

### Teil III

## Free-living Nematodes from Fookien and Chekiang

By

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Until the present time only very little was known of free-living freshwater and soil nematodes from China and to our knowledge no one has ever studied free-living nematodes from Fookien and Chekiang.

The present investigation was undertaken principally to find out whether the nematode fauna in the localities examined was different from similar places in other parts of the world. Since only a comparatively short time was devoted to the examinations, this study can form but a small contribution to the knowledge of the nematode fauna of Southern China. No data concerning the very interesting ecological problems are given.

Our material was collected between the spring and fall of 1927 from different places on the islands of Amoy and Queemoy (Fookien), from Chip Bee (continent near Amoy) and from Wenchow (Chekiang). The number of nematodes present in samples from the same place varied in the different seasons of the year. Whereas as a rule and especially in samples taken from soil, there were less nematodes during the colder parts of early spring and late autumn and more nematodes during the warmer parts of the year, on the other hand they were even less numerous during the hottest season, during which the upper parts of the soil are very warm and often practically deprived of water. It would be certainly interesting to compare the change in the nematode fauna f. e. in rice-fields in the course of a year; and although we did not make special investigations about this point we found distinct differences in the course of the different seasons with regard to the total number and the prevalence of certain species.

Due to conditions beyond our control, the present study is based on only 15 samples out of a collection of fifty-seven. As a whole we found nematodes very abundant in our material especially in the samples taken from the muddy soil of rice-fields which, as is known, are under water for certain parts of the year.

The soil or mud samples were collected in small glass tubes with 10% formaline. The specimens were picked out by a fine bamboo needle under a binocular microscope and transferred into glycerine with acetic acid.

#### Special part

Altogether we found 14 different species, namely: *Alaimus multipapillatus* n. sp., *Aphelenchus parietinus* Bastian, 1865 var.

sinensis n. var., *Dorylaimus filiformis* Bastian, 1865 var. chekiangensis n. var., *Actinolaimus nudus* n. sp., *Monhystera filiformis* Bastian, 1865 var. pseudobulbosa n. var., *Monhystera spiralis* n. sp., *Monhystera wangi* n. sp., *Prismatolaimus dolichurus* De Man, 1880 var. brevicaudatus n. var., *Primatolaimus hsuei* n. sp., *Ethmolaimus pratensis* De Man, 1880 var. arcticus Steiner, 1916, *Plectus longicaudatus* Bütschli, 1873, *Plectus pusillus* Cobb, 1893, *Prionchulus muscorum* (Dujardin), 1845, *Trilobus allophysis* (Steiner), 1919.

*Alaimus multipapillus* n. sp. (figs. 1—3, pl. VI)

Diagnosis: Fourteen preanal papillae form the outstanding character of *A. multipapillatus*.

Two adult males from soil of a rice-field, Wenchow, collected September 1927.

Length: 1,5—2,1 mm.

Formula of De Man:  $\alpha = 52-53$ ;  $\beta = 6,3-8,4$ ;  $\gamma = 23,2-26$ ;  $n = 2$ .

Cuticle smooth, no striation. No setae at the anterior end but 6 distinct papillae and 3 lips. One testis reaching forward near the posterior end of the oesophagus. There are 14 preanal papillae with equal intervals between each one. Tail without caudal gland and spinneret. In neither specimens could we see the amphids. The nerve ring is located about midway the oesophagus.

There have been two species of *Alaimus* described bearing papillae at the anterior end: *A. filiformis* v. Daday, 1898 and *A. papillatus* v. Daday, 1901 (*Aphanolaimus papillatus* v. Daday, 1901). *A. filiformis* is a large worm nine mm long; its formula of De Man is:  $\alpha = 90$ ;  $\beta = 18$ ;  $\gamma = 45$ . *A. papillatus* has a tail which is very much longer than that of *A. multipapillatus* ( $\gamma = 4$  in the female).

There exists some similarity between *A. multipapillatus* and *A. primitivus* De Man, 1880. ( $\alpha = 48$ ;  $\beta = 5$ ;  $\gamma = 10$ ), but as can be seen from De Man's formula the tail in *A. primitivus* is longer, and no papillae have been found at the anterior end. The great number of preanal papillae (14) in *A. multipapillatus* forms the most outstanding character of the new species.

*Alaimus* species have been reported from Europe, North America, South Africa and Australia. They have been found in marshy ground, in the soil of meadows and the sandy soil of dunes.

