Literature review and data of distribution of *Taphrina* species in Northern Hungary, special the Mátra region

Adatok a Taphrina-fajokhoz és szakirodalmi áttekintésük Észak-Magyarországról, különös tekintettel a Mátravidékre

Dominik Dredor[1,2] and Tünde Szmatona-Túri [1]

[1]*Északi ASzC Mátra Erdészeti Technikum, Szakképző Iskola és Kollégium, Mátrafüred, e-mail: turitunde79@gmail.com*

[2]*Illyés Gyuláné Egységes Gyógypedagógiai Módszertani Intézmény, Óvoda, Általános Iskola, Szakiskola, Fejlesztő Nevelés-oktatást Végző Iskola és Készségfejlesztő Iskola, Salgótarján, e-mail: dredor.dominik@gmail.com*

Correspondence: e-mail: dredor.dominik@gmail.com

Abstract: During our work, we reviewed the literature on the species five *Taphrina* and provided data on their distribution in northern Hungary, with focusing on the Mátra region. From all 22 data 11 data comes from oak habitats. Some of the species found cause witches' broom, while others cause leaf curling on the infected plant. After reviewing the literature, it is likely that the fungistics data reported in the enumeration for the Mátra region are new data and the first confirmed occurrence of the pathogens. It can be stated that the species described in the publication are relatively common and generally distributed, and more data is expected to appear with further field work.

Keywords: *witches' broom, hypertrophic lesion, distribution, host plant*

Összefoglalás: Munkánk során áttekintettük hat *Taphrina* faj szakirodalmát és adatokat szolgáltattunk az észak-magyarországi elterjedésükhöz, különös tekintettel a Mátravidékre. Az összes 22 adatból 11 adat tölgyes élőhelyről származik. A megtalált fajok közül van, amelyik boszorkányseprőt, valamint van, amelyik levélfodrosodást okoz a megtámadott növényen. A szakirodalom áttekintése után valószínűsíthető, hogy a Mátravidékre nézve az enumerációban közölt fungisztikai adatok új adatnak és első igazolt megjelenésnek számítanak. Megállapítható, hogy a közleményben leírt fajok viszonylag gyakoriak és általánosan elterjedtek, további terepmunkával több adat megjelenése várható.

Kulcsszavak: *boszorkányseprű, hipertrófiás elváltozás, elterjedés, gazdanövény*

1 Introduction

Taphrina species belong to the regnum *Fungi*, phylum *Ascomycota*, class Taphrinomycetes, order *Taphrinales*, family *Taphrinaceae*, genus *Taphrina* (GBIF, 2023a). A common characteristic of these pathogens is their biotrophic lifestyle, which induces morphological changes, deformations, and hypertrophy in their host plants. These fungi have not a sporocarp, a thin hymenium layer forms on the host plant, which lacks paraphyses and forms a frost-like whitish-gray coating on the plants, typically on the leaves (Bánhegyi et al., 1985). The fungus

does not penetrate the cells, does not form haustoria (Mix, 1935, Csorba, 1952), but the mycelium spreads in the passages between the cells, causing the plant cells to grow abnormally (Csorba & Berend, 1965). Common lesions are the leaf curl, witches' broom formation, pocket plum and protrusions presence on the pseudo-cones and flowers. These typically appear in spring (Bánhegyi, 1968). *Taphrina* species are distributed worldwide (Mix, 1949; http2; GBIF, 2023e), and Ubrizsy (1967) reports several species of the genus from Hungary. They are typically hosspecialists, often tied to a specific plant genus or species.

Leaf curl is a lesion when wrinkled-vesicular phenomena and distortions can be observed on the surface of the leaf and sometimes a color change can also be detected (e.g. pinkish-reddish in *T. deformans*, red in *T. crataegi*) (Moesz, 1935; Bánhegyi et al., 1985). According to Csorba and Berend (1965), the reason for the color change is the chlorophyll defect, which causes other plant pigments become visible (e.g. carotenoids, xanthophyll) at the expense of green chlorophyll.

Witches' broom is a hypertrophic growth disorder induced by the fungus, characterized by excessive branching and distortion of the shoots, resulting in a structure resembling a witches' broom (Haracsi, 1956; Bánhegyi et al., 1985). It can appear on both trees and shrubs, for example, on the hornbeam *T. carpini (C. betulus)* or the blackthorn *T. insititiae (P. spinosa)* (Győrfi, 1963).

