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Competing interests

No competing interests have been declared.

Copyright notice© The Author(s) 2019. This is an Open Access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits redistribution, commercial and noncommercial, provided that the article is properly cited.**Citation**Pusz W, Malicki M, Patejuk K, Ronikier M, Suchan T. First record of *Exobasidium rhododendri* (Fuckel) C. E. Cramer in Poland. Acta Soc Bot Pol. 2019;88(3):3632. <https://doi.org/10.5586/asbp.3632>**SHORT COMMUNICATION****First record of *Exobasidium rhododendri* (Fuckel) C. E. Cramer in Poland**Wojciech Pusz¹, Marek Malicki^{2,3}, Katarzyna Patejuk^{1*}, Michał Ronikier⁴, Tomasz Suchan⁴¹ Department of Plant Protection, Wrocław University of Environmental and Life Sciences, pl. Grunwaldzki 24A, 50-363 Wrocław, Poland² Department of Botany, Institute of Environmental Biology, University of Wrocław, Kanonia 6/8, 52-328 Wrocław, Poland³ Karkonosze National Park, Chałubińskiego 23, 58-570 Jelenia Góra, Poland⁴ Molecular Biogeography Group, W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland* Corresponding author. Email: katarzyna.patejuk@upwr.edu.pl**Abstract**

We report here the first wild locality of *Exobasidium rhododendri* (Fuckel) C. E. Cramer in Poland. This peculiar species is an obligatory pathogenic basidiomycete, which induces formation of galls on leaves of *Rhododendron*. It was found for the first time in Poland in 2017 on *Rhododendron ferrugineum* L. plants in a population of this shrub in the Karkonosze Mts (the Sudetes range). The species was recently shown to be native and a relict. We also present a basic description of the species based on the specimens from the abovementioned locality.

KeywordsBasidiomycota; distribution; fungal pathogens; *Rhododendron ferrugineum***Introduction**

Exobasidium is a genus of Basidiomycota belonging to the class Exobasidiomycetes, which includes obligatory pathogens of plants from the family Ericaceae and order Theales. *Exobasidium* species parasitizing Ericaceae include two distinct clades evolutionarily linked with their plant host groups: the genus *Rhododendron* (Ericoideae) and members of the subfamily Vaccinioideae [1]. *Exobasidium* spp. are found in most parts of the world but are especially well represented at high latitudes and altitudes. They produce a systemic infection of the plant. The most common symptoms are strongly localized hypertrophies, which cause red-colored galls on the leaf surface or deformation of a whole shoot. Infected tissues die off after reaching the pathogen matures. Their disappearance in late summer makes them difficult to find [2].

Exobasidium rhododendri (Fuckel) C. E. Cramer is an obligatory phytopathogenic basidiomycete growing on European species of *Rhododendron* sect. *Rhododendron*: *R. ferrugineum* L., *R. hirsutum* L., *R. myrtifolium* Schott et Kotschy, and the hybrid *R. ×intermedium* Tausch (*R. ferrugineum* × *R. hirsutum*), shrubs occurring in the sub-alpine zone of major European mountain ranges (mainly the Alps, Carpathians, and Pyrenees) [3–5]. In natural conditions, *E. rhododendri* is commonly found throughout the distribution ranges of its plant hosts. Low maximum temperature of development (below 25°C) may suggest adaptation of the pathogen to the cold (high-mountain) environment [3,6]. However, single occurrences of this species were also reported outside the natural ranges of host species from gardens and arboreta in England, Scotland, Germany, and Canada [7–9], where it was most likely introduced together with plants imported from the Alps [3]. It was also noted on cultivars (*R. ×laetevirens*, a hybrid involving *R. ferrugineum*) [3].

In Poland, *R. ferrugineum* is considered a cultivated species present only due to local planting [10]. Recently, the natural and relict character of one population of this shrub growing in the Karkonosze Mts (Sudetes range; southwestern Poland) was demonstrated, based on detailed phylogeographical data [11]. Detailed observations of this population included a survey of fungi infecting individuals of *R. ferrugineum*. As the most interesting mycological finding, we identified the presence of a native population of *E. rhododendri* accompanying its plant host in this site. Here, we report the first natural locality of *E. rhododendri* in Poland, with a short description of this population and morphological features of the specimens.