*Aphelenchus parietinus* Bastian, 1865 var. sinensis n. var.  
fig. 4, pl. VI

Diagnosis: *Aphelenchus parietinus* Bastian, 1865 var. sinensis n. var. resembles *A. parietinus* but has a longer tail.

Three females from the mossy soil in front of the Biological Building of the University of Amoy, collected May 1927.

Length: 0,38—0,41.

$\alpha = 21-28$ ;  $\beta = 8,5-9,6$ ;  $\gamma = 5,4-6,2$ ;  $n = 3$ .

Micoletzky (1921) points out the great variation in this species. In our specimens the cuticle showed very fine striations. Behind the mouth opening the walls of the pharynx have small chitinous structures. We could recognise neither amphids nor nerve ring. There is no distinct posterior bulb. The tail in our three specimens was comparatively long ( $\gamma = 5,4-6,2$ ), whereas Micoletzky (1921) gives 11—23. With regard to this difference we think it justified to add our specimen as a new variety to *A. parietinus*.

*A. parietinus* is cosmopolitan. It has been found under very different ecological conditions among others in the overflow of the Castle Geyser in Yellowstone Park.

*Dorylaimus filiformis* Bastian var. *chekiangensis* n. var.  
figs. 5—9, pl. VII

Diagnosis: *Dorylaimus filiformis* Bastian var. *chekiangensis* n. var. resembles *Dorylaimus filiformis*, but has no preanal papillae in the male.

Three females and one male between algae on rocks of a stream and from the soil of a rice-field, Wenchow, collected September 1927.

Length: ♀ 1,2—1,5 mm.

$\alpha = 24-29,8$ ;  $\beta = 5,5-5,7$ ;  $\gamma = 9,9-15$ ;  $n = 3$ .

Length: ♂ 1,8 mm.

$\alpha = 26$ ;  $\beta = 4,3$ ;  $\gamma = 30$ ;  $n = 1$ .

In the front view of fig. 6 one recognizes no lips, but 6 small head papillae. The spicules are rather simple, we saw no gubernaculum, but may have overlooked it on account of its small size. Strangely enough, although we examined our specimens several times we could not find a row of preanal papillae usually present in the typical form of this species.

*D. filiformis* is cosmopolitan and has been found in all kinds of soil.

*Actinolaimus nudus* n. sp. figs. 10—13, pl. VIII

Diagnosis: *Actinolaimus* without preanal papillae in the male.

One male and three females, between algae and rocks of a stream, Wenchow, collected September 1927.

Length: ♀ 1,97—2,97 mm.

$\alpha = 40,6-49,5$ ;  $\beta = 3,8-5,1$ ;  $\gamma = 10-12,4$ ;  $n = 3$ .

Length: ♂ 2,59 mm.

$\alpha = 37$ ;  $\beta = 4,9$ ;  $\gamma = 129$ ;  $n = 1$ .

Our specimens showed a well developed chitinous ring behind the mouth opening. In front view 6 very small lips each bearing one papilla, were visible. The spear is large and rather broad. The vestibulum has small chitinous structures. We could not recognize the amphids. The nerve ring is placed at the end of the anterior

third of the oesophagus. The ovaries are symmetrical, the vulva is about midway the body-length. The tail in the female is slender.  $\gamma = 10-12,4$ , in the male it is very short,  $\gamma = 129$ . The structure of the spicules is simple, no accessory piece was seen. Just as in the case of *Dorylaimus filiformis* we could not recognize any preanal papillae even after several examinations. The absence of these papillae causes us to establish a new species for our specimens.

*Actinolaimus* species occur chiefly in muddy soil, but they have been also found in fresh water, and have been reported from different parts of the world.

*Monhystera filiformis* Bastian, 1865 var. *pseudobulbosa*  
n. var. figs. 14-17, pl. IX

Diagnosis: *Monhystera filiformis* Bastian 1865 var. *pseudobulbosa* n. var. resembles *M. filiformis*, but the most anterior part of the intestine exhibits a bulbous swelling without chitinous structures.

Two females from the mud of a ditch, Wenchow, collected September 1927.

Length: 0,49-0,59 mm.

$\alpha = 24,5-29,5$ ;  $\beta = 5,4-5,9$ ;  $\gamma = 4,1-4,5$ ;  $n = 2$ .

