

Appl. Ent. & Phlytopath.

Vol. 57. Nos : 1 & 2, Feb. 1990

PREDATORY NEMATODES (MONONCHINA)

FROM IRAN

P. A. A. LOOF.; S. BAROOTI & A. KHEYRI

Department of Nematology. Agricultural University, Wageningen,
Netherlands; Plant Pests and Diseases Research Institute; College of Agriculture,
university of Tehran.

Abstract

Eight species of Mononchina are reported from Iran. This is the first report of this group from this country .

Introduction

During 1956 - 1986 a large number of species of plant - parasitic nematodes were found in Iran (Barooti, 1987) but predatory nematodes of the group Mononchina have not yet been reported. From 1986 to 1989 the second author collected some 300 soil samples from 27 localities in seven provinces of Iran. In 16 of these localities mononchs were found. Fig. 1 shows these localities. Eleven are in the northern, moist part of the country (two of them near the Caspian Sea where the climate is subtropical, allowing cultivation of citrus and rice, but not of banana and palms). The soil there is sandy, except for localities 3 and 8-11 where it is heavier and cooler. The other five are in the southeastern part, where citrus, rice, banana and palms can be cultivated where moisture allows it. No samples were taken from the central, dry part of the country .

Methods

The nematodes were extracted by the centrifugation - flotation technique

described by Jenkins (1964), fixed (in TAF) and killed after de Grisse (1965) and transferred to glycerin with the method of Seinhorst (1959).

Characterization of mononchs

The Mononchina, colloquially called mononchs, can be recognized easily. The surface of the cuticle appears smooth under the light microscope. The head end is more or less truncate, often with distinct papillae but without setae. The buccal cavity is large and wide, the walls are thick and sclerotized. At least one large tooth is always present. The oesophagus or pharynx is very muscular, of uniform thickness all over; anteriorly it envelops only the basal part of the buccal cavity. The tail varies in shape; caudal glands are present or absent. Females have mostly two genital branches; males have two testes, two spicules and a row of ventromedian supplements.

Key to the five genera found

1. —Buccal cavity with flat bottom and three equal teeth which point backward (Fig. 2, A).
Cardia tuberculate (Fig. 2, F)..... *Anatonchus* Cobb, 1916.
—Buccal cavity with tapering bottom and one large dorsal tooth, directed forward; other, smaller, teeth may also be present
Cardia non - tuberculate (Fig. 2, G)2.
2. —The lateral walls of the buccal cavity bear numerous small denticles, usually arranged into transverse rows (Fig. 2, B). Tail short, with caudal glands *Mylonchulus* Cobb, 1916 .
—No denticles on lateral walls of buccal cavity; tail longer, curved to ventral side , without caudal glands3.
3. —Buccal cavity with two subventral

denticulate ridges (Fig. 2, C) *Prionchulus* Cobb, 1916.

—Buccal cavity without subventral

denticulate ridges4.

4. —Buccal cavity with smooth ventral

ridge (Fig. 2, D)..... *Clarkus* Jairajpuri, 1970.

—Buccal cavity without ventral

ridge (Fig. 2, E).....*Coomansus* Jairajpuri & Khan, 1977 .

Genus *Anatonchus* Cobb, 1916 .

of this genus one species was found .

Anatonchus tridentatus (de Man, 1876) Cobb, 1916

(Fig. 2A, F; Fig. 3)

Material collected : five females and four juveniles. Dimensions of females :

L=2. 44 mm (2. 21 - 2. 61); a=29. 5 (27—33); b=4. 0 (3. 8—4. 4); c=9. 6 (8. 9—11. 0); c'=5. 3 (4. 8—6. 5); V=64 (62—67); G₁=6 (5—11); G₂=7 (5—13); head width=52 μm(49—55); buccal cavity length (excl. cheil-ostome)=53μm (46—55), width=39 μm(33 — 42); tail length=249 μm (205 - 294). The specimens are somewhat flattened, width of buccal cavity being usually 23—33μm. In adults the three teeth are located near the middle of the buccal cavity. The females have two, opposite genital branches. The tail is - elongate, curved ventrad regularly and tapering gradually to rounded terminus. Caudal glands are present, opening through a terminal pore .

Males were not found, though they are common. The tail is curved ventrad proximally, almost straight distally. Spicules slender, curved, 81—123 μm long. There is a series of 11—17 ventromedian precloacal supplements .

Often the mid—intestine contains complete nematodes which can still

be identified as rhabditids, dorylaims, mononchs etc. In juveniles the teeth are located close to the bottom of the buccal cavity. The J - 1 has only one tooth, pointing forward. The other stages have three teeth; in the J-2 they are more or less transverse, in the J-3 and J-4 they are directed backward as in the adults. The cuticle of the tail is distinctly striated transversally in juveniles (Loof, 1987) . Tail shape in juveniles is the same as in females .

