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Contribution to the biodiversity of rust fungi (Uredinales) in the Bohemian Forest (Šumava Mts.)

Jaroslava Marková

Department of Botany, Faculty of Science, Charles University,
Benátská 2, CZ-128 01 Praha 2, Czech Republic
markovaj@natur.cuni.cz

Abstract
The rust fungi (Uredinales) were investigated on eleven localities of the Šumava National Park. The occurrence of 39 species parasitizing on particular vascular plant species was recorded. The frequency of occurrence of selected rust species is presented in comparison with literature data. The highest biodiversity of rusts has been found in the area of the Vydra River and the mires of Houska and Mlynářská slať. The most frequent rust species *Puccinia luzulae-maximae* and *Uromyces airae-flexuosae* seems to be regular inhabitants of the natural ecosystems.

Key words: parasitic fungi, Uredinales, biodiversity, Šumava National Park

Introduction

The history of the investigation of non-vascular plants on the territory of the Šumava National Park reviewed Váňa (1996). The microscopic fungi, including parasitic ones, were studied a long time ago and their recent biodiversity is practically unknown. Svrček (1965) and Skalický (1967, 1969) reviewed the data on mycological research and all publications from the Bohemian Forest (Šumava Mts.). The knowledge of parasitic microfungi in central summits of the Bohemian Forest is very fragmentary and only some species have been collected in the corries of lakes and some other localities in the central part of the Bohemian Forest, which recently represent the most protected area. There are no published data either from the Bohemian Forest mires or from the other localities, which are considered as the centers of biodiversity. Recent mycological research has focused on selected groups of microfungi (Prášil & Reblová 1998, Kubátová & al. 1998). The aim of the present investigation is to evaluate the rust flora and compare it with the past data.

The rust fungi (Uredinales) were studied by Bubák (1906). In his paper on rust flora of Bohemia, he recorded 33 species of rusts from the central part of the Bohemian Forest, 15 species of which were collected by the author or by W. Krieger at the localities referred to in this paper. Hilitzer (1926) listed 5 rust species, including 3 species collected in the headwall of Černé Lake (Jezerní stěna). In the virgin forest of Boubínský prales, Kavina (1920–1921) found only one species of rust, *Melampsorella caryophyllacearum*, forming witches' broom on a fir branche. Maloch (1933) published 3 collections of rust species from the Bohemian Forest but no locality was situated in the area studied in this paper. Later on, he published the findings of 7 rust species (Maloch 1936). Two of them were recorded from localities near the Vydra River. Urban (1966) commented the occurrence of rusts on grasses in the mountains of the former Czechoslovakia; see bellow for his data concerning the Bohemian Forest.

The historical survey of rust species recorded in the Bohemian Forest by the following authors

Bubák (1906)

