

N.D. University of Agriculture and Technology, Faizabad, India

SYNERGISM BETWEEN *HETERODERA CAJANI* AND
FUSARIUM UDUM ATTACKING *CAJANUS CAJAN*

by
A. HASAN

During a survey along the Aligarh-Delhi road in Uttar Pradesh, certain fields of pigeon pea, *Cajanus cajan* (L.) Millsp. showed severe wilt symptoms while the incidence of the disease in other nearby fields was not severe even though the same local variety was grown in all the fields. Soil and root samples collected from the fields (of pigeon peas) were processed by appropriate laboratory procedures and the nematodes *Tylenchorhynchus vulgaris* Upadhyaya *et al.*, *Helicotylenchus indicus* Siddiqi and *Hoplolaimus indicus* Sher were found. The wilt fungus, *Fusarium udum* Butler was recovered from roots of plants from fields with severe and mild wilt. The cyst nematode, *Heterodera cajani* Koshy was found only in those fields where there was a high incidence of wilt. Laboratory experiments were undertaken to establish the role of these nematodes in relation to the severity of disease development.

A single spore culture of *F. udum* maintained on PDA was the source of the fungus. Inoculum was grown in Czapek's liquid medium contained in 500 ml conical flasks kept under aseptic conditions at room temperature. Pure cultures of *T. vulgaris*, *Helicotylenchus indicus* and *Hoplolaimus indicus* started from single females were raised separately on tomato, *Lycopersicon esculentum* L. The culture of *Heterodera cajani* was reared from a single cyst on pigeon pea. All nematodes host plants were grown in clay pots filled with steam sterilized soil.

Six pigeon pea seedlings were raised in each 15 cm clay pots filled

Table I - Disease development and nematode multiplication when pigeon pea was inoculated with fungus or nematodes alone and in combination.

Treatments	Per cent plants wilted				Final nematode population per pot			
	Tyl.	Hel.	Hop.	Het.	Tyl.	Hel.	Hop.	Het.
1. Nematode alone	0.0	0.0	0.0	0.0	2470	3836	1784	18436 (2135)
2. Fungus alone	13.4				—	—	—	—
3. Nematode + Fungus (simultaneously)	11.6	17.2	13.8	52.5*	1232*	1190*	920*	5840* (782*)
4. Nematode + Fungus (1 week prior to fungus)	17.5	10.4	12.5	68.3*	985*	1066*	1036*	7332* (845*)
5. Nematode + Fungus (3 weeks prior to fungus)	12.8	20.3	20.8	93.6*	1070*	930*	800*	7548* (812*)
6. Uninoculated control	0.0	0.0	0.0	0.0	—	—	—	—

Tyl. = *Tylenchorhynchus vulgaris*, Hel. = *Helicotylenchus indicus*, Hop = *Hoplolaimus indicus*, Het. = *Heterodera cajani*; figures in parenthesis indicate number of cysts produced; * data statistically significant (P = 0.01) — development of wilt compared with treatment two and nematode population with treatment one.

with autoclaved soil-sand-compost mixture (3:2:1). When the seedlings had grown to the 5 leaf stage the pots were inoculated with 500 nematodes of each species (male, female, larvae; or 2nd stage larvae of the cyst nematode) and/or 3 g of macerated mycelial mat. The combinations of nematodes and fungus and the sequence of the inocula are indicated in Table I. Each treatment was replicated six times.

Ten weeks from the date of nematode inoculation the number of wilted plants was counted. Soil populations of the nematodes were determined using Cobb's sieving and decanting and Baermann's funnel techniques or the Fenwick can technique for extraction of cysts.

No wilting occurred when seedlings were inoculated with various nematodes alone (Table I). However, 13.4% of the plants wilted where the fungus was present alone. In mixed inoculations where fungus and *T. vulgaris*, *Helicotylenchus indicus* or *Hoplomaimus indicus* were inoculated either simultaneously or sequentially no significant difference with regard to wilt development was observed. Where *H. cajani* was associated with the fungus, there was a significant increase in wilting. Higher incidence of wilt development was recorded for treatments involving sequential inoculations compared to simultaneous inoculation and the highest incidence of wilting (93.6% of the plants) occurred where seedlings were inoculated with cyst nematode three weeks prior to the fungus inoculation.

The cyst nematodes, *H. glycines* and *Globodera rostochiensis* have been reported to increase the severity of *Fusarium/Verticillium* wilt in soybean and potato respectively (Ross, 1965; Corbett and Hide, 1971). Jorgenson (1970) and Miller (1975), on the other hand, have reported that the severity of *Fusarium* wilt in tomato and sugarbeet was reduced in presence of *H. tabacum* and *H. schachtii*.

With a starting population of 500/pot, all treatments showed an increase in nematode population. In all treatments where nematodes were inoculated with the fungus, either simultaneously or sequentially, the population did not increase as much as there without the fungus (Table I).

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