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Resistance and susceptibility of prey nematodes to predation and strike rate of the predators, *Mononchus aquaticus*, *Dorylaimus stagnalis* and *Aquatides thornei*

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Summary — The strike rate of the predators, *Mononchus aquaticus, Dorylaimus stagnalis* and *Aquatides thornei* and the degree of resistance and susceptibility of *Acrobeloides* sp. *Cephalobus* sp. *Rhabditis* sp., *Panagrellus redivivus, Tylenchorhynchus mashhoodi, Hoplolaimus indicus, Helicotylenchus indicus, Scutellonema* sp., *Hemicycliophora* sp., *Hemicriconemoides mangiferae, Hirschmanniella oryzae, Longidorus* sp., *Paralongidorus citri, Paratrichodorus* sp., *Xiphinema americanum* and the second stage juveniles of *Meloidogyne incognita, Heterodera mothi* and *Anguina tritici* to predation was measured and quantified using methods of Bilgrami and Jairajpuri (1989*a*). *M. aquaticus* was the most successful predator with maximum strike rate (SR = upto 100 %) on various species of nematodes. All saprophagous nematodes were highly susceptible to predation (PS > 90 %) except *Rhabditis* sp. which showed some degree of behavioural resistance in the form of active body undulations. *Helicotylenchus indicus* resisted predation by chemical means, i.e. toxic/unfavourable secretions. *X. americanum, P. citri, Longidorus* sp., and *Paratrichodorus* sp. are provided with physical characteristics (cf. cuticle) which provided partial resistance against predation. *Hoplolaimus indicus, Scutellonema* sp., *Hemicycliophora* sp. and *H. mangiferae* were totally resistant to predation by *D. stagnalis* and *A. thornei;* their individuals were neither injured nor killed by the two predators.

Résumé — ***Résistance et sensibilité à la prédation de nématodes-proies; taux d'agressivité des prédateurs* Mononchus aquaticus, Dorylaimus stagnalis *et* Aquatides thornei** — La méthode de Bilgrami et Jairajpuri (1989*a*) a permis de mesurer et de quantifier le taux d'agressivité des prédateurs *Mononchus aquaticus, Dorylaimus stagnalis* et *Aquatides thornei* ainsi que le degré de résistance ou de sensibilité des nématodes *Acrobeloides* spp., *Cephalobus* spp., *Rhabditis* spp., *Panagrellus redivivus, Tylenchorhynchus mashhoodi, Hoplolaimus indicus, Helicotylenchus indicus, Scutellonema* sp., *Hemicycliophora* sp., *Hemicriconemoides mangiferae, Hirschmanniella oryzae, Longidorus* sp., *Paralongidorus citri, Paratrichodorus* sp., *Xiphinema americanum* et des juvéniles de deuxième stade de *Meloidogyne incognita, Heterodera mothi* et *Anguina tritici. M. aquaticus* s'est montré le prédateur le plus performant avec un taux d'agressivité (SR) maximum (jusqu'à 100 %) envers différentes espèces de nématodes. Tous les nématodes saprophages sont très sensibles à la prédation (PS > 90 %) sauf *Rhabditis* sp. qui a un comportement de résistance grâce à des ondulations rapides du corps. *Helicotylenchus indicus* résiste à la prédation au moyen de substances chimiques (substances toxiques ou non favorables). *X. americanum, P. citri, Longidorus* sp., et *Paratrichodorus* sp. ont des caractéristiques physiques liées à la cuticule qui leur confèrent une résistance partielle contre la prédation. *Hoplolaimus indicus, Scutellonema* sp., *Hemicycliophora* sp. et *H. mangiferae* sont totalement résistants à la prédation par *D. stagnalis* et *A. thornei;* leurs individus ne sont en effet jamais blessés ou tués par ces deux prédateurs.

Key-words : *Mononchus, Dorylaimus, Aquatides,* prey nematodes, resistance, predation.

