous outbreaks [Sierpiska 1998; Kamata, 2000; Borisov et al., 2001; Kryukov et al., 2010]. Only a few species of teleomorph entomopathogenic ascomycetes are known in Siberia: *Cordyceps militaris* (L.: Fr.) Fr. [Ogarkov, Ogarkova, 2000; Petrov, 2002; Lednev et al., 2007; Kryukov et al., 2010], *Cordyceps* sp. [Kryukov et al., 2010], *Ophiocordyceps acicularis* (Ravenel) Petch [Ogarkov, Ogarkova, 2000] and *O. unilateralis* (Tul. et C. Tul.) Petch [Koval, 1984].

In 2009–2010 the entomopathogenic fungus *Ophiocordyceps gracilis* (Grev.) G.H. Sung, J.M. Sung, Hywel-Jones et Spatafora (Ophiocordycipitaceae, Hypocreales, Sordariomycetes, Ascomycota) (Fig. 1, Plate I) was found for the first time in Siberia in the lower part of the subalpine zone of humid uplands of East and West Sayan Mountains. On 16 July 2009 the first observation of *O. gracilis* solitary stromata was noted in the Kryzhin range region of the West Sayan

Mountains territory — 53°58'55" N, 95°26'54" E, 1370 m AMSL (Kuraginsk region, Krasnoyarsk Krai). In August 2010 six fruit bodies of the same species were noted again during investigation of mycobiota of West Sayan Mountains tall grass association (territory of the «Ergaki» nature park, Ermakovsk region, Krasnoyarsk Krai). It emerged that the pathogen hosts are lepidoptera larvae. Probably they belong to Hepialidae family as they have a strongly sclerotized prothorax, a prognathous head and a rare chaetotaxy. Also it is known that exactly this family of Lepidoptera is the main host of *O. gracilis* [Petch, 1933; Lauritzen, 1971 cyt. by Klingen et al., 2002; Samson, Brady, 1983]. However the detailed diagnostics of the collected specimens was impossible because of intense cadaver destruction. The fungus *O. gracilis* is of great interest to biocoenosis and biomedical investigations. Therefore focused research on *O. gracilis* local populations is necessary.

Ophiocordyceps gracilis (Grev.) G.H. Sung,
J.M. Sung, Hywel-Jones et Spatafora, 2007

Plate I: 2–6.

Xylaria gracilis Grev., 1824: Scot. Crypt. Fl. 2. T. 8;
Cordyceps gracilis (Grev.) Durieu et Mont., 1846: Fl. Algérie
Crypt. 1: 449;
=*Cordyceps mawleyi* Westwood, 1891: Gard. Chron. Ser. 3.
No. 9: 553.

Material. RUSSIA: Krasnoyarskiy krai, Ermakovskiy raion, West Sayan Mountains, river Bolshaya Baklanikha upper reaches, h-1300 m a.s.l., 52°44'17" N, 93°18'45" E; 3.08.2010, I.A. Gorbunova — 6 specimens; identified by I.A. Gorbunova, V.Yu. Kryukov. Samples stored in a Herbarium of inferior plant laboratory Central Siberian Botanical Garden SB RAS.

Description. Stromata usually solitary, rarely paired, straight or bent, 5–6 cm long, come out of larva thorax somites. A fertile part is apical, globular ellipsoidal, 5–9×4–5 mm, red-ochreous, pale orange colored, with more dark dots of perithecia pore. A stalk is 4–5 cm long, 0.7–2.5 mm in diameter, a stalk near a fertile part is white, pale ochreous below, yellowish, smooth, compact. Perithecia are embedded, elongate-oviform, 220–270×630–705 mkm. Asci are

