Morphological feature of *Picipes* (*Polyporus*) *rhizophilus*

Vyacheslav Vlasenko[1]*, and *Dejidmaa* Turmunkh[2]

[1]Central Siberian Botanical Garden SB RAS, 630090 Zolotodolinskaya st., 101, Novosibirsk, Russia
[2]Plant Protection Research Institute of Mongolia, 17024, Khoroo 11, Khan-Uul district, Ulaanbaatar, Mongolia

Abstract. Based on morphological research methods, the morphological characteristics of a rare species of polyporoid fungi – *Polyporus rhizophilus*, adapted to live as a parasite of grasses in steppe communities of subarid and arid regions, were evaluated. Morphological structures of fruiting bodies of fungi are subject to variability, which may be due to the influence of environmental factors and the specifics of the substrate on which the fruiting bodies of fungi develop. The appearance of identical morphological features in different phylogenetic groups is adaptive convergent. In this regard, molecular genetic research is a necessary condition for distinguishing taxa and clarifying their phylogenetic relationships.

1 Introduction

The species *Polyporus rhizophilus* was first described from Algeria in 1894. In Russia, it is common in subarid regions, where it is found in steppe communities, on the roots of plants from the grass family, mainly on *Stipa* sp.

Due to the ecological characteristics of the species, due to the destruction of habitats, plowing of steppes and grazing, this species is under threat of extinction. It is included in the list of taxa in the Red Book of the Russian Federation [1], as a species that needs special attention to the state in the natural environment and monitoring. It is also included in a number of regional Red Books. Due to the rarity of the species, its weak representation in herbariums of Russia (about 20 samples) and their poor preservation, the morphology of well-preserved fruiting bodies of *P. rhizophilus* from Russia was studied in detail and characterized using light microscopy methods to identify and characterize its regional specificity.

2. Materials and methods

Samples of *P. rhizophilus* fruiting bodies were selected to study morphological features. A total of 14 samples of fruiting bodies of *P. rhizophilus* were studied, stored in the herbariums of the CSBs SB RAS (7 samples) and BIN RAS (7 samples).

* Corresponding author: vlasenkomyces@mail.ru

Among the diagnostic features were taken into account morphometric parameters of the pores and spores (L, min – minimum length; L max is the maximum length, Lm, is the average length; W min – minimum width; W max – maximum width; Wm is the average width; Q, min – ratio the minimum length to minimum width; Q max – the ratio of maximum length to maximum width; Qm, the ratio of average length to average width), and the number of pores per 1 mm.

Macromorphological features were studied using the SteREO Discovery.V20. The spores were studied in detail using a light microscope AxioImager.A1. Samples for microscopy were prepared from a piece of tissue tubes that were placed in a drop of water with the dye methylene blue on a slide. The samples were studied by viewing and changing the parameters of morphological structure.

3. Results and Discussion

Among the complex of morphological species of *Polyporus* s. l., a number of species have traditionally been assigned to the intragenital morphological Polyporellus group. This group includes the following species *P. arcularius*, *P. brumalis*, *P. ciliatus* (fig. 1), widespread in Russia [2, 3], and also *P. corylinus*, found in the Mediterranean regions of Europe and Western North Africa, similar to it is Mediterranean-Macaronesian *P. meridionalis*, and also tropical *P. tricholoma*.

Species of this group are characterized by medium-sized basidiocarps, up to 10 cm in height, with a Central leg, without a black cuticle, except for old fruit bodies, medium-sized spores, 6–8 by 2–3. 5 microns [4, 5].

The pore parameters of the studied *P. rhizophilus* samples varied within the following limits (table 1): L, mm min = 0.13–0.38; L, mm max = 0.26–1.14; Lm, mm = 0.42; W, mm min = 0.08–0.23; W, mm max = 0.21–0.70; Wm, mm = 0.24; Q, mm min = 1.20–2.22; Q, mm max = 1.13–2.70; Qm, mm = 1.74. The average number of pores per 1 mm based on the average length and width of the pores is 2.4–4.1 pieces per 1 mm.

Table 1. Pore parameters of the studied *P. rhizophilus* samples from Russia.

Specimens	L, mm	Lm, mm	W, mm	Wm mm	Q mm	Qm mm
NSK 1013092	0.23-0.61	0.38	0.13-0.40	0.24	1.76-1.52	1.58
NSK 1013093	0.20-0.56	0.37	0.11-0.21	0.17	1.80-2.70	2.17
NSK 1013095	0.33-0.82	0.55	0.17-0.48	0.33	1.94-1.71	1.66
NSK 1013150	0.21-1.14	0.68	0.15-0.70	0.43	1.40-1.63	1.58
NSK 1013094	0.17-0.32	0.23	0.15-0.22	0.18	1.20-1.45	1.28
NSK 1013096	0.18-0.70	0.52	0.09-0.30	0.20	2.00-2.33	2.60
NSK 1013097	0.38-0.62	0.50	0.22-0.53	0.37	1.73-1.17	1.35
LE 31206	0.21-0.57	0.41	0.17-0.40	0.26	1.23-1.42	1.58
LE 31183	0.19-0.57	0.43	0.11-0.37	0.22	1.73-1.54	1.95

LE 18555	0.13-0.30	0.24	0.08-0.25	0.14	1.62-1.20	1.71
LE 31202	0.31-0.64	0.48	0.14-0.33	0.22	2.21-1.94	2.18
LE 291919	0.19-0.67	0.46	0.12-0.47	0.28	1.58-1.42	1.64
б/н 2194	0.20-0.26	0.24	0.09-0.23	0.15	2.22-1.13	1.60
LE 201199	0.32-0.54	0.42	0.23-0.31	0.27	1.39-1.74	1.55

The spore parameters of the studied *P. rhizophilus* samples varied within the following limits (table 2): L, µm min = 6.22–7.91; L, µm max = 8.06 – 10.64; Lm, µm = 7.80; W, µm min = 2.42–3.29; W, µm max = 3.36–4.71; Wm, µm = 3.52; Q, µm min = 2.00–2.64; Q, µm max = 1.86–2.40; Qm, µm = 2.22.