The predatory nematodes possess different mechanisms to overpower their prey and to feed upon them. Similarly, the prey nematodes also have characteristics, hereditory or acquired, to defend themselves from predation (Bilgrami, 1990 *a, b*; Jairajpuri & Bilgrami, 1990). The anti-predation adaptations are in the form of physical, chemical and behavioural characteristics (Esser, 1963, 1987; Esser & Sobers, 1964; Bilgrami & Jairajpuri, 1989*a*). Esser (1963) provided a list of resistant or susceptible prey nematodes to predation by different mononchs and dorylaims. Grootaert *et al.* (1977) measured susceptibility and resistance of tylenchid, areolaimid, enoplid and dorylaimid nematodes to predation while Small and Grootaert (1983) described their anti-predation adaptations. Very recently Bilgrami and Jairajpuri (1989*a*) have defined resistance and susceptibility of prey nematodes and strike rate of the predators and proposed methods to determine and quantify them using *Mononchoides longicaudatus* and *M. fortidens* as predators against a variety of free-living, ecto- and endo-parasitic nematodes. The present experiments were conducted to determine the degree of resistance and susceptibility of different trophic groups viz., saprophagous, ecto- and endoparasitic and predaceous nematodes to predation and the strike rate of the predators, *Mononchus aquaticus, Dorylaimus stagnalis* and *Aquatides thornei.*

Materials and methodes

The predaceous nematodes viz., *Mononchus aquaticus* (Mononchida), *Dorylaimus stagnalis* (Dorylaimina)

and *Aquatides thornei* (Nygolaimina) were cultured by the methods of Bilgrami and Jairajpuri (1988). The adult individuals of *Acrobeloides* sp., *Cephalobus* sp., *Rhabditis* sp., *Panagrellus redivivus, Tylenchorhynchus mashhoodi, Hoplolaimus indicus, Helicotylenchus indicus, Scutellonema* sp., *Hemicycliophora* sp., *Hemicriconemoides mangiferae, Hirschmanniella oryzae, Paralongidorus citri, Longidorus* sp., *Paratrichodorus* sp., *Xiphinema americanum* and the second stage juveniles of *Meloidogyne incognita, Anguina tritici* and *Heterodera mothi* were used as prey. The three predators were also used as prey against each other.

The ectoparasitic nematodes were isolated fresh from the soil by decantation and Baermann's funnel techniques for each experiment. The second stage juveniles of *M. incognita, H. mothi* and *A. tritici* were obtained from their populations maintained on tomato, moth grass and wheat galls respectively. The free living nematodes were obtained from the culture maintained in Petri-dishes containing 1 % water-agar supplemented with infant milk powder (Lactogen).

Fifty encounters were observed between predators and prey. The encounters (i.e., lip contact of predators with the prey at right angles) between predators and prey were observed in Petri-dishes containing 1 % water agar using a stereoscopic bionocular microscope. A prey nematode was placed in front of the head of an active predator with the help of a fine needle without touching (disturbing) the predators in any manner. Only those observations were recorded where the predators behaved as normally as could be ensured. For each encounter a new predator and prey individuals were used (irrespective whether the predator failed or succeeded in attacking prey). To reduce the effect of satiation and prey habituation, 4-6 day starved predators were tested. The strike rate (SR) of the predators *M. aquaticus, D. stagnalis* and *A. thornei* and the degree of prey resistance (PR) and susceptibility (PS) to predation were determined using methods of Bilgrami and Jairajpuri (1989*a*). The percentage of predators which started feeding after wounding the prey and the prey which were left unconsumed by the predators were also determined (calculated respectively out of the total number of prey individuals wounded and individuals upon which feeding actually initiated). All species of predators were tested separately.

