Occurrence of lettuce rust in Onoway, Alberta in 1989

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Six lettuce fields in Onoway, Alberta were examined from early to late June 1989 for the presence of leaf rust. By the end of June, disease incidence for the fall-seeded cultivars Parris Island and Buttercrunch was 100%, whereas disease incidence of four spring-seeded cultivars was less than 1%. No significant differences in disease incidence were observed among four cultivars seeded in the spring (Parris Island, Buttercrunch, Red Rapids and Grand Rapids). Based on the morphological examination of aeciospores and peridia using scanning electron microscopy, *Puccinia dioicae* Magn. was identified in the lettuce fields.

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On a examiné six champs de laitue à Onoway (Alberta) du début à la fin de juin 1989 pour y déceler la présence de rouille des feuilles. À la fin de juin, le taux de morbidité des cultivars semés à l'automne, Parris Island et Buttercrunch, était de 100 %, alors que celui de quatre cultivars semés au printemps était inférieur à 1 %. On n'a constaté aucune différence significative dans le taux de morbidité de quatre cultivars semés au printemps (Parris Island, Buttercrunch, Red Rapids et Grand Rapids). Grâce à l'examen morphologique des écidiospores et des péridies au moyen de la microscopie électronique, on a pu identifier *Puccinia dioicae* Magn. dans les champs de laitue.

Introduction

Leaf rust of field lettuce (*Lactuca sativa* L.) can be incited by either *Puccinia chondrillae* Corda, an autoecious macrocyclic rust, or *P. dioicae* Magn., a heteroecious microcyclic rust (2, 5). This disease was first recorded at Edmonton, Alberta in 1956 (3), but there have been no subsequent published records of its occurrence in Alberta. Leaf rust of lettuce was recently observed again in a lettuce market garden in Onoway, 60 km northwest of Edmonton. Because very heavy infection was observed in some lettuce cultivars, although others showed little or no infection, studies were undertaken to determine the identity and incidence of leaf rust on different cultivars of field lettuce planted in this garden.

Materials and methods

Six lettuce field plots at one Onoway market garden were examined for the incidence of leaf rust disease. The field site had grown forage grasses for several years and was in summer fallow prior to planting lettuce. No fertilizer was incorporated into the soil because it was full of organic matter. Seeds were hand-sown at a depth of 1 cm and a rate of 0.5 g/m^2. Lettuce cvs. Parris Island and Buttercrunch were sown in the fall of 1988 and the spring of 1989. Lettuce cvs. Grand Rapids and Red Rapids were sown only in the spring of 1989. Fall-seeded plots were 1.5 m × 7.5 m, and spring-seeded plots were 1.5 m × 5.0 m. Each plot was isolated by a 30 cm strip that was kept harrowed throughout the growing season. During the early summer of 1989, the number of plants per plot infected with leaf rust was assessed visually.

The species determination was made by examining morphological characteristics of aecia. Leaf segments with aecia were fixed in 2% glutaraldehyde in 0.1 M cacodylate buffer at pH 7.2 for 16 h, washed in 0.1 M cacodylate buffer, and postfixed in 1% osmium tetroxide in the same buffer for 4 h. The samples were then dehydrated through an ethanol series, critical point dried (using liquid CO_2 as transitional fluid), and affixed to metal stubs with silver paint. The specimens were sputter coated with gold (15 nm thick), examined, and photographed with a Hitachi S510 scanning electron microscope (SEM).

Results and discussion

Whitish-yellow aecia exposing a powdery mass of yellow aeciospores were found in groups of 50-200 on the lower surface of the outer leaves. Each group of aecia was about 1.5 cm across and its presence did not cause hypertrophy of the leaf tissue (Figs. 1 and 2). On the corresponding upper leaf surfaces large yellow spots developed.

SEM observations revealed that the mature aecium was cupulate with nearly globoid aeciospores borne within the confines of the peridium (Fig. 3). The well-developed peridium was one cell layer thick, and it clearly delimited the peripheral boundaries of the aecium. Mature aeciospores were densely ornamented with smooth, knoblike verrucae, except for a circular smooth patch (Fig. 4). Four to five germ pores were located equatorially around the aeciospore. The pores were covered with plugs (Fig. 4). Based on the morphology of aeciospores and peridia, as well as the need of an alternate host to complete its life cycle, only one rust species, *P. dioicae* Magn., was identified in the lettuce fields (2, 5).

Rust pustules were first observed in early June 1989, on the fall-seeded lettuce cvs. Parris Island and Buttercrunch, and the level of infection was very low. By the end of June, a large difference in numbers of infected plants was observed between fall-seeded and spring-seeded plots.

