EFFECT OF HETERODERA CICERI ON YIELD OF CHICKPEA AND LENTIL AND DEVELOPMENT OF THIS NEMATODE ON CHICKPEA IN SYRIA

BY

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Experiments were undertaken in 1984-1986 to assess losses caused by Heterodera ciceri to chickpea and lentil and to investigate the development of the nematode in Syria. Pots containing 5.5 dm³ of soil were sown to spring chickpea in 1985 and microplots containing 34 dm³ of soil sown to winter chickpea or lentil in 1985-1986. There were nine pots or ten microplots for each plant species and population density levels (0, 0.125, 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64 and 128 eggs of H. ciceri/cm³ soil). Sixteen more microplots were sown to winter chickpea and 14 to spring chickpea, to investigate the development of the nematode. When plant size was considered, tolerance limits (T) to H. ciceri were 0.22 and 0.6 eggs/cm³ soil and minimum relative plant sizes 0.6 and 0.47 for winter sown chickpea and lentil, respectively. Tolerance limits of 1, 1.15, and 2.51 eggs/cm³ soil for spring and winter chickpea and lentil, respectively, and relative minimum yields of 0 for chickpea and 0.5 for lentil were instead estimated for grain and total plant weights. Seed protein content was also negatively affected by the nematode. Second stage juveniles of the nematode had invaded roots of both winter and spring chickpea by the time of emergence of the plants. Females appeared on 13 March and 10 April on the roots of winter and spring chickpea, and cysts 14 and 6 days later, respectively, when 212-227 day degrees had accumulated. Maximum reproduction rates of H. ciceri at very small initial population densities were large (249-297) and about the same on winter chickpea and lentil and 4.5 on spring chickpea.

Keywords: chickpea cyst nematode, development, chickpea, lentil, yield losses, host parasite relations, mathematical models.

The chickpea cyst nematode, Heterodera ciceri Vovlas, Greco & Di Vito, causes severe damage to chickpea (Cicer arietinum L.) and lentil (Lens culinaris Medic.) in Syria (Greco et al., 1984; Vovlas et al., 1985). The nematode also affects pea (Pisum sativum L.) and can reproduce on a number of leguminous species (Greco et al., 1986b). Under controlled conditions only one generation was completed (Kaloshian et al., 1986). To investigate the development of H. ciceri under field conditions and its pathogenicity to the main crops affected, chickpea and lentil, experiments were done in Syria, in 1984 to 1986. Although chickpea is usually grown as a spring crop, winter sown chickpea was included in the experiments because recent studies by Hawtin and Singh (1984) have shown that its grain yields are considerably larger than of spring

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sown chickpea. Chickpea and lentil sown in December 1984 were heavily damaged by frost in early 1985, which left only an experiment with spring sown chickpea in that year. The experiments with winter chickpea and lentil were repeated in 1985-1986.

MATERIALS AND METHODS

Effect of population densities of H. ciceri on lentil and chickpea. Cysts were extracted in November 1984 from infested soil from a field in the Idleb area (North Syria), in which chickpea had been damaged severely by H. ciceri. Cysts and debris were then dried at room temperature, mixed with 40 kg of steam sterilized sand and used as inoculum. To estimate the nematode population of this inoculum ten subsamples, 10 g each, were poured onto a 250 μm sieve and rinsed to remove fine soil particles. Cysts were then collected on a paper filter, counted and crushed according to Bijloo's modified method (Seinhorst & Den Ouden, 1966) to determine egg contents (standard error = 8.6% of the average). The correct amounts of the inoculum and 80 g of a fertilizer (18% N, 46% P₂O₅) were then added to and thoroughly mixed with lots of 148.5 dm³ of soil per population level, in a concrete mixer, to establish the following range of population densities: 0, 0.125, 0.25, 0.5, 1, 2, 4, 8, 16, 32, 64 and 128 eggs of H. ciceri/cm³ soil. The infested soil was divided between 27 plastic pots per nematode density (5.5 dm³ per pot). The pots were sunk into the soil at ICARDA's principal research station at Tel Hadya (Aleppo, North Syria) to 5 cm below the edge and nine at each nematode density were sown to spring chickpea on 3 March 1985 (5 seeds of ILC 482 per pot, thinned to three per pot soon after emergence). The inoculum for the 1985-1986 experiments was collected from a similar field in the same way as the year before and the same range of nematode densities was prepared. Ten replicates at each population level and plant species were established, this time in microplots made of 55 cm long and 31 cm wide plastic tubes without bottom, sunk into the soil at the same location as the previous experiments. The bottom 5 cm layer of each microplot was filled with sterilized soil and then 34 dm³ of the infested soil added to fill the microplots up to 5 cm below the edge. Because of the large volume of the microplots the soil of each was infested and fertilized (as in 1984) separately. Six seeds of chickpea (ILC 482) or 15 of lentil (ILL 4401 local small) were sown per microplot on 10 December and, after emergence of the plants, thinned to four and ten per microplot, respectively.

Pots and microplots were inoculated with the appropriate Rhizobium species soon after sowing.

Length and width of winter chickpea and lentil were measured on 5 May. At harvest (spring chickpea: 20 June 1985, lentil: 20 May 1986, winter chickpea: 5 June 1986), grain and straw plus grain were weighed. Chickpea and lentil seeds were tested for protein content (Nx6.25) using a NEOTEC