Results (Tables 1 and 2)

Resistance and susceptibility of prey to predation and strike rate of *M. aquaticus*

Among saprophagous nematodes, encounters with *P. redivivus, Cephalobus* sp., and *Acrobeloides* sp., resulted in maximum strike rate (SR = 98 — 100 %) and prey wounding (AW = 98 — 100 %) while amongst endo parasitic nematodes *M. aquaticus* had maximum strike rate against *A. tritici* juveniles (SR = 98 %) with 98 % prey wounding. *M. aquaticus* was most successful against *T. mashhoodi* and *H. oryzae* (SR = 92 — 94 %) and wounded maximum individuals (AW = 93 — 94 %) in comparison to other ecto-parasitic nematodes. *M. aquaticus* exhibited high degree of success upon their own individuals (SR = 88 %) but not on other predators viz., *D. stagnalis* and *A. thornei. Hoplolaimus indicus* (PR = 87 %); *Scutellonema* sp. (PR = 91 %); *D. stagnalis* (PR = 83 %) and *A. thornei* (PR = 88 %) were most resistant prey species while *T. mashhoodi* (PS = 93 %), *H. oryzae* (PS = 94 %); *A. tritici* juv. (PS = 98 %); *M. incognita* juv. (PS = 100 %); *H. mothi* juv. (PS = 96 %); *P. redivivus* (PS = 98 %); *Cephalobus* sp. (PS = 98 %); *Acrobeloides* sp., (PS = 100 %) and *Longidorus* sp. (PS = 91 %) were highly susceptible species of prey nematodes to predation. Predators which started feeding upon prey after wounding was maximum (FW = 100 %) on *P. redivivus, Cephalobus* sp., *Acrobeloides* sp., *Rhabditis* sp., *A. tritici,* and *M. incognita* juveniles. Feeding after wounding (FW) *H. oryzae, T. mashhoodi* and *H. oryzae* was 91 % and 95 % respectively, while that on other prey nematodes ranged between 50-89 %. *M. aquaticus* though wounded, 80 % of *Helicotylenchus indicus* but fed upon 25 % of individuals leaving 60 % of them either unconsumed or partially eaten. 36 % individuals of *H. mangiferae* and 23 % of *Scutellonema* sp., were also left unconsumed by the predators. Other prey species were left unconsumed in lesser numbers (0-16 %). *M. aquaticus* took a minimum of 7-11 (9) min and 8-15 (10) min to consume completely an individual of *M. incognita* and *Acrobeloides* sp., respectively and maximum of 86-113 (96) min to finish *D. stagnalis.*

Resistance and susceptibility of prey to predation and strike rate of *D. stagnalis*

Encounters with *M. incognita, H. mothi* and *A. tritici* juveniles yielded maximum success (SR = 82 %; 80 % and 82 %) and wounding (AW = 93 %, 80 % and 90 %) respectively. Among ectoparasitic nematodes *D. stagnalis* attacked *T. mashhoodi* with maximum success (SR = 84 %) and wounding (AW = 86 %). Encounters with saprophagous nematodes yielded maximum success with *Cephalobus* sp., (SR = 80 %) but more *P. redivivus* were wounded by the predators (AW = 95 %). With others it resulted into a moderate to high rate of wounding (AW = 5-90 %). *D. stagnalis* failed to wound any individuals of *Hoplolaimus indicus, Scutellonema* sp., *H. mangiferae, Hemicycliophora* sp., and *D. stagnalis* (PR = 100 %). *P. redivivus, Cephalobus* sp., *A. tritici* and *M. incognita* juveniles were highly susceptible to predation by *D. stagnalis* (PS = 90-95 %). *Acrobeloides* sp., *T. mashoodi* sp., *H. oryzae, H. mothi, X. americanum, Longidorus* sp., *Paratrichodorus* sp., possessed low to moderate degree of resistance (PR = 10-24 %). *Rhabditis* sp., and *Helicotylenchus indicus* exhibited moderate to high degree of resistance (PR = 30-53 %) against predation. *D. stagnalis* initiated feeding upon

Table 1. Strike rate of *Mononchus aquaticus* (MA); *Dorylaimus stagnalis* (DS); *Aquatides thornei* (AT) and resistance and susceptibility of prey to predation.