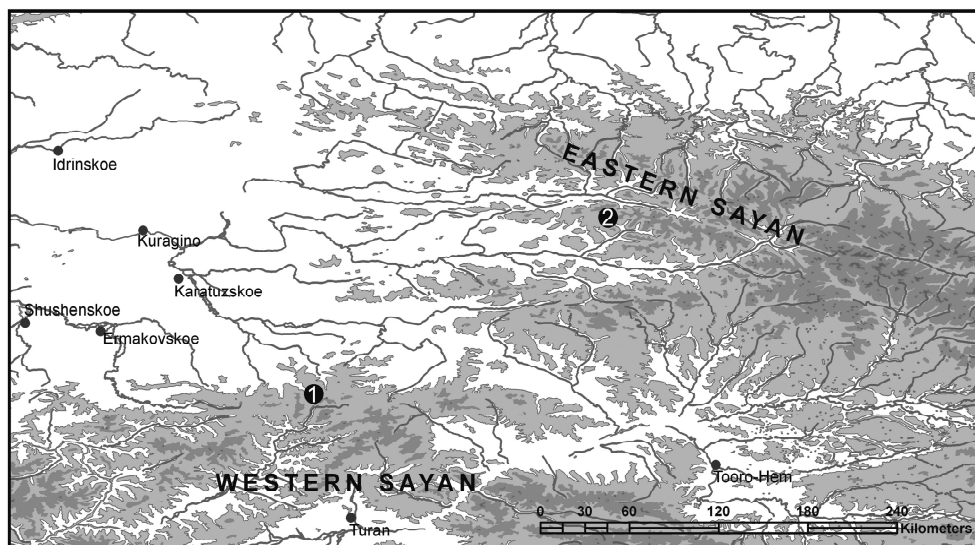


Fig. 1. Localities of *Ophiocordyceps gracilis* in Sayan Mountains: 1 — the «Ergaki» nature park, 2 — the Kryzhin range region.
Рис. 1. Места обнаружения *Ophiocordyceps gracilis* в Саянах: 1 — природный парк «Ергаки», 2 — окр. хр. Крѣжина.

cylindrical, 260–500 mkm long, 5–8 mkm width, with cap 4–5×5–12 mkm. Ascospores are filiform, 1–1.8 mkm width, multiseptate, breaking into one-celled fragments 6–8×1–1.8 mkm.

Habitat. Fungi were found in tall grass and meadow associations, combined with light forests (*Abies sibirica*, *Pinus sibirica*) in the lower part of subalpine zone of humid uplands (h~1200–1500 m a.s.l.). The total cover of tall grass associations is 90–100 %. Species of subalpine and forest tall grasses dominated in high sub-layer (140–170 cm height): *Aconitum sajanense* (West Sayan Mountains), *Bupleurum longifolium*, *Delphinium elatum*, *Heracleum dissectum*, *Lilium pilosiusculum*, *Saussurea latifolia*, *Stemmacantha carthamoides*, *Thalictrum minus*. *Bistorta major*, *Carex aterrima*, *Crepis lyrata*, *Euphorbia pilosa*, *Geranium albi-florum*, *Pedicularis incarnate*, *Ranunculus grandifolius*, *Rumex alpestris*, *Trollius asiaticus* dominated in low sub-layer (45–70 cm height) (Plate I: 1).

Distribution. In Russia: Far East, Primorye [Koval, 1984]; Moscow region [Borisov, 2005]. General range: Europe (Estonia, Byelorussia, England, Germany, Sweden, Norway, former Czechoslovakia, Asia (China), North and South America, Africa (Algeria, Congo) [Nizshie rasteniya, 1991].

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Вклейка I ❖ Plate I

I.A. Gorbunova et al. P.17–18. Plate I. Entomopathogenic fungus *Ophiocordyceps gracilis*: 1 — habitat (West Sayan); 2–3 — fruit bodies; 4 — perithecia, 5 — asci with cap, 6 — fragments of ascospores. Scale bars: 2–3 — 1 cm, 4 — 100 mkm, 5–6 — 10 mkm. Foto: 1–2 — I.A. Gorbunova, E.G. Zibzeev; 3 — R.Yu. Dudko; 4–6 — V.Yu. Kryukov, O.N. Yaroslavtseva.