Pocket-plum is a phenomenon when the fruit of *Prunus* species such as plums, becomes distorted. The fruit affected by the disease is elongated, flat, has a wrinkled surface, is slightly curved and does not contain seeds (Szigeti-Gyula, 1902; Moesz, 1935; Bánhegyi et al., 1985).

Also in the case of *T. alni*, the scales of the pseudocone of the *Alnus glutinosa* (L.) Gaertn. 1790 or the *Alnus incana* (L.) Moench 1794 become abnormally elongated, and tongue-like structures appear on them (Hazslinszky, 1885; Moesz, 1923; Bánhegyi et al., 1985). Such species are also *Taphrina johansonii* and *Taphrina rhizophora*, which cause tongue-like, hollow-inside lesions resembling galls on the inflorescences of aspens, from which their name also arises: aspen tongue (Mix, 1949; Rodrigues & Fonseca, 2003).

The aim of our work is to present the *Taphrina* species specific of the Mátra region and to provide data on the distribution of the species.

1.2 Description and literature review of the species found during our work

***Taphrina carpini* (Rostr.) Johanson 1886**

Microscopic characters of the species are the unstemed, cylindrical asci, 20–30 × 7–14 μ, wider at the bottom, 20–24 μ, hyaline, containing 8 oval or round ascospores measuring 2.5–3.5 × 2–3 μ (Mix, 1949; Bánhegyi et al., 1985; Bacigálová, 1992). Its macroscopic recognition is ensured by its characteristic witches' broom formation (Figure 1), as well as the host, which is always hornbeam *(C. betulus)* or oriental hornbeam *(C. orientalis)* (Mix, 1949; Bacigálová, 1992), although data on oriental hornbeam have not yet been reported from our country. Witches' broom is a formation consisting of distorted and very densely growing shoots (Ubrizsy, 1953), resembling bird's nests in winter, without leaves. The leaves on diseased shoots are smaller, light green, wavy, and during spring the hoar like grayish coating of the fungus is visible (Ubrizsy, 1953), and the leaves dry out sooner than the healthy leaves on the foliage (own observation). It can be up to 1 meter wide (Ubrizsy, 1953). It does not cause significant damage to the tree (Ubrizsy, 1953; Haracsi, 1956). According to Csorba (1952) it is quite common, according to Bánhegyi et al. (1985) it is rare in Hungary. According to Kibby (2018), the fungus is more common than we think, but it is rarely reported because most of the nature enthusiast and professional forest walkers do not assume that the phenomenon is caused by a

fungus. Based on Kibby's (2018) observations, the occurrence of the fungus was more common where the trees grew in shady and humid places. According to Reid (1969), it is also rare in Great Britain.

Synonymous or formerly used names: *Ascomyces trientalis var. carpini* (Rostr.) Quél. 1886, *Exoascus carpini* Rostr. 1881, *Lalaria carpini* Á. Fonseca, J. Inácio & M. G. Rodrigues, 2004 (GBIF 2023b, Mycobank).



Figure 1 *Witches' broom on a hornbeam (C. betulus)*

Taphrina cerasi (Fuckel) Sadeb. 1980

It lives on *Cerasus avium* (L.) Moench 1794, *Prunus cerasus* L. 1753, *Prunus padus* L. 1753, *Prunus fruticosa* Pall. 1784 and *Prunus serotina* Ehrh. 1788 species, where it causes witches' brooms up to 3 m in diameter (Figure 2) (except for *P. padus*, which is only 0.5 m), which are almost spherical in shape (Bánhegyi et al., 1985). Its occurrence is scattered, and its damage to plantations is more frequent during rainy weather (Schweigert & Makó, 2003).

The ascus is knobstick-shaped or cylindrical, hyaline, 17–53 × 5–15 µ in size, the ascospores contained within are 6–9 µ in size. It is more likely to appear in trees growing on lime-deficient soils (Csorba & Berend, 1965). The leaves of witches' broom are smaller, light green, even slightly reddish, and have a hoar like coating on the backside (Csorba, 1952). It is interesting that the leaves have a hay-like coumarin odor (Csorba & Berend, 1953).

