First report of downy mildew caused by Bremia lactucae *on* Sonchus asper *L. (Hill) and* S. tenerrimus *L. in Haryana, India*

S. K. Sain, D. Monga & H. Dewasi

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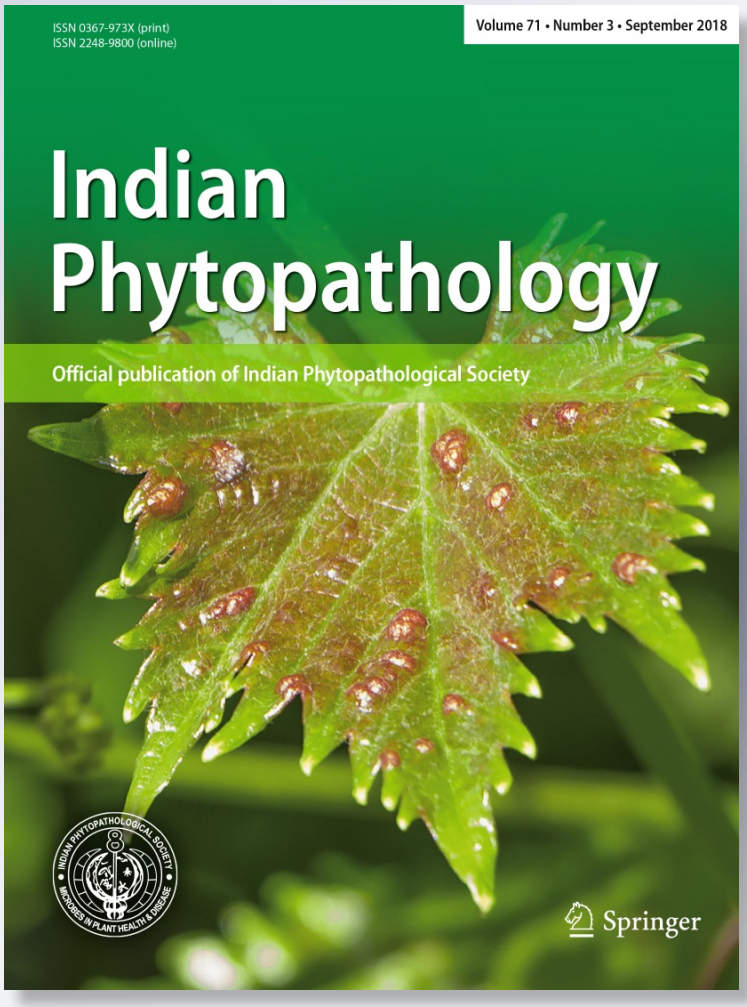

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NEW REPORTS

First report of downy mildew caused by *Bremia lactucae* on *Sonchus asper* L. (Hill) and *S. tenerrimus* L. in Haryana, India

S. K. Sain[1] · D. Monga[1] · H. Dewasi[1]

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Abstract
Downy mildew caused by *Bremia lactucae* Regel on different members of Asteraceae has been reported from different parts of the world. In India, the pathogen is recorded for the first time on *Sonchus asper* and *S. tenerrimus*. This could be one of the option for biological control of *Sonchus asper* and *S. tenerrimus*.

Introduction

Spiny sowthistle (*Sonchus asper* (L.) Hill) and slender sowthistle (*S. tenerrimus* L.) are the annual flowering plants of Asterasceae. The *Sonchus* species are invasive weeds and serve as host for many sucking pests including *Bemisia tabaci,* a vector of cotton leaf curl disease during the winter season in India. During February–April 2017 and 2018, typical symptoms of downy mildew were observed on the leaves of *Sonchus asper* and *S. tenerrimus* at research farm of ICAR- Central Institute of Cotton Research, Regional Station Sirsa, Haryana, India. Two types of downy mildew symptoms i.e. localized and systemic symptoms were observed on the leaves. The initial localized disease symptoms began as irregularly to angular shaped yellow interveinal chlorotic lesions on adaxial surface of the leaf margin or at the center of the lamina, up to the size of 5 cm. The typical white grayish sign of downy mildew growth was observed on the abaxial surface of the leaves corresponding to the chlorotic/necrotic tissues surrounding them (Fig. 1). These necrotic patches later caused death of leaf lamina. In severe cases, these necrotic patches coalesced to form large area and entire leaves appeared blighted. The localized symptoms were observed only on the *Socnchus asper*. However, in case of systemic infection, light chlorosis of the adaxial side of the lamina is seen. The typical greyish-white profuse and uniform downy mildew growth was observed on the lower surface of the leaves uniformly both on *S. asper* and *S. tenerrimus* (Figs. 2, 3, respectively). Later on, these infected leaves become chlorotic brownish in colour and in some cases whole leaves dried up and cracked.