Coleosporium senecionis on *Senecio nemorensis* – relatively frequent in the Bohemian Forest
Hyalopsora polypodii-dryopteridis (= *H. aspidiotus*) on *Polypodium dryopteris* – near Čertovo Lake, Železná Ruda
Chrysomyxa abietis on *Abies excelsa* – Železná Ruda
Chrysomyxa pirolae (= *Ch. pirolatum*) on *Pirola minor* – the Špičák Mt.
Melampsora hypericorum on *Hypericum quadrangulum* – Železná Ruda, Debrník, Nová Studnice
Melampsorella blechni (= *Milesina blechni*) on *Blechnum spicant* – Bílá strž at the Ostrý Mt.
Melampsorella caryophyllacearum on *Abies pectinata* – Železná Ruda, between Debrník and Laka Lake, Šatavský revír (= Zátoňský revír at present)
Melampsorella kriegeriana (= *Milesina kriegeriana*) on *Aspidium spinulosum* – road from the Špičák Mt. to Černé Lake
Puccinia acetosae on *Rumex arifolius* – road between Debrník and Laka Lake
P. anthoxanthi (= *P. graminis*) on *Anthoxanthum odoratum* – the Špičák Mt.
P. argentata (= *P. impatientis*) on *Impatiens noli-tangere* – between Debrník and Laka Lake
P. cirsii (= *P. laschii*) on *Cirsium heterophyllum* – between Horní Vltavice and Šatava (= Zátoň at present)
P. mulgedii on *Mulgedium alpinum* – Debrník, Laka Lake
P. obscura on *Luzula maxima* – relatively frequent (Černé and Čertovo Lakes, Jezerní stěna, the Ostrý Mt., between Debrník and Laka Lake)
P. prenanthis-purpureae (= *P. maculosa*) on *Prenanthes purpurea* – in the Bohemian Forest up to 1200–1300 m a.s.l.
P. pygmaea on *Calamagrostis halleriana* – Bílá strž at the Ostrý Mt., Černé Lake, between Debrník and Laka Lake
P. soldanellae on *Soldanella montana*
P. thesii on *Thesium pratense* – Nová Studnice near Modrava
P. willemetiae on *Willemetia hieracioides* – Hamry, the Špičák Mt., Železná Ruda
P. zopfii (= *P. calthicola*) on *Caltha palustris* – frequent in the Bohemian Forest (the Ostrý Mt., the Špičák Mt., Železná Ruda, Nová Studnice, Javoří Pila)
Pucciniastrum chamaenerii (= *P. epilobii*) on *Epilobium angustifolium* – Černé Lake
Thecopsora pirolae (= *Pucciniastrum pyrolae*) on *Pirola uniflora* – the Špičák Mt.
Thecopsora vacciniorum (= *Naohidemyces vaccinii*) on *Vaccinium uliginosum* – frequent in the Bohemian Forest
Thecopsora vacciniorum (= *Naohidemyces vaccinii*) on *Vaccinium vitis-idaea* – between Kvilda and Filipova Huť
Triphragmium ulmariae on *Ulmaria pentapetala* – Lenora
Uredinopsis filicina on *Phegopteris polypodioides* – around Černé Lake, near Železná Ruda, between Debrník and Laka Lake
Uromyces alchemillae (= *Trachyspora intrusa*) on *Alchemilla vulgaris* – in the Bohemian Forest
Uromyces valerianae on *Valeriana dioica* – Železná Ruda

Hilitzer (1926)

Calyptospora goeppertiana (= *Thecopsora goeppertiana*) III on *Vaccinium vitis-idaea* – Můstek and Jezerní stěna
Cronartium ribicolum II, III on *Ribes nigrum* – Hamry near Železná Ruda
Puccinia major I on *Crepis paludosa* – Jezerní stěna
P. prenanthis-purpureae (= *P. maculosa*) II, III – in forests at Hraničář near Nýrsko
Phragmidium rubi-idaei I, II, III na *Rubus idaeus* – Jezerní stěna

Maloch (1933)

Puccinia major on *Crepis paludosa* – in the ditch in the spruce forest downhill the Ostrý Mt.
Puccinia mei-mamillata on *Polygonum bistorta* – meadow at Hamry
Puccinia soldanellae on *Soldanella* – in the spruce forest near Železná Ruda

Maloch (1936)

Calyptospora goeppertiana on *Vaccinium vitis-idaea* – between Hůrky and Polom
Melampsora larici-caprearum (= *M. caprearum*) on *Salix caprea* – road near Turnerská chyše (= Turnerova chata at present)
Phragmidium on *Rosa* – right riverside of the Vydra River, near Čeňkova Pila, 650 m a.s.l.
Puccinia major on *Crepis paludosa* – beech forest between Javoří Pila and Nová Studnice, 1100 m a.s.l.
Puccinia prenanthis-purpureae on *Rumex arifolius* ? – spruce forest at Javoří Pila, 1100 m a.s.l.
rust on *Alchemilla* – downhill Sklenářský vrch, 800 m a.s.l.
Uromyces alchemillae on *Alchemilla* – wet meadow, downhill Sklenářský vrch, 800 m a.s.l.

Urban (1966)

Puccinia pygmaea on *Calamagrostis villosa* – Bílá strž at the Ostrý Mt., Černé Lake, between Debrník and Laka Lake
Uromyces airae-flexuosae on *Avenella flexuosa* – in the Bohemian Forest, up to 900 m a.s.l

Methods

Eleven localities in the most preserved and strictly protected area of the Šumava National Park, which are considered as the centers of biodiversity, have been selected for this study. The characteristics of most localities presented Prášil & Řeblová (1998) and their positions are in Fig. 1. The rusts were collected randomly between 1994 and 2000.

