

## CAUSE OF WITHERING OF STAGHORN SUMACH (*RHUS TYPHINA* L.) IN SELECTED LOCALITIES IN SLOVAKIA

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### ABSTRACT

Health state of *Rhus typhina* was evaluated in 59 localities and 74 sites over the years 2001-2003 with scope (1) to identify the parasitic mycoflora of *R. typhina* in Slovakia and (2) to identify the occurrence of *Cryphonectria parasitica*, declared as a quarantine pest by the EPPO, besides the chestnut (*Castanea sativa* Mill.) and oak (*Quercus* sp.) also on *R. typhina*. The fungus *Botryosphaeria ribis* (Gross.) Dugg. (pycnidial state *Dothiorella mali* (Ell.) Ev) caused damage to the *R. typhina*. Damage to *R. typhina* caused by *B. ribis* was only recorded in 15 localities. Mean growth rate of hyphae of the fungus ranged from 25.7 to 48.3 mm after 96 hours of cultivation. The most appropriate medium for cultivation was 3% potato dextrose agar.

The occurrence of the fungus *Fusarium oxysporum* Schlecht and mainly of quarantine fungus *C. parasitica* has not been recorded in the evaluated sites.

**KEY WORDS:** *Botryosphaeria ribis*, *Cryphonectria parasitica*, *Fusarium oxysporum*, *Rhus typhina*.

### INTRODUCTION

Dieback of the ornamental tree *Rhus typhina* L. in consequence of infection with the fungus *Botryosphaeria ribis* Gross (Dugg.) (teleomorph) – pycnidium state (anamorph) *Dothiorella mali* (Ell.) Ev has been recorded in several localities in Slovakia. The fungus occurs in Slovakia since 1981, however, this fact has not yet been documented with detailed studies (Juhásová 1986).

Really dangerous pathogens of the *R. typhina* disease are the fungi *Fusarium oxysporum* Schlecht., *B. ribis* and *Endothia parasitica* syn. *Cryphonectria parasitica* (Murr.) Barr in North America (Toole 1949; Bragonier 1949). The fungus *F. oxysporum* has caused damage with symptoms of drying branches to other host trees in North America and Great Britain. *C. parasitica*, the chestnut blight fungus, was found on *R. typhina* in USA (Peace 1962). *R. typhina* is one of the many hosts of *C. parasitica* (Stipes et al. 1978). The fungus *C. parasitica* destroyed a whole plantation of *R. typhina* on which the plant was cultivated to obtain tannin (Příhoda 1999).

The goals of this research were (1) to establish the parasitic mycoflora of *R. typhina* in Slovakia and (2) to establish the occurrence of *C. parasitica*, declared as a qua-

rantine pest by the EPPO, besides chestnut (*Castanea sativa* Mill.) and oak (*Quercus* sp.) on *R. typhina*.

### MATERIALS AND METHODS

The health state of *R. typhina* was evaluated over the years 2000-2002 in Nitra and in selected localities in Slovakia. The list of the evaluated localities is presented in Table 1.

The general health state was assessed in localities. The degree of damage to trees was evaluated according to a six-point scale:

h – healthy: without symptoms of disease;

1-st degree: rare occurrence of branches with thinned leaves;

2-nd degree: dry, thin branches in number 1-15 per one plant, no visible wounds on trunk;

3-rd degree: dry, thin branches, sharing 1/3 in volume. Dripping wounds in size up to 2-3 cm on trunk;

4-th degree: drying branches in 1/2 crown volume caused by fungus *B. ribis*. Damage of main and constructive branches is dominant. Dripping wounds on trunk, in size up to 5 cm;

TABLE 1. Results of evaluation of occurrence of *Rhus typhina* and degree of damage caused by fungus *Botryosphaeria ribis* in selected localities in Slovakia.

