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Institut für Pflanzenkrankheiten der Universität Bonn, 5300 Bonn 1, Fed. Rep. Germany

STUDIES ON HOST RANGE OF THE NORMAL AND GIANT FABA BEAN RACES OF *DITYLENCHUS DIPSACI*

by
B. Augustin[1] and R.A. Sikora

Summary. The results of a survey on the host status of weeds in *Vicia faba* fields in Syria to the giant faba bean race of *Ditylenchus dipsaci* showed that *Ranunculus arvensis*, *Convolvulus arvensis*, and *Avena sterilis* were good hosts. A similar study of weeds in fields in Germany infested with the normal faba bean race demonstrated that *Atriplex patula*, *Stellaria media*, *Lamium amplexicule*, and *Polygonum persicaria* are good hosts.Field trials in Syria showed that indigenous plants acted as hosts of *D. dipsaci* on fallow land, thereby, insuring future damage to the succeeding faba bean crop. Field trials conducted in Germany demonstrated that in addition to faba bean, onion, phlox and oats were good hosts and white clover, tobacco, phacelia, sugar beet and maize were fair hosts of the normal faba bean race.

Several biological races of *Ditylenchus dipsaci* (Kuehn) Filipjev have been distinguished on the basis of host preference, morphometrics, and chromosome number (Sturhan 1964, 1965, 1966). Faba bean (*Vicia faba* L.) is the most common host of the faba bean race, although several other races are able to multiply on this host. Whereas the giant race is dominant on faba bean in the Mediterranean region, where it can cause considerable yield loss (Schreiber, 1977) the normal race is prevalent in most European countries (Sturhan, 1975; Augustin, 1985). The giant race, however, is found in England were it caused more severe damage to faba bean than the normal race (Hooper, 1983). Microplot studies in Germany have demonstrated that the giant race of *D. dipsaci* can survive and multiply on faba bean under local climatic conditions (Sturhan, pers. comm). Spread of *D. dipsaci* infestations through seed limit export of *V. faba* and have made the nematode a quarantine pest in many countries.

The goals of our studies were to re-examine the host range status of both the giant faba bean race from the Mediterranean region and normal faba bean race from Germany on commercial and wild plant species to determine if similarity in host plant status exists which may be important in determining the future status of introduced populations of the giant race, and determine the importance of weed hosts in nematode survival under normal and clean fallow.

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[1] Present address of senior author: Landespflanzenschutzamt, Essenheimerstr. 144, 6500 Mainz, Fed. Rep. Germany.

Material and methods

Wild plants, growing as weeds, were collected from randomly selected *V. faba* fields in Syria and West Germany in 1982 and 1983. The plants were cut into 1 cm long segments, submerged in water for 24 hr, the resulting solution concentrated on a 25 µ sieve, and the extracted nematodes examined microscopically.

Morphometric studies of the body length of adult nematodes demonstrated that only the giant race was present in the Syrian experimental field and the normal race in the test site in Germany.

A field trial was conducted on the ICARDA experimental site at Boustan Pasha, Syria (on the coast approx. 25 km west of Lattakia) in the 1981/82 growing season to determine the host status of the local weeds to *D. dipsaci* and the influence of the local weeds on the population density of the giant faba bean race. Changes in soil and plant nematode population densities and the determination of host status was studies in field plots with clean fallow and normal fallow. The plots were 2m x 2m and were located in a *D. dipsaci* infested field that was planted to faba bean the previous season. The two treatments were replicated 6 times. The clean fallow plots were cultivated by hand at regular intervals to maintain weed-free conditions.

The initial nematode soil density was determined by taking 15 soil probes from each replicate to a depth of 20 cm and by extracting the nematodes from 200 cm^3 of soil from each plot using the wet sieve-decantation technique. The residue from the 45 µ sieve was placed on a modified Baermann extraction dish at 15-20°C for 48 hr and the extracted nematodes were counted. The initial mean population density/replicate was 31 nematodes/100cm^3 of soil. The final soil density was determined by extracting the nematodes from 200 cm^3 of soil as already described. The population density in the weeds was determined by submerging 50 g of chopped air dried plant material of each weed species in water for 24 hr.

Another field trial was conducted in an experimental field of the Institut für Pflanzenkrankheiten, University of Bonn at Poppelsdorf in 1984. The normal faba bean race of *D. dipsaci* was maintained in a field planted to *V. faba* in a 12 year monoculture. The initial population density of the normal race was five nematodes/100 cm^3 of soil. The plots consisted of two 5 m rows of the crops or ornamental plants listed in Table II. The final nematode density was determined by extracting the nematodes from 10 g of the air dried plant material as already described. Since the nematode can penetrate and cause severe malformations on nonhost crops, only plants that supported populations having at least three different nematode developmental stages, indicating nematode reproduction after penetration, were given host status.

The climatic conditions in the winter (Oct.-Feb.) or cool and wet rainy season in Syria are very similar to growing conditions in Germany. The temperature ranges between 15 and 20°C and light rainfall is typical at the start of the growing season. Both regions have conditions highly favorable to *D. dipsaci* survival and development.