Synonymous and formerly used names: *Exoascus wiesneri* Ráthay, 1880, *Taphrina wiesneri* (Ráthay) Mix, 1954, *Exoascus cerasi* Fuckel 1870 (GBIF. 2023f, Mycobank).

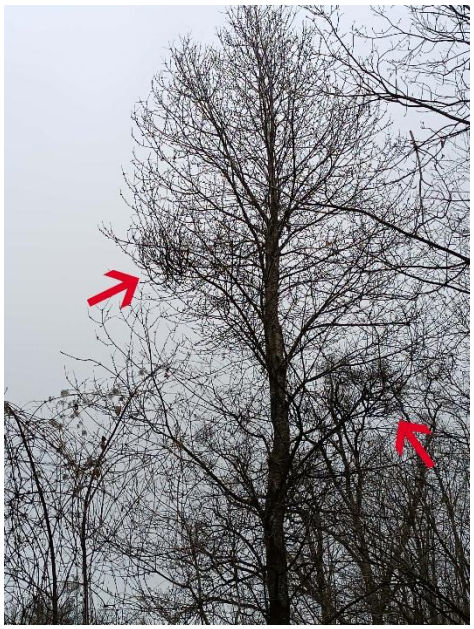


Figure 2 *Witches' broom on a wild cherry (C. avium)*

Taphrina crataegi Sadeb. 1890

It lives on *Crataegus monogyna* Jacq. 1775 and *Crataegus laevigata* (Poir.) DC. 1825 species, causing significant changes mainly on their leaves, which are manifested in red bumps and leaf curl (Figure 3). The leaf blade thickens in places, with a whitish-grey hoar coating visible (Csorba & Berend, 1965). In rare instances, it may appear on flowers or cause upward-facing witches' broom formation of shoots (Csorba & Berend, 1965; Bánhegyi et al., 1985). The red bumps on the leaves are similar to the galls caused by *Dysaphis crataegi* Kaltenbach, 1843 (Hawthorn-carrot aphid) (http1), but they do not have a white-grey fungal coating, and in this case the fungus is not visible in the microscopic specimen. Its microscopic recognition are the cylindrical-conical asci measuring 25–36 × 8–15 µ, and the colorless, spherical spores measuring 4–6.5 µ (Csorba & Berend, 1965; Bánhegyi et al., 1985). According to Bánhegyi et al. (1985) it is not frequent.

Synonymous and formerly used names: *Exoascus crataegi* (Sadeb.) Sadeb 1892, *Exoascus marginatus* Lambotte & Fautrey, 1893, *Taphrina marginata* Lambotte & Fautrey, 1895 (GBIF 2023c, Mycobank).



Figure 3 *Leaf curl on C. monogyna leaves*

***Taphrina deformans* (Berk.) Tul. 1866**

According to several sources, it is the most significant fungal pathogen of peach (*Prunus persica* (L.) Batsch, 1801), and can also occur on almond (*Prunus dulcis* (Mill.) D. A. Webb, 1967), which is the closest relative of peach (Alioto et al., 2020). The most visible symptoms are observed on the leaves, the leaf blade thickens and it becomes wavy and bumpy, and its color becomes yellowish-green, yellowish-brown or reddish-pink. In addition, the shoot may be affected, which becomes curved, the fruit may become bulging, and even the flower, in which the petals, stamens and the seed coat may thicken (Laubert, 1928 in Csorba & Berend, 1965). In all cases, a grayish-white hoar like fungal coating can be detected on the plant parts (Csorba, 1952, Glits, 2000). The ascus is cylindrical-ovate, hyaline, widening at the apex, 17–56 × 7–15 µ in size, containing 8, rarely 4 ascospores with a diameter of 3–7 µ, which can emerge (Csorba, 1952; Csorba & Berend, 1965; Bánhegyi et al., 1985). It infects at low temperatures, 4–14 °C, and it prefers rainy, foggy weather (Glits, 2000). The disease can be controlled using copper-containing fungicides (Csorba, 1952; Bánhegyi, 1968). Multiple infections can weaken trees to the point they necrose. Different peach varieties are not equally susceptible to diseases (Gyökös et al., 2015). It is widespread, occures almost everywhere where peaches are cultivated (Csorba & Berend, 1965; Bánhegyi et al., 1985).