Number of locality	Name of localities	Degree of damage	Number of trees
1	Arborétum Mlyňany	1-5	25
2	Behynce	h	5
3	Bošany	h	2
4	Bratislava	h – 5	21
5	Brodzany	h	2
6	Bytča	1-5	5
7	Dubnica nad/Váhom	h	3
8	Galanta	1-5	8
9	Jasov	h	7
10	Jelenec	1-2	2
11	Jelšovce	h	2
12	Turčianské Kľačany	h	2
13	Klačno	1-3	5
14	Kočkovce	h	5
15	Komárno	1-3	8
16	Košeca	h	2
17	Košice	h	10
18	Kotešová	h	2
19	Krušovce	h	1
20	Ladce	h	2
21	Tunežice	h	5
22	Lietavská Lúčka	h	1
23	Lučenec	h	2
24	Ludanice	h	1
25	Malé Uherce	h	5
26	Malý Šariš	h	5
27	Martin	h	8
28	Medzev	h	5
29	Moldava nad Bodvou	h	5
30	Modra	h	3
31	Myjava	h	5
32	Nedožery-Brezany	h	2
33	Nitra	h – 5	89
34	Nováky	h	2
35	Nové Mesto nad/Váhom	h	5
36	Nové Zámky	h	8
37	Oslany	h	1
38	Ožďany	h	8
39	Pezinok	1-5	9
40	Piešťany	h	5
41	Poluvsie	h	2
42	Považská Bystrica	h – 1	15
43	Prešov	h	10
44	Prievidza	h	2
45	Radošina	h – 1	5
46	Rajecké Teplice	h	12
47	Ripňany	h	2
48	Riňovce	h	5
49	Strážská	h	2
50	Svederník	h	2
51	Sverepec	h	3
52	Chminianska Nová Ves	h	10
53	Topoľčany	1 – 5	15
54	Chrabrany	h	2
55	Trenčín	h	10
56	Výčapy	h	3
57	Žabokreky	h	1
58	Zemianske Kostoľany	h	1
59	Žilina	1-5	50

h – healthy

1 – 5 degree of damage according to Materials and methods

5-th degree: the tree is totally dry or in very advanced drying stage, or dry branches comprise more than 2/3 of crown in volume.

The following media were used for isolation and cultivation of the fungi (*B. ribis* and *C. parasitica*) sampled from *R. typhina*: 3% Malt agar, 3% Saccharose agar, 3% Potato dextrose agar.

Growth rates of the hyphae of fungi were evaluated on three different media after each 24 hours of cultivation. The samples for measuring of growth rates were collected in Nitra at two different sites in October 1, 2002 and in Bytča in October 12, 2002. The fungus *C. parasitica* was isolated and cultivated according to Juhásová (1999).

The material for laboratory testing was sampled from shrubs with symptoms of damage. Pieces of bark, 2x2 cm in size, were cut from the trunk and branches from:

- transition zone between health and infected part,
- reproductive bodies of fungus (pycnidium and perithecium),
- mycelium of fungus,
- dripping wound.

Pieces of host tissues 2-3 mm large were placed into the medium after superficial sterilisation with 0.15% NaClO. The fungus was cultivated at a constant temperature between 24-25°C.

## RESULTS

The fungus *B. ribis* was for the first time recorded in Žilina (on 50 trees) in 1981. By the year 1992, were found five new localities in Slovakia (Bratislava (18 infected trees), Komárno (8 infected trees), Nitra (72 infected trees), Arborétum Mlyňany (25 infected trees), Galanta (8 infected trees). The health state of *R. typhina* was evaluated in 59 localities and 74 sites within the years 2001-2002 (Fig. 4). By the year 2003, the fungus *B. ribis* was recorded on further seven localities (Bytča, Jelenec, Klačno, Pezinok, Považská Bystrica, Radošina, Topoľčany). 228 trees of *R. typhina* from a total number of 445 evaluated in Slovakia were damaged by *B. ribis*. The results of evaluation of the damage degree to *R. typhina* are shown in Table 1.

The fungus *B. ribis* attacks various species of genus *Ribis* and it can cause serious damage of branches to *R. typhina*. The first symptoms of the disease occur in the phenological phase as complete leaf unfolding (Fig. 1). The leaves lose step by step their natural green colour, wither and very rapidly dry. Not only leaves do wither, but also terminal sprouts. The drying proceeds so rapidly that the leaves do not fall down, the ends of the damaged branches seem to be broke. It is conspicuous that the damaged parts maintain hanging on branches. Dry leaves remain on branches, too. The mycelium of the fungus penetrates from the terminal branches to the older parts. Whole branches dry out in the second year of infection. On bark surface a depression arises. The bark on stronger branches dries out and cracks, open blight cankers arise and frequently reach the xylem. Blight cankers fuse together, reaching the final dimensions up to 50 mm. The bark around the blight cankers is coloured red to violet. Black stromata that penetrate through the periderm are very well visible with a magnifying glass. The fungus causes also damage to very young and older shrubs.

Pycnidia of the fungus usually germinate at the end of July (Fig. 2). They are well visible by naked eye, brown-coloured, arranged concentrically on the necrotised part of



Fig. 1. *Rhus typhina* in Bratislava (Patrónka, SAS) damaged with the fungus *Botryosphaeria ribis* Gross (Dugg.) – pycnidial state anamorph *Dothiorella mali* (Ell.) Ev. The damage to *Rhus typhina* significantly appears in phenological phase complete leaf unfolding. The leaves and terminal parts of branches wither and very rapidly dry. The damaged parts maintain hanging on branches (August 8, 2003).