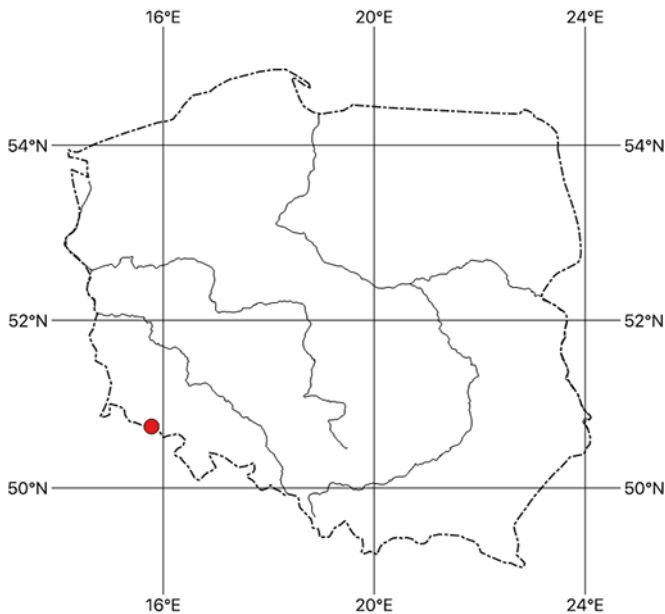


Fig. 1 Location of the *Exobasidium rhododendri* site in Poland.

Description

The observed symptoms of *E. rhododendri* in the studied population were limited to the leaves, as is typical in the entire distribution range of the fungus. It induced formation of semicircular or irregular spongy swellings of the proliferating plant tissue (approximately 1–2 cm diameter galls) initially greenish in color, then yellowish to pink and red, with whitish hymenium visible at maturity. Characteristics of specimens studied on 40 samples of galls were congruent with typical values reported in literature, according to descriptions of Sundstrom [6] and Nannfeldt [3]. Microscopic features of the Polish specimens were as follows: basidia with four sterigmata, with dimensions $42\text{--}45 \times 10\text{--}12 \mu\text{m}$, clampless, basidiospores cylindrical, smooth, often slightly curved, with dimensions $12\text{--}13.5 \times 2.5\text{--}3.5 \mu\text{m}$, nonseptate or rarely with single septa. Conidia not observed. Specimens studied: Karkonosze Mountains, Sowia Dolina, Poland, approximately at $50^{\circ}44' \text{N}$, $15^{\circ}46' \text{E}$; 1,175–1,190 a.s.l. (more detailed location available on request for conservation reasons), on *R. ferrugineum*, in the plant community from *Genisto pilosae-Vaccinion* alliance.

Comments

Exobasidium rhododendri was found in 2017 in the natural population of *R. ferrugineum* in the Sowia Dolina, Karkonosze Mountains, Poland. The population of the plant host consists of 68 ramets (57 fully grown and juvenile, 11 seedlings) [11]. It is located in the upper part of the valley, between 1,175 and 1,190 m a.s.l. Shrubs of *R. ferrugineum* grow on a steep rock outcrop (slope $70\text{--}90^{\circ}$) on the western slope, as a component of an acidophilus dwarf-heath plant community classified to *Genisto pilosae-Vaccinion* alliance [11]. We observed the occurrence of disease symptoms caused by *E. rhododendri* on leaves of *R. ferrugineum* both in 2017 and 2018. The symptoms occurred on approximately 80% of individuals causing typical deformation of leaves. Our findings show that the pathogen accompanies its plant host even in a highly isolated and extremely small population. The presence of obligatory, host-specific fungal pathogens was attempted to be used as indicators of historical and demographic processes in the plant populations [12–15] and might be another indicator of the natural and relict status of *R. ferrugineum* population. Future molecular analyses may reveal whether the fungal population has undergone a long-term isolation, as demonstrated for the plant [16], or instead appeared and/or maintained genetic connectivity with the main range via long distance spore dispersal.

Thus far, two other of *Rhododendron*-related taxa of *Exobasidium*, *E. discoideum* Ellis and *E. dubium* Raciborski, have been found in Poland on a related native plant

species, *R. luteum* Sweet [17,18]. *Exobasidium* sp. was also observed on *R. japonicum* Shirai [18,19]. *Exobasidium rhododendri*, being an occasional pathogen of ornamental cultivars of the genus *Rhododendron*, was probably mentioned by Orlikowski and Łabanowski [20] in their popular science book, under the name “*Exobasidium vaccinii*”, which is obviously a mistake due to the range of hosts of both species [3,18]. For the same reason, the first historical note on the occurrence of *E. rhododendri* in Poland from 1913 should be treated with caution, as this species was described from *R. simsii* in a greenhouse in Warsaw; no herbarium material is available for this report [21]. The closest confirmed record of *E. rhododendri* to Poland is from the Ukrainian Carpathians (Chornohora and Marmarosh massifs) on *R. myrtifolium* [22,23]. To date, there are no confirmed reports of the occurrence of any species of *Exobasidium* on *R. ferrugineum* in Poland. Thus, we presently provide the first documented record for Poland.

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