Nematol. medit. (1984), *12*: 41-45.

Section of Nematology, Department of Zoology,
Aligarh Muslim University, Aligarh-202001, India

OBSERVATIONS ON THE PREDATORY BEHAVIOUR OF *MONONCHUS AQUATICUS*

by
A. L. BILGRAMI, I. AHMAD and M. S. JAIRAJPURI

There have been few studies on the predatory potential of mononchs since the work of Steiner and Heinly (1922). Thorne (1927) suggested that *Clarkus papillatus* (Bastian) might be used to control sugar-beet nematodes. More recently, Nelmes (1974) described the feeding behaviour of *Prionchulus punctatus* (Cobb). The life cycle of *Mononchus aquaticus* Coetzee has been studied by Grootaert and Maertens (1976). Jairajpuri and Azmi (1978) studied the predatory behaviour of *Mylonchulus dentatus.*

This paper describes the predatory behaviour of adults and juveniles of *Mononchus aquaticus* Coetzee.

Material and Methods

Mononchus aquaticus were collected from the campus of the Aligarh Muslim University. Soil samples were processed by sieving and decantation and Baermann's funnel method. This method was used for all stages except the first stage juveniles, which were obtained by placing gravid females in 1% water agar at 25° C; the eggs laid by these females then hatched and the juveniles were collected.

The rate of predation was observed over a period of 24 h with five specimens each of adults and juvenile stages of *M. aquaticus* which

were kept separately with 25 individuals of *Chiloplacus symmetricus* (Thorne) or *Cephalobus* sp. as prey, in separate cavity blocks containing a small quantity of 1% water agar. Observations were made after 24 h.

To determine whether *M. aquaticus* is attracted towards its prey, a plastic tube 5 cm long and 5 mm in diameter with a hole in the middle was used. At one end of the tube another 1 cm piece of tubing of the same diameter was attached and a piece of filter paper was placed between the joint, thus forming a 6 cm long tube, divided into a 5 cm part and a 1 cm part. The tube was filled with agar from both ends and pieces of filter paper applied to prevent drying. 50 specimens of nematodes to serve as prey were put in the smaller part of the tube and the predator, *M. aquaticus*, in the larger tube through the central hole. The distribution of predators was observed after 3 h by cutting the tube into 1/2 cm blocks. Attraction was tested by using *C. symmetricus* alone as prey or a combination of the following nematode species: *C. symmetricus, Cephalobus* sp. and *Aglenchus parvus* Siddiqi.

To detect whether the prey numbers affect the rate of predation, separate cavity blocks containing 25, 50, 100 and 150 specimens of *C. symmetricus* and *Cephalobus* sp. in 1% water agar were introduced with five *M. aquaticus* each. After 24 h the number of prey killed or ingested was counted for each block.

To find out whether *M. aquaticus* showed any preference for prey, various combinations of prey were subjected to predation. The prey combinations used were: 20 *C. symmetricus* + 5 *Cephalobus* sp.; 20 *C. symmetricus* + 5 *Mesorhabditis* sp.; 20 *Mesorhabditis* sp. + 5 *Cephalobus* sp.; 20 *Cephalobus* sp. + 5 *Mesorhabditis* sp. The prey and predators were placed together in cavity blocks containing 1% water agar. The number of prey killed or ingested was counted after 24 h.

To determine the rate of feeding over a period of ten days, 5 *M. aquaticus* were placed together with 25 prey specimens in cavity blocks containing 1% water agar. Observations were made at 24 h and the predators were transferred to fresh media containing 25 prey specimens of the same type. *C. symmetricus* and *Cephalobus* sp. served as prey.

The rate of predation of *M. aquaticus* which were starved for 0, 2, 4, 6, 8, 10, 12 and 14 days was determined by using 25 specimens each of *C. symmetricus* and *Cephalobus* sp. as prey, separately.

Results

Mononchus aquaticus moves in a typical undulatory wave pattern. During locomotion contacts were made with the prey. After one of many such contacts the predator moved its head vigorously and attacked the prey. The attacks did not always result in killing as very often the prey moved out of the predators grip. The prey was usually attacked when full contact was made with the lip region of the predator. The predators showed no preference in attacking any particular part of the body of the prey. The smaller prey nematodes were swallowed whole but the cuticle of the larger ones was ruptured and the internal parts then ingested. The prey species apparently seemed unable to detect the presence of the predator and took no evasive action. Often the predator and the prey were seen moving in close proximity.

While observing the feeding behaviour of different stages of *M. aquaticus*, it was found that adults, fourth stage and third stage juveniles were predacious in behaviour. Adults and fourth stage juveniles killed the maximum number of prey during 24 h. The number of prey removed by these two was not significantly different ($P > 0.05$). Third stage juveniles also attacked the prey but in lesser numbers compared with adults and fourth stage juveniles. This low rate of predation among third stage juveniles was significantly different ($P < 0.02$) from the adults and fourth stage juveniles. Second and first stage juveniles were not predacious as they were not observed to remove any prey. They did not attempt to feed on prey even when lip contact was made with them. They appeared to ingest agar by rapid side ways movements of the head. Fourth and third stages preyed in the same manner as adults. Adults, fourth stage and third stage juveniles killed significantly ($P < 0.01$) more individuals of *Cephalobus* sp. than of *C. symmetricus*.