Synonymous or formerly used names: *Ascomyces deformans* Berk. 1857, *Ascosporium deformans* (Berk.) Berk. 1860, *Exoascus amygdali* Jacz. 1926, *Exoascus deformans* (Berk.) Fuckel 1870, *Lalaria deformans* R.T. Moore 1990, *Taphrina amygdali* (Jacz.) 1936 (GBIF 2023d, Mycobank).



Figure 4 *Leaf curl of P. persica*

***Taphrina insititiae* (Sadeb.) Johanson 1886**

It occurs most often on Prunus domestica L. 1753 (Fig. 8), *Prunus insititia* Fr. ex M. Roem. 1847 and *Prunus spinosa* L. 1753 (Gombocz, 1925; Gulyás, 1936; Ubrányi 1936), but Csorba & Berend, 1965 also describes it on *Prunus pennsylvanica* Sarg. 1892. On these hosts, it produces an upward-curving witches's broom consisting of many buds (Figure 4), which can be up to 1.5 meters wide (Ubrányi, 1936; Bánhegyi et al., 1985). The leaves are curled and wavy, their undersides often have a gray hoar like coating typical of *Taprhina* species, and they

often fall off earlier than healthy ones (Csorba & Berend, 1965). The witches's broom is not developing any fruits, the shoots are infertile, containing only leaf buds (Schilberszky, 1908; Csorba, 1952). This is especially noticeable during spring (Figures 5, 6), in April, when the blackthorn is in blooming and the formations that are devoid of flowers and just bearing green leaves are visible. The asci are hyaline, knobstick-shaped, cylindrical, rounded or slightly pointed at the top, measuring 17–33 × 5–10 µ, containing round spores measuring 3–5 µ. Previously, it was often considered synonymous with the species *Taprhina pruni* (Fuckel) Tul. 1866 (Mix, 1949), but genetic studies confirme that it represents a distinct species (Petrydesová, 2013). In Hungary, it is mentioned by Hazslinszky (1885) and Moesz (1942) from Budapest, and according to Bánhegyi et al. (1985) it is rare in the country.

Synonymous or formerly used names: *Exoascus insititiae* Sadeb., 1883 (GBIF 2023f, Mycobank).



Figure 5 *Witches' broom on P. spinosa*



Figure 6 *Witches' brooms can be easily observed in spring, on flowering P. spinosa before the leaves emerge*

2 Materials and Methods

The datas of the species presented in our work were collected during field work between 2019–2026. The samples were taken from the diseased plant we found and identified it using a Bresser Researcher Bino light microscope based on the identification of Bánhegyi et al. (1985). The identification of the host plants was based on the work of Gencsi and Vancsura (1992). All data shown are collected by the authors. The results provide the collection of location, time, host, and habitat type or vegetation of the detected species. The detected species and their data are summarized in Tables 1, 2, 3, 4, 5, 6.

3 Results, enumeration

Table 1 The found habitats of Taphrina carpini, date of collecting, the host and vegetation or habitat

Location of habitats	Date of collection	Host	Habitat or vegetation
Mátraháza, near road 24	05. 04. 2025.	*C. betulus*	oak-hornbeam-beach forest
Mátraháza, Nagy-Hidas Brook valley	06.25.2023.	*C. betulus*	oak forest
Gyöngyösoroszi-Károlytáró	10. 04. 2023.	*C. betulus*	oak-hornbeam forest
Gyöngyössolymos, Nagy Bükk	04.20.2023.	*C. betulus*	oak-hornbeam forest
Parádsasvár, Köszörű Brook valley	04.17.2023.	*C. betulus*	oak-hornbeam-beach forest
Mátraszentlászló, side of Ágasvár	06.21.2025.	*C. betulus*	oak-hornbeam forest
Mátraszentlászló, Büdös-lápa saddle	06.21.2025.	*C. betulus*	oak-hornbeam forest
Mátraszentimre, at the end of Deák Ferenc St.	07.06.2025.	*C. betulus*	Village
Mátraszentimre, side of Nagy-nyak	07.06.2025.	*C. betulus*	oak-hornbeam forest

Table 2 The found habitats of Taphrina cerasi, date of collecting, the host and vegetation or habitat