The books by Gäumann (1959), Poelt & Zwetko (1997), Zwetko (2000) and Urban (1966) were used for the determination of rust species and their nomenclature. Usual symbols for the life stages of rusts are presented (0 – spermogonia, I – aecia, II – uredia, III – telia). The names of host plants are used according to Hejný & Slavík (1988, 1990, 1992) and Slavík (1995); the other host species are used according to Dostál (1989).

The specimens of the rusts were collected by the author unless the name of collector is mentioned. All specimens cited are preserved in the herbarium PRC.

Results

The detailed statement on the biodiversity of rust fungi was summarized for the following localities.

Svaroh and Jezerní hora

Melampsora cf. *caprearum* Thüm. II on *Salix aurita* L., 18 July 1995 – near a former cottage (Juránkova chata), coll. J. Váňa
Melampsora cf. *caprearum* Thüm. II on *Salix caprea* L., 18 July 1995 – Jezerní hora, stream toward Čertovo Lake
Puccinia hieracii (Schum.) Mart. II on *Hieracium argillaceum* Jord., 18 July 1995 – near a former cottage (Juránkova chata)
Puccinia luzulae-maximae Diet. II on *Luzula sylvatica* (Huds.) Gaud., 18 July 1995 – relatively frequent
Puccinia poarum Niels. I on *Tussilago farfara* L., 18 July 1995 – near a former cottage (Juránkova chata), coll. J. Váňa
Trachyspora intrusa (Grev.) Arth. II on *Alchemilla* sp., 18 July 1995 – near a former cottage (Juránkova chata)
Uromyces airae-flexuosae Ferd. et Winge II on *Avenella flexuosa* (L.) Drejer, 18 July 1995 and 23 July 1996 – periglacial scree downhill Svaroh; 18 July 1995 – Jezerní hora, stream toward Čertovo Lake; 22 July 1996 – frequent in Jezerní hora; 23 July 1996 – Svaroh 1330 m a.s.l.

Černé Lake

Melampsora cf. *caprearum* Thüm. II on *Salix caprea* L., 20 July 1995 – left shore under the cottage
Puccinia chondrillae Cda II, III on *Mycelis muralis* (L.) Dumort., 20 July 1995 – road from Špičácké sedlo to Černé Lake

Puccinia luzulae-maximae Diet. II on *Luzula sylvatica* (Huds.) Gaud., 14 July 1994 and 20 July 1995 – right shore, first tributary; 23 July 1996 – upper edge of the lake headwall (Jezerní stěna)
Puccinia maculosa (Str.) Röhl. II on *Prenanthes purpurea* L., 14 July 1994 – road from Špičácké sedlo to Černé Lake; 20 July 1995 – left shore under the cottage; II, III, 23 July 1996 – road from Špičácké sedlo to Černé Lake
Puccinia poae-nemoralis Otth II on *Poa nemoralis* L., 20 July 1995 – left shore under the cottage, very abundant
Puccinia poarum Niels. II on *Poa angustifolia* L., 20 July 1995 – left shore under the cottage
Puccinia silvatica Schroet. II on *Vignea brizoides* (L.) Reichenb., 18 July 1995 – road from Špičácké sedlo to Černé Lake
Trachyspora intrusa (Grev.) Arth. II, III on *Alchemilla* sp., 20 July 1995 – left shore under the cottage
Uromyces airae-flexuosae Ferd. et Winge II on *Avenella flexuosa* (L.) Drejer, 14 July 1994 – on lake shore; 20 July 1995 – between Špičácké sedlo and Černé Lake; 23 July 1996 – upper edge of the lake headwall (Jezerní stěna)

