A powdery mildew on sugar beet in Alberta

F. R. Harper[1] and P. Bergen[2]

Powdery mildew was found in January 1975 on sugar beet ***(Beta vulgaris)*** plants that had been lifted from the field in September 1974 and planted in a greenhouse at Taber, Alberta. A trace of the disease was also found in 7 of 15 fields of sugar beets examined in October 1975 just before harvest. This powdery mildew appears to be the same as that which caused serious losses in the western United States in 1974 and was also widespread in 1975. No cleistothecia of the fungus were found but the conidia were similar in morphology and size to those of ***Erysiphe polygoni*** DC. and ***E. betae*** (Vanha) Weltzien. The original infection on sugar beets in the greenhouse was eradicated by repeated fumigation with sublimed sulfur over a 1-month period. This, plus the fact that the disease appeared just before harvest in 1975, indicate that powdery mildew did not overwinter in Alberta. This is the first report of powdery mildew on sugar beet in Canada.

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En janvier 1975, on a observe du blanc sur des plants de betterave a sucre ***(Beta vulgaris)*** preleves au champ en septembre 1974 et plantes en serre a Taber (Alberta). On a egalement constaté une légère infection dans 7 des 15 champs de betterave a sucre examines en october 1975, juste avant la recolte. Ce type de blanc semble dtre le mdme que celui qui a cause de lourdes pertes dans l'ouest des Etats-Unis en 1974 et qui était aussi largement repandu en 1975. On n'a observe aucun cleistothece de champignons, mais les conidies avaient une morphologie et une taille semblables a celles d'***Erysiphe polygoni*** et d'***E. betae.*** L'infection originale sur betterave a sucre en serre a ete enrayée par fumigation repetee de soufre sublime durant 1 mois. Ce traitement, plus le fait que la maladie est apparue immediatement avant la recolte de 1975, montrent que le blanc n'a pas hiverne en Alberta.
C'est le premier signalement de la presence du blanc sur la bettrave a sucre au Canada.

A powdery mildew of sugar beet, considered by Vanha (11) to be ***Microsphaera betae,*** was first reported in 1903 from Europe. The disease appears to have been of little importance for the next half-century except under greenhouse conditions. In the 1960's, however, serious outbreaks were reported from several sugar-beet growing areas in Europe and the Middle East (2, 5, ***8,*** 12). The incitant of the powdery mildew on sugar beet in Eurasia is now generally considered to be ***Erysiphe betae*** (Vanha) Weltzien (8, 12). In the United States, powdery mildew was first reported on sugar beet in 1937 (13). Since then, it has been found occasionally in California and Washington but has caused little damage (1, 9, 10). In 1974, however, powdery mildew spread throughout the western States from an initial outbreak in California and reduced sugar-beet yields by up to 6.8 t/ha and sugar concentrations by up to 1.5% (9, 10). In 1975, the disease was more widespread, although less severe, than in 1974 (Personal communication, E. G. Ruppel, **USDA** Crops Research Laboratory, Fort Collins, Colorado). Powdery mildew on sugar beet has not previously been reported in any of the sugar-producing areas of Canada or in British Columbia where sugar-beet seed is produced.

[1] *Plant Pathologist, Research Station, Agriculture Canada, Lethbridge, Alberta T1J 4B1*

[2] *Chief Research Agriculturist, Canadian Sugar Factories Company, Taber, Alberta TOK 2GO*

Observations

In early January 1975, sugar beet breeding material lifted from the field plots at Taber, Alberta, in September 1974 and grown in a nearby greenhouse showed evidence of powdery mildew on much of the upper and lower surfaces of the older leaves (Fig. 1). Young plants in an adjoining greenhouse remained almost free from the disease. Because this infestation was considered a potential hazard to the 1975 crop in the surrounding area, the pathogen was eradicated by repeated fumigations with vaporized sulfur. The infected plants showed no evidence of leaf infection during the next 4 months in the greenhouse or during their continued growth in the field in the summer of 1975.