Fig. 2. Pycnidial fruiting bodies of the fungus *Botryosphaeria ribis* Gross (Dugg.) – pycnidial state anamorph *Dothiorella mali* (Ell.) Ev. They are well visible by naked eye, 2-4 mm large, arranged concentrically on the necrotised part of the branch, white or light-brown coloured, later in germination brown-coloured.

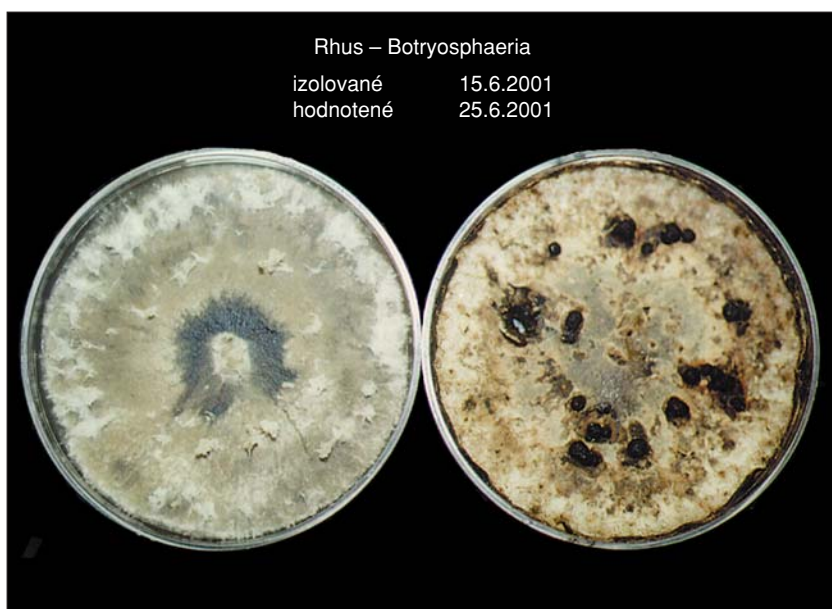


Fig. 3. Isolate of the fungus *Botryosphaeria ribis* Gross (Dugg.) on 3% malt agar after 10 days of cultivation are formed dark fruiting bodies with pycnospores.