Čertovo Lake

Puccinia luzulae-maximae Diet. II on *Luzula sylvatica* (Huds.) Gaud., 14 July 1994 – tributary of the lake; 18 July 1995 – corrie, 1090 m a.s.l.; 22 July 1996 – corrie, frequetly infested by hyperparasite *Eudarluca caricis* (Fr.) O. Erikss.
Trachyspora intrusa (Grev.) Arth. II, III on *Alchemilla* sp., 18 July 1995 – near the lake outflow, 1035 m a.s.l.
Uredinopsis filicina (Niesel) Magnus II on *Phegopteris connectilis* (Michx fil.) Watt, 18 July 1995 – 1085 m a.s.l., coll. V. Rejzlová; 22 July 1996 – corrie
Uromyces airae-flexuosae Ferd. et Winge II on *Avenella flexuosa* (L.) Drejer, 14 July 1994 – right shore; 14 July 1994 and 21 July 1995 – water-shed between Černé and Čertovo Lakes 1159 m a.s.l.; 22 July 1996 – headwall of Čertovo Lake

Špičácké sedlo

Puccinia cnici-oleracei Pers. ex Desm. III on *Cirsium heterophyllum* (L.) Hill, 24 July 1996
Puccinia hieracii (Schum.) Mart. II, III on *Hieracium argillaceum* Jord., 24 July 1996

Laka Lake and Nová Hůrka

Melampsora cf. *caprearum* Thüm. II on *Salix aurita* L., 13 July 1994 – road NW of the lake; 19 July 1995 – near the lake outflow
Melampsora cf. *caprearum* Thüm. II on *Salix caprea* L., 13 July 1994 – right shore of the lake
Puccinia cf. *senecionis* Lib. I on *Senecio ovatus* (Gaertn., Meyer et Scherb.) Willd., 13 July 1994 – road between Nová Hůrka and the lake
Puccinia hieracii (Schum.) Mart. II on *Hieracium argillaceum* Jord., 26 July 1996 – NW shore, ruins of barracs
Puccinia luzulae-maximae Diet. II on *Luzula sylvatica* (Huds.) Gaud., 13 July 1994 – corrie; 20 June 1995 – corrie; 26 June 1996 – corrie (with hyperparasite *Eudarluca caricis* (Fr.) O. Erikss.)
Puccinia perplexans Plow. II, III on *Alopecurus pratensis* L., 13 July 1994 – Nová Hůrka
Puccinia poarum Niels. I on *Tussillago farfara* L., 13 July 1994 – Nová Hůrka
Puccinia willemetiae Bub. II on *Calycocorsus stipitatus* (Jacq.) Rauschert, 13 July 1994 – NW shore, ruins of barracks; I – 26 June 1996 – on the same locality and additional one near the lake outflow
Trachyspora intrusa (Grev.) Arth. II, III on *Alchemilla* sp., 13 July 1994 – NW shore, ruins of barracks; 20 June 1995 and 19 July 1995 – near the lake outflow
Uromyces airae-flexuosae Ferd. et Winge II on *Avenella flexuosa* (L.) Drejer, 13 July 1994 – Laka Lake
Uromyces dactylidis Otth II, III on *Dactylis glomerata* L., 13 July 1994 – Nová Hůrka

Ždanidla

Melampsora cf. *caprearum* Thüm. II on *Salix caprea* L., 15 July 1994 – E slope of the mount
Puccinia hypochoeridis Oud. II on *Hypochoeris radicata* L., 26 June 1996 – the road in lower part of beech forest
Puccinia luzulae-maximae Diet. II on *Luzula sylvatica* (Huds.) Gaud., 15 July 1994 – E slope; 20 June 1995 – beech forest; 26 June 1996 – U zlatého stolečku (with *Eudarluca caricis*)
Puccinia poarum Niels. 0 on *Tussilago farfara* L., 26 June 1996 – on the road to Laka Lake, rare
Puccinia pygmaea Erikss. II (III) on *Calamagrostis villosa* (Chaix) J.F. Gmel., 15 July 1994 – one specimen from the top and another from E slope

Fig. 1. – The map of the Bohemian Forest indicating the localities under study. 1: Svaroh Mt. and Jezerní hora Mt., 2: Černé Lake, 3: Čertovo Lake, 4: Špičácké sedlo, 5: Laka Lake, 6: Ždanidla Mt., 7: Roklanská smrčina (spruce forest), 8: Mlynářská slať (mire), 9: Surroundings of the Vydra River, 10: Plešné Lake, 11: Houska (mire). Drawn by K. Prášil.