И.А. Горбунова и др. С.17–18. Вклейка I. Энтмопатогенный гриб *Ophiocordyceps gracilis*: 1 — местообитание (Западный Саян); 2–3 — стромбы; 4 — перитеции; 5 — аски с головками; 6 — фрагменты аскоспор. Масштабные линейки: 2–3 — 1 см, 4 — 100 мкм, 5–6 — 10 мкм. Фото: 1–2 — И.А. Горбунова, Е.Г. Зибзеев; 3 — Р.Ю. Дудко; 4–6 — В.Ю. Крюков, О.Н. Ярославцева.

Вклейка II ❖ Plate II

R.V. Yakovlev. С.19–21. Вклейка II: 1–11. *Cecryphalus* spp., внешний вид бабочек и этикетки типов: 1–8 — *C. nubila*: котип *Zeuzera nubila* Staudinger, 1895 (1); голотип *Zeuzera strix* Grun-Grshimailo, 1895 (2); голотип *Zeuzera speyeri* Austaut, 1897 (3); голотип *Zeuzera nubila babadzhanidii* Sheljuzhko, 1913 (4); ♂, Кыргызстан (5); ♂, Казахстан (6); ♂, Северо-Западный Китай (7); ♀, Юго-Западный Таджикистан (8); 9–11 — *C. helena*: голотип *Zeuzera helena* Le Cerf, 1924 (9); ♂, Алжир (10); ♀, Алжир (11).

R.V. Yakovlev. P.19–21. Plate II: 1–11. *Cecryphalus* spp., imago habitus and labels of the types: 1–8 — *C. nubila*: cotype of *Zeuzera nubila* Staudinger, 1895 (1); holotype of *Zeuzera strix* Grun-Grshimailo, 1895 (2); holotype of *Zeuzera speyeri* Austaut, 1897 (3); holotype of *Zeuzera nubila babadzhanidii* Sheljuzhko, 1913 (4); ♂, Kyrgyzstan (5); ♂, Kazakhstan (6); ♂, NW China (7); ♀, SW Tajikistan (8); 9–11 — *C. helena*: holotype of *Zeuzera helena* Le Cerf, 1924 (9); ♂, Algier (10); ♀, Algier (11).

A.V. Volynkin et al. С.23–30. Вклейка II: 12–23. Совки, внешний вид бабочек: 12 — *Autophila rasilis*, ♂; 13 — *Cucullia hannemanni*, ♀; 14 — *Caradrina fuscifusa*, ♂; 15 — *Rhiza laciniosa odontographa*, ♂; 16 — *Palaeagrotis inops*, ♀; 17 — *Anarta insolita uigurica*, ♂; 18 — *A. sabulorum*, ♀; 19 — *Ctenoceratoda zetina*, ♀; 20 — *Actebia poecila*, ♀; 21 — *A. laetifica*, ♂; 22 — *Dichagyris kaszabi*, ♀; 23 — *Euxoa subconspicua*, ♀.

A.V. Volynkin et al. P.23–30. Plate II: 12–23. Noctuidae, general view of moths: 12 — *Autophila rasilis*, ♂; 13 — *Cucullia hannemanni*, ♀; 14 — *Caradrina fuscifusa*, ♂; 15 — *Rhiza laciniosa odontographa*, ♂; 16 — *Palaeagrotis inops*, ♀; 17 — *Anarta insolita uigurica*, ♂; 18 — *A. sabulorum*, ♀; 19 — *Ctenoceratoda zetina*, ♀; 20 — *Actebia poecila*, ♀; 21 — *A. laetifica*, ♂; 22 — *Dichagyris kaszabi*, ♀; 23 — *Euxoa subconspicua*, ♀.