Prey	Predators	EA	SR (%)	Wounding			Feeding		Duration of feeding upon single prey (min)
				AW (%)	PR (%)	PS (%)	FW (%)	prey left-un consumed (%)	
SAPROPHAGOUS NEMATODES									
	MA	50	100	98	2	98	100	0	10-16 (13)
P. redivivus	DS	38	76	95	5	95	78	7	9-15 (14)
	AT	40	80	95	5	95	88	6	8-12 (10)
	MA	50	100	98	2	98	100	0	13-19 (16)
Cephalobus sp.	DS	40	80	90	10	90	67	8	14-22 (19)
	AT	42	84	93	7	93	82	3	12-16 (15)
	MA	49	98	100	0	100	100	0	8-16 (15)
Acrobeloides sp.	DS	35	70	89	11	89	71	9	10-17 (15)
	AT	36	72	94	6	94	82	4	10-22 (14)
	MA	44	88	86	14	86	100	5	19-26 (23)
Rhabditis sp.	DS	39	78	67	33	67	77	15	26-34 (30)
	AT	42	84	76	24	76	78	8	20-24 (22)
ECTOPARASITIC NEMATODES									
	MA	46	92	93	7	93	95	4	14-26 (19)
T. mashhoodi	DS	42	84	86	14	86	77	7	22-38 (28)
	AT	44	88	89	11	89	69	7	18-32 (30)
	MA	47	94	94	6	94	91	10	22-34 (30)
H. oryzae	DS	37	74	86	14	86	26	12	31-47 (36)
	AT	39	78	90	10	90	86	3	30-49 (39)
	MA	46	92	13	87	13	77	10	30-51 (41)
Hoplolaimus indicus	DS	41	82	0	100	0	0	0	0
	AT	37	74	0	100	0	0	0	0
	MA	45	90	89	11	89	25	40	35-42 (37)
Helicotylenchus indicus	DS	40	80	47	53	47	31	33	39-56 (46)
	AT	42	84	52	48	52	36	88	30-52 (39)
	MA	44	88	9	91	9	67	23	29-49 (39)
Scutellonema sp.	DS	40	80	0	100	0	0	0	0
	AT	42	84	0	100	0	0	0	0
	MA	39	78	41	59	41	50	36	24-29 (26)
H. mangiferae	DS	32	64	0	100	0	0	0	0
	AT	34	68	0	100	0	0	0	0
	MA	42	84	33	67	33	50	13	20-33 (28)
Hemicycliophora sp.	DS	33	66	0	100	0	0	0	0
	AT	36	72	0	100	0	0	0	0
	MA	43	86	84	16	84	72	3	28-43 (37)
X. americanum	DS	34	68	76	24	76	69	7	42-63 (52)
	AT	32	64	91	19	91	83	13	38-69 (52)
	MA	43	86	91	9	91	79	12	41-56 (48)
Longidorus sp.	DS	34	68	76	24	76	69	22	50-66 (57)
	AT	36	72	33	33	67	75	22	44-84 (68)
	MA	43	86	84	16	84	89	16	46-59 (51)
P. citri	DS	34	68	85	15	85	52	26	58-72 (66)
	AT	33	66	76	24	76	84	29	61-94 (72)
	MA	45	90	91	9	91	88	9	25-34 (30)
Paratrichodorus	DS	38	76	42	58	42	81	13	34-46 (42)
	AT	36	72	44	56	44	81	13	31-49 (41)

All figures are in nearest whole numbers; Figures in paranthesis indicate mean feeding time.
EA = Encounters resulted into attack; AW = Attacks resulted into prey wounding; PS = Prey susceptibility to predation; SR = Strike rate of predators; PR = Prey resistance to predation; FW = Feeding after wounding prey.

Table 2. Strike rate of *Mononchus aquaticus* (MA); *Dorylaimus stagnalis* (DS); *Aquatides thornei* (AT) and resistance and susceptibility of prey to predation.

