

Occurrence of *Puccinia xanthii* Schw. on cockleburs in Hungary

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Abstract

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Puccinia xanthii Schw., a widespread rust on cocklebur species, is possible to be used as a biological agent in control of these weeds. There have been, however, some reports about certain hybrids of sunflower infected with this rust from several parts of the world. This rust was observed for the first time on the Italian cocklebur in Hungary in 2002. Since then, infections of cockleburs occurred yearly in advanced growing season. *P. xanthii* has not yet infected any of 15 hybrids of sunflower grown in Hungary, either in a field experiment or in the greenhouse. *Ambrosia artemisiifolia* grown together with infected cockleburs have not developed symptoms of presence of *P. xanthii* under field conditions since the first occurrence of the rust in Hungary. Although the rust can infect cockleburs even at their cotyledonous stage, natural infections start in the second part of the growing season, so the role of *P. xanthii* seems to be without significance in biological control of cocklebur species in Hungary at present.

Key words

Puccinia xanthii, *Ambrosia artemisiifolia*, cocklebur spp., biological control

Introduction

Puccinia xanthii, a widespread rust on cockleburs, has been reported to be a possible agent for biological control of cocklebur species JULIEN et al., 1979, MORIN et al., 1992a).

The host range of *Puccinia xanthii* is relatively restricted and includes *Xanthium* spp., *Ambrosia* spp., *Calendula officinalis*, some cultivars of sunflower and artichoke (PARMELEE, 1969; BATRA, 1981; ALCORN, 1976; ALCORN and KOCHMAN, 1976; PRETORIUS et al., 2000; GULYA and CHARLET, 2002).

The genus *Xanthium* is highly susceptible to this rust (MORIN et al., 1993), there are, however, differences in susceptibility of *Ambrosia* species or populations. PARMELEE (1969) observed that hosts of the rust were *Ambrosia artemisiifolia* L., *A. psilostachya* DC., *A. trifida* L., but MORIN et al. (1993) did not find infections by *P. xanthii* on Australian *A. artemisiifolia*. BATRA (1981) reports that *P. xanthii* forma specialis *ambrosia-trifidae* attacks *A. trifida* and reduces the seed

and pollen production, seed weight and seedling vigor, however, these teliospores did not infect *A. artemisiifolia* in his tests.

P. xanthii is a microcyclic autoecious rust, lacking pycnial, aecial and uredinal stages. „Telia pulvinate, mostly hypophyllous, in compact circular groups up to 10 mm diam or occasionally scattered individually or in small groups, dark brown, becoming cinereous from center, usually surrounded by conspicuous chlorotic tissue. Teliospores narrowly ellipsoid to ovoid, apex obtuse, base tapered, usually constricted at septum, 32–72 x 13–24 μ ; wall dark yellow-brown, smooth, not conspicuously laminate, 0.8–1.0(–1.6) μ at side, 3.2–11.8 μ at apex; pores apical and septal; pedicel yellow-brown, persistent, 15–50 μ long” (PARMELEE, 1969).

The optimum temperature for the germination of teliospores of *P. xanthii* was between 20 and 30 °C, and the optimum temperature for the production and germination of basidiospores was 20 °C. The highest levels of infection of *X. occidentale* were observed at temperatures of 20 and 25 °C. A dew period of 2–3 h was

sufficient to achieve a high level of infection (MORIN et al 1992a).

The world distribution of this rust consists of Canada, USA, Mexico, Carribean, Hawaii, Japan, India and Southern Europe (Spain, Southern France, Romania, Bulgaria) (PARMELEE, 1977; MORIN et al., 1992b).

In Hungary, this rust was reported for the first time in 2002 (DÁVID et al., 2003).

Material and methods

Infections of *Xanthium italicum* Moretti, *Ambrosia artemisiifolia* by *Puccinia xanthii* have been studied on several arable lands of the Hajdú-Bihar county in every year since 2002 when the rust was found in Hungary for the first time.

A pathogenicity test was conducted in a greenhouse (24 °C and a high relative humidity) according to the “leaf disc method” proposed by MORIN et al. (1993) on Italian cocklebur leaves freshly collected, in the first year.

