RESEARCH NOTES

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Susceptibility of Nevada Synthetic XX Germplasm to a California Race of *Meloidogyne hapla*[1]

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The northern root-knot nematode, *Meloidogyne hapla* Chitwood, is widely distributed in the western United States. It is commonly found in the northern states where soil temperatures drop to 0 C or below and where summer temperatures seldom exceed 25–30 C (12). It has been found, however, at soil temperatures exceeding 30 C (10). *Meloidogyne hapla,* occurring in most areas where alfalfa, *Medicago sativa* L., is grown, is economically the most important *Meloidogyne* species associated with alfalfa (4,5,7). Resistance is the only economical means of nematode control in alfalfa (2). Selections of the hardy alfalfa cultivar Vernal are resistant to *M. hapla* (11). Resistant Nevada Synthetic XX (Nev Syn XX) (9) has been used in the development of *M. hapla* resistant cultivars (2); however, a *M. hapla* population (CA) from Visalia, California, parasitizes and reproduces on Nev Syn XX under field conditions (McKenry, unpubl.).

Because physiological races of populations of *Meloidogyne* spp. on alfalfa are known to occur (3,8), the host–parasite relations of the CA population and a population (UT) obtained originally from lettuce at Ogden, Utah, were compared.

Alfalfa cultivars used in the study were the *M. hapla* resistant Nev Syn XX and the susceptible Deseret. Alfalfa seeds were scarified, treated with captan, germinated on filter paper in petri dishes for 48 hours, washed six times with deionized water, and planted (four seeds per container) into steam-sterilized sandy loam soil (89% sand, 7% silt, 4% clay, 0.5% organic matter; pH 7.4) in 15-cm-d plastic containers. After 28 days growth in a greenhouse at 26 ± 2 C, plants were thinned to one seedling per container and roots were inoculated by adding equal amounts of inocula through four openings in the soil. Treatments, arranged in a randomized block and replicated 20 times, were 1) 100 CA *M. hapla* eggs and second-stage juveniles (J2) per seedling (6), 2) 100 UT *M. hapla* eggs and J2 per seedling, and 3) uninoculated control. Plants of each treatment were harvested 14 days after inoculation, roots were stained in hot lactoglycerol (1:1:1 lactic acid : glycerol : distilled water) and acid fuchsin (1), and nematode invasion was determined.

In a similar experiment, 28-day-old Nev Syn XX and Deseret seedlings were inoculated with 1,000 CA or UT eggs and J2. Treatments, including uninoculated controls, were arranged in a randomized block and replicated 20 times. The experiment was terminated after 120 days growth, and plant growth, root galling (1 = no galling; 6 = 80–100% root tissue galled), nematode reproduction (final nematode population density/initial nematode population density [Pf/Pi]), and plant susceptibility (Pf/Pi > 1.0) were determined. Data from both experiments were analyzed with ANOVA.

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There were significant differences ($P < 0.05$) between CA and UT *M. hapla* populations in nematode invasion, root galling, plant growth suppression, and nematode reproduction on Nev Syn XX but not on Deseret alfalfa. Fifty-four CA J2 and 31 UT J2 invaded each Nev Syn XX seedling, whereas 66 CA J2 and 63 UT J2 invaded Deseret seedlings. Deseret was considered to be 100% susceptible to both CA and UT, whereas Nev Syn XX was 100% and 9% susceptible to CA and UT, respectively. Both nematode populations suppressed ($P < 0.05$) the growth of Deseret alfalfa, but only CA suppressed the growth of Nev Syn XX below that of uninoculated controls. Mean shoot weights of Deseret were 1.89, 1.76, and 2.78 g/plant for CA, UT, and uninoculated plants, respectively. Mean shoot weights of Nev Syn XX were 1.82, 2.64, and 2.70 g/plant for CA, UT, and uninoculated plants, respectively.

Root galling indices on galled plants were 5.4 on Deseret and 4.7 on Nev Syn XX plants inoculated with CA, and 5.2 on Deseret and 1.4 on Nev Syn XX inoculated with UT. The nematode reproductive indices of *M. hapla* CA on galled plants were 35 on Deseret and 24 on Nev Syn XX, whereas *M. hapla* UT indices were 38 on Deseret and 3 on Nev Syn XX.

The development and release of Nev Syn XX was accomplished by extensive screening and exposure to *M. hapla* populations from California, Nevada, Oregon, Utah, and Washington (9). It has been an excellent source of resistance since its release in 1976 (2). This study shows, however, the variability in nematode populations in different geographical locations that may result in differences in resistance and susceptibility. When selecting for resistance to nematodes, plant breeders should be cognizant of this and expose the germplasm to different populations from the areas in which the cultivar is to be used. Not all populations can be tested, however, and types that attack the resistant variety may be found later.

Literature Cited

1. Bridge, J., S. Page, and S. Jordan. 1982. An improved method for staining nematodes in roots. 1981 Rothamsted Experiment Station Report, Part 1, p. 171.

2. Elgin, J. H., Jr., R. E. Welty, and D. B. Gilchrist. 1988. Breeding for disease and nematode resistance. Pp. 827–858 *in* A. A. Hansen, D. K. Barnes, and R. R. Hill, Jr., eds. Alfalfa and alfalfa improvement. American Society of Agronomy, Madison, WI.

3. Goplen, B. P., E. H. Stanford, and M. W. Allen. 1959. Demonstration of physiological races within three root-knot nematode species attacking alfalfa. Phytopathology 49:653–656.

4. Griffin, G. D. 1984. Nematode parasites of alfalfa, cereals, and grasses. Pp. 243–321 *in* W. R. Nickle, ed. Plant and insect nematodes. New York: Marcel Dekker.

5. Griffin, G. D., and J. H. Elgin, Jr. 1977. Penetration and development of *Meloidogyne hapla* in resistant and susceptible alfalfa under differing temperatures. Journal of Nematology 9:51–56.

6. Hussey, R. S., and K. R. Barker. 1973. A comparison of methods of collecting inocula of *Meloidogyne* spp. including a new technique. Plant Disease Reporter 57:1025–1028.

7. Inserra, R. N., J. H. O'Bannon, and G. S. Santo. 1980. The effect of *Meloidogyne hapla* on the growth of alfalfa seedlings. Nematologica 26:379–381.

8. Mojtahedi, H., G. S. Santo, and N. J. Pinkerton. 1988. Differential response of Thor alfalfa to *Meloidogyne chitwoodi* races and *M. hapla*. Journal of Nematology 20:410–416.

9. Peaden, R. N., O. J. Hunt, L. R. Faulkner, G. D. Griffin, H. J. Jensen, and E. H. Stanford. 1976. Registration of a multiple-pest resistant alfalfa germplasm (Reg. No. GD 51). Crop Science 16:125–126.

10. Radewald, J. D., P. G. Mowbray, A. O. Paulus, R. Shibuya, and J. M. Rible. 1969. Preplant soil fumigation of California head lettuce. Plant Disease Reporter 53:385–389.

11. Stanford, E. H., B. P. Goplen, and M. W. Allen. 1958. Sources of resistance in alfalfa to the northern root-knot nematode, *Meloidogyne hapla*. Phytopathology 48:347–349.

12. Taylor, A. L., and J. N. Sasser. 1978. Biology, identification, and control of root-knot nematodes (*Meloidogyne* species). Raleigh: North Carolina State University Graphics.