Statice Downy Mildew and Plant Susceptibility to *Peronospora statices*

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Abstract

Downy mildew symptoms were observed on all aboveground statice parts. *Peronospora statices* develops on plants during whole vegetation period and even in wintertime, when the temperature rises above 5°C. Even on partially protected plantations most plants die in the second-year of growth. Among statice plants three groups related to plants and leaves shape can be distinguished: very susceptible, moderately susceptible and tolerant. No resistant plants were found.

Keywords: *Peronospora statices*; symptoms; German statice; disease spread; susceptibility

INTRODUCTION

German statice, *Goniolimon tataricum* (L.) Boiss., is the main perennial plant grown in Poland for dry bouquets. Several pathogens were reported on statice including phytoplasma, *Fusarium* spp., *Rhizoctonia solani* Kühn, *Botrytis cinerea* Pers. and *Uromyces limonii* (DC.) Berk. Diseases may strongly decrease the plants development, diminish flower quality and lower their yield. Surveys of SZABÓ and VIRÁNYI (1990), KOIKE *et al*. (1998), SKRZYPCZAK (1999) indicated on *Peronospora statices* Lobik as the most dangerous threat of statice. Till now *Peronospora statices* was reported in Poland only on cultivated *Goniolimon tataricum* plants.

The objectives of the study were to describe disease symptoms, to investigate the spread and development of statice downy mildew and to find some relationship between morphological diversity of statice plant and their susceptibility to pathogen.

MATERIAL AND METHODS

Development of downy mildew symptoms on Goniolimon tataricum. Observations of downy mildew symptoms were done on plants grown in the field and under plastic condition. During few growing seasons, plants were observed weekly and checked for pathogen sporulation and disease symptoms.

Spread and development of statice downy mildew. Experiments were conducted under plastic tunnel and in open field conditions. Statice seedlings used in all trials, were obtained from seeds taken from commercial plantations, naturally infested with *P. statices*. All plants were surveyed visually at weekly intervals for disease symptoms. In the plastic tunnel the spread of *Peronospora statices* on plants was observed during the next 63 weeks and in the field for 42 weeks except wintertime. Experimental design was completely randomised with 4 replications and at least 50 plants in each rep. Results of experiments were statistically evaluated using analysis of variance. Duncan's multiple range test was used for means separation.

Susceptibility of statice plants to Peronospora statices. To find out relationship between morphological differences of statices and their susceptibility to pathogen young leaves with fully expanded blades were collected. The ratio of length to width of sampled leaves was calculated. Besides that, on the base of leaf shape similarity, we tried to classify leaves into groups and also find mean ratio to each group. Specimens were sampled from four months old plants grown in the open field, one leaf from each plant.

RESULTS AND DISCUSSION

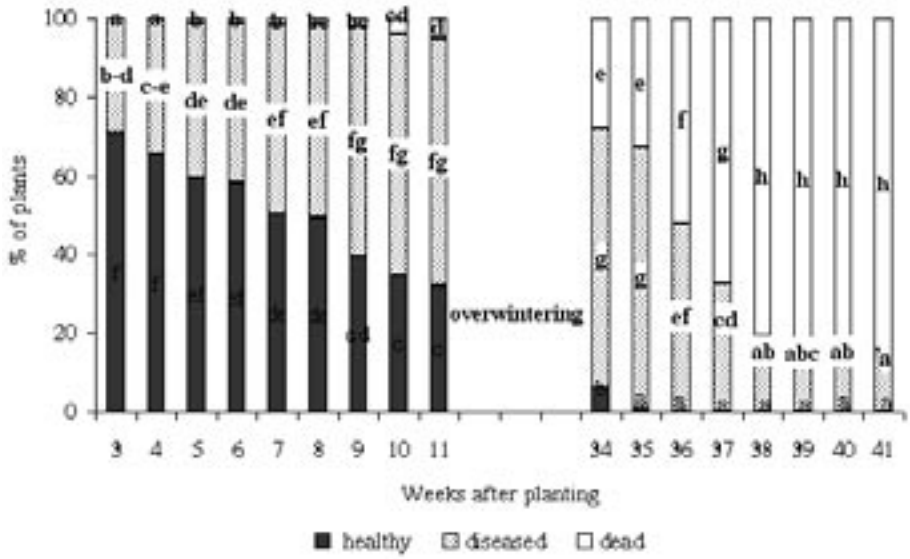
Development of downy mildew symptoms on Goniolimon tataricum. Infection started from boat-shaped