Location of habitats	Date of collection	Host	Habitat or vegetation
Mátraháza, near the training camp	26. 03. 2026.	*C. avium*	oak-hornbeam forest with wild cherry

Table 3 The found habitats of Taphrina crataegi, date of collecting, the host and vegetation or habitat

Location of habitats	Date of collection	Host	Habitat or vegetation
Verpelét, Várhegy	20. 04. 2025.	*C. monogyna*	Dry-semidry pioneer scrub with blackthorn and hawthorn

Table 4 The found habitats of Taphrina deformans, date of collecting, the host and vegetation or habitat

Location of habitats	Date of collection	Host	Habitat or vegetation
Gyöngyös, near the Toka-brook	10. 05. 2019.	*P. persica*	Garden
Kisnána, Béke Street	20. 04. 2025.	*P. persica*	Garden

Table 5 The found habitats of Taphrina insititiae, date of collecting, the host and vegetation or habitat

Location of habitats	Date of collection	Host	Habitat or vegetation
Gyöngyöspata near road 2406	26. 02. 2025.	*P. spinosa*	Dry-semidry pioneer scrub with blackthorn and hawthorn
Pálosvörösmart, Benehát szíjja parcel	12. 03. 2025.	*P. spinosa*	Intensive wineyards shrubby with blackthorn
Tar, before Villástelep	14. 04. 2025.	*P. spinosa*	Dry-semidry pioneer scrub with blackthorn
Pásztó, Gépállomás housing estate, bus stop	14. 04. 2025.	*P. spinosa*	Dry-semidry pioneer scrub with blackthorn
Novaj, between Ostoros-brook and Novaj-brook	17. 04. 2025.	*P. spinosa*	Dry-semidry pioneer scrub with blackthorn
Verpelét, Várhegy	20. 04. 2025.	*P. spinosa*	Dry-semidry pioneer scrub with blackthorn and hawthorn
Salgótarján-Salgópuszta	19. 05. 2025.	*P. spinosa*	oak-hornbeam forest
Parádfürdő, Ilona-valley	03. 04. 2026	*P. domestica*	Farm near the oak forest

Location of habitats	Date of collection	Host	Habitat or vegetation
Gyöngyös-Sástó, tourist rest area	05.04.2025.	*P. spinosa*	Dry-semidry pioneer scrub with blackthorn and hawthorn of a recreation area near the Sástó



Figure 8 *Numerous witches' broom on plum*

4 Discussion

In conclusion, it can be said that *Taphrina* species are widespread in the studied areas of Hungary (Mátra region and its surroundings), and it is likely that more data will be obtained in the future during more field work. Based on Kibby's work, which states that the fungi registration system of Great Britain and Ireland contained only 40 records of the species *T. carpini* in 2018. This is similar in Hungary, there are only a few described data, but the fungi may be much more common than previously reported in the literature. This may be because these fungi are less of a focus for mycologists and even less data are published. Their forestry-economic importance is negligible (except for T. deformans, which is a significant pathogen), but from an ecological point of view they can be viewed positively in terms of biodiversity.

Each such hypertrophic lesion also creates a useful microhabitat for the microbiome, which has already been demonstrated in beech trees (goiter, witches' broom) (Frank & Aszalós, 2024). In Hungary, the only *Taphrina* species that specifically lives on oaks is *Taphrina caerulescens* (Desm. & Mont.) Tul. 1866 (Bánhegyi et al., 1985), which causes oak leaf blister (Birdwell, 1996), and we did not find it during our work. No species causing witches' broom has yet been found on oaks in our country. Witches' broom is caused by *Taphrina kruchii* (Vuill.) Sacc. 1892, mainly on *Quercus ilex* L., 1753 species in its distribution area, in the Mediterranean region (Spooner, 2007). However, we have managed to detect data of five species 11 from oak habitats, thus proving that *Taphrina* species are characteristic elements of the oak ecosystem of the Mátra region.

In this work, we report 22 data of five species on seven host plant, which contribute to the knowledge of the fungi of Northern Hungary and to the understanding of the distribution and

host plants of the species. Considering that, most likely only one *Taphrina* species, *Taphrina pruni* (Fuckel) Tul. 1866, has been reported yet from the Mátra region (Hódosi, 1965), the number of species recorded of the genus increases to six of the mesoregion.

Acknowledgements

We would like to express our gratitude to Boglárka Korpai for the language review.