Powdery mildew was not found during periodic field inspections of sugar beets in the summer of 1975. However, during the harvest period in October, a survey of 15 sugar-beet fields scattered throughout the production area of southern Alberta revealed trace infections in seven. Only a few lightly infected plants were found at scattered locations in each of the seven fields. Rarely a more severely diseased plant was observed, but even then it was invariably surrounded by apparently uninfected plants. All fields examined and virtually all sugar beets grown commercially in Alberta in 1975 were Canadian Sugar Factories variety CS 43.

When assessed for powdery mildew at harvest, a sugar-beet variety test containing several European and American cultivars revealed a range of disease reaction.

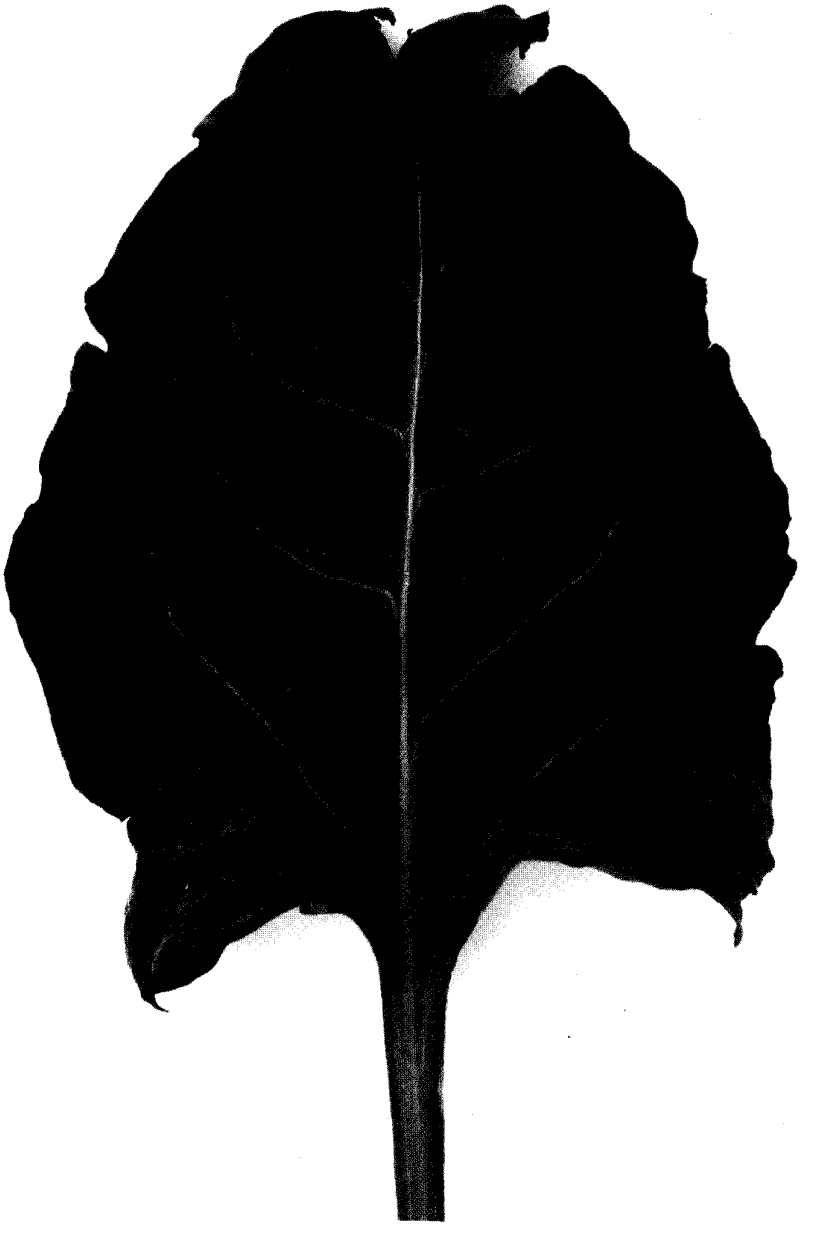

Figure 1. Sugar—beet leaf, collected from a field near Picture Butte, Alberta, showing evidence of powdery mildew.

