Nematol. medit. (1993), 21: 275-277

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PATTERNS OF INTERSPECIFIC ASSOCIATIONS IN PLANT PARASITIC NEMATODES OF SUGARCANE ECOSYSTEMS

by
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Summary. Interspecific association analysis of four nematode species in sugarcane fields of India revealed that *Pratylenchus zeae* showed negative association with *Hoplolaimus indicus* and *Tylenchorhynchus annulatus* and a positive association with *Helicotylenchus dihystera*. Feeding site and feeding habit are the primary factors responsible for association of the two nematodes.

Sugarcane is cultivated under varied conditions ranging from the tropics to the sub-tropics. At present 48 genera and 275 species of nematodes have been associated with sugarcane from 36 countries (Spaull and Cadet, 1990). Species of five genera viz. *Pratylenchus*, *Hoplolaimus*, *Helicotylenchus*, *Tylenchorhynchus* and *Meloidogyne* can be listed as the major plant parasitic nematodes; they have a wide distribution and are of common occurrence in sugarcane soils of India (Mehta, 1992).

Host plant response to a plant parasitic nematode may be altered by the presence of one or more nematode species as one species may enhance the development and reproduciton of other species (Johnson and Nusbaum, 1970; Sikora *et al.*, 1972) while the reverse effect may be observed with other nematodes (Amosu and Taylor, 1975; Pinochet *et al.*, 1976). Analyses were carried out to study the pattern of association of *Pratylenchus zeae* Graham with three other nematode species on sugarcane in Tamil Nadu state of India.

Materials and methods

An intensive survey was conducted in 11 sugarcane growing districts encompassing 21 sugar factories in Tamil Nadu. Soil samples were collected randomly at different locations in sugarcane fields at a depth 15 cm using a screw type soil auger. After collection of five soil samples, the soil was mixed together as a single composite sample. A total of 5000 samples were collected for the study. Nematodes were extracted from the soil using a decanting sieving technique followed by the centrifugal floatation method (Caveness and Jensen,1955). Four nematode species viz., *P. zeae*, *Hoplolaimus indicus* Sher, *Helicotylenchus dihystera* (Cobb) Sher and *Tylenchorhynchus annulatus* (Cassidy) Golden were identified and their numbers estimated. Association analysis was prepared by calculating sample variance, species variance (Ludwig and Reynolds, 1988), variance ratio, chi-square value and Jaccard index.

Results

Association analysis within the 21 sugar factory areas surveyed indicated that *P. zeae* had a negative association pattern with *H. indicus* in 18 zones and a positive asociation pattern in three factory zones (Table I). The degree of negative association between the two species, *P. zeae* and *H. indicus*, was maximum in Dharmapuri and minimum in Myladudurai zone. Association pattern of *P. zeae* and *T. annulatus* was negative in 18 zones and positive in three zones with a maximum degree of association in Deccan and minimum in Chengalrayan zone. In 15 zones *P. zeae* showed positive association with *H. dihystera* but negative association between the two species was observed in six zones. Degree of positive association between these species was maximum in Anna sugars zone and minimum in Sivagangai.

Discussion

Any ecological community has a number of biotic and abiotic factors that interact and control the distribution, density, frequency and population level of plant or animal species concerned (Norton, 1978). This type of an interaction was observed among the major nematode species identified that co-exist in sugarcane fields. Analysis of the

TABLE I - *Interspecific association of* Pratylenchus zeae *with* Hoplolaimus indicus, Tylenchorhynchus annulatus *and* Helicotylenchus dihystera.