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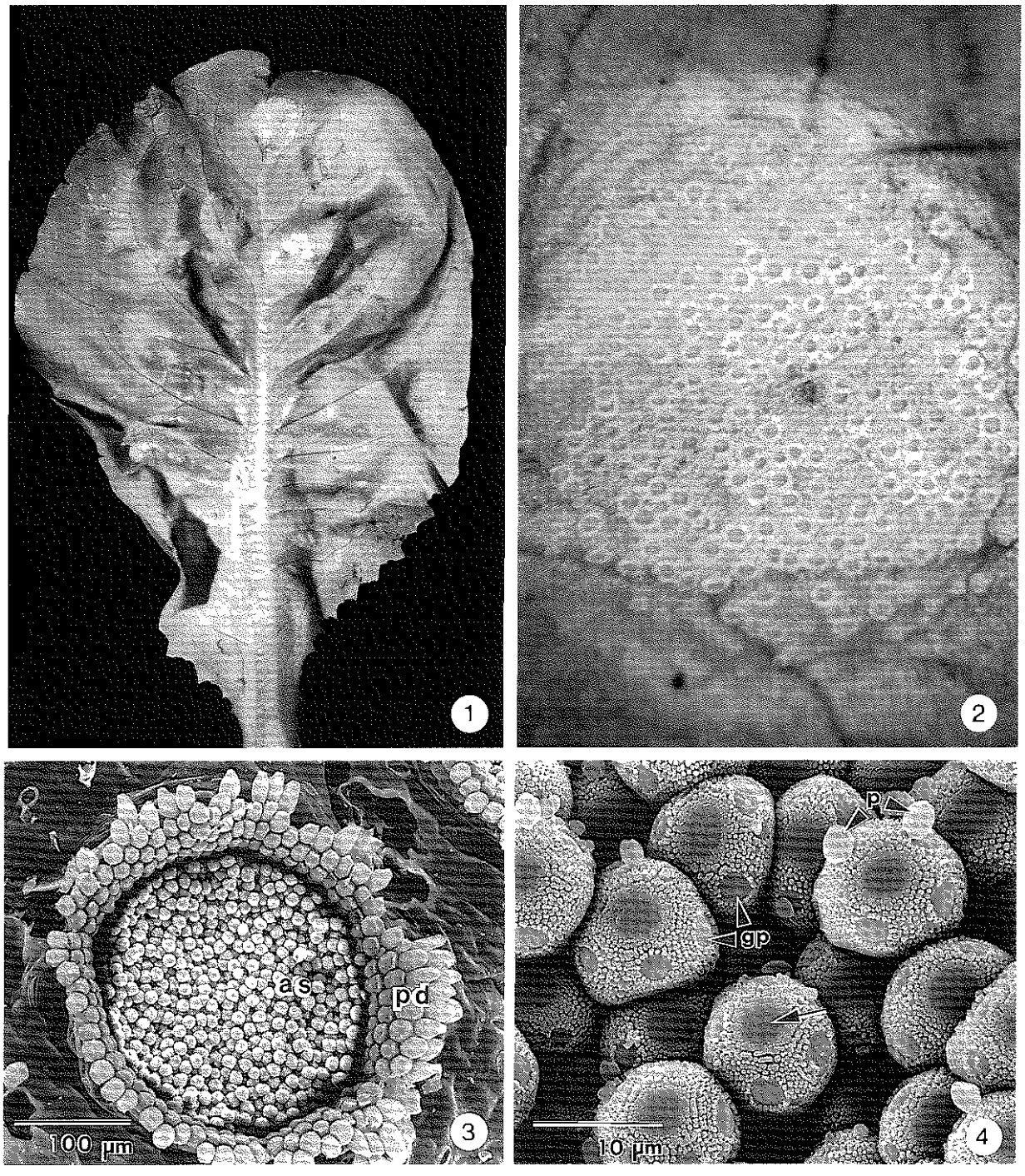

Figs. 1-2. *Puccinia dioicae* on field lettuce (*Lactuca sativa* L.)

Fig. 1. Aecia on the lower leaf surface. × 0.7.

Fig. 2. Group of aecia on the lower leaf surface. × 30.

Figs. 3-4. SEM of aecial state of *Puccinia dioicae*.

Fig. 3. Mature aecium bordered by one cell layer peridium (pd) and hundreds of mature aeciospores (as) within the aecium. × 130.

Fig. 4. Mature aeciospores showing the germ pores (gp) with plugs (p) and with knoblike verrucae (v), except for the circular smooth patches (arrow) free of verrucae. × 2250.

For both cvs. Parris Island and Buttercrunch, fall-seeded plots had the greatest disease incidence of 100%, whereas spring-seeded plots had the least disease incidence at less than 1% (Table 1). No significant differences were observed among the four spring-seeded cultivars (Parris Island, Buttercrunch, Red Rapids and Grand Rapids) in their resistance to leaf rust disease, since the disease incidence of all four was less than 1%.

Table 1. Disease incidence of leaf rust on four different cultivars of field lettuce (*Lactuca sativa L.*).

Cultivar	Time of Seeding*	No. of Plants Sampled	Disease Incidence %
Parris Island	Fall	450	100
	Spring	800	< 1
Buttercrunch	Fall	250	100
	Spring	500	< 1
Red Rapids	Spring	800	< 1
Grand Rapids	Spring	600	< 1

* Seeds planted either in fall of 1988 or spring of 1989. Fall-seeded lettuce reached early maturity with 13 to 15 leaves and spring-seeded lettuce with 5 to 8 leaves.

Our results demonstrate that all fall-seeded lettuce cultivars had disease incidence ratings of 100%, compared to spring-seeded cultivars with ratings less than 1%. Furthermore, the germination rate of fall-seeded lettuce is much lower than that of spring-seeded lettuce because of the reduction of seed viability (1). However, many growers still favor the practice of fall seeding, mainly because this leads to earlier maturity and higher market prices in the following season.

The yield loss of lettuce due to leaf rust has always been considered very negligible in North America (6, 8), simply because rarely more than a few infected leaves were found present in a field. In Europe, however, leaf rust of lettuce can occasionally be very destructive (7). Data from this study indicate that economic losses due to *P. dioicae* can be significant when environmental factors and cultural practices favor its development, and when populations of the alternate host, sedge grass (*Carex muricata* L.), occur nearby for completion of the rust life cycle (4). It is evident, therefore, that yield loss due to infection by lettuce rust may be more significant than generally recognized, and that further study in this aspect is needed to determine the extent of yield loss in lettuce.

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