Puccinia silvatica Schroet. I on *Taraxacum officinale* Weber in Wiggers, 20 June 1995 – near the top of the mountain; 26 June 1996 – on the road to Laka Lake
Trachyspora intrusa (Grev.) Arth. II, III on *Alchemilla* sp., 26 June 1996 – different places on the mount
Uromyces airae-flexuosae Ferd. et Winge on *Avenella flexuosa* (L.) Drejer, 15 July 1994 – E slope; 26 June 1996 – U zlatého stolečku

Roklanská smrčina

Puccinia luzulae-maximae Diet. II on *Luzula sylvatica* (Huds.) Gaud., 26 June 1996 (frequently infested by hyperparasite *Eudarluca caricis* (Fr.) O. Erikss.)

Mlynářská slať

Melampsora caprearum Thüm. II, III on *Salix caprea* L., 22 July 1995 – E side of the mire (only II on a juvenile plant); 24 July 1996 – 2 specimens near the road
Melampsoridium betulinum (Pers.) Kleb. II (III) on *Betula pendula* Roth, 31 August 1994 – sporadic

Puccinia cf. *senecionis-acutiformis* Hasler I on *Senecio ovatus* (Gaertn., Meyer et Scherb.) Willd., 24 July 1996 – E part, near the road
Puccinia deschampsiae Arth. II on *Deschampsia caespitosa* (L.) Beauv., 24 July 1996 – E part, near the road
Puccinia leontodontis Jacky II, III on *Scorzoneroides autumnalis* (L.) Moench, 22 July 1995 – near the road
Puccinia luzulae-maximae Diet. II, III on *Luzula sylvatica* (Huds.) Gaud., 19 June and 22 July 1995 – forest between E and central part of the mire, locally abundant; 24 July 1996 – Mlynářská slať
Puccinia obscura Schroet. II, III on *Luzula multiflora* (Ehrh. ex Retz.) Lej., 24 July 1996 – near the road in central part of the mire
Puccinia pygmaea Erikss. II, III on *Calamagrostis villosa* (Chaix) J.F. Gmel., 31 August 1994 – Mlynářská slať
Naohidemyces vaccinii (Wint.) Sato, Katsuya et Y. Hiratsuka (= *Thecopsora vaccinii* (Wint.) Hiratsuka fil.) II on *Vaccinium uliginosum* L., 31 Aug. 1994 – relatively frequent
Uredo festucae DC. II on *Festuca rubra* L., 22 July 1995 – little meadow near the road between E and central part of the mire, only few uredinia; 24 July 1996 – near the road
Uromyces airae-flexuosae Ferd. et Winge II on *Avenella flexuosa* (L.) Drejer, 22 July 1995 – road from Roklanský potok to the mire
Uromyces flectens III on *Trifolium repens* L., 24 July 1996 – near the road