M. aquaticus was not attracted towards its prey either alone or in mixed populations. Movements appeared to be somewhat inhibited and the majority of the specimens remained in the zones adjoining the point of inoculation. The number of *M. aquaticus* on the two sides of the point of inoculation showed no significant difference ($P > 0.05$).

The abundance of prey did not influence predation as there was no significant difference ($P > 0.05$) in the rate of predation when 25,

50, 100 or 150 specimens of *Cephalobus* sp. or *C. symmetricus* were used as prey.

M. aquaticus when placed in various combinations of prey *viz.*, *Cephalobus* sp., *Mesorhabditis* sp. and *C. symmetricus*, showed some degree of selection. *Cephalobus* sp. in combination with *Mesorhabditis* sp. or *C. symmetricus* was always preyed on more than the other two nematodes. In the combination of *Mesorhabditis* sp. and *C. symmetricus* the former was killed more frequently than the latter, but always less than *Cephalobus* sp.; *C. symmetricus* was always devoured the least.

M. aquaticus did not show any set pattern of predation and in observations over a period of ten days the number of prey killed by five predators was only slightly different each day.

The starvation of predators did not alter the rate of predation. The difference in predation after two and fourteen days was not significant ($P > 0.05$).

Discussion

Steiner and Heinly (1922) and Esser (1963) suggested that predacious nematodes were unable to detect their prey even from a very short distance. Their opinion was supported by Grootaert and Maertens (1976) in their study of *M. aquaticus*. Our observations on *M. aquaticus* also reveal that it was not attracted towards potential prey species or their secretions. Predation depends purely on chance encounters, as was also suggested by Nelmes (1974) for *P. punctatus*. Theoretically, the increase in the number of prey should also increase the probability of contacts and consequently also the rate of predation. Our observations contradict this as an increase in the number of prey did not significantly increase the rate of predation.

The prey catching mechanism, however, seems to vary slightly from that reported by Nelmes (1974) and Grootaert and Wyss (1979). While lip contact was essential, and contact with any other parts of the body did not provoke an attack, not all lip contacts initiated feeding or killing. Prey was attacked more frequently when the head of the predator made full contact with the prey, than when there were glancing contacts. Probing before attack has been described by Grootaert and Wyss (1979) but the same could not be detected in *M. aquaticus*. In *P. punctatus* short term deprivation of food tended

to enhance predation rate, while prolonged starvation tended to reduce it (Nelmes, 1974). Jairajpuri and Azmi (1978) also observed enhanced rate of predation in unfed *Mylonchulus dentatus* compared to well fed ones. With *M. aquaticus* however, starvation did not produce any significant effect on predation.

We thank the Chairman, Department of Zoology, for providing necessary laboratory facilities and Professor Ather H. Siddiqi for his suggestions. The first author is grateful to U.G.C. and the second to C.S.I.R. for financial assistance.

SUMMARY

The predatory behaviour of adult and juvenile *Mononchus aquaticus* was studied in agar plates. The results indicate that *M. aquaticus* is not attracted towards its prey and contact is necessary to initiate an attack. Smaller prey nematodes were usually swallowed whole, but with larger ones only the internal parts were ingested. Adults, fourth stage and third stage juveniles were predacious, while second and first stage juveniles were assumed to feed on the agar. Prey number and starvation did not significantly influence the rate of predation.

LITERATURE CITED

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

GROOTAERT P. and MAERTENS D., 1976 - Cultivation and life cycle of *Mononchus aquaticus*. *Nematologica, 22*: 173-181.

GROOTAERT P. and WYSS U., 1979 - Ultrastructure and function of the anterior feeding apparatus in *Mononchus aquaticus*. *Nematologica, 25*: 163-173.

JAIRAJPURI M. S. and AZMI M. I., 1978 - Some studies on the predatory behaviour of *Mylonchulus dentatus*. *Nematol. medit., 6*: 205-212.

NELMES A. J., 1974 - Evaluation of the feeding behaviour of *Prionchulus punctatus*, a nematode predator. *J. Anim. Ecol., 43*: 553-565.

STEINER G. and HEINLY H., 1922 - The possibility of control of *Heterodera radicicola* and other plant injurious nemas by means of predatory nemas specially by *Mononchus papillatus* Bastian. *J. Wash. Acad. Sci., 12*: 367-385.

THORNE G., 1927 - The life history, habits and economic importance of some mononchs. *J. Agric. Res., 34*: 265-286.

Accepted for publication on 3 September 1983.