

## Spring Wheats Immune or Highly Resistant to *Ustilago tritici*

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### ABSTRACT

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A total of 2,644 lines or cultivars of spring wheat of diverse origin were tested for their reaction to 31 races of *Ustilago tritici* that originated from 12 countries. Two hundred four immune or highly resistant entries were identified by an improved partial-vacuum technique of inoculation. Because new races of loose smut of wheat appear to arise infrequently, the resistance of these entries may be long-lasting.

Loose smut of wheat, caused by *Ustilago tritici* (Pers.) Rostrup, occurs wherever wheat, *Triticum aestivum* L. and *T. turgidum* (L.) Thell., is grown. It is more common in climates with cool moist weather at flowering of the host (49). Yet, even in the dry and warm summer of the Canadian prairies, economic losses occur. In 1981, the cultivar Sinton occupied 20.6% (308,610 ha) of the acreage seeded to wheat in the province of Manitoba, Canada. Loose smut was

found in 95% of the fields of Sinton, with an average infection of 1.5%, causing an estimated loss of \$1.67 million. This loss could have been prevented if all farmers had followed the recommendation to treat the seed of this cultivar with an appropriate fungicide every second year. The annual cost of the fungicide would have been about \$390,000.

The desirability of resistance has been realized in many countries, and lines and cultivars were identified that could be used as sources for resistance in Argentina (2,8,16), Australia (41,42), Belgium (36), Bulgaria (13,31), Canada (1), China (54), Czechoslovakia (45), Germany (12,40,46,50), Great Britain (5,14), India (6,7,18,21-23,27-30,33,39,52), Iraq (48), Netherlands (38), Pakistan (43), Poland (44), Rumania (15,51), South Africa (20), Sweden (24,37), United States (3,4,11,17,47,53), and USSR, (19,25,26).

Unfortunately, the inocula used to

detect resistance were composed of undefined field collections or races from the area for which the future resistant cultivars were intended. This approach, based on limited selection pressure, resulted in the release of cultivars with resistance that was short-lived because of the appearance of new races. These were probably either already present in the area in low frequency or were introduced. Increasing trade and exchange of seed within and between countries increases the possibility of introducing a race that is virulent on a hitherto resistant local cultivar.

When searching for enduring resistance to loose smut, it is therefore imperative that the lines or cultivars be tested to as wide a spectrum of races as possible. An entry that passes such a screening has a good chance of being resistant to most races that may be introduced from abroad. When used in another country, it is likely to be resistant to most or all races found there. From this, it is obvious that the search for sources of resistance to *U. tritici* has to go hand in hand with a survey of the races of the pathogen as they occur worldwide (34). This approach has been taken in the screening of lines and cultivars to be described in this paper.

The purpose of this study was to build up a stock of diverse sources of resistance to all races of *U. tritici* so far identified for use in Canada and other countries.

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countries were also resistant in my tests in Canada. The cultivars Preto Amarelo and Sinvalocho were resistant in Argentina (2) and Mercury was resistant in Bulgaria (31). There were also a few cases where a cultivar was susceptible abroad but resistant to the inocula used in this study. They are cultivar Capiti 8 in the USSR (25) and Czakinskaya 226, Hordeiforme 496, and Regent in Czechoslovakia (45). The first three cultivars are durum wheats. Because most races of loose smut are specialized on either common or durum wheats, it is probable that a race with virulence on these three and possibly other durum cultivars exists.

The common wheat cultivar Regent was resistant when released in 1941, but field collections with virulence on it were found later (W. Popp, unpublished). The race with this virulence was not maintained and has not been found since in collections from Canada or elsewhere. Such a race will possibly also be virulent on its resistant parent H44 and on cultivars such as Selkirk with resistance derived from H44 or cultivar Hope.

To detect races that may be virulent on these or other entries, I would welcome either tests of this collection of resistant cultivars with local inocula in other countries or the receipt of field collections of loose smut for an analysis of the races they represent. This continuing survey will assist in incorporating resistance to all known races into new cultivars. The spring wheats listed here are, at present, the best sources for such resistance.

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