Results

In Syria three species of plants, all common weeds in faba bean fields, proved to be hosts of the giant faba bean race of *D. dipsaci*: *Ranunculus arvensis* L., *Convolvulus arvensis* L., and *Avena sterilis* L. In Germany four species of weeds were hosts for the normal faba bean race: *Atriplex patula* L., *Stellaria media* Cyr., *Lamium maculatum* L. and *Polygonum persicaria* L.

A plant was considered to be a host when more than 150 nematodes/g of dried plant material were present. A wide range of symptoms were induced by the nematode and the degree of symptom espression varied with plant species attacked and intensity of the infestation (Augustin, 1985). The plants exhibited varying degrees of stunting and stem, petiole and leaf swellings.

The presence of weeds did not significantly influence nematode soil population level of the giant race which increased from 5/200 cm^3 to 12/200 cm^3 soil during the season. There were, however, distinct differences in population development between weed species (Table I). Two known hosts, *Convolvulus arvensis* and *Avena sterilis*, had a strong and a slight effect on nematode multiplication, respectively.

The results of the field study conducted with the normal race in Germany are given in Table II. Four crops were considered to be good hosts of the normal race of *D. dipsaci* and contained more than 1500 nematodes per 10 g of dried plant material: phlox, onion, faba bean, and oat. Five plant species were fair hosts with less than 900 nematodes per 10 g of plant material: white clover, tobacco, phacelia, maize, and sugar beet. The host status of summer rye and parsley were not clear and requires further testing.

Discussion

Wild plants have been repeatedly described as host plants of the stem nematode (Steiner and Buhrer, 1932; Staniland, 1945; Goodey, 1947; Salentiny, 1957 and 1959; Green, 1980; Hooper and Stone, 1980). Variation in host status between these studies was probably caused by differences in the compositon of the flora and in the nematode race or mixture of races present, giving an unclear picture of host range.

Although *C. arvensis* was the main weed host of the giant faba bean race in Boustan Pasha, Syria it can not compete with other indigenous plants. *C. arvensis* growth and multiplication was limited by the presence of other fast growing *D. dipsaci* non-host species which may have caused the observed reduction in nematode multiplication on a per plot basis. This plant emerges late in the season and can survive early weed control efforts in normal cropping systems. It can, therefore, act as an important alternate host for the nematode in between faba bean production cycles. The low final soil population densities were also induced in part by the removal of the weeds for estimation of floral composition and determination of nematode population densities. In addition, low levels may have been caused by vertical migration of *D. dipsaci* into deeper soil horizons during the dry season (Tseng *et al.*, 1968; Wilson and French, 1975). The results emphasize the significance of proper weed control in supporting the positive effects of crop rotation for *D. dipsaci* control (Webster and Greet, 1967; Hooper and Stone, 1980).

The fact that both *C. arvensis* and *R. arvensis* were good hosts for the giant race in Syria is important. Both plants are common weeds in Europe and could serve as hosts for introduced populations of this race, thereby aiding establishment and spread of this race.

Crops other than faba bean proved to be good and even better hosts of the normal faba bean race of *D. dipsaci* in the study conducted in Germany. Symptom expression was not always related to intensity of nematode attack. This may have indicated differences in degree of plant tolerance to this race.

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TABLE I - *Numbers of* Ditylenchus dipsaci *recovered from weed hosts in Syria.*

Host plant	Plant dry weight g/plot	*D. dipsaci* /50 g air dried tissue	Nematodes/plot
Avena sterilis L.	1389	10	278
Chichorium intybus L.	1267	5	127
Anthemis hyalina DC.	1048	0	0
Tholaris paradoxa L.	982	4	79
Sinapis arvensis L.	827	3	50
Adonis aestivalis L.	118	3	7
Convolvulus arvensis L.	14	4733	1278
Leguminosae	283	0	0
Lathirus aphaca L.			
Coronilla scorpioides (L.) Koch			
Scorpiurus subvillosa L.			
Trifolium spp.			
Other dicotyledon mainly *Galium* spp.	362	16	116

TABLE II - *Susceptibility of various crops to* Ditylenchus dipsaci *(normal race) derived from* Vicia faba.

Species	Nematodes/ 10 g air dried plant material	Host status	Visible symptoms (+ present − absent)
Parsley, *Petroselinum hortense* Hoffm.	196	?	−
Phlox, *Phlox carolina* L.	232500	good	+
Onions, *Allium cepa* L.	7885[a]	good	+
Faba beans, *Vicia faba* L.	6810	good	+
Oat, *Avena sativa* L.	1514	good	+
White clover, *Trifolium repens* L.	867	fair	−
Summer rye, *Secale cereale* L.	540	?	+
Tobacco, *Nicotiana tabacum* L.	441	fair	−
Phacelia, *Phacelia tanacetifolia* Benth.	400	fair	−
Sugar beet, *Beta vulgaris* L.	134[a]	fair	+
Corn, *Zea mais* L.	42	fair	+
Potato, *Solanum tuberosum*	12	non host	−
Alfalfa *Medicago sativa* L.	9	non host	−
Red clover, *Trifolium pratense* L.	4	non host	−
Tomato, *Lycopersicon esculentum* Mill.	2[a]	non host	−
Strawberry, *Fragaria ananassa* Duch.	0	non host	−
Chickpea, *Cicer arietinum* L.	0	non host	−
Summer wheat, *Triticum aestivum* L.	0	non host	−

[a] Extraction of fresh plant material.

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