Prey	Predators	EA	SR (%)	Wounding			Feeding		Duration of feeding upon single prey (min)
				AW (%)	PR (%)	PS (%)	FW (%)	prey left-un consumed (%)	
ENDO-PARASITIC NEMATODES									
	MA	49	98	98	2	98	100	13	8-14 (11)
A. tritici	DS	40	90	90	10	90	83	10	12-28 (20)
	AT	42	93	78	7	93	85	6	10-26 (18)
	MA	48	96	100	0	100	100	2	7-14 (9)
M. incognita	DS	41	82	93	7	93	74	7	16-32 (24)
	AT	41	82	95	5	95	77	3	12-30 (21)
	MA	48	96	85	4	96	96	6	8-15 (10)
H. nothi	DS	40	80	80	20	80	90	18	15-30 (21)
	AT	42	84	86	14	86	33	6	12-24 (18)
PREDATORY NEMATODES									
	MA	30	60	17	83	17	60	8	86-113 (96)
D. stagnalis	DS	5	10	0	100	0	0	0	0
	AT	14	28	0	100	0	0	0	0
	MA	32	64	12	8	12	71	0	59-78 (64)
A. thornei	DS	7	14	0	100	0	0	0	
	AT	8	16	0	100	0	0	0	0
	MA	44	88	68	32	68	67	0	47-62 (52)
M. aquaticus	DS	19	38	5	95	5	100	0	34 (34)
	AT	18	36	0	100	0	0	0	0

All figures are in nearest whole numbers; Figures in parentheseis indicate mean feeding time.
EA = Encounters resulted into attack; AW = Attacks resulted into prey wounding; PS = Prey susceptibility to predation; SR = Strike rate of predators; PR = Prey resistance to predation; FW = Feeding after wounding prey.

31 % of individuals belonging to *Helicotylenchus indicus* but 33 % of them were left unconsumed. Maximum feeding occurred on *H. mothi* juveniles (FW = 90 %) and *Trichodorus* sp. (FW = 81 %). *D. stagnalis* took a minimum time of 9-15 (14) min to consume completely an individual of *P. redivivus* and maximum of 58-72 (60) min to finish *P. citri.*

Resistance and susceptibility of prey to predation and strike rate of *A. thornei*

A. thornei attacked all species of prey nematodes with highest strike rate (SR = 84 %) on *Rhabditis* sp., among saprophagous nematodes; 82-84 % on the second stage juveniles of endo-parasitic nematodes, *M. incognita, H. mothi* and *A. tritici* and 88 % on ectoparasitic nematodes, *T. mashhoodi. A. thornei* was least successfull on *D. stagnalis, M. aquaticus* and upon its own individuals (SR = 16-36 %). *Hoplolaimus indicus, Scutellonema* sp. *Hemicycliophora* sp., *D. stagnalis, M. aquaticus* and *A. thornei* were totally resistant to predation by *A. thornei* (PR = 100 %. *P. redivivus, Cephalobus* sp., *Acrobeloides* sp., *H. oryzae* and the second stages of *M. incognita, H. mothi* and *A. tritici* were most vulnerable species of prey (PS = 86-95 %). *Rhabditis* sp., *T. mashhoodi, Helicotylenchus indicus, X. americanum, P. citri, Longidorus* sp., and *Paratrichodorus* sp., possessed low to moderate degree of resistance (PR = 10-50 %). Maximum feeding occurred on *Cephalobus* sp. (FW = 82 %), *A. tritici* (FW = 77 %) and *H. oryzae* (FW = 86 %) among different trophic groups of prey. *A. thornei* initiated feeding only upon 36 % individuals of *Helicotylenchus indicus* but left maximum of them unconsumed (88 %). The number of individuals of *P. redivivus, Cephalobus* sp., *Acrobeloides* sp., *Rhabditis* sp., *T. mashhoodi, H. oryzae, H. mothi* and *M. incognita* juveniles left unconsumed were significantly low (3-8 %, $p < 0.05$). However, comparatively, greater number of individuals of *X. americanum* (13%); *Longidorus* sp. (22 %), *P. citri* and *Paratrichodorus* sp. (13 %), were left partially consumed. *A. thornei* required a maximum of 61-94 (72) min to consume an individual of *Paralongidorus citri* and minimum of 8-12 (10) min to finish *P. redivivus.*