Distribution in Iran : Found in soil around roots of :

Chamaecyparis sp., Klardasht (2); cherry, Soleghan (5) and apple, Tehran (4), all in the central and northern part of the country; and *Citrus* sp., Shahdad (14) in the southern part .

Geographical distribution : Known from Europe, North America and Mexico. The Wageningen nematode collection contains specimens from Turkey, Saudi Arabia and Iraq. Body length of adults may range from 1.7 to about 3.5 mm.

Genus *Mylonchulus* Cobb, 1916

Of this large genus three species were found, which may be distinguished as follows :

- 1. —Female tail with finger - shaped, offset terminal part..... *M. sigmaturus*.
 —Female tail curved ventrad regularly, without offset terminal part2.
- 2. —Female tail tapering all over its length , opening of caudal glands subdorsal *M. brachyuris*.
 —Female tail with almost cylindrical distal part, opening of caudal glands terminal *M. minor*.

M. brachyuris (Bürschli, 1873) Cobb, 1916

(Fig. 4B, 5B)

Material collected : 37 females and 9 juveniles. Dimensions of 25 females :

$L=1.34$ mm (1.23-1.42); $a=30$ (25-36); $b=3.6$ (3.3-4.1); $c=29$ (25-36); $c'=1.8$ (1.6-2.0); $V=60$ (57-62); $G_1=9$ (6-15); $G_2=8$ (6-10); head width= $22\ \mu\text{m}$ (20-24); buccal cavity length= $22\ \mu\text{m}$ (21-25); buccal cavity width= $11\ \mu\text{m}$ (10.12); neck= $368\ \mu\text{m}$ (342-396); tail= $47\ \mu\text{m}$ (39-55).

Denticles arranged into distinct transverse rows. Females with two opposed genital branches. Tail plump, curved ventrad, with caudal glands opening dorsally from terminus.

Males were not found, though they do occur. They have plump, weakly curved spicules 38-55 μm long, and a series of 8-13 ventromedian precloacal supplements, the posterior one being smaller than the others.

Distribution in Iran : Found in soil around roots of : *Cedrus* sp., Rasht (1) and Talesh (7); *Acer* sp., Talesh (7); potato, Avadj (3); *Magnolia* sp., Tehran (4); cherry, Soleghan (5); apple, Bijar (8); grapevine, Zanjan (9) and alfalfa, Hamadan (10); all localities in the northern and west part of the country.

Geographical distribution : A cosmopolitan species.

M. sigmaturus Cobb, 1917

(Fig. 4A, 5A)

Material collected : 41 females, 2 males and 17 juveniles. Dimensions of 25 females :

$L=1.31$ mm (1.11-1.50); $a=32$ (25-42); $b=3.4$ (3.0-3.8); $c=29$ (24-34); $c'=1.5$ (1.4-1.8); $V=63$ (61-67); $G_1=9$ (7-12); $G_2=10$ (7-15); head width= $23\ \mu\text{m}$ (21-24); buccal cavity length= $23\ \mu\text{m}$ (22-25); buccal cavity width= $13\ \mu\text{m}$ (12-14); neck= $388\ \mu\text{m}$ (332-426); tail= $45\ \mu\text{m}$ (39-50).

Dimensions of two males :

$L=1.29-1.53$ mm; $a=30-41$; $b=3.4-3.6$; $c=25-29$; $c'=1.4-1.5$; $VD=33$; $G_1=13-14$; $G_2=13-14$; head width= $22-23\ \mu\text{m}$; buccal

cavity length=24—25 μm ; buccal cavity width=12—15 μm ; neck=374 - 425 μm ; tail=51—53 μm ; spicules=48—63 μm ; supplement number=11.

This species resembles *M. brachyuris* but it is generally longer and more slender, and has a very distinctive tail shape. Caudal glands opening through a terminal pore. In the male the distal part of the tail is offset only slightly (cf. also Mulvey, 1961). Distribution in Iran : Found in soil near roots of : *Cedrus* sp., Rasht (1); *Pinus* sp., Ghilan (1); *Citrus* sp., Tonekabon (2); apple and — *Platanus orientalis*, Tehran (4); walnut, Taleghan (4) and Zanjan (9); cherry , Soleghan (5); apple, Shahriar (6) and apricot, Julfa (11), all in the northern part of the country. In the southern part it was found near roots of *Citrus* sp., Shahdad (14) and fig. Behbahan (15) .

Geographical distribution : A cosmopolitan species. Found also in Iraq.

M. minor (Cobb, 1893) Cobb, 1916

(Fig. 4C)

Material collected: two females and five juveniles. Dimensions of females: L=1. 20—1. 25 mm; a=24. 33; b=3. 6; c=22—26; c'=1. 6—1. 8 ; V=53 - 57; G₁=5-8 ; G₂=5—6; head width=23—24 μm ; buccal cavity 27 - 30x15—18 μm ; tail length=48—56 μm .

