

NEW AND LITTLE KNOWN TYLENCHIDS (NEMATODA, TYLENCHIDA)
TOGETHER WITH DESCRIPTION OF A CASE OF GYNANDROMORPHISM
IN THE GENUS APHELENCHOIDES

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In the present article the diagnosis of two new nematodes of the order Tylenchida Thorne, 1949 are given. A new species of the genus Tylenchorhynchus and a new form of the species Aphelenchus avenae are described. Besides this, a case of gynandromorphism in the superfamily Aphelenchoidea, and in particular in the genus Aphelenchoides, is described for the first time. The species Aphelenchoides limberi Steiner, 1936, which is regarded as rare, is briefly considered.

Tylenchorhynchus tartuensis n. sp.
(Fig. 1)

3 ♀♀: L = 764 - 1,040 μ m; a = 30.6 - 34.6; b = 4.6 - 5.2; c = 17.1 - 18.5; v = 54.7 - 56.0%

The new nematode belongs to the group of those Tylenchorhynchus which have longitudinal lines on the body. The head of the new species is clearly offset and is provided with a well developed, chitinous supporting apparatus [= labial framework]. There are 6 transverse annules on the head; there are 6 longitudinal lines in the lateral field. Stylet 24 μ m in length, and of a shape usual for the genus. Esophagus of a typical structure, with a well developed median bulb. The esophageal glands open into the lumen of the esophagus not far from the base of the stylet. Female sexual organs paired, vulva situated behind the middle of the body and provided with semicircular thickenings, as in the species T. quadrifer Andr assy, 1952. Annulation missing on tail end. Phasmids well marked. Males were not found.

The new species stands the closest to T. ornatus Allen, 1955. It is slightly larger; the lips are more strongly cuticularized and are clearly offset. The new species is well differentiated from T. tessellatus Goodey, 1952 by the absence of annulation on the tail tip. T. tartuensis n. sp. is also very close to T. quadrifer Andr assy, 1952, but differs from it by the smaller number of longitudinal striae on the cuticle (from 24 to 28 instead of 60), and by the presence of not five, but six annules on the head. The new species differs from T. lenorus Brown, 1956 by larger measurements, a short tail and by a well developed supporting apparatus on the head.

Three females were observed in the soil of a potato field in the environs of the city of Tartu, at a depth from 0 to 10 and from 10 to 20 cm.

Type: ♀ No. 1 in the collection of the Institute of Zoology and Botany, Academy of Sciences of the Estonian SSR.

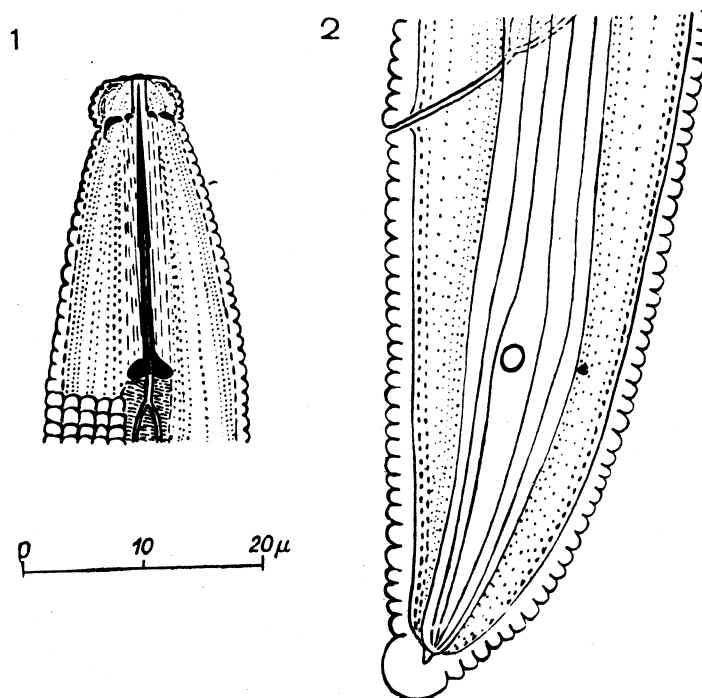


Fig. 1. Tylenchorhynchus tartuensis n. sp.

1 - head; 2 - tail.

Aphelenchus avenae Bast. f. tricaudata forma nova

The decaying oat nematode Aphelenchus avenae Bast. (Fig. 2) is one of the most common plant nematodes. This species, which is distributed everywhere, is encountered in the rotting portions of many plants. The pathogenic significance of A. avenae is still not entirely clarified. According to the data of many authors, it causes damage to plants.

A. A. Paramonov considers this species a plant nematode of nonspecific pathogenic effect that feeds on the mycelium of fungi (Paramonov & Kharichkova, 1953; Paramonov, 1956). Migration of this species in the tissues of plants has been experimentally demonstrated, a fact that is undoubtedly connected with traumatic injury of the latter (Lordello, 1958).