Discussion

Wounding is an important factor in predation (Bilgrami & Jairajpuri, 1989*a*). Small and Grootaert (1983) and Esser (1987) also suggested that resistance of a prey is lost if wounded or in a weakened condition. A wound may also result in the loss of hydrostatic pressure of the body affecting locomotion and thereby making the prey more vulnerable to predation. Wounding may also permit invasion of pathogenic micro-organisms resulting into the death of prey. Thus, it is the wounding which determines the degree of resistance and susceptibility of a prey and ability of predators more precisely and hence, was considered as the primary determinant.

The prey nematodes can resist predation by physical, chemical and behavioural characteristics (Esser, 1963, 1987; Esser & Sobers, 1964; Bilgrami & Jairajpuri, 1989*a*) such as thick cuticle (Esser, 1963; Small & Grootaert, 1983), annulations in criconematids (Esser, 1963; Bilgrami & Jairajpuri, 1989*a*); gelatinous matrix (Small & Grootaert, 1983); speed (Esser, 1963; Bilgrami & Jairajpuri, 1989*a*); vigorous escape response (Grootaert *et al.*, 1977; Small & Grootaert, 1983; Bilgrami & Jairajpuri, 1989*a*) and toxic/unfavourable secretions (Esser, 1963; Bilgrami & Jairajpuri, 1989*a*). The environmental soil factors e.g., temperature, pH, moisture, soil type, chemical composition of soil, etc., also play a significant role in governing activities of predators as is evident from experiments on temperature (Wallace, 1969; Bilgrami *et al.*, 1983); crowding (Azmi & Jairajpuri, 1979), chemicals (Bilgrami & Jairajpuri, 1985*a*), pH (Bilgrami & Jairajpuri, 1985*a*) and soil types (Small, 1979).

During present study the high susceptibility of *P. redivivus* sp., *Cephalobus* sp., *M. incognita*, *A. tritici* and *H. mothi* juveniles to predation by *M. aquaticus*, *D. stagnalis* and *A. thornei* may be attributed to their small body size, slow rate of movement (Bilgrami *et al.*, 1983) and lack of anti-predation devices (Small & Grootaert, 1983). The ecto-parasitic nematodes seem to be more vulnerable to predation specially by mononchs. This is evident as many species of mononchs have been found containing resistant species of nematodes viz., *Hoplolaimus*, *Helicotylenchus*, *Scutellonema*, *Hemicriconemoides*, *Hemicycliophora*, *Rhabditis*, *Xiphinema*, etc., entire in their intestine besides many other tylenchs, dorylaims, mononchs and rhabditids (Bilgrami *et al.*, 1986). No predation on *Hoplolaimus indicus*, *Scutellonema*, *H. mangiferae* and *Hemicycliophora* sp., by *D. stagnalis* and *A. thornei* suggests resistance due to thick cuticle and annulations (physical resistance) (Bilgrami & Jairajpuri, 1989*a*). Moderate to high degree of resistance (PR = 24-58 %) in *Paratrichodorus* sp., *Longidorus* sp., *P. citri* and *X. americanum* to predation by *D. stagnalis* and *A. thornei* appeared to be of physical nature. *D. stagnalis* also possessed physical resistance in the form of thick and tough cuticle.