Tail slender, curved ventrad regularly, caudal pore terminal . Denticles arranged more irregularly than in the two preceding species, not forming clear transverse rows; this was found in specimens from Brazil also. Females with two opposite genital tubes. Males are unknown .

Distribution in Iran : Soil around roots of banana, Bam (12)) and *Citrus* sp., Jiroot (13) .

Geographical distribution : This species is widespread in the tropics but does not occur in the colder regions. Its distribution in Iran is in accordance with this .

Genus *Clarkus* Jairarajpuri, 1970

Single species found : *C. papillatus* (Bastian, 1865)

Jairajpuri, 1970 (Fig. 2D, 6A & B).

Material collected : 19 females and 9 juveniles. Dimensions of 15 females:

L=1. 29 mm (1. 13—1. 61); a=27 (24—31); b=3. 7(3. 5—4. 0); c=16 (14—18); c'=3. 0 (2. 6—3. 5); V=62 (60—64); G₁=10 (8—13); G₂=10 (7—12); head width=25 μm (23—26); buccal cavity length=26 μm (25—28); buccal cavity width=12 μm (11—13); apex of dorsal tooth=85% (82—88); neck=342 μm (312—394); tail=83 μm (68—97).

Tail curved to ventral side, tapering regularly to narrowly rounded terminus. Female with two opposite genital branches. Males were not found; they are extremely rare.

Distribution in Iran : Found in soil near roots of : potato, Avadj (3); *Platanus orientalis* and *Magnolia* sp., Tehran (4); walnut, Taleghan (4); cherry, Soleghan(5), walnut and grapevine, Zanjan (9). All in the central northern part of the country.

Geographical distribution : A cosmopolitan species

Genus *Coomansus* Jairajpuri & Khan, 1977

Single species found : *C. parvus* (de Man, 1880) Jairajpuri & Khan, 1977 (Fig. 2E, 7 A & B).

Material collected : four females. Dimensions :

L=1. 10 mm (1. 05—1. 17); a=24 (23—26); b=3. 6 (3. 5—3. 9); c=11 (10—11); c'=4. 1 (3. 7—4. 4); V=60 (59—61); G₁=11 (9. 12); G₂=11 (9—11); head width=21 μm (20—22); buccal cavity length = 25 μm (25-26) ; buccal cavity width=11 μm; apex of dorsal tooth=69% (67—70) ; neck=300 μm(296—309); tail=104 μm (94—112).

This species resembles *Clarkus papillatus* but it is smaller, the tail is longer and more slender and the tooth is located much farther back in the buccal cavity. Males are unknown. Found in soil near roots of *Acer* sp. and *Cedrus* sp., Talesh(4)

Genus *Prionchulus* Cobb, 1916

Three females belonging to this genus were found. They belong to the group of species without spermatheca and without sphincter between uterus and

oviduct (see e. g. Mulvey. 1967). This group contains the common and widespread species *P. muscorum* (Dujardin, 1845) and *P. punctatus* Cobb, 1917. (Zell 1985) described more species in this group but the Iranian specimens do not belong to any of these. These two species are difficult to separate. *P. punctatus* can be recognized by the echinulate egg shell, but none of the three females bore eggs. The best diagnostic character is size of the buccal cavity; this was worked out by Arpin et al. (1984) who coined the index $d = 0.804 \times \text{length of buccal cavity} + 0.594 \times \text{width of buccal cavity}$ (both in microns) — 7.409. The value of this index is 44—59 in *muscorum*, 32—43 in *punctatus*. Other differences are the position of the apex of the dorsal tooth (*muscorum* 71-78%; *punctatus* 77-87%) and the denticulation of the subventral ridges : in *muscorum* the denticles are relatively large, regular, extending almost to the base of the ridge; in *Punctatus* they are smaller, irregular and do not extend so far back. Generally *muscorum* has a more slender tail than *punctatus*, but tail shape is rather variable in both species. Males are extremely rare in both .

On the basis of the abovementioned characteristics of the buccal cavity we conclude that one female is *P. muscorum*, the two others belong to *P. punctatus*

P. muscorum (Dujardin, 1845) Cobb, 1916

(Fig. 8, C and F)

Dimensions : L=2.60 mm : a=23 (specimen somewhat flattened); b=4.3; c=15; c'=3.1; V=64; G₁=8; G₂=8; head width=46 μm; buccal cavity length=44 μm; buccal cavity width=30 μm; d=45; apex of dorsal tooth =77%; neck=605 μm; tail=178 μm. Found in soil around roots of *Quercus* sp., Kamfiroz (16) in the southern part of the country .