References

Alioto, T., Alexiou, K. G., Bardil, A., Barteri, F., Castanera, R., Cruz, F., Dhingra, A., Duval, H., Fernández i Martí, Á., Frias, L., Galán, B., García, J. L., Howad, W., Gómez-Garrido, J., Gut, M., Julca, I., Morata, J., Puigdomènech, P., Ribeca, P., Rubio Cabetas, M. J., Vlasova, A., Wirthensohn, M., Garcia-Mas, J., Gabaldón, T. and Casacuberta, J. M. 2020. Transposons played a major role in the diversification between the closely related almond and peach genomes: results from the almond genome sequence. Plant Journal. **101** (2) 455–472. https://doi.org/10.1111/tpj.14538

Bacigálová, K. 1992. New localities of Taphrina carpini (Rostr.) Johans, on Carpinus betulus in Slovakia. Česká Mykologie. **46** (3–4) 296–302. http://czechmycology.org/_cm/CM46316.pdf (downloaded January 4, 2026). https://doi.org/10.33585/cmy.46316

Bánhegyi, J. 1968. Gombák. In Árokszállásy, Z., Bánhegyi, J., Boros, Á., Gallé, L. and Hortobágyi, T. Növényhatározó, I. kötet, Baktériumok-mohák. 197–358.

Birdwell, D. O. B. 1996. Pathogenicity studies of Taphrina caerulescens causal organism of oak leaf blister disease. Stephen F. Austin State University. 65 p.

Csorba, Z. 1952. Ascomycetes (Tömlősgombák). In Ubrizsy, G. (ed.) Növénykórtan. Akadémiai Kiadó, Budapest, 385–558.

Csorba, Z. and Berend, I. 1953. Gyümölcsfák betegségei. In Ubrizsy, G. (ed.) A növényvédelem gyakorlati kézikönyve. Mezőgazdasági Kiadó, Budapest, 468–516.

Csorba, Z. and Berend, I. 1965. Ascomycetes. In Ubrizsy, G. (ed.) Növénykórtan II. Akadémiai Kiadó, Budapest, 97–318.

Frank, T. and Aszalós, R. 2024. Az erdei biodiverzitás-megőrzés gyakorlati lehetőségei kezelt bükkösökben. In Bartha, D., Csóka, Gy. and Mátyás, Cs. (eds) A bükk és bükkösök Magyarországon. Az MTA Erdészeti Tudományos Bizottságának Tanulmánykötete IV. Soproni Egyetem Kiadó, Sopron, 434–450.

GBIF. 2023a. Taphrina Fr., 1815. In GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset. https://doi.org/10.15468/39omei (accessed via GBIF.org on January 2, 2026).

GBIF. 2023b. Taphrina carpini (Rostr.) Johanson. In GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset. https://doi.org/10.15468/39omei (accessed via GBIF.org on January 9, 2026).

GBIF. 2023c. Taphrina crataegi Sadeb. In GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset. https://doi.org/10.15468/39omei (accessed via GBIF.org on January 14, 2026).

GBIF. 2023d. Taphrina deformans (Berk.) Tul. In GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset. https://doi.org/10.15468/39omei (accessed via GBIF.org on January 27, 2026).

GBIF. 2023g. Taphrina ulmi (Fuckel) Johanson. In GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset. https://doi.org/10.15468/39omei (accessed via GBIF.org on January 28, 2026).

GBIF. 2023e. Taphrina Fr., 1815. In GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset. https://doi.org/10.15468/39omei (accessed via GBIF.org on February 18, 2026).

GBIF. 2023f. Taphrina cerasi (Fuckel) Sadeb. In GBIF Secretariat (2023). GBIF Backbone Taxonomy. Checklist dataset. https://doi.org/10.15468/39omei (accessed via GBIF.org on March 29, 2026).

Gencsi, L. and Vancsura, R. 1992. Dendrológia. Mezőgazda Kiadó, Budapest, 728 p.

Gjaerum, H. B. 1964. The genus Taphrina Fr. in Norway. Nytt Magasin for Botanikk. **11** 5–26.

Glits, M. 2000. Gyümölcsfélék betegségei. In Glits, M. and Folk, Gy. (2000). Kertészeti növénykórtan. Mezőgazda Kiadó, Budapest, 167–262.

