



## THE MOST DANGEROUS PATHOGENS OF HERBS FROM LAMIACEAE AND PLANTAGINACEAE FAMILY

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**Abstract.** Studies on the diversity of fungi colonizing and damaging various parts of herbs from Lamiaceae family were carried out in 2004-2009 and from Plantaginaceae family in 2009-2011 correspondingly. *Phoma strasseri*, the most dangerous pathogen of peppermint (*Mentha piperita*) was commonly obtained from peppermint rhizomes and stems with symptoms of necrosis and tissue disintegration. *Phomopsis sclarea* was isolated from sage (*Salvia officinalis*) stems, showing symptoms of necrosis, peeling off and bark breaking. *Phoma nepeticola* was obtained from the motherwort (*Leonurus cardiaca*) leaves and stems with symptoms of small necrotic spots. *Phyllosticta plantaginis* was isolated from leaves of ribwort (*Plantago lanceolata*) showing symptoms of small, regular, necrotic spots.

**Key words:** *Phoma nepeticola*, *Phoma strasseri*, *Phomopsis sclarea*, *Phyllosticta plantaginis*, fungi, occurrence, peppermint, sage, motherwort, ribwort

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### Introduction

In recent years, in south-eastern Poland spice and medicinal plants from the Lamiaceae family, e.g. motherwort (*Leonurus cardiaca* L.), sage (*Salvia officinalis* L.), and peppermint (*Mentha piperita* L.) and Plantaginaceae family e.g. ribwort (*Plantago lanceolata* L.) have been cultivated. Grouping of the herbaceous plants in this region causes their frequent return to the same field, which contributes to the accumulation of fungi decreasing the quality and quantity of the yield (ZIMOWSKA & MACHOWICZ-STEFANIAK 2005; ZIMOWSKA 2007, 2011).

The present paper discusses the results of perennial studies on the diversity of fungi occurring and damaging the underground and aboveground parts of herbs from Lamiaceae and Plantaginaceae families.

### Material and methods

The studies conducted in 2004-2009 concerned three plantations of two-year-old motherwort plants, sage plants and peppermint

and in 2009-2011 three one-year-old plantations of ribwort plants. The percentage of plants with necrotic symptoms on the stems and the leaves, and in the case of peppermint, also on the rhizomes, was determined each year at the beginning of vegetation and at full vegetation, directly in the fields. Plants with disease symptoms were taken for laboratory studies. The presence of fungi was established on the basis of etiological symptoms occurring on the infected parts of plants, and on the basis of mycological analysis. Fungi were isolated from the superficially disinfected roots, the stems up to the height of 25 cm from the base, leaves and peppermints rhizomes. The plant material was disinfected in 10% sodium hypochlorite and the mineral medium was used for the isolation of fungi (ZIMOWSKA & MACHOWICZ-STEFANIAK 2005). The obtained fungal colonies, after segregation and after making single-spore cultures, were marked for the species on the maltose medium or on standard media (RIFAI 1969; ELLIS 1971; RAMIREZ 1982; NELSON *et al.* 1983; UECKER 1988; VAN DER AA & VANEV 2002; BOEREMA *et al.* 2004).

## Results

During the studies, different disease symptoms on all examined parts of plants were observed. Regular, necrotic spots of 3-5 mm diameter occurred on motherwort leaves and stems up to the height of 5 to 20 cm from the base. Etiological signs in the form of conidia with the features typical of *Phoma* genus were found on such plant parts. *Phoma nepeticola* (Melnik) Dorenb was isolated from the stems and the leaves showing above mentioned symptoms. The mean proportion of the isolates of this fungus constituted 11.74% and 8.57% of all fungi obtained from the studied parts, respectively.

Characteristic disease symptoms were observed on the sage stems at the height of 10 to 20 cm from the base. Those were brown, oblong spots, which frequently merged together, covering the stem around. Peeling off and breaking of the bark occurred in such places. Conidioma and conidia with the morphological features characteristic of *Phomopsis* genus were found in the cracks of the stem bark. *Phomopsis sclarea* Sarwar was obtained from the sage stems with such symptoms. The isolates of this species constituted 8.86% of all fungi obtained from that part.