✉ S. K. Sain
sain.skumar@gmail.com

[1] ICAR-Central Institute for Cotton Research, Regional Station, Sirsa, Haryana 125055, India

Pathogen description

The hyaline sporangiophores emerged singly or in a group of 2–5 sporangiophores through stomata. Sporangiophores measured 711.2–993.2 × 41.3–48.3 µm (the length of the sporangiophores up to the first branch were 365.4–470.2 µm) (Fig. 4a). The sporangiophores were dichotomously branched, terminate to swollen peaks or vesicles (23.3–28.2 µm) bearing 3–5 terminal sterigmata (16.2–24.2 µm). Sterigmata produced pale olivaceous, ovoid to globose sporangia, 194.1–226.4 µm (Fig. 4b). Oospores were not observed in the leaf tissue. On the basis of symptomatology and microscopic study of the casual agent, the pathogen was identified as *Bremia lactucae* Regel (Shin and Choi 2000). The dried specimens examined and deposited in the Herbarium Cryptogramme Indiae Orientalis (*Sonchus asper* HCIO-52176 and *S. tenerrimus* HCIO-52177).

In order to confirm pathogenicity test, freshly infected leaves were collected and the sporangial suspension was prepared in double distilled water (1×10^4 sporangia/ml) using small artist's brush. Leaves of healthy plants were spray inoculated with sporangial suspension and the whole plants were covered with plastic bags for 48 h at 18–24 °C. Non-inoculated control plants were also maintained under the same conditions. After 10 days, downy mildew leaf symptoms were developed on inoculated plants and the controls remained asymptomatic. Microscopic examination of the pathogen from experimental host confirmed that

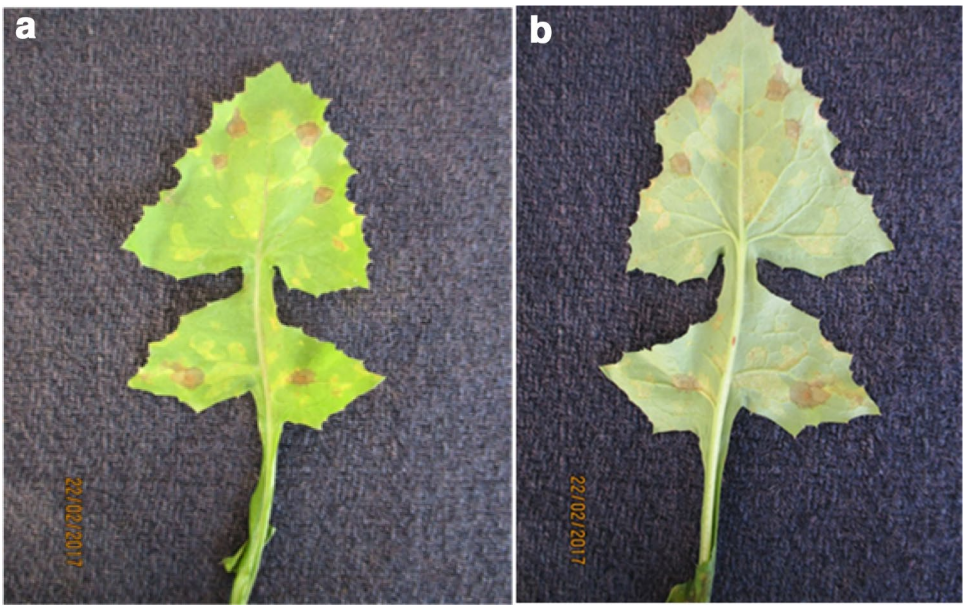

Fig. 1 Symptoms and signs of downy mildew (localized) on the upper (**a**) and lower surfaces (**b**) of a *Sonchus asper* leaf