The anterior end has a circle of setae arranged in such a way that on each lateral side there is only one seta, submedian there are two setae, each submedian group consisting of a longer and a shorter seta. The shorter one is lateral. The mouth cavity is short. The circular amphidial openings are placed at one third the distance from the anterior end to the nerve ring. Cuticle smooth; oesophagus gradually increasing in diameter. The most anterior part of the intestine exhibits a bulbous swelling. Within this pseudobulb we were unable to recognize the two chitinous structures described by v. Daday for *M. pseudobulbosa*. There is a single straight ovary.

Our specimens exhibit the characteristics of *M. filiformis* with addition of a pseudobulb. With regard to *M. pseudobulbosa* v. Daday Micoletzky suspects that v. Daday's specimens belong to *M. filiformis* and that the pseudobulb is due to a contraction of the anterior part of the intestine. If Micoletzky is right it is nevertheless a little strange that our two specimens showed this same contraction. We therefore think it advisable to put our form as a new variation under *M. filiformis*, especially since we could not recognize chitinous structures in the pseudobulb.

*M. filiformis* occurs chiefly in fresh-water and moist soil.

*Monhystera spiralis* n. sp. fig. 18, pl. IX

Diagnosis: *Monhystera spiralis* n. sp., resembles *M. filiformis*, but has spiral-like amphids, located midway between the nerve ring and the anterior end. Further the tail is longer in the new species.

Four females between algae covering the rocks of a little half dried stream, Amoy, collected October 1927.

Length: 0,32—0,54.

$\alpha = 23-27$ ;  $\beta = 4,7-5,4$ ;  $\gamma = 3,3-3,7$ ;  $n = 4$ .

In its main characteristics the new form is very similar to *M. filiformis*. The difference is in the length of the tail which is longer in the new species, and in the position and structure of the amphids. These latter are located, midway between the nerve ring and the anterior end and show a spiral-like structure under high magnification. With respect to the fact that the amphids play an important role in the modern classification of free-living nematodes, we think it necessary to create a new species.

*Monhystera wangi* n. sp. figs. 19—24, pl. X

Diagnosis: *Monhystera* with unusually long spicules and large round amphids situated at the proximal end of the mouth cavity.

Three males and five females in the mud of a pond with waterlily, Wenchow, collected September 1927.

Length: ♀ 0,81—0,99 mm.

$\alpha = 24,7-28$ ;  $\beta = 5,5-5,7$ ;  $\gamma = 5,4-5,8$ ;  $n = 5$ .

Length: ♂ 0,81—0,93 mm.

$\alpha = 21,3-31$ ;  $\beta = 5,4-5,6$ ;  $\gamma = 5,3-7,1$ ;  $n = 3$ .

The cuticle of the new species is smooth. The anterior end bears 6 minute papillae and 6 small setae. The amphids are round and large and situated very near to the anterior end. The oesophagus increases in its diameter gradually towards the posterior end. The nerve ring lies about halfway the length of the oesophagus.

The intestine has a distinct well marked cardiac bulb at its anterior end. Because this bulb was present in all of our specimens we are of the opinion that it is a characteristic of this form and not simply due to a contraction of the intestine. The ovary is straight, the vulva posterior to the middle of the body. There is only one testis and the spicules are unusually long (see Fig. 22).

*M. wangi* has some similarity in its measurements with *M. filiformis*, but is characteristically different in the size and shape of the spicules.

The cardiac bulb of *M. wangi* makes this form also somewhat similar to *M. pseudobulbosa* v. Daday and to *M. filiformis* var. *pseudobulbosa*. Apart from the size of the spicules the chief difference between *M. wangi* and these forms is the position of the amphids. In *M. wangi* they are immediately behind the anterior end at the proximal end of the mouth cavity, whereas in the two other forms the amphids are placed at a certain distance from the anterior end.

Representatives of the genus *Monhystera* have been reported from different parts of the world.

*Prismatolaimus dolichurus* De Man, 1884 var. *brevicaudatus* n. var. fig. 25, pl. XI

Diagnosis: *Prismatolaimus dolichurus* De Man, 1880 var. *brevicaudatus* n. var. resembles *P. dolichurus*, but has a much shorter tail.

One female in the mud of a canal with brakish water near the University of Amoy, collected November 9, 1927.

