

Sexual compatibility types of *Bremia lactucae* isolates originating from *Lactuca serriola*

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Abstract

Results are given on the occurrence of sexual compatibility types of seven isolates of *Bremia lactucae* originating from *Lactuca serriola* (prickly lettuce). It is concluded that the isolates studied are heterothallic. Both compatibility types (B1 and B2) were determined, but type B2 was prevalent. Sexual recombination of *B. lactucae* isolates originating from wild and cultivated lettuce may occur.

Additional keywords: *Lactuca sativa*, wild plant- and crop-pathosystem, oospore formation

Sexual reproduction of *Bremia lactucae* Regel can be important for intraspecific variation. Micheltore and Ingram (1980) have demonstrated that *B. lactucae* is heterothallic and that two sexual compatibility types exist, viz. B1 and B2. Homothallism is never found but secondary homothallism can occur (Micheltore and Ingram, 1982). From genetical studies it is known that avirulence genes in *B. lactucae* are mostly inherited independently (Koch and Blok, 1985; Norwood and Crute, 1984). Until now oospores of lettuce downy mildew were observed and studied mostly in *Lactuca sativa* (Crute and Dixon, 1981). In some parts of the world *B. lactucae* is common on *L. serriola* (Lebeda, 1984) and it is evident (Lebeda, 1986, 1989a, b) that *B. lactucae* isolates from *L. serriola* can be categorized as physiological races.

Until now no data were available on compatibility types of the isolates from *L. serriola*. The present study is a first contribution to this topic.

Isolates of *B. lactucae* from *L. serriola* (LSBL 12/81, LSBL 26/81, LSBL 27/81, LSBL 1/82, LSBL 2/82, LSBL 3/82 and LSBL 4/82), collected in Czechoslovakia (Lebeda, 1984) were cultured on seedlings of *L. serriola*, line PI 273617. *B. lactucae* isolates from *L. sativa* (the Dutch races NL5, NL6, NL12 and NL15) were maintained on seedlings of cv. Hilde or cv. Plenos. All races had been found to be heterothallic. Races NL6, NL12 and NL15 were identified as B1 types; NL5 as B2 type (Micheltore and Ingram, 1980; Blok, unpublished).

Inoculation experiments were carried out on leaf discs (8 mm in diameter) of different *Lactuca* spp., lines or cultivars, susceptible for both isolates in a combination. Because of the different virulence phenotypes of the *B. lactucae* isolates a suitable host was not available for all combinations. In each replication eight or nine discs were included. Conidial suspensions of a B1 and a B2 type were separately mixed with isolates

Table 1. Production of oospores by combinations of *Bremia lactucae* isolates from *Lactuca serriola* (LSBL isolates) and from *L. sativa* (NL isolates).

LSBL isolate	NL isolate				Sexual compatibility type
	NL5 (B2)	NL6 (B1)	NL12 (B1)	NL15 (B1)	
12/81	—	+	nd	nd	B2
26/81	—	nd	++	nd	B2
27/81	—	++	nd	nd	B2
1/82	—	++	nd	nd	B2
2/82	+	nd	—	—	B1
3/82	—	nd	nd	++	B2
4/82	++	+	nd	nd	B1 ¹

+ = sparse formation of oospores; ++ = abundant formation of oospores; — = no formation of oospores; nd = not determined.

¹ See text.

from *L. serriola* and were inoculated with a Pasteur pipette on the abaxial surface of the leaf discs. The inoculated discs were incubated in Petri dishes (Blok, 1981) on moistened filter paper at 15 °C and 18 h photoperiod. To detect the oospores the leaf discs were fixed and cleared by boiling in 96% ethyl alcohol 6 and 14 days after inoculation. Subsequently they were examined microscopically for the presence of oospores.

The results are summarized in Table 1. The isolates of *B. lactucae* from *L. serriola* did not appear to be self-fertile i.e. homothallic. In the set studied both sexual compatibility types were determined.

In some combinations oospores were formed sparsely 14 days after inoculation, but in most combinations oospores were produced abundantly already 6 days after inoculation. The LSBL isolates 12/81, 26/81, 27/81, 1/82 and 3/82 produced spores in combination with a B1 type of *B. lactucae*, indicating that they are of the B2 compatibility type. The LSBL isolates 2/82 and 4/82 produced oospores in combination with NL5 (= B2), indicating that they are of the B1 type. The isolate 4/82, however, produced also a limited number of oospores when combined with NL6 (= B1). The experiment with this isolate should be repeated to see whether the isolate is not pure or is secondary homothallic.

This investigation has demonstrated for the first time the occurrence of sexual reproduction in *B. lactucae* between isolates from *L. serriola* and isolates from *L. sativa*. The importance of sexual reproduction in the life cycle of lettuce downy mildew was stressed in many previous studies (Crute, 1987; Michelmores et al., 1988). Lebeda (1986, 1989a, b) has shown that isolates of *B. lactucae* from *L. serriola* may be important in the breakdown of some new effective resistance resources located in wild *Lactuca* species and used in cultivated lettuce. In middle-Europe *L. serriola* is a very common weed. In accordance with our observations (Lebeda, unpublished) *L. serriola* plants are frequently infected by *B. lactucae* during the second half of the season (end of July - September), and their spores can easily be transferred to cultivated lettuce. A second possibility is the exchange of genes between the wild plant- and crop-pathosystem

through sexual recombination. Some *Lactuca sativa* and *L. serriola* genotypes may serve as a host for sexual reproduction of *B. lactucae* from both species (Lebeda, 1983, 1986, 1989a).

From our results it is evident that sexual recombination of *B. lactucae* isolates originating from wild plant- and crop-pathosystems may occur. When this occurs in nature and the oospores yield viable progeny, isolates with new virulence phenotypes could be produced which are compatible with the resistance genes (*Dm* genes) in cultivars with resistance derived from wild *Lactuca* species. Crute and Norwood (1983) stressed that laboratory production of isolates with hitherto unrecorded virulence phenotypes may contribute to the efficiency of breeding programmes.

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Samenvatting

Sexuele compatibiteitstypen van isolaten van Bremia lactucae afkomstig van Lactuca serriola

Zeven isolaten van *Bremia lactucae*, afkomstig van *Lactuca serriola* in TsjechoSlowakije, zijn onderzocht op hun sexuele compatibiteitstype door ze te combineren met Nederlandse fysio's van *B. lactucae*, afkomstig van cultuursla (*L. sativa*), waarvan het compatibiteitstype (B1 of B2) bekend is. Alle isolaten van *L. serriola* bleken heterothalisch te zijn, waarbij type B2 meer werd aangetroffen dan type B1. Sexuele recombinitie van *Bremia*-isolaten van wilde *Lactuca*-soorten en cultuursla blijkt goed mogelijk te zijn.

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