Name of the factory zone	Species pair	Association	Chi-square	Jaccard index	Name of the factory zone	Species pair	Association	Chi-square	Jaccard index
Ambur	Pz+Hi	-	20.50	0.14		Pz+Hd	-	0.00	0.39
	Pz+Hd	+	7.48	0.60		Pz+Ta	-	3.02	0.34
	Pz+Ta	-	5.92	0.34	Kothari	Pz+Hi	-	7.50	0.16
Anna	Pz+Hi	-	19.39	0.10		Pz+Hd	+	5.69	0.62
	Pz+Hd	+	18.62	0.81		Pz+Ta	-	8.89	0.20
	Pz+Ta	-	12.04	0.15	Myladudurai	Pz+Hi	+	1.18	0.20
Aruna	Pz+Hi	-	16.01	0.10		Pz+Hd	+	0.07	0.47
	Pz+Hd	+	11.63	0.70		Pz+Ta	-	4.44	0.35
	Pz+Ta	-	10.06	0.27	Madura	Pz+Hi	-	9.95	0.25
Bannari	Pz+Hi	-	12.61	0.09		Pz+Hd	+	0.16	0.44
	Pz+Hd	+	2.25	0.50		Pz+Ta	+	8.02	0.65
	Pz+Ta	-	3.49	0.31	Maduranthagam	Pz+Hi	+	1.71	0.40
Cauvery	Pz+Hi	-	13.85	0.06		Pz+Hd	-	11.55	0.14
	Pz+Hd	+	10.88	0.85		Pz+Ta	-	3.28	0.43
	Pz+Ta	-	13.85	0.06	National	Pz+Hi	-	8.47	0.17
Chengalrayan	Pz+Hi	-	0.65	0.35		Pz+Hd	-	0.10	0.41
	Pz+Hd	-	2.56	0.33		Pz+Ta	+	2.68	0.47
	Pz+Ta	-	0.05	0.63	Sakthi	Pz+Hi	-	17.89	0.63
Deccan	Pz+Hi	-	16.39	0.08		Pz+Hd	+	7.00	0.21
	Pz+Hd	+	13.35	0.78		Pz+Ta	-	7.82	0.00
	Pz+Ta	-	14.85	0.15	Sivagangai	Pz+Hi	-	17.53	0.10
Dharani	Pz+Hi	-	11.67	0.10		Pz+Hd	-	0.01	0.46
	Pz+Hd	+	5.00	0.63		Pz+Ta	+	1.44	0.50
	Pz+Ta	-	0.06	0.58	South India	Pz+Hi	+	2.74	0.48
Dharmapuri	Pz+Hi	-	21.98	0.15	Sugar	Pz+Hd	-	11.67	0.12
	Pz+Hd	+	12.57	0.64		Pz+Ta	-	2.70	0.52
	Pz+Ta	-	5.97	0.39	Rajshree	Pz+Hi	-	6.77	0.28
Eid Parry	Pz+Hi	-	1.52	0.10		Pz+Hd	+	5.77	0.60
	Pz+Hd	+	2.65	0.53		Pz+Ta	-	2.56	0.33
	Pz+Ta	-	1.64	0.40	Vellore	Pz+Hi	-	10.91	0.15
Kallakurichi	Pz+Hi	-	7.67	0.15		Pz+Hd	+	10.91	0.73
						Pz+Ta	-	10.91	0.15

N.b.: Pz = *Pratylenchus zeae*; Hi = *Hoplolaimus indicus*; Hd = *Helicotylenchus dihystera*; Ta = *Tylenchorhynchus annulatus*; + = positive; - = negative.

survey samples showed that along with *P. zeae*, *H. indicus*, *H. dihystera* and *T. annulatus* also occur at various densities. When the factors are conducive for the co-existence of species the relationship becomes positive and the influence of such factors determines the nature of the relationship (Sikora *et al.*, 1972).

P. zeae was negatively associated with *H. indicus* in 18 factory zones (Table I). Since both nematodes are endoparasites in this crop (Mehta, 1992) and depend on sugarcane roots for their feeding, reproduction and multiplication there exists a competition for their survival resulting in a negative association. Location of zones do not form a basis for co-existence of the two nematode species. Even in zones that are located in different districts, with a varied agroclimatic condition, the interrelationship of the two nematodes is constant, being negative. However, the intensity of negative association varied within the same zone as indicated by Jaccard index (Table I).

In three factory zones *viz.*, Madurandagam, Myladudurai and South India, the association of *P. zeae* with *H. indicus* is positive. This can be attributed to the fact thart there is a coordinated rapid multiplication of both the species in the same niche, all factors being congenial for both the nematodes (Inserra *et al.*, 1985). In such zones where a positive association exists it becomes important to take steps to control both the nematodes simultaneously.

Association of *P. zeae* with *H. dihystera* in 18 sugar factory regions was positive. Such association between these two nematode species is due to differences in the nature of their feeding and selection of feeding site. *H. dihystera* being a cortical feeder, feeds mainly on the cortical cells from outside of root (Brathwaite, 1980). It lay eggs and completes its life cycle in the rhizosphere without entering the root. On the other hand *P. zeae* being an endoparasite, penetrates the cortex, lays eggs inside the cortex and completes its life cycle therein (Sudararaj and Mehta, 1992). Since *P. zeae* and *H. dihystera* do not interfere with each other for their feeding or reproduction the interaction between the two nematodes remains positive.

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Accepted for publication on 18 September 1993.