or rolled, young leaves. First, sporadically noticed statice seedlings with chlorotic leaves and irregular brown spots on the blades were already observed on 4-month-old plants under plastic tunnel. After the next 2–3 weeks the leaves changed colour to brown and died. On the older plants most of the young leaves in the rosette centre were chlorotic. Sporadically, small, brown lesions were observed. The weather conditions, especially air humidity and temperature, strongly influenced the development of sporulation on the invaded leaves. A minimum 2 weeks after changing of blade colour to light-green or green-yellow, on the under surface and sometimes on upper part of leaves whitish conidiophores with conidia of *P. statices* were noticed. In high humidity sporulation was often observed on the upper side of leaf blades. On plants grown in high, constant humidity and temperature below 18°C the number of conidiophores increased and fungal organs were greyish-brown. Extension of the pathogen sporulation and increase of conidiophore numbers resulted in their browning. On the upper side of leaf blades, in the sporulating areas, brown, oval or irregular spots developed from the edge of leaves and extending to the main veins were observed. During warm and dry weather spots on invaded leaf areas, looked like sunburn on the upper side of statice leaves. The bases of the lower parts of leaf petioles were soft and dark violet. Necrosis extended to the surrounding leaf petioles. Finally, almost all rosettes of statice died. When pulled up, the rosettes invaded easily break-up, whereas the roots were still healthy.

On field-grown statice, in the second year, a canopy of inflorescence produced by invaded statice plants, was drastically stunted and chlorotic. SKRZYPCZAK's (1992) studies showed that yield of non-protected statice flowers decreased about 30–50%. In the beginning, the inflorescence branches were light green, and yellow, and later orange-brown and brown. The edges of stems were yellow-green and the spikes were bent but not wilted. On some parts of the branches abundant sporulation of *P. statices* was observed. The fungus sporulated, however, mainly on inflorescence spikes. Heavy infected spikes and branches were brown and decayed.

Spread and development of statice downy mildew. In the field experiment, after 3-weeks-growth, 30% of the plants showed downy mildew symptoms (Figure 1).

To the first frost almost 70% of statice were invaded by *P. statices*. First, dead plants were observed after 5 weeks of growth and within 11 weeks about 5% of plants died. Overwintering period did not stop the development of downy mildew. After that time only about 5% of plants looked healthy, whereas close to 30% were dead. This process increased very quickly during the next 4 weeks. On May and at the beginning of June 1999 the development of the disease was very slow (Figure 1). The data obtained confirmed the observation of healthiness of statice plantations. Even



Means marked with the same letter do not differ at 5% of significance (Duncan's multiple range tests). Means separation for each category of plants

Figure 1. The spread and harmfulness of *Peronospora statices* on *Goniolimon tataricum* grown in the field (N = 1000 plants). Planting time: 1998-08-14; first observation: 1998-09-07; last observation: 1999-06-04

on partially protected plantations most plants die in the second-year of growth. This indicates that the disease can develop very rapidly when weather conditions, and probably plant fertilisation, favour it.

The question arises to the source of the pathogen in Poland. The fungus may survive in infected, evergreen leaves. Observations showed the development of the pathogen even in wintertime, when the temperature rises above 5°C. This shows that the fungus survives as dormant mycelium in statice leaf rosette or crown of the plants. Oospores were not found in statice tissue infected by *P. statices*. HALL *et al*. (1997) recorded however, the first occurrence of oospores-forming strain of *P. statices* on *Limonium sinuatum* in 3 European countries.

Susceptibility of German statices plants to Peronospora statices. Morphological diversity is characteristic phenomena for generatively propagated statice plants. On the bases of many year observations, among statice plants three groups related to plants and leaves shape can be distinguished: very susceptible, moderately susceptible and tolerant. No resistant plants were found. Very susceptible plants have compact shape and obovate leaves with short petiole, whereas leaves of tolerant plants have narrow lanceolate blades. Leaves of moderately susceptible statices have oblong-lanceolate shape.

Ratio value of collected leaves varied from two to over five (Figure 2). About 62% of the measured leaves belong to the group of value 3–3.9, 23% to the group of value 2–2.9, 13% to the group 4–4.9 and only 2.5% to the group 5–5.9. Statice plants belonging to groups 2–2.9 and 5–5.9 seems to be tolerant, whereas of the most numerous groups contained very sensitive and moderately sensitive statice plants. Attempts to classify statice into group according to their leave shape similarity do not gave good results because ratio value of separated groups was divergent.

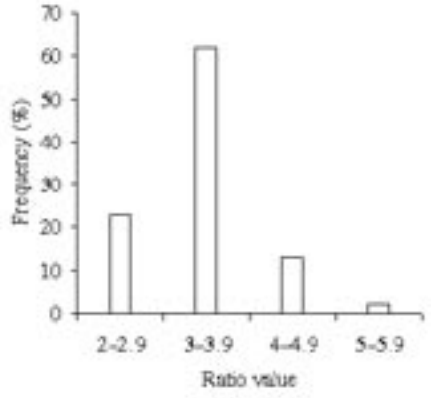


Figure 2. Characteristic of statice population in relation to length/width ratio value of their leaves

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