Table 2. Spore parameters of the studied *P. rhizophilus* samples from Russia.

Specimens	L, µm	Lm, µm	W, µm	Wm µm	Q µm	Qm µm
NSK 1013092	6.22-9.05	8.06	2.69-4. 55	3.74	2.31-1.99	2.15
NSK 1013093	6.96-8.86	7.84	3.05-4.13	3.60	2.28-2.14	2.18
NSK 1013095	6.88-8.86	8.08	3.00-4.38	3.74	2.29-2.02	2.16
NSK 1013150	7.91-9.24	8.35	3.00-4.56	3.50	2.64-2.03	2.39
NSK 1013094	6.57-8.64	7.55	3.29-3.95	3.65	2.00-2.19	2.07
NSK 1013096	5.84-8.91	7.57	2.42-3.79	2.93	2.41-2.35	2.58
NSK 1013097	6.56-10.64	7.84	3.10-4.71	3.75	2.12-2.26	2.09
LE 31206	7.06-8.62	8.05	3.00-3.85	3.34	2.35-2.24	2.41
LE 31183	7.07-8.94	7.75	3.26-3.91	3.62	2.17-2.29	2.14
LE 18555	6.68-8.06	7.30	3.10-4.02	3.53	2.15-2.00	2.07
LE 31202	6.42-8.28	7.43	2.83-4.45	3.46	2.27-1.86	2.15
LE 291919	6.28-9.11	7.48	3.10-4.22	3.54	2.02-2.16	2.11
б/н 2194	6.41-8.71	7.64	3.10-4.06	3.54	2.07-2.14	2.16
LE 201199	6.78-8.07	8.32	2.76-3.36	3.35	2.46-2.40	2.48

4. Conclusions

The study showed that *P. rhizophilus* belongs to the polyphyletic morphological Polyporellus group of the complex of morphological species *Polyporus* s. l. According to molecular phylogeny [6], this species is a member of the phylogenetic Picipes clade *Polyporus* s.l.

This example shows that macromorphological structures of fruiting bodies of fungi are subject to variability, as a result of the influence of environmental factors and the specifics of the substrate on which the fungus develops.

The appearance of identical morphological features in different phylogenetic groups is adaptive convergent. Conducting molecular genetic research and phylogenetic analysis is a necessary condition for distinguishing taxa and clarifying phylogenetic relationships.

Due to the rarity of the species, its weak representation in herbariums and their poor preservation, the morphology of well-preserved fruiting bodies of P. rhizophilus from Russia was studied in detail and characterized to identify and characterize its regional specificity.

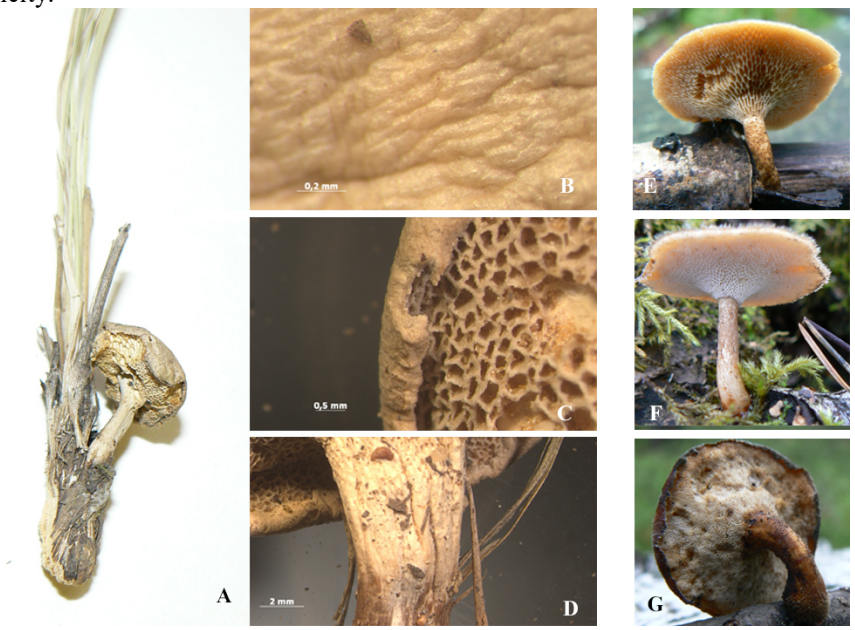

Fig. 1. Species of the morphological Polyporellus group of the *Polyporus* s.l. morphological complex, distributed in Russia. A: general habitus of *P. rhizophilus*, the fungus grows on the roots of grasses. B: the surface of the cap of *P. rhizophilus*. C: pores of *P. rhizophilus*. D: stem of *P. rhizophilus* at the top. E: *P. arcularius*. F: *P. brumalis*. G: *P. ciliatus*.

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