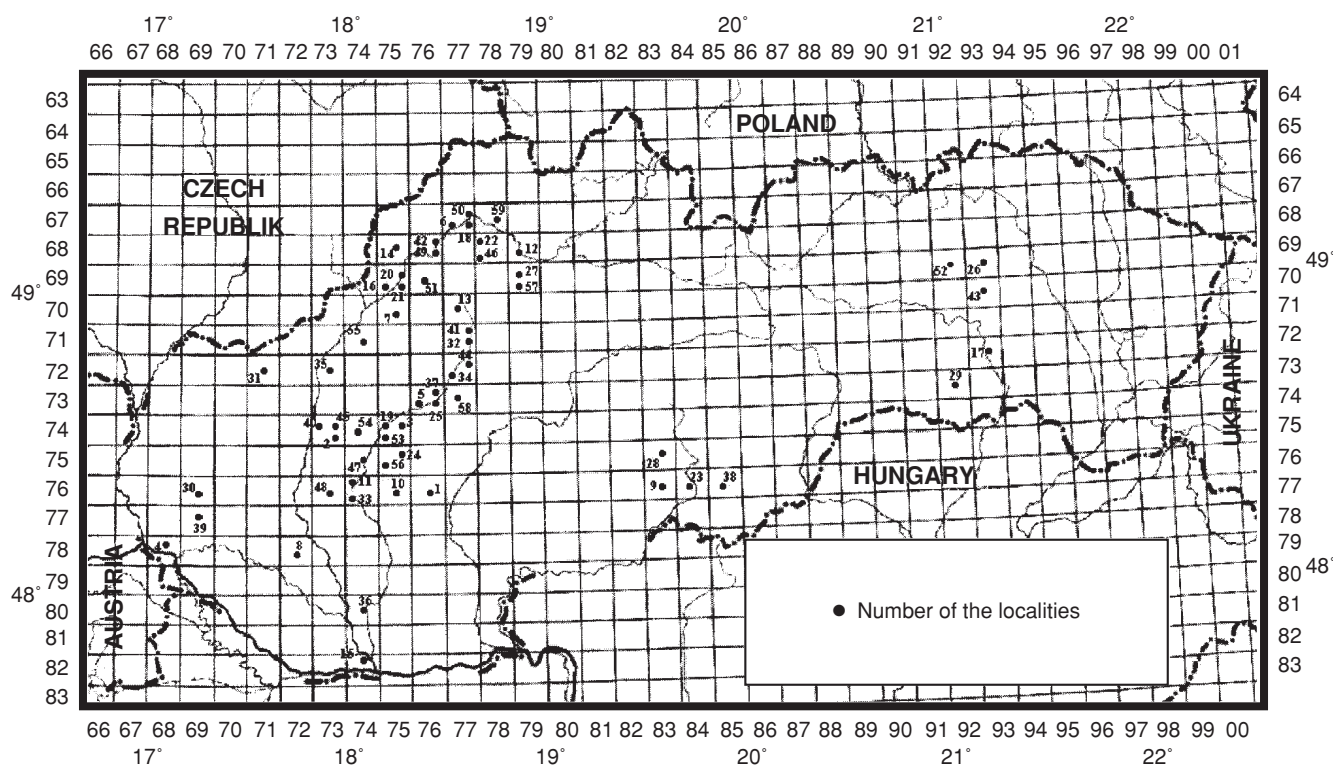


Fig. 4. Map of *Rhus typhina* occurrence in selected localities in Slovakia. The numbers in the map correspond with number of localities in Table 1.

the branch. Pycnospores are hyaline, one-celled, 18-34×4-9 µm in size. Asci are 75-130×19-21 µm large. One ascus contains eight ascospores (17-25×5-8 µm). The fungus is a wound pathogen. The spores are spread by air, wind and water. The literature refers about insect of the genus *Pse-nococus* as a vector of this fungus. In our conditions, ascospores are spread to the end of April. Conidia are spread during the season.

The isolates of the fungus *B. ribis* were obtained in the conidial state *D. mali*. The isolation was successful on all used media (Fig. 3). The results of evaluation of growth rate are in Table 2.

The mean growth rate of hyphae of the fungus ranged from 25.7 to 48.3 mm after 96 hours of cultivation. The most appropriate medium for cultivation was 3% potato dextrose agar. The least suitable was saccharose agar, because no increase in mycelium length after first 48 hours could be recorded.

Symptoms of infection with the fungus *C. parasitica* were not present on shrubs in the observed localities. Mycelium of the fungus is yellow-coloured, fan-shaped and is located under the bark of the host woody plant. The fungus produces both red-orange pycnidia and perithecia of the sa-

me colour. Neither mycelium nor stromata of reproductive bodies of this internationally recognized quarantine pest were recorded on drying branches of *R. typhina*.

## DISCUSSION

The fungus *B. ribis* cause damage to *R. typhina* shrubs. The fungus *F. oxysporum* and quarantine pest *C. parasitica* were not detected in the studied localities within the year 2003.

Toole (1949), Bragonier (1949) identified the fungi *F. oxysporum*, *B. ribis* and *E. parasitica* syn. *C. parasitica* as really dangerous pathogens of *R. typhina* disease. The health state in this shrub was evaluated in total at 74 sites on 59 localities. No occurrence of the fungus *B. ribis* was detected over the evaluated sites. The damage to *R. typhina* caused by *B. ribis* was only recorded in 13 localities.

Neither occurrence of the fungus *F. oxysporum* Schlecht and nor of the quarantine fungus *C. parasitica* was recorded over the evaluated sites. The fungus *C. parasitica* was detected in Slovakia, but on other host trees, on *Castanea sativa* and on *Quercus* sp. (Juhásová 1999).

The optimum temperature range for germination of ascospores is 12-15°C and the optimum temperature for mycelium growth in the fungus *B. ribis* is 28°C (Savanasto 1932).

The appropriate media for cultivation of this fungus are agar media with different ingredients (Savanasto 1932). We used 3% Malt agar, 3% Saccharose agar and 3% Potato dextrose agar for isolation and cultivation of the fungus *B. ribis* at a temperature 24-25°C. We have concluded that the worst medium for cultivation of this fungus was the Saccharose agar, because no growth of hyphae was observed during the first 48 hours of cultivation.

TABLE 2. Length (in mm) of hyphae of fungus *Botryosphaeria ribis* on different media at 24 hours intervals.

Medium	Mycelium length at the end of cultivation interval (in hours)				average
	24 h	48 h	72 h	96 h	
Malt agar	12.5	33.6	48.6	63.3	39.5
Saccharose agar	—	—	15.6	35.8	25.7
Potato dextrose agar	9.3	36.9	67	80	48.3

The optimum temperature for mycelium growth on artificial media was detected as 28°C, the minimum 10°C and the maximum 32°C. The cultures were kept viable at a temperature of about 0°C for more than 22 months (Savanasto 1932).

#### CONCLUSIONS

Benčať (1982) recorded the occurrence of *Rhus typhina* in 119 localities in Slovakia. The health state, with regard to the occurrence of quarantine fungus *Cryphonectria parasitica* and *Botryosphaeria ribis*, was assessed on 59 localities over the years 2001-2004. *C. parasitica* has not been recorded. *B. ribis* was isolated from 13 localities. This fungus causes serious damage of this ornamental tree that proves like drying of damaged branches after first year of infection. It is recommended to remove the damaged parts of host due to eliminate the source of infection.

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