

## Article

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H.C. Sharma, J.E. Foster, H.W. Ohm et F.L. Patterson  
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## A note on resistance to Hessian fly (*Mayetiola destructor*) [Diptera: Cecidomyiidae] biotype L in tribe Triticeae

H. C. Sharma<sup>1</sup>, J. E. Foster<sup>1,2</sup>, H. W. Ohm<sup>1</sup>, and F. L. Patterson<sup>1</sup>

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Forty-one accessions of primitive and wild wheats (*Triticum species*), 16 accessions of *Aegilops* species, and 20 accessions or cultivars of *Agropyron* species were evaluated for the first time for reaction to biotype L of Hessian fly (*Mayetiola destructor*). Three accessions of *Triticum monococcum*, 13 accessions of *Aegilops* species, and 13 accessions or cultivars of *Agropyron* species were found homogeneously resistant. Antibiosis was operative in some cases but in others there appeared to be physical resistance due to the presence of leaf pubescence or ligule. Pubescence of *Triticum boeoticum* was not effective in providing resistance.

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Quarante et une accessions de blés primitifs et indigènes (*Triticum* spp.), 16 accessions du genre *Aegilops* et 20 accessions ou cultivars du genre *Agropyron* ont été évaluées pour la première fois pour leur réaction au biotype L de la mouche de Hesse (*Mayetiola destructor*). Trois accessions du *Triticum monococcum*, 13 accessions du genre *Aegilops* et 13 accessions ou cultivars du genre *Agropyron* ont été trouvées résistantes de façon homogène. L'antibiose s'est manifestée dans certains cas mais dans certains autres, il est apparu une résistance physique attribuable à la présence de la pubescence foliaire ou de la ligule. La pubescence du *Triticum boeoticum* n'a pas été efficace afin de procurer de la résistance.

Hessian fly (*Mayetiola destructor* Say) [Diptera: Cecidomyiidae], an obligate parasite of grasses of the tribe Triticeae is a serious pest of wheat (*Triticum aestivum* L.) in North America and many other countries (Maxwell and Jennings 1980). The larvae feed at the base of the leaf sheath and damage wheat by stunting. Of the 13 biotypes, biotype GP is the least and biotype L is the most virulent (Gallun 1977; Sosa 1981). Twenty genes have been identified in *Triticum aestivum*, *Triticum turgidum* var. *durum* Desf. and *Aegilops*

*squarrosa* L. that confer resistance against different biotypes of the fly, but some of the resistance has been overcome by new virulent biotypes (Amri *et al.* 1990; Obanni *et al.* 1989). Thus, new sources of resistance must be sought continuously in domesticated wheats as well as in their related species.

Hatchett and Gill (1983) and Gill *et al.* (1986) reported resistance in *Aegilops* species to biotype D of Hessian fly. Gill *et al.* (1983) screened wild wheats *Triticum boeoticum* Boiss em. Schiem., *Triticum timopheevii* var. *araraticum* Jakubzn. and *Triticum turgidum* var. *dicoccoides* Schrank, and found resistance to biotype D in some accessions. Friebe *et al.* (1990) reported resistance to biotype L in a

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1. Dept. of Agronomy, USDA-ARS, Purdue University, W. Lafayette, Indiana  
2. Present address: Dept. of Entomology, University of Nebraska, Lincoln, Nebraska

hexaploid wheat with a wheat-rye translocation. We report, for the first time, on the results of screening of primitive and wild wheats (*Triticum* species), *Aegilops* species, and *Agropyron* species for resistance to biotype L.

Forty-one accessions of primitive and wild wheats, 16 accessions of *Aegilops* species, and 17 accessions and three cultivars of *Agropyron* species (Table 1) were screened for reaction to biotype L of Hessian fly.

Seeds were planted in 54 cm x 36 cm x 8 cm wooden flats filled with prepared greenhouse soil mixture. There were 12 equidistant rows widthwise in each flat. Twenty-five to thirty seeds were planted in each row. Common wheat cultivars Seneca and Abe were included as susceptible controls in each of the 12 flats used in this study. The number of plants of each accession varied from 6 to 60 depending on the number of seeds available and their germination rate. The methods of infestation and evaluation were similar to those described by Cartwright and Lahue (1944). Seedlings were infested at one-leaf stage in a growth chamber (19°C, 12 h photoperiod, high humidity). Plant reactions to larval feeding were determined 3 wk later. Plants that were stunted and dark green were classified as susceptible, and the plants that were yellowish green and not stunted were classified as resistant. Plants of the resistant accessions were examined for the presence of egg cases on the leaf blade and for larvae at the base of the leaf sheath. Similarly, susceptible plants were examined for live larvae at the base of the leaf sheath. Some of the resistant accessions were progeny-tested in which seeds produced by the tested plants on self-pollination were planted and screened for reaction to biotype L to confirm homozygosity. Observations were also made on the presence or absence of leaf pubescence, the ligule and auricles.

The controls were uniformly susceptible in all flats. Of the 41 accessions of primitive and wild wheats, three were homogeneously resistant, while others were either homogeneously susceptible or heterogeneous (Table 1). The three resistant accessions were 'G1471', 'PI191146' (G1560) and 'PI221415' (G3304)

of the primitive diploid *Triticum monococcum* L. Of the 25 progeny plants of 'G1471' and 42 of 'PI221415', only one plant in 'PI221415' was susceptible. Egg cases found on leaf and dead larvae observed at the base of leaf sheath indicated that the mechanism of resistance was antibiosis (Gallun 1977). It may be added that no progeny test was performed on G1560 and as such resistance reaction of this accession should be considered preliminary.