Esser (1963) suggested chemical resistance in the species of *Helicotylenchus* as he observed dorylaim predators rarely attacking or succeeding in devouring the individuals of *Helicotylenchus* spp. The meagre responses of *Mononchoides longicaudatus* and *M. fortidens* towards *Helicotylenchus indicus* — live or excised — (Bilgrami & Jairajpuri, 1988), their inhibited feeding and leaving greater number of wounded prey unconsumed (Bilgrami & Jairajpuri, 1989*a*, 1990) support chemical resistance in *Helicotylenchus indicus*. The same has been observed during present investigations except in *M. aquaticus* which wounded and killed a large population of *Helicotylenchus indicus* and fed equally upon them, leaving least number of prey unconsumed. This disparity is possible specially with mononchs as 1) they are capable to overcome resistance of varying types (Bilgrami & Jairajpuri, 1989*a*); 2) their predation/feeding is aleatory (Bilgrami *et al.*, 1986) depending exclusively on chance encounters (governed mostly by mechanoreceptors) and 3) no evidence of chemical perception (prey secretions) is available in mononchs (Bilgrami *et al.*, 1984). In contrast, the dorylaim (Esser, 1963; Shafqat *et al.*, 1987), nygolaim (Bilgrami *et al.*, 1985) and diplogasterid predators (Bilgrami & Jairajpuri, 1988; able to perceive prey secretions, attracted towards them and aggregated around a previously injured prey at feeding sites (Bilgrami & Jairajpuri, 1989*b*).

Rhabditis oxycerca, *Pelodera* and *Plectus* sp., possess characteristics such as active body undulations and vigorous escape response which provide resistance against predation (Small & Grootaert, 1983). *Rhabditis* sp., seems to rely primarily on active body undulations and vigorous escape response to resist predation by *M. aquaticus*, *D. stagnalis* and *A. thornei* as is evident by the combination of high strike rate of the three species of predators against *Rhabditis* sp., and comparatively lower rate of wounding and higher rate of feeding upon wounded prey individuals. The abilities of predators themselves govern their efficiency as predators and also the degree to overcome prey resistance as some predators possess strong predatory potentials. This is evident from the present observations on *M. aquaticus* which showed maximum strike rate upon all the prey nematodes and almost all prey nematodes were most susceptible to *M. aquaticus* in comparison to *D. stagnalis* and *A. thornei*.

M. aquaticus avoided predation by other predators viz., *D. stagnalis* and *A. thornei* mainly with its active body undulations (behavioural resistance). However, their high degree of susceptibility to predation by their own members conforms cannibalistic tendency in mononchs as has been reported earlier (Azmi & Jairajpuri, 1979; Bilgrami & Jairajpuri, 1985*b*; Bilgrami *et al.*, 1986). The phenomenon of cannibalism is not evident either in *D. stagnalis* or *A. thornei* (Shafqat *et al.*, 1987; Bilgrami *et al.*, 1985).

References

AZMI, M. I. & JAIRAJPURI, M. S. (1979). Effect of mechanical stimulation and crowding on *Mylonchulus dentatus*. *Nematol. medit.*, 7 : 203-207.

BILGRAMI, A. L. (1990*a*). Diplogasterid predators. *In :* Jairajpuri, M. S., Alam, M. M. & Ahmad, I. (Eds). *Nematode bio-control, Aspects and Prospects.* Delhi, India. CBS Publishers : 135-142.

BILGRAMI, A. L. (1990*b*). Predacious dorylaims. *In :* Jairajpuri, M. S., Alam, M. M. & Ahmad, I. (Eds). *Nematode bio-control, Aspects and Prospects.* Delhi, India. CBS Publishers : 143-148.

BILGRAMI, A. L., AHMAD, I. & JAIRAJPURI, M. S. (1983). Some factors influencing predation by *Mononchus aquaticus*. *Revue Nématol.*, 6 : 325-326.

BILGRAMI, A. L., AHMAD, I. & JAIRAJPURI, M. S. (1984). Observations on the predatory behaviour of *Mononchus aquaticus*. *Nematol. medit.*, 12 : 41-45.