Length: 1 mm.

$$\alpha = 41; \beta = 5,1; \gamma = 6,2; n = 1.$$

Cuticle with very fine striations; anterior end with ten setae arranged in the typical way. There are two ovaries, the distal ends of which are turned towards the vulva. Nerve ring midway the oesophagus. The amphids could not be seen. The tail is so much shorter than in the typical form that it seemed advisable to establish a new variety.

In De Man's plate XII (1884) the picture of *P. dolichurus* shows only one ovary with a long posterior branch of the uterus. Micoletzky (1921) describes *P. dolichurus* as having two ovaries.

*P. dolichurus* has been reported always from marshes and mud.

*Prismatolaimus hsuei* n. sp. fig. 26, pl. XII

Diagnosis: *Prismatolaimus* with twelve setae at the anterior end, with a mass of glandular tissue between oesophagus and intestine and with a uterus reflexed at about the middle of its length.

Three females from a half dried little stream near the University Temple, Amoy, sandy soil. Collected September 1927.

Length: 0,5—0,6 mm.

$$\alpha = 17-23; \beta = 3,8-4; \gamma = 3,9-5,2; n = 3.$$

A rather strange form. The mouth cavity is typical of the genus. There are twelve setae at the anterior end. The amphids could not be seen. The cuticle shows a marked striation. The oesophagus increases in diameter towards the posterior end. The nerve ring is located midway the oesophagus.

Between the posterior end of the oesophageal muscular tissue and the beginning of the intestine there is a globular mass of a tissue which probably represents a gland.

There is only one ovary; the whole female sexual systems lies anterior to the vulva. The uterus is reflexed at about the middle of its length so that the end of the ovary reaches the region of the vulva. A caudal gland is present.

*P. hsuei*, because of the twelve setae at the anterior end, the glandular tissue between oesophagus and intestine, and the arrangement of the sexual organ, has the distinct characteristics which justify the establishment of a new species.

*Prismatolaimus* species have been reported from Europe, America, Australia and the Arctic.

*Ethmolaimus pratensis* De Man, 1884 var. *arcticus*  
Steiner, 1916

Four females from mud near the sea-shore, Chip Bee village, continent near Amoy. Collected November 1927.

Length: 0,46—0,76 mm.

$$\alpha = 19,4—20,7; \beta = 5,0—6,6; \gamma = 7,5—11,3; n = 4.$$

*Ethmolaimus* species have been reported from Europe and North America. It is interesting to find the arctic variety of *E. pratensis* also in a subtropical climate.

*Plectus longicaudatus* Bütschli, 1873

Four females from Pearl Hill, Queemoy, mossy ground. Collected August 16, 1927.

Length: 0,48—0,58 mm.

$$\alpha = 18—23; \beta = 4,8—5,3; \gamma = 3,5—4,1; n = 4.$$

From our material we found De Man's statements (De Man 1921) in all points correct. In our specimens the tail was comparatively a little longer than described by Bütschli and De Man. At the insertion of the setae the diameter of the anterior end is one half the diameter at the proximal end of the mouth cavity. The amphids are midway the length of the mouth cavity; they form a short spiral.

*P. longicaudatus* has been described from Germany, Southern France and Northern Russia.

It has been found chiefly in the soil of meadows and in mossy ground.

*Plectus pusillus* Cobb, 1893 figs. 27—30, pl. XII

Three females from the mud of a ditch, Wenchow, collected September 1927.

Length: 0,47—0,66 mm.

$$\alpha = 23—33; \beta = 3,3—3,6; \gamma = 9,4—11; n = 3.$$

Cobb does not give a picture of this species which according to Micoletzky may belong to *P. cirratus* (var. *rizophilus*). Because our measurements are the same as Cobb's and are a little different from the variations of *P. cirratus* as given by Micoletzky we prefer to put our material under Cobb's species. The cuticle exhibits a fine cross striation. The anterior end bears four small setae. There are six very small lips each with a minute papilla. Between the insertion of the setae and the mouth opening the anterior end shows a distinct swelling. The amphids are spiral shaped, very distinct and situated at about the middle of the length of the mouth cavity. The oesophagus has a well developed bulb. The nerve ring surrounds the oesophagus in its middle region. The female sexual organs are short and symmetrical, the ovaries are turned towards the vulva. There is a distinct outlet tube of the spinneret.