In Estonia A. avenae is widely distributed and is found in the roots, in above-ground portions and in the tubers, and also in the soil around the roots, of the potato. We noted mass reproduction in one instance in a rotting potato tuber (Krall', 1958).

Morphologically the decaying oat nematode varies relatively little; it has been described fully enough by many authors, as a consequence only illustrations of the anterior part of its body and tail are given here (Fig. 2:1,2). The form of the tail sometimes varies a little; usually it is cylindrical but its tip can be rounded or more or less blunt.

In one specimen, observed in the rotten root neck of a potato on the island of Saaremaa (Oricaare region, July 22, 1956), the tail had a very peculiar form. The middle part of its tip was normally rounded, but dorsally and ventrally there were two notches on the tip, giving the tail a three-tipped form (Fig. 3).

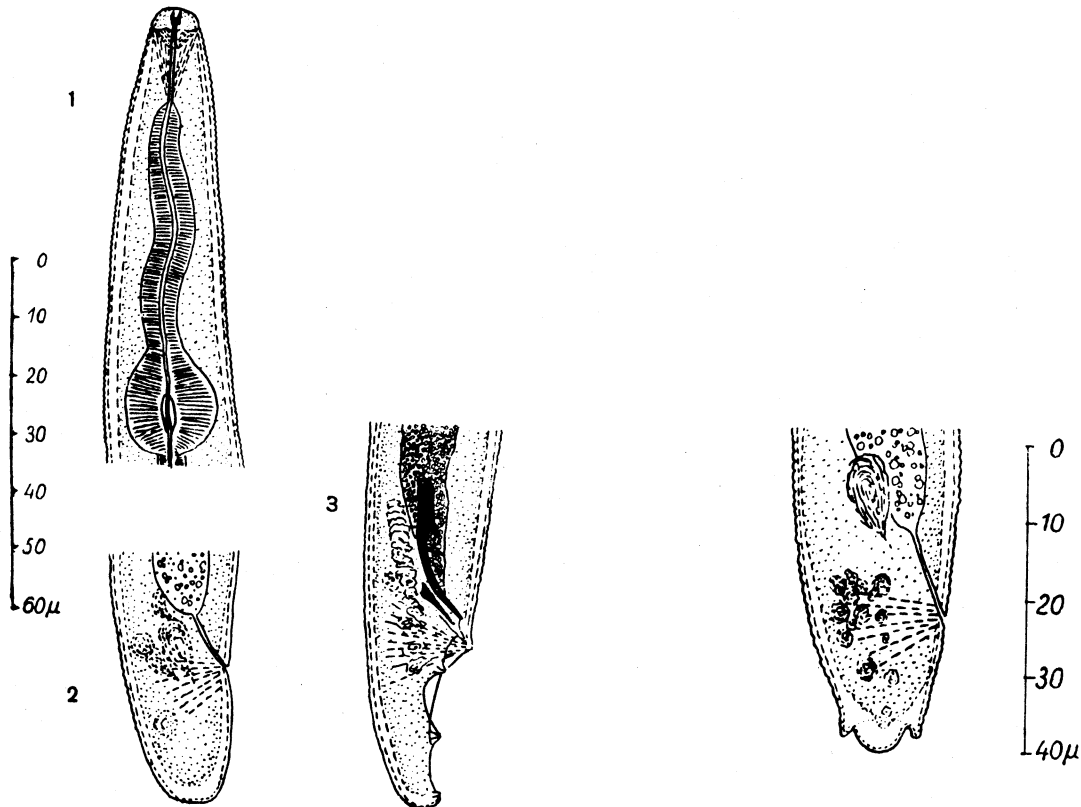


Fig. 2. *Aphelenchus avenae* Bast.

1 - anterior part; 2 - tail of the female; 3 - tail of the male.

Fig. 3. *Aphelenchus avenae* Bast. f. tricaudata f. nov. (tail of the female).

The measurements of the observed female are the following:

$L = 835 \mu\text{m}$, $a = 26.0$, $b = 8.8$, $c = 41.7$, $V = 80.2\%$.

So long as other individuals, observed in this same sample, did not deviate from the norm, the author avoids description of a new species and considers the specimen found as merely a new form--forma tricaudata f. nov.

In the species *A. avenae* propagation takes place parthenogenetically: as a rule only females are encountered in its populations. Males were

described for the first time by Steiner (1931); afterwards other investigators only rarely observed them. In our material males were encountered only in one sample, in the roots of diseased potato (city of Tartu, June 30, 1957). It is interesting to note that in this same small sample there were also observed several males of the species Acrobeles ciliatus Linst., in which only females are usually encountered.