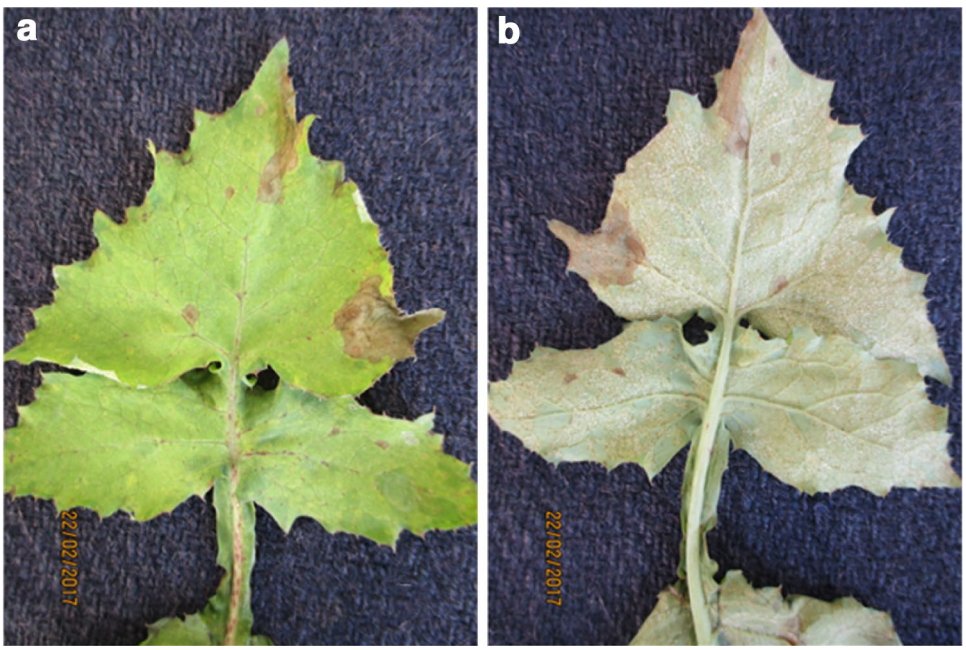

Fig. 2 Symptoms and signs of downy mildew (systemic) on the upper (**a**) and lower surfaces (**b**) of a *Sonchus asper* leaf

morphologically it is identical to that of the preliminary material.

Downy mildew caused by *B. lactucae* is an endemic disease in lettuce and also reported to affect a wider host range belonging to several botanical families, including Asteraceae (Crute and Dixon 1981), Cynareae and Lactuceae tribes and Astereae (Kenneth and Palti 1984; Farr and Rossman 2010). To our knowledge, this is the first report of downy mildew on *Sonchus asper* and *S. tenerrimus* in Haryana (India). As, the *Sonchus* species acts as invasive weeds in several crops and play an important role in harboring the sucking insect-pests which are the vector of several plant virus diseases, and this pathogen could be one of the option for biological control of *Sonchus asper* and *S. tenerrimus*.

Fig. 3 Symptoms and signs of downy mildew (systemic) on the upper (**a**) and lower surfaces (**b**) of a *Sonchus tenerrimus*

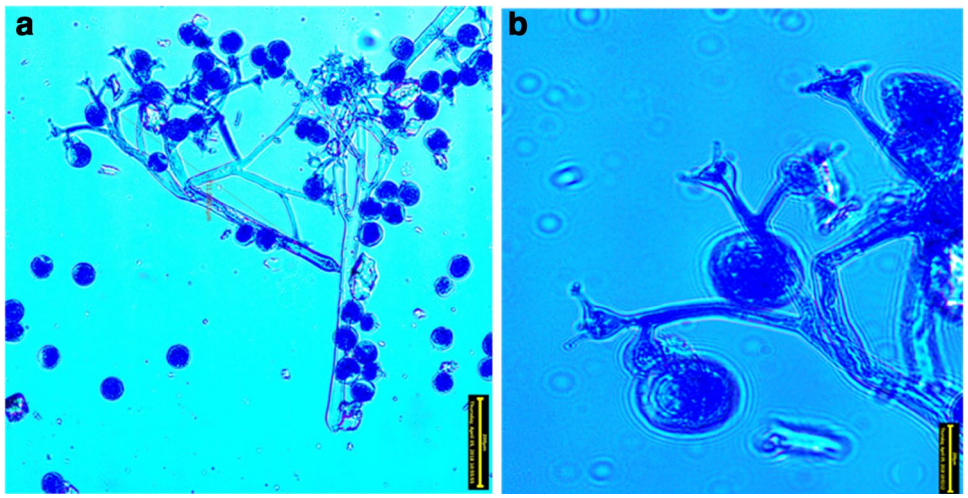

Fig. 4 Branched sporangiophores and sporangia, bar = 200 µm (**a**) and vesicles, sterigmata, and sporangia, bar = 200 µm (**b**) of *Bremia lactucae*

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