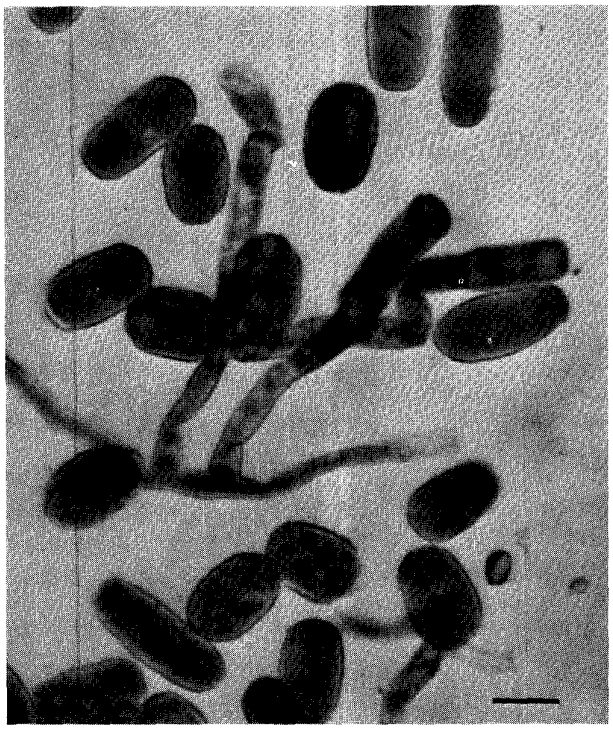

Figure 2. Conidiophores and conidia of an ***Erysiphe*** sp., collected from an infected sugar-beet leaf in a field near Picture Butte, Alberta, Bar represents 20 μm.

Several cultivars, including CS 43, appeared to be resistant to the disease.

Condiophores from diseased leaves were unbranched, hyaline, mycelial in appearance, arising as branches at right angles to hyperdermal hyphae (Fig. 2). Conidia were hyaline, oblong to oblong-elliptical or ovate, usually occurring in chains of two to five, measuring 16.6 μm (range 12-22) by 38.5 μm (range 30-51). No cleistothecia were found on diseased leaves.

Discussion

The occurrence of powdery mildew on sugar beets in a greenhouse after the 1974 crop was harvested and its occurrence in the field only at the end of the 1975 growing season suggest that the initial inoculum of the pathogen arrived in southern Alberta late in the growing season each year. The 1974 epiphytotic of powdery mildew in the United States was detected in Montana and eastern Washington, the states nearest to Alberta, only in September (10). Eastern Washington is about 350 miles west-south-west of southern Alberta and in the direction from which the most frequent and strongest winds blow. This rather long distance between foci of infection is no greater than others recorded during the 1974 epiphytotic in the United States (10). Long-distance dissemination of ***Erysiphe*** spp. has also been recorded in Europe (7).

The fungus that caused the 1974 and 1975 powdery mildew epiphytotics in the United States was designated as ***E. polygoni*** DC. (3, 9). Our evidence indicates that the Canadian pathogen is the same organism, although proof based on the sexual stage is lacking. Whether E. ***polygoni*** found in North American is the same as or different from ***E. betae*** found in Eurasia is not known at present. It is curious that powdery mildew has only recently become an important disease of sugar beets in Eurasia even though it was first recognized at the beginning of this century and that the more recent experience with the disease in North America appears to parallel that in Eurasia. Possibly more pathogenic biotypes of the pathogen(s) have arisen recently, or increased susceptibility to the pathogen was inadvertently introduced into newly developed cultivars.

Powdery mildew is a potential threat to the Canadian sugar-beet industry. The disease was less serious in the western United States in 1975 than in 1974 because of early and general use of sulfur to control it, especially in the southwest, but, nevertheless, infection was more widespread (Personal communication, E. G. Ruppel). If E. ***polygon;*** is the same fungus as E. ***betae,*** its host range is restricted to ***Beta*** spp. (4), and there appears to be little danger from its overwintering in Canada as mycelium in its hosts except in British Columbia where sugar beets are overwintered for seed production. The conidia of ***E. betae*** are not viable after short periods at -10 to -22°C (6), temperatures that frequently occur on the Great Plains of North America. If the sexual stage of the fungus is rare in the United States and Canada (3, 9), overwintering by this means may be of little importance. However, infected beets growing in a greenhouse during the winter could serve as sources of inoculum for the next year's crop in nearby fields, as could infected, overwintering ***Beta*** spp. in the field in seed-producing areas.

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