Gombocz, E. 1926. Rendszeres növénytan 2. Gombák, zuzmók, mohák. Tudományos Gyűjtemény 25, 167.

Gulyás, A. 1936. Adatok a boszorkányseprő kérdéséhez. Növényvédelem. **12** (12) 267–268.

Gyökös, I. G., Timon, B. and Szalay, L. 2015. Őszibarackfajták fogékonysága a Taphrina deformans (Berk.) Tul. kórokozóra. Kertgazdaság. **47** (2) 14–24.

Hazslinszky, F. 1885. Magyarhon és társországainak szabályos discomycetjei. Mathematikai és Természettudományi Közlemények. **21** 11–18.

Hódosi, S. 1965. Adatok a kertgazdasági növényeinket károsító mikroszkópikus gombaflórához. In Máthé, I. (ed.) Botanikai Közlemények. **52** (1) 1–5.

http1. Dysaphis crataegi (Hawthorn-carrot aphid) – Identification and Gall Morphology. https://influentialpoints.com/Gallery/Dysaphis_crataegi_Hawthorn-umbellifer_aphids.htm

http2. https://www.cabidigitallibrary.org/doi/10.1079/DMPD/20046500192

Kibby, G. 2018. A striking witch's broom caused by Taphrina carpini. Field Mycology. **19** (3) 81–82. https://doi.org/10.1016/j.fldmyc.2018.07.006

Mix, A. J. 1935. The life history of Taphrina deformans. Phytopathology. **25** (1) 41–66.

Mix, A. J. 1949. A monograph of the genus Taphrina. University of Kansas Science Bulletin. **33** 1–167. https://doi.org/10.5962/bhl.part.16125

Moesz, G. 1923. Gombaokozta gubacsok. Természettudományi Közlöny. **55** 20–31.

Moesz, G. 1935. A növénybetegségek csoportosítása és megnevezése. In Szabó, Z. (ed.) Botanikai Közlemények. **32** (1–6) 9–143.

Moesz, G. 1942. Budapest és környékének gombái. In Lengyel, G. and Moesz, G. (eds) Botanikai Közlemények. **39** (6) 281–599.

Petrydesová, J., Bacigálová, K. and Sulo, P. 2013. The reassignment of three 'lost' Taphrina species (Taphrina bullata, Taphrina insititiae and Taphrina rhizophora) supported by the divergence of nuclear and mitochondrial DNA. International Journal of Systematic and Evolutionary Microbiology. **63** 3091–3098. https://doi.org/10.1099/ijs.0.052712-0

Reid, D. A. 1969. New or interesting British plant diseases. Transactions of the British Mycological Society. **52** 19–38. https://doi.org/10.1016/S0007-1536(69)80156-7

Rodrigues, M. G. and Fonseca, Á. 2003. Molecular systematics of the dimorphic ascomycete genus Taphrina. International Journal of Systematic and Evolutionary Microbiology. **53** (2) 607–616. https://doi.org/10.1099/ijs.0.02437-0

Schilberszky, K. 1908. Gyümölcsfáink boszorkányseprőiről. Gyümölcskertész. **18** (23–24) 373–376.

Schweigert, A. and Makó, Sz. 2003. A cseresznye védelme. Növényvédelem. **39** (2) 65–84.

Spooner, B. 2007. A Taphrina species on Quercus ilex in Britain. Field Mycology. **8** (3) 77–79. https://doi.org/10.1016/S1468-1641(10)60461-6

Szigeti-Gyula, A. 1902. A bábaszilva és az őszi baraczkfa levélfodrosodása. Természettudományi Közlöny. **34** (389–400) 73–6749.

Ubrányi, J. 1936. Boszorkányseprő. Növényvédelem. **12** (9) 197–198.

Ubrizsy, G. 1953. Erdei növények betegségei. In Ubrizsy, G. (ed.) A növényvédelem gyakorlati kézikönyve. Mezőgazdasági Kiadó, Budapest, 714–781.

Ubrizsy, G. 1967. Review of the mycoflora of Hungary. Part II. Acta Phytopathologica. **2** 265–285.

This work is licensed under a
Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

A műre a Creative Commons 4.0 standard licenc alábbi típusa vonatkozik:
CC-BY-NC-ND-4.0.