Susceptibility of 15 hybrids (Zoltán, Hysun-321 PR, Alexandra PR, Rigasol PR, PR 63 A 90, NS-H-909, NS-H-930, NS-H-919, NS-H-703, NS-H-474, NS-H-901, NS-H-906, NS-H-927, NS-H-928, NS-H-923) of sunflower was examined in a field experiment and in the greenhouse. In the field experiment, cockleburs and sunflower plants were grown together, and the plants were examined weekly, after appearance of the first symptoms on cockleburs.

In the greenhouse, susceptibility of sunflower hybrids was studied by the “leaf disk method”, under optimal conditions for the rust development.

Results and discussion

Puccinia xanthii was detected on Italian cocklebur in 2002 in Debrecen, eastern Hungary. The symptoms were found on leaves, stems and petioles of plants. Density of a hunter burr population influenced the rate of infection. If the population density was high (20 plants m⁻²), the infection reached 70 percent by September. The first symptoms appeared towards the end of July, in the form of small chlorotic raised spots on the abaxial side of leaves. Dark brown telia (3.8 mm diam in average) developed on the spots. Elliptical telia occurred at a rate of 0.02–2.37 pustules cm⁻² on leaves. Elongated pustules caused swelling and epidermal splitting on stems and petioles.

The teliospores were brown, two-celled, 35 to 56 x 15 to 21 µm in size, with the walls from 0.8 to 1.0 µm at the side and 5 to 8 µm at the apex, the septum 1 to 1.5 µm, and persistent pedicel 15 to 50 µm. Under op-

timum conditions, teliospores germinated immediately, producing metabasidia, and basidiospores were produced within 5 hours.

Infections of cockleburs occurred in every year since 2002. The first symptoms developed towards the end of July in 2003 and 2004, in August in 2005 and in September in 2006.

In spite that infections in 2003 and 2004 were heavy, the rust attack at later stages of growth did not affect significantly plant growth, seed production and seed germination.

Sunflower hybrids did not develop any symptoms, either in field or in the glasshouse experiments.

Common ragweed did not develop symptoms in field experiments grown together with the infected cockleburs, in any year.

At present, *Puccinia xanthii* does not seem to be endangering the sunflower growing in Hungary, however, several hybrids growing in other parts of the world have already developed symptoms of the rust (ALCORN and KOCHMAN, 1976; GULYA and CHARLET, 2002; MORIN et al., 1993; PRETORIUS et al., 2000). It follows that introducing new hybrids should require a special care.

The rust did not infect *A. artemisiifolia* associations spread in Hungary, so our results could not confirm observations by PARMELEE (1969) and ALCORN (1976).

Although the rust occurring in Hungary can infect cockleburs even at the cotyledonous stage (KISS L., unpubl. result), and attack by *P. xanthii* in an early plant development phase can shorten the plant life cycle and significantly reduce its growth and burr production (JULIEN et al., 1979); natural infections only start in the second part of the growing season, so the role of *P. xanthii* does not seem to be significant in biological control of cocklebur species in Hungary at present.

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Výskyt huby *Puccinia xanthii* Schw. na voškovníkoch v Maďarsku

Súhrn

Puccinia xanthii Schw. je bežne rozšírená huba na voškovníkoch, predpokladá sa jej využitie v biologickej ochrane. Z mnohých pestovateľských oblastí vo svete udávajú, že huba je schopná infikovať rôzne hybridy slnečnice.

Hubu v Maďarsku prvýkrát zaznamenali v roku 2002 na voškovníku talianskom (*Xanthium italicum* Mor.). Infekcia sa od tohto roku vyskytla každoročne v druhej polovici vegetácie. V pokusoch sme hodnotili citlivosť 15 hybridov slnečnice voči hrdzi *P. xanthii* pestovaných na voľnej ploche aj v skleníkoch, ale ani v jednom prípade sme nezaznamenali infekciu touto hubou.

Od prvého výskytu huby v Maďarsku pravidelne sledujeme výskyt možnej infekcie na ambrózii palinolistej (*Ambrosia artemisiifolia* L.) na výskumných plochách, kde sa spoločne vyskytuje s voškovníkmi. Príznaky ochorenia na ambrózii palinolistej sme doteraz nezaznamenali.

Hoci huba *P. xanthii* identifikovaná v Maďarsku je schopná infikovať voškovníky už v kotyledónovom štádiu, prirodzené infekcie sa každoročne zaznamenali až v druhej polovici vegetácie, a preto táto huba v Maďarsku nemá významnú úlohu v biologickej ochrane voči voškovníkom.