The measurements of the male of A. avenae found by us are the following: L = 972 μ m, a = 35.4, b = 8.8, c = 24.5. Spicules length 27.5 μ m; ventrally they have a small appendage. There is also a gubernaculum. The form of the tail is conical with four papillae and with a bursa (Fig. 2,3).

Aphelenchoides limberi Steiner, 1936

This species was described by Steiner (1936) in the bulbs of an iris from Holland. It is characterized by a finger-like tail, by narrow lateral fields with four lines and by some other characteristics.

The species was included in Schneider's key of free-living and plant-parasitic nematodes (Schneider, 1939). In illustration 432, page 239 of this same key, the posterior part of the nematode Aphelenchus avenae is erroneously illustrated instead of A. limberi.

Using the original literature (Steiner, 1936) I succeeded in establishing the existence of this species also in Estonia (Krall', 1958). Here it was observed in several potato tubers from storehouses (of the Likhula and Pyarnu-Yaagupi districts in May 1957 and of the Kallaste district in June 1957).

Descriptive and measurement data of the Estonian specimens (Fig. 4) agree well in general with Steiner's data. For comparison we list here the corresponding figures.

According to Steiner (1936):

L = 0.55 - 0.64 mm
a = 30.6 - 33.0
b = 6.5 - 9.2
c = 14.5 - 16.0
V = 66 - 72%

Our material:

L = 0.64 - 0.85 mm
a = 30.3 - 33.4
b = 7.6 - 9.95
c = 14.1 - 18.7
V = 68.9 - 70.2%
egg (1) = 65.5 x 20 μ m

As follows from the listed figures, the Estonian material is merely larger; to wit, a much greater difference is observed in the length of the stylet: 11 microns for Steiner, but 13 - 15 microns for our data. Probably one can explain the difference in measurements by different conditions of existence.

In the USSR this species has been noted up to now only by I. M. Sudakova in the Chuvash Autonomous SSR (Sudakova, 1958).

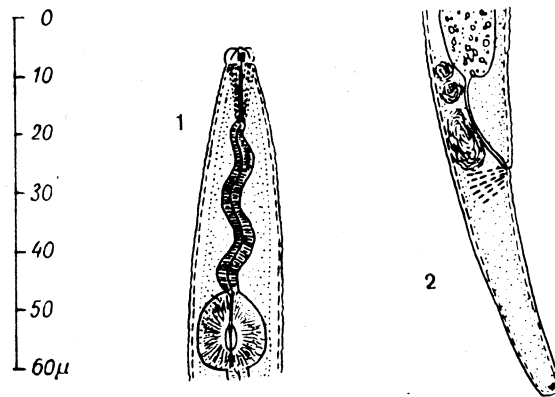


Figure 4. Aphelenchoides limberi Steiner, 1936

1 - anterior part; 2 - tail of the female.

A case of gynandromorphism

In the rotting tuber of a potato with characteristics of dry rot (Kallaste district, Mustyarve, June 25, 1957) nematodes of the species Aphelenchus avenae Bast., Aphelenchoides parietinus Coll., A. tenuicaudatus de Man, A. limberi Steiner, Rhabditis aspera Butschli, and Cheilobus quadrilabiatus Cobb were observed. All the species indicated were represented by single specimens. The prevailing species turned out to be A. parietinus, of which 20 specimens were observed, 8 of them males, 11 females, and one intersex (gynandromorphic) individual (Fig. 5).

Measurements of the observed intersex are the following:

$L = 956 \mu\text{m}$, $a = 35.7$, $b = 10.1$, $c = 20.5$, $V = 71\%$; measurements of the egg are $46.7 \times 21.0 \mu\text{m}$; the length of the spicules is $23.4 \mu\text{m}$, and the stylet is $16.7 \mu\text{m}$.

As is known, A. parietinus described by Bastin is a mixture of species; after its redescription from a neotype by M. Franklin (1955), several very close other species were described. In all probability, one can expect descriptions of a whole series of new species from this group, and clarification on the systematic status of some old species which have been considered as synonyms up to now. We therefore consider A. parietinus sensu lato as the only designation that it is possible to use preliminarily, while noting that the characteristics of the species we found do not completely fit the description of Franklin (it is possible that some characteristics of the observed specimen were confused with those of A. helophilus or other close species).