Thirteen of the 16 accessions of the *Aegilops* species were resistant and three accessions of *Aegilops squarrosa* had both resistant and susceptible seedlings (Table 1). When progenies of five of the seven resistant accessions of *Aegilops squarrosa*, and progenies of *Aegilops speltoides* Tausch, and *Aegilops caudata* L. were tested, all were homozygous resistant. In the case of the progeny of accession 'G3395' of *Aegilops squarrosa*, egg cases and dead larvae were observed; thus, antibiosis was the basis of resistance (Gallun 1977). In three accessions of *Aegilops squarrosa*, and one each of *Aegilops speltoides*, *Aegilops caudata*, and *Aegilops kotschyi* Boiss. examined, egg cases, dead eggs or dead larvae were present on leaf blade but no dead larvae were found at the base of leaf sheath. The leaves in these accessions were pubescent and liguled, and the resistance observed could be due to non-preference. Roberts *et al.* (1979) observed that the number of Hessian fly eggs that hatched and developed into puparia was lower on pubescent-leaved than on glabrous-leaved wheat. Of the seven accessions of *Aegilops squarrosa* found resistant to biotype L in the present study, five were resistant to biotype D also (Gill *et al.* 1986). Therefore, resistance in these accessions does not appear to be biotype specific.

Of the 20 accessions or cultivars of *Agropyron* species tested, 13 were homogeneously resistant, 1 was homogeneously susceptible, and 6 were heterogeneous (Table 1). In the resistant collection of *Agropyron intermedium* (Host) Beauv. from South Dakota, dead larvae were found behind the leaf sheath indicating antibiosis. In *Agropyron trichophorum* (Link) Richter cv. Luna, which has densely pubescent leaves, and in *Agro-*

*pyron intermedium* cv. Oahe, which has sparsely pubescent leaves with hairy ligules, dead eggs were present on leaf blades but no dead larvae were found at the leaf base. The same was true in the progeny test of Oahe. The leaf pubescence may have caused desiccation of eggs or hairy ligules may have hindered larva migration.

Isolation of homozygous resistant and homozygous susceptible accessions of *Triticum monococcum* provided the basis for a genetic study of resistance to biotype

L at the diploid level. Resistant accessions of *Triticum monococcum* identified represent potentially new sources of genetic variation. Genes from *Triticum monococcum* have been transferred to common wheat by natural recombination in appropriate hybrids because *Triticum monococcum* has one of the three genomes of common wheat (Kerber and Dyck 1973). The expression of transferred genes may sometimes (Dyck and Kerber 1985; Valkoun *et al.* 1986), but not always (McIntosh *et al.* 1984), suffer from «dilution effect». Likewise *Aegilops squarrosa*

**Table 1. Reaction of *Triticum* (*T.*) species, *Aegilops* (*Ae.*) species, and *Agropyron* (*A.*) species to Hessian fly biotype L**

Species	Number of accessions or cultivars tested	Number of accessions found within each type of reaction		
		Homogeneously resistant	Homogeneously susceptible	Heterogeneous
<i>T. monococcum</i>	21	3	9	9
<i>T. boeoticum</i>	9	0	2	7
<i>T. urartu</i>	8	0	5	3
<i>T. dicoccoides</i>	2	0	1	1
<i>T. araraticum</i>	1	0	0	1
<i>Ae. squarrosa</i>	10	7	0	3
<i>Ae. longissima</i>	1	1	0	0
<i>Ae. speltoides</i>	1	1	0	0
<i>Ae. caudata</i>	1	1	0	0
<i>Ae. kotschyi</i>	1	1	0	0
<i>Ae. ventricosa</i>	1	1	0	0
<i>Ae. cylindrica</i>	1	1	0	0
<i>A. intermedium</i>	2	2	0	0
<i>A. elongatum</i> (2n = 14) <sup>a</sup>	1	1	0	0
(2n = 70)	1	0	0	1
<i>A. trichophorum</i>	1	0	0	1
<i>A. junceum</i>	6	5	0	1
<i>A. yezoense</i>	1	1	0	0
<i>A. trachycaulum</i>	2	0	0	2
<i>A. ciliare</i>	1	0	0	1
<i>A. campestre</i>	1	1	0	0
<i>A. batalini</i>	1	1	0	0
<i>A. nodosum</i>	1	1	0	0
<i>A. stipifolium</i>	1	1	0	0
<i>A. caespitosum</i>	1	0	1	0

<sup>a</sup> One diploid and one decaploid.

is the donor of the D genome to common wheat and transfer of resistance of G3395 into wheat should be possible. However, the transfer of resistance from *Agropyron* into wheat will require specialized techniques because of non-homology of the chromosomes.

Although leaves of *Triticum boeoticum* were pubescent, no resistant accessions were found in this species. The pubescence in *Triticum boeoticum* was not sparser or shorter than in resistant *Aegilops* or *Agropyron* species. It may be speculated that the type of pubescence in *Triticum boeoticum* accessions differs from that of the *Aegilops* and *Agropyron* accessions tested. Lemke and Mutschler (1984) observed that different trichome types may impart different protection levels from insects.

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