*Prionchulus muscorum* (Dujardin), 1845

One female, Pearl Hill, Queemoy Island, mossy ground. Collected August 16, 1927.

Length: 1,8 mm.

$$\alpha = 23,5; \beta = 3,8; \gamma = 15,7; n = 1.$$

We have nothing to add to the descriptions as given by earlier observers.

This species which is generally not very abundant is cosmopolitan according to Cobb.

It has been reported from mossy and muddy soil and from the moist soil of meadows and ponds.

*Trilobus allophysis* (Steiner), 1919

Males and females, found in mud from a rice field near the University of Amoy, collected August 1927; and in vegetative mass from a stream near Wenchow, collected September 1927.

Amoy material:

Length: ♂ 1,1 mm.

$$\alpha = 23,1; \beta = 6,1; \gamma = 10,4; n = 1.$$

Length: ♀ 1,27 mm.

$$\alpha = 19,6; \beta = 5,8; \gamma = 8,4; n = 1.$$

Wenchow material:

Length: ♂ 1,41 mm.

$$\alpha = 28; \beta = 6,7; \gamma = 16; n = 1.$$

Length: ♀ 0,98—1,5 mm.

$$\alpha = 19—37; \beta = 4,4—6,7; \gamma = 6,5—10; n = 7.$$

In the males we found 6 preanal papillae of equal size. They are arranged at nearly the same distance from each other. Nevertheless we have to point out that this arrangement does not seem to be absolutely constant, because we found slight variations of the intervals in the different specimens.

This species has been described in detail by Steiner who also gives good illustrations and therefore it is not necessary to give here any further description.

*T. allophysis* is cosmopolitan. It occurs mostly in fresh water but also in moist soil and has been found in the overflow of a geyser in Yellowstone Park.

## Summary

From fifteen samples collected on the islands of Amoy and Queemoy, on the continent near the Island of Amoy and in Wenchow, Chekiang, there are described 14 different species of free-living nematodes; 5 of them represent new species, 4 are new varieties, whereas 5 are species already described from other parts of the world.

The specimens occurred in a respective „milieu“ as reported for the same or closely related species in other countries. Our samples were taken from mud, from soil of rice-fields, from mossy ground, from the sandy bottom of little streams and from the vegetation on rocks in running water.

As a whole the results of our investigations indicate that the nematode fauna in different parts of the world is fundamentally not very different and that forms typical for a certain „milieu“ are the same or little different in far distant places.

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## Explanation of Plates

### Plate VI

*Alaimus multipapillatus* n. sp. figs. 1—3

- Fig. 1. Anterior end, frontal view.
- " 2. Male, anterior end, lateral view.
- " 3. Male, posterior end, lateral view.
- " 4. *Aphelenchus parietinus*, Bastian, 1865, var. *sinensis*, n. var., female.

### Plate VII

*Dorylaimus filiformis* Bastian, 1865 var. *chekiangensis* n. var.

- Fig. 5. Male.
- " 6. Anterior end, frontal view.
- " 7. Male, anterior end, lateral view.
- " 8. Male, posterior end, lateral view.
- " 9. Female.

### Plate VIII. *Actinolaimus nudus* n. sp.

- Fig. 10. Female.
- " 11. Anterior end, frontal view.
- " 12. Anterior end, lateral view.
- " 13. Male, posterior end, lateral view.

### Plate IX

*Monhystera filiformis* Bastian, 1865 var. *pseudobulbosa* n. var. figs. 14—17

- Fig. 14. Female.
- " 15. Anterior end, frontal view.
- " 16. Anterior end, lateral view.
- " 17. Female, vulva.
- " 18. *Monhystera spiralis* n. sp. female.

### Plate X. *Monhystera wangi* n. sp., figs. 19—24

- Fig. 19. Male.
- " 20. Anterior end, lateral view.
- " 21. Anterior end, frontal view.
- " 22. Male posterior end, lateral view.
- " 23. Female.
- " 24. Vulva.

### Plate XI

*Prismatolaimus dolichurus* De Man, 1884 var. *brevicaudatus* n. var.

- Fig. 25. Female.

### Plate XII

- Fig. 26. *Prismatolaimus hsuei*, n. sp., female.

### *Plectus pusillus* Cobb, 1893, figs. 27—30

- Fig. 27. Female.
- " 28. Anterior end, frontal view.
- " 29. Anterior end, lateral view.
- " 30. Vulva.