Surroundings of the Vydra River

Melampsora cf. *caprearum* Thüm. II on *Salix caprea* L., 1 July 1999 – repeatedly between Antýgl and Čeňkova Pila
Phragmidium fusiforme Schroet. II, III on *Rosa pendulina* L., 1 July 1999 – between Turnerova chata and Čeňkova Pila
Puccinia aegopodii (Schum.) Röhl. III on *Aegopodium podagraria* L., 1 July 1999 – Turnerova chata
Puccinia asarina Kunze III on *Asarum europaeum* L., 1 July 1999 – Čeňkova Pila
Puccinia cf. *silvatica* Schroet. I on *Senecio ovatus* (Gaertn., Meyer et Scherb.) Willd., 1 July 1999 – near Antýgl
Puccinia cf. *silvatica* Schroet. I on *Taraxacum officinale* Weber in Wiggers, 1 July 1999 – Antýgl
Puccinia coronata Cda. var. *coronata* II on *Alopecurus pratensis* L., September 2000 – the former village of Zhůří, coll. B. Voženílková
Puccinia coronata Cda. var. *coronata* II,III on *Holcus mollis* L., September 1999, September and 2 November 2000 – Zhůří, coll. B. Voženílková
Puccinia festucae Plowr. II, III on *Festuca* cf. *ovina* L., 1 July 1999 – near Čeňkova Pila
Puccinia graminis Pers. subsp. *graminicola* Urban, II on *Deschampsia caespitosa* (L.) Beauv., September 1999, September and 2 November 2000 – Zhůří, coll. B. Voženílková
Puccinia maculosa (Str.) Röhl. (I), II, III on *Prenanthes purpurea* L., 1 July 1999 – near Antýgl
Puccinia perplexans Plow. II(III) on *Alopecurus pratensis* L., September 1999 – Zhůří, coll. B. Voženílková
cf. *Puccinia perplexans* Plow. 0, I on *Ranunculus acris* L., 31 May 2000 – Zhůří
Puccinia poae-nemoralis Otth II on *Poa nemoralis* L., 1 July 1999 – Antýgl
Puccinia poae-nemoralis Otth II on *Poa annua* L., 1 July 1999 – between Antýgl and Turnerova chata
Puccinia poae-nemoralis Otth II on *Poa nemoralis* L., 1 July 1999 – under Turnerova chata
Puccinia poarum Niels. II on *Poa trivialis* L., 1 July 1999 – near Čeňkova Pila
Puccinia poarum Niels. II on *Poa pratensis* L., September 1999 and September 2000 – Zhůří, coll. B. Voženílková
Puccinia retifera Lindr. II, III on *Chaerophyllum aureum* L., 1 July 1999 – Čeňkova Pila
Trachyspora intrusa (Grev.) Arth. II, III on *Alchemilla* sp., 1 July 1999 – a former cottage (Hálkova chata)
Uredo festucae DC. II on *Festuca rubra* L., September 1999, September and 2 November 2000 – Zhůří, coll. B. Voženílková
Uromyces dactylidis Otth II, III on *Dactylis glomerata* L., 1 July 1999 – Turnerova chata; near Čeňkova Pila

Plešné Lake

Melampsora cf. *caprearum* Thüm. II on *Salix caprea* L., 30 June 1999 – near the lake outflow
Puccinia deschampsiae Arth. II on *Deschampsia caespitosa* (L.) Beauv., 30 June 1999 – near the lake outflow
Puccinia luzulae-maximae Diet. II on *Luzula sylvatica* (Huds.) Gaud., 30 June 1999 – corrie and upper part of the lake headwall
Puccinia poarum Niels. I on *Tussilago farfara* L., 30 June 1999 – near the lake outflow
Trachyspora intrusa (Grev.) Arth. II, III on *Alchemilla* sp., 30 June 1999 – near the lake outflow

Houska

Melampsora cf. *caprearum* Thüm. II on *Salix caprea* L., 29 June 1999 – near the road
Melampsora laricis Hartig ex Kleb. II on *Populus tremula* L., 29 June 1999 – near the road
Naohidemyces vaccinii (Wint.) Sato, Katsuya et Y.Hiratsuka (= *Thecopsora vaccinii* (Wint.) Hiratsuka fil.) II on *Vaccinium myrtillus* L., 29 June 1999 – central part of the mire
Naohidemyces vaccinii (Wint.) Sato, Katsuya et Y.Hiratsuka (= *Thecopsora vaccinii* (Wint.) Hiratsuka fil.) II on *Vaccinium uliginosum* L., 29 June 1999 – central part of the mire
Puccinia aegopodii (Schum.) Röhl. III on *Aegopodium podagraria* L., 29 June 1999 – near the road
Puccinia bistortae DC. II, III on *Bistorta major* S.F.Gray, 29 June 1999 – meadow between the mire and railway
Puccinia pimpinellae (Str.) Röhl. II, III on *Pimpinella major* (L.) Huds., 29 June 1999 – near the road
Puccinia coronata Cda. I on *Frangula alnus* Miller, 29 June 1999 – near the river
Puccinia laschii Lagerh. II, III on *Cirsium heterophylum* (L.) Hill, 29 June 1999 – near the road
Puccinia perplexans Plow. II, (III) on *Alopecurus pratensis* L., 29 June 1999 – meadow between the mire and railway
Puccinia poae-nemoralis Otth II on *Poa chaixii* Vill. in L. 29 June 1999 – meadow between the mire and railway
Puccinia poarum Niels. I on *Tussilago farfara* L., 29 June 1999 – near the road
Puccinia sessilis W.G. Schneid. in Schroet. 0 on *Maianthemum bifolium* (L.) F.W. Schmidt, 29 June 1999 – near the river
Puccinia cf. *silvatica* Schroet. I on *Senecio ovatus* (Gaertn., Meyer et Scherb.) Willd., 29 June 1999 – near the road
Puccinia cf. *silvatica* Schroet. I on *Taraxacum officinale* Weber in Wiggers, 29 June 1999 – near the road
Triphragmium ulmariae (Hedw. f. ex DC.) Link II on *Filipendula ulmaria* (L.) Maxim., 29 June 1999 – near the road

Altogether 130 specimens representing 39 species of rust fungi were collected at the 11 localities studied. Fig. 2 shows comparison of the frequencies of rust species among localities.

