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# Resistance in *Triticum* and *Aegilops* spp. to *Meloidogyne chitwoodi*[1]

I. KALOSHIAN,[2] P. A. ROBERTS,[3] AND I. J. THOMASON[4]

*Abstract:* Two lines of *Aegilops squarrosa* (G 3489 and G 1279) and *Triticum* cultivars Anza, Cocorit, Produra, Chinese Spring, Nugaines, and a synthetic hexaploid were screened for resistance to *Meloidogyne chitwoodi.* Reproduction of *M. chitwoodi,* expressed as eggs per gram root, was low ($P < 0.01$) on G 3489 and the synthetic hexaploid. Reproduction on all other cultivars tested was high although differences ($P < 0.01$) existed among them.

*Key words: Aegilops squarrosa,* Columbia root-knot nematode, *Meloidogyne chitwoodi,* resistance, *Triticum aestivum,* wheat.

*Meloidogyne chitwoodi* Golden, O'Bannon, Santo & Finley is a serious pest of potato (*Solanum tuberosum* L.) in the Pacific northwest and in the Tulelake area of northern California (6). The nematode can greatly suppress yield and tuber quality, making the crop unmarketable (4). Approximately $9 million are spent annually on chemicals to control root-knot nematodes on potato in Washington (7). The nematode also can reproduce on, and cause injury to, several other crops including wheat, corn, barley, and oat (8). Potato is commonly grown in rotation with small grain cereals. This cultural practice supports the buildup and maintenance of high nematode population densities.

*Aegilops squarrosa* L. accession G 3489 from Afghanistan is resistant to *Meloidogyne incognita* (Kofoid and White) Chitwood and *M. javanica* (Treub) Chitwood (5). *Aegilops squarrosa,* a wild diploid species, is the D genome donor to hexaploid bread wheat (2). This resistance was introduced into commercial wheat, resulting in a synthetic allohexaploid, through a cross between G 3489 and the tetraploid durum wheat cultivar Produra (9). The present work was conducted to test *Ae. squarrosa* (G 1279 and G 3489) and *Triticum* cultivars Cocorit, Produra, Anza, Chinese Spring, Nugaines, and the synthetic hexaploid for resistance to *M. chitwoodi.*

## MATERIALS AND METHODS

The nematode culture was isolated from a field population of *M. chitwoodi* on potato and increased on tomato (*Lycopersicon esculentum* Mill. cv. Tropic) in the greenhouse. Nematode eggs for inoculum were obtained by macerating tomato roots in a blender in a 0.1% NaOCl solution (1).

Seeds of *Ae. squarrosa* accessions G 3489 and G 1279 and wheat cultivars Cocorit, Produra, Anza, and Chinese Spring were obtained from the University of California–Riverside wheat germplasm collection. Seeds were surface sterilized in 1% NaOCl for 3 minutes, rinsed three times in sterile water, and germinated at 25 C on moist filter paper in petri dishes. Seedlings were planted singly 2-cm deep in steam-sterilized loamy sand (93% sand, 4% silt, 3% clay) contained in 10-cm-d fiber pots. A suspension of 5,000 eggs was pipetted into three holes in the root zone of 2-week-old seedlings. Tropic tomato plants were inoculated as susceptible controls to test inoculum viability. Plants were arranged on greenhouse benches in a randomized block design with 10 replicates. Plants were fertilized weekly with 30 ml of 20-20-20 (N-P-K). Soil temperature in experimental pots was maintained at 20–24 C. Plants were harvested after ca. 950 degree days (base threshold 7 C) were accumulated. Root systems were washed free of soil, damp dried with paper towels, and weighed. Eggs were collected from root systems by the

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[1] Portion of a Ph.D. dissertation by the first author.
[2] Instituto de Nematologia Agraria del Consiglio Nazionale delle Ricerche, Via G. Amendola, 165/A-70126, Bari, Italy.
[3] Department of Nematology, Riverside, and Kearney Agricultural Center, Parlier, CA 93648.
[4] Department of Nematology, University of California, Riverside, CA 92521.

TABLE 1. Reproduction of *Meloidogyne chitwoodi* on wild and domesticated wheat.

| | Eggs/g fresh root | |
|---|---|---|
| | Experiment 1 | Experiment 2 |
| *Aegilops squarrosa* L. | | |
| G 1279 | 1,978 bc | 181 cd |
| G 3489 | 57 e | 15 e |
| *Triticum turgidum* L. var. *durum* | | |
| cv. Cocorit | 7,550 a | 556 b |
| cv. Produra | 3,144 b | 287 bc |
| *T. aestivum* L. | | |
| cv. Anza | 12,935 a | 2,321 a |
| cv. Chinese Spring | 1,437 c | 146 d |
| cv. Nugaines | 1,878 bc | 208 bcd |
| Synthetic hexaploid G 4299 | 484 d | 6 e |
| *Lycopersicon esculentum* Mill | | |
| cv. Tropic | 42,150 | 7,630 |

Each value is the mean of 10 replicates.
Means followed by the same letter within a column are not different based on Duncan's multiple-range test ($P < 0.01$) performed on $\log_{10}(x + 1)$ transformed data.

NaOCl technique (1) and subsamples were counted.

The experiment was conducted twice: Experiment 1 ran from September to November 1987 and experiment 2 from February to April 1988. The data were subjected to ANOVA and means were separated by the Duncan's multiple-range test.

## Results and Discussion

*Meloidogyne chitwoodi* developed and reproduced on all the wheat cultivars tested, but to varying levels (Table 1). Nematode reproduction was greater in experiment 1 than in experiment 2, but the trend was similar. Wheat was a poor host, compared with tomato. The highest reproductive rate on wheat in both experiments occurred on the commercial hexaploid Anza. Fewest eggs ($P < 0.05$) were produced on the synthetic hexaploid G 4299 and on *Ae. squarrosa* G 3489. Fewer eggs ($P < 0.01$), however, were produced on the *Ae. squarrosa* G 3489 than on the synthetic hexaploid in experiment 1. Reproduction on Cocorit was not different ($P < 0.01$) from that on Anza in experiment 1. Intermediate rates of reproduction occurred on Produra, *Ae. squarrosa* G 1279, Chinese Spring, and Nugaines.

Wheat is a much poorer host of *M. chitwoodi* than tomato, although some cultivars allow substantial reproduction. *Aegilops squarrosa* G 3489 and the synthetic hexaploid developed from it are resistant but not immune to *M. chitwoodi*. This level of resistance should suppress field populations densities over time.

Less than optimum experimental conditions in the second test resulted in poor reproduction even on tomato. However, the relative levels of parasitism of *M. chitwoodi* on the range of wheat lines tested were similar in both experiments.

Resistance to *M. chitwoodi* is the most promising means of controlling the nematode. Soil fumigants were more effective than nonfumigants in reducing nematode population densities (7); however, recent environmental and health problems with nematicides, as well as marked increases in their costs, have led to more emphasis on developing resistant crops for management of nematode populations. The use of resistance in rotation crops offers a means of managing *M. chitwoodi*.

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