BILGRAMI, A. L., AHMAD, I. & JAIRAJPURI, M. S. (1985). Predatory behaviour of *Aquatides thornei* Nygolaimina: Nematoda). *Nematologica* (1984), 30 : 457-462.

BILGRAMI, A. L., AHMAD, I. & JAIRAJPURI, M. S. (1986). A study of the intestinal contents of some mononchs. *Revue Nématol.*, 9 : 191-194.

BILGRAMI, A. L. & JAIRAJPURI, M. S. (1985*a*). Cannibalism in *Mononchus aquaticus*. *Indian J. Nematol.*, 14 (1984) : 202-203.

BILGRAMI, A. L. & JAIRAJPURI, M. S. (1985*b*). The responses of *Mononchus aquaticus* to chemicals and pH. *Indian J. Nematol.*, 14 (1984) : 171-174.

BILGRAMI, A. L. & JAIRAJPURI, M. S. (1988). Attraction of *Mononchoides longicaudatus* and *M. fortidens* (Nematoda : Diplogasterida) towards prey and factors influencing attraction. *Revue Nématol.*, 11 : 195-202.

BILGRAMI, A. L. & JAIRAJPURI, M. S. (1989*a*). Resistance of prey to predation and strike rate of the predators, *Mononchoides longicaudatus* and *M. fortidens* (Nematoda : Diplogasterida). *Revue Nématol.*, 12 : 45-49.

BILGRAMI, A. L. & JAIRAJPURI, M. S. (1989*b*). Aggregation of *Mononchoides longicaudatus* and *M. fortidens* (Nematoda : Diplogasterida) at feeding sites. *Nematologica* (1988), 34 : 119-121.

BILGRAMI, A. L. & JAIRAJPURI, M. S. (1990). Predation by *Mononchoides fortidens* and *M. longicaudatus* (Nemadota : Diplogasterida). *Nematologica*, 35 : 475-488.

ESSER, R. P. (1963). Nematode interactions in plates of non-sterile water-agar. *Proc. Soil Crop Sci. Fla*, 23 : 121-138.

ESSER, R. P. (1987). Biological control of nematodes by nematodes I. Dorylaims (Nematoda : Dorylaimida). *Nematol. Cir.* No. 4, 4 p.

ESSER, R. P. & SOBERS, E. K. (1964). Natural enemies of nematodes. *Proc. Soil Crop Sci. Soc. Fla.*, 24 : 326-353.

GROOTAERT, P., JAQUES, A. & SMALL, R. W. (1977). Prey selection in *Butlerius* sp. (Rhabditida : Diplogasteridae). *Meded. Fac. Landbouww. Rijksuniv. Gent.* 42: 1559-1563.

JAIRAJPURI, M. S. & BILGRAMI, A. L. (1990). Predatory nematodes. *In :* Jairajpuri, M. S., Alam, M. D. & Alam, I. (Eds) *Nematode Bio-control : Aspects and Prospects.* New-Delhi, CBS Publishers & Distributers Pvt. Ltd. : 95-125.

SHAFQAT, S., BILGRAMI, A. L. & JAIRAJPURI, M. S. (1987). Evaluation of the predation ability of *Dorylaimus stagnalis* Dujardin, 1845 (Nematoda : Dorylaimida). *Revue Nématol.*, 10 : 455-461.

SMALL, R. W. (1979). The effect of predatory nematodes on population of plant parasitic nematodes in pots. *Nematologica.*, 25 : 94-103.

SMALL, R. W. (1987). A review of the prey of predatory soil nematodes. *Pedobiologia*, 30 : 179-206.

SMALL, R. W. & GROOTAERT, P. (1983). Observations on the predation abilities of some soil dwelling predatory nematodes. *Nematologica*, 29 : 109-118.

WALLACE, H. R. (1969). Wave formation of infective larvae of the plant parasitic nematode, *Meloidogyne javanica*. *Nematologica*, 15 : 65-75.