The area around the Vydra River and both mires Houska and Mlynářská slať seem to be rich in plant species and consequently in their rusts. On the other hand, only one species was found in the spruce forest, Roklanská smrčina characterized by low plant diversity.

Table 1 summarizes the list of all rust species and numbers of their specimens collected during this study (cf. Fig. 3). Seven species were collected only twice and nineteen species were found only once. The most frequent species, *Puccinia luzulae-maximae* was found at 8 localities, three species, *Melampsora caprearum*, *Puccinia poarum*, and *Trachyspora intrusa*, were collected at 7 localities. All the other species listed were present only at 4 or fewer localities.

Discussion and Conclusions

The comparison of the results of the recent study with the pertinent literature leads to the following conclusions: twelve species known from the literature have not been found recently again at the localities investigated, e.g. *Coleosporium senecionis, Hyalopsora polypodii-dryopteridis* (Čertovo Lake), *Chrysomyxa pirolae* (the Špičák Mt.), *Melampsorella kriegeriana* (the Špičák Mt., Černé Lake), *Phragmidium rubi-idaei* (Jezerní stěna), *Puccinia major* (Jezerní stěna), *P. mulgedii* (Laka Lake), *P. soldanellae*, *P. zopfii* (the Špičák Mt.), *Pucciniastrum chamaenerii* (Černé Lake), *P. goeppertianum* (Jezerní stěna), *Thecopsora pirolae* (the Špičák Mt.). On the other hand, 13 species given in the literature have been found again on these localities.

The other group of rust species with a common distribution has been found recently in the Bohemian Forest but they were not considered in the literature survey (for example *Melampsora caprearum, Melampsoridium betulinum, Puccinia deschampsiae, Puccinia perplexans, Puccinia poae-nemoralis, Puccinia poarum, Puccinia pygmaea, Trachyspora intrusa, Uredo festucae,* etc.)

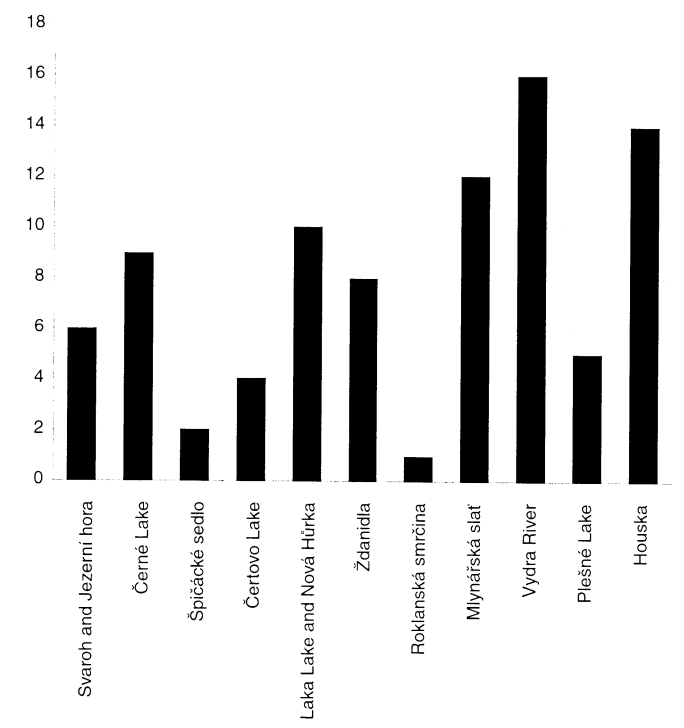

Fig. 2. – Number of rust species at particular localities.