Geographical distribution : A cosmopolitan species .

Zell (1985) raised objections to the use of the author name Dujardin , 1845 for this species, but his contention that Dujardin's description rather applies to *Mylonchulus brachyuris* is open to doubt. For the moment we therefore prefer to consider Dujardin as first describer of this species .

P. punctatus Cobb, 1917

(Fig. 8, A, B, D, E)

Dimensions of the two females :

L=1.91—2.15 mm; a=22—26; b=4.1—4.2; c=20—22; c'=2.0—2.4; V=64—66; G₁=13—14; G₂=11; head width=37—38 μm; buccal cavity length=30—35 μm; buccal cavity width=23 μm; d=30—34; apex of dorsal tooth=80%; neck=460—525 μm; tail=94—99 μm.

Found in soil near *Pinus* sp., Ghilan (1) and of *Acer* sp. and *Cedrus* sp., Talesh (7).

Economic importance of mononchs

Several observations have been made which suggest that mononchs may suppress plant parasitic nematodes. Cobb (1913) noted that *Clarkus papillatus* fed upon the citrus nematode *Tylenchulus semipenetrans* Cobb, 1913; Cohn & Mordechai (1974) studied predation of the same species by *Mylonchulus sigm- aturus* and considered this species to offer encouraging possibilities. Steiner & Heinly (1922) found encouraging possibilities for control of the beet cyst eelworm *Heterodera schachtii* Schmidt, 1871 by mononchs, especially *Clarkus papillatus*. Small & Grootaert (1983) noted that *Prionchulus punctatus* attacked the root knot nematode *Meloidogyne naasi* Franklin, 1965.

Acknowledgment

The authors wish to thank Prof. Dr. A. F. van der Wal, Wageningen, and prof. Dr. B. Parsi, PPDR, Tehran for making cooperation possible.

References

- ARPIN, P., SAMSOEN, L., PONGE, J. F. & KHAN, S. H. (1984). Ecology and systematics of the Mononchid nematodes from wood - and grassland areas in the wet temperate climate. II. The genus *Prionchulus* Cobb, 1916. *Rev. Nématol.* 7 : 215 - 225.
- BAROOTI, S. (1987). A list of plant parasitic nematodes of Iran. *Publ. Plant pests and Diseases Res. inst., Tehran*, 35 pp.
- COBB, N. A. (1913). Citrus root nematode. *J. Wash. Acad. Sci.* 2 : 217 - 230.

- COHN, & MORDECHAI, M. (1974). Experiments in suppressing citrus nematode populations by use of a marigold and a predaceous nematode. *Nemat. medit.* 2 : 43 - 53 .
- DE GRISSE, A. (1965). A labour - saving method for fixing and transferring eelworms to anhydrous glycerin. offset, University of Gent, 3 pp.
- JENKINS, W. R. (1964). A rapid centrifugal - flotation technique for separating nematodes from soil. *Pl. Dis Reptr* 42 : 692 .
- LOOF, P. A. A. (1987). On the systematic position of *Mononchus bathybius* Micoletaky, 1913 (Mononchina : Nematoda). *Rev. Nématol.* 10 : 491-493.
- MULVEY, R. H. (1961). The Mononchidae: a family of predaceous nematodes I. Genus *Mylonchulus* (Enoplida : Mononchidae). *Can. J. Zoology* 39: 665 - 696 .
- MULVEY, R. H. (1967). The Mononchidae: a family of predaceous nematodes VII. Genus *Prionchulus* (Nematoda : Mononchidae). *Can. J. Zoology* 45 : 941 - 953 .
- SEINHORST, J. W. (1959). A rapid method for the transfer of nematodes from fixative to anhydrous glycerin. *Nematologica* 4 : 67 - 69.
- SMALL, R. W. & GROOTAERT, P. (1983). Observations on the predation abilities of some soil dwelling predatory nematodes. *Nematologica* 89 : - 109 - 118 .
- STEINER, G. & HEINLY, H. (1922). The possibility of control of *Heterodera radicola* and other plant infesting nemas by means of predatory nemas, especially by *Mononchus papillatus* Bastian. *J. Wash. Acad. Sci.* 12 : 367-386.
- ZELL, H. (1985). Nematoden eines Buchenwaldbodens 3. *Prionchulus muscorum* (Nematoda, Monochida). *Carolinea* 42 : 57 : 74 .

Address of the authors :

Dr A. A. LOOF. Department of Nematology, Agricultural University
P. O. Box : 8123, 6700 ES Wageningen, Netherlands.

Eng. S. BAROOTI. Plant Diseases Research Department, Plant
Pests & Diseases Research Institute. P.O.Box : 1454, Tehean-19395, Iran .

Dr. A.KHEYRI. College of Agriculture, University of Tehran, Karadj, Iran