*Phoma strasseri* Moesz was commonly isolated from the stems and the rhizomes of peppermint showing symptoms of necrosis and tissue disintegration. The mean proportion of the isolates of this fungus constituted 9.47% and 15.15% of all fungi obtained from the examined parts.

Isolates of *Phyllosticta plantaginis* Sacc. were obtained in all studied years for the leaves of ribwort with the symptoms of small, irregular, necrotic spots with the diameter ranging from 2 to 4 mm, where etiological signs were observed in the form of pycnidia including conidia with the features typical of genus *Phyllosticta*. Totally, 161 isolates of *P. plantaginis* were obtained during the 3 years of studies, which constitutes 32.99% of all fungi obtained from the analyzed leaves of ribwort plantain.

## Discussion and conclusions

The present studies pointed to diversity of pathogenic fungi occurring in the cultivated environment of the studied herb species from Lamicaeae and Plantaginaceae families. One of these fungi is *Phoma nepeticola*, which was obtained from the stems and leaves of motherwort with the symptoms of regular necrotic spots. The fungus is described in literature as a commonly occurring pathogen of *nepeta* (*Nepeta cataria* L.) and other species from genus *Nepeta* (DE GRUYTER *et al.* 2002). Monographic studies also provide information on the possibility of the above mentioned species infecting other plants from the family of Lamicaeae, e.g. motherwort and peppermint (MEL'NIK 2000; DE GRUYTER *et al.* 2002; BOEREMA *et al.* 2004).

The species of *Phomopsis sclarea* was recognized as the main cause of specific symptoms on sage stems, in the form of necrotic spots and breaking of the bark (UECKER 1988). Such a conclusion is justified by the fact of isolating the fungus cultures from the infected places and the presence of etiological signs in the form of fungal conidia. Among the many species from genus *Phomopsis*, over 60 are regarded as important pathogens to different host plants, including herbaceous ones (UECKER 1988). The latter include, for example, *P. diachenii* Sacc., occurring on caraway and causing dying out of umbels (GABLER & EHRIG 2000; MACHOWICZ-STEFANIAK 2009), *P. subordinaria* (Desm.) Trav., causing necrosis and dying out of buckthorn plantain inflorescences (LAINE 2003), *P. lavandulae* (Gabotto) Cif. & Vigni, lavender pathogen commonly occurring in Europe (BEUS 2006) and *P. sclarea*, isolated in Poland for the first time (UECKER 1988, ZIMOWSKA 2010).

The species of *Phoma strasseri* was recognized as the cause of necrosis, and then rot of the stems and rhizomes of peppermint (BOEREMA *et al.* 2004). Common isolation of the fungus cultures from the dying parts, the presence of etiological signs on them as well as positive results of pathogenicity tests justify such conclusions (ZIMOWSKA 2012). Black rot of mint stems and

rhizomes also called mint phomosis is at present one of the most dangerous diseases of plants cultivated in India, Japan, the United States and in Europe (MELOUK & HORNER 1972; KALRA *et al.* 2004; ZIMOWSKA 2007). Yield losses reaching even 90% are caused by quickly proceeding tissue degradation resulting from the enzymatic decomposition of pectin compounds by polygalacturonase and macerating enzymes produced by *P. strasseri* (MELOUK & HORNER 1973).

What deserved special attention is obtaining the species that was not noted in Poland before, namely *Phyllosticta plantaginis*, from ribwort leaves with the symptoms of small necrotic regular spots. The fungus is described in literature as a pathogen causing the spots of ribwort and broadleaf (*Plantago major L.*) (SACCARDO 1878; FARR *et al.* 1995). Isolation of numerous fungus cultures from the leaves showing specific disease symptoms, the presence of etiological signs on them and the fulfillment of Koch's postulates for selected isolates of the fungus in pathogenicity tests in *in vitro* conditions allow to consider *P. plantaginis* as a pathogen of ribwort.

The satisfactory and repeatable quality of raw materials obtained from herbaceous plants depends on a number of abiotic and biotic factors. One of them is the phytosanitary condition of plants during their cultivation. The present studies pointed to the diversity of pathogenic fungi, which – as a result of injuring the plants – exerts a negative effect on the quality and quantity of raw materials. In the light of GAP principles, all injured plants or their parts must be eliminated from the further process of production.

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