Althogether 39 species of rust fungi were collected at the 11 localities under study. Other 12 species recorded in the literature have not been recently found. However, it does not mean that they could not be found. The frequency of occurrence of parasitic fungi often depends on climatic conditions in a given year. Moreover, the investigation was not regular and frequent enough during the whole vegetation period.

In natural communities, the rusts *Melampsora caprearum*, forming uredinia and telia on *Salix* sp. div., and *Puccinia luzulae-maximae*, producing only uredinia on *Luzula sylvatica*, have been commonly distributed. Overwintered uredinia of the last species, however, have been often infested by the hyperparasite *Eudarluca caricis*. URBAN (1966) considered other two frequently found species, *Uromyces airae-flexuosae* and *Trachyspora intrusa*, as North–

Table 1. – Rust species in the Bohemian Forest – the alphabetical list with numbers of the specimens collected.

Melampsora caprearum	12	*Puccinia luzulae-maximae*	17
Melampsora laricis	1	*Puccinia maculosa*	4
Melampsoridium betulinum	1	*Puccinia obscura*	1
Naohidemyces vaccinii	3	*Puccinia perplexans*	4
Phragmidium fusiforme	1	*Puccinia pimpinellae*	1
Puccinia aegopodii	2	*Puccinia poae-nemoralis*	5
Puccinia asarina	1	*Puccinia poarum*	9
Puccinia bistortae	1	*Puccinia pygmaea*	2
Puccinia cf. *senecionis*	1	*Puccinia retifera*	1
Puccinia cf. *senecionis-acutiformis*	1	*Puccinia sessilis*	1
Puccinia cnici-oleracei	1	*Puccinia silvatica*	7
Puccinia coronata	4	*Puccinia willemetiae*	2
Puccinia deschampsiae	2	*Trachyspora intrusa*	9
Puccinia festucae	1	*Triphragmium ulmariae*	1
Puccinia graminis	2	*Uredinopsis filicina*	2
Puccinia hieracii	3	*Uredo festucae*	4
Puccinia hypochoeridis	1	*Uromyces airae-flexuosae*	16
Puccinia chondrillae	1	*Uromyces dactylidis*	2
Puccinia laschii	1	*Uromyces flectens*	1
Puccinia leontodontis	1		

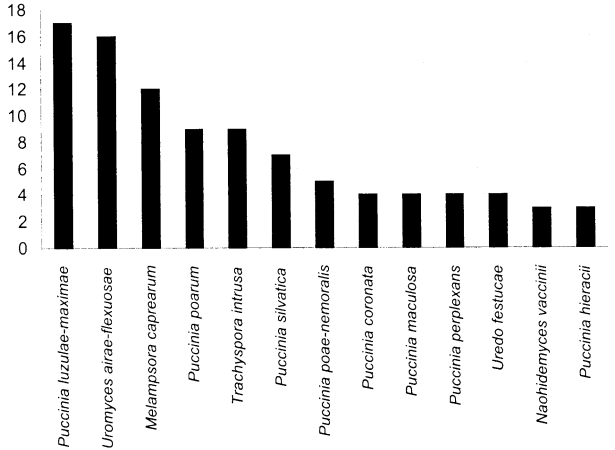

Fig. 3. – Specimen frequencies of selected species.

Central European suboceanic elements according to their climate-ecological and chorological characteristics. The main geographical distribution of the both rusts in the Czech Republic is at higher elevations (over 450 m a.s.l.) where high degree of annual precipitations (over 400 mm during the vegetational season) and humidity predominate.

Higher biodiversity of parasitic microfungi was observed at the localities influenced by human activity, e.g. near the roads to Černé Lake and Mlynářská slať or on the places, where some buildings were destroyed (on left shore of Černé Lake, the former cottage – Juránkova chata on the Svaroh Mt., former barracks near Laka Lake, etc.).

When comparing the numbers of the rust species at the investigated localities, it seems evident that the localities near the Vydra River and both mires Houska and Mlynářská slať display the highest degree of microfungi diversity. The biodiversity of the rusts depends mainly on the host biodiversity. Thus, the richness of the host plant species in plant communities influences the occurrence and distribution of their parasites – the rusts.

Finally, one could conclude that the parasitic microfungi represent an integral component of plant communities and that they play an important role in self-regulation of the natural ecosystems.

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