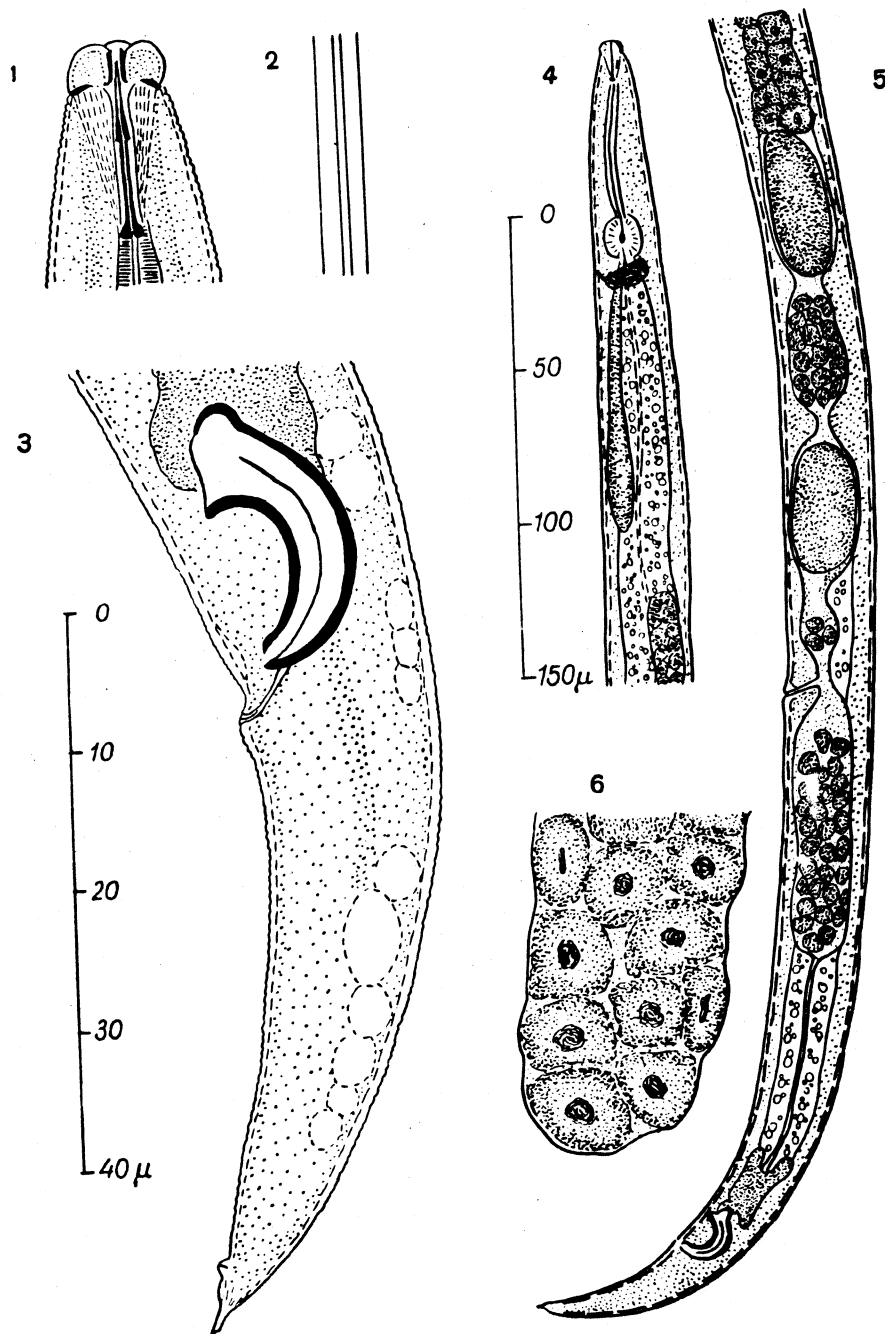


Fig. 5. Gynandromorphic individual of Aphelenchoides parietinus.

1 - head; 2 - lateral field; 3 - tail; 4 - anterior part of the body; 5 - posterior part of the body; 6 - part of the posterior uterus with spermatozooids.

The intersex which was found was a sexually mature female with the fully developed spicular apparatus of a male. Besides the spicules, the

presence of the vestigial posterior part of a male genital tract was also noted. Also characteristic of male there were two pairs of postanal tail papillae.

The female sexual organs were normally developed. The individual had an ovary, an oviduct, a spermatheca, a uterus, a vulva and a posterior uterus. In the uterus a well developed, normal egg was found. Another egg, located in the oviduct, was found to be still not fully shaped. The spermatheca and the posterior uterus were filled with spermatozooids.

A whole series of discoveries of intersexual forms in nematodes is known from the literature. In Steiner's work (Steiner, 1923) a survey is given of known intersexes among nematodes, and in particular among mermithids. In this work it is underscored that intersexes are observed fairly often among mermithids. Cases of gynandromorphism in the group named have already been described by various authors in the last century. The survey of these works together with the description of intersexes in Paramermis contorta Linst. has been given in the work of Comas (1927).

Among free-living nematodes intersexes are usually found only within the limits of the genus Trilobus, in particular in the species T. gracilis Bastian. Thus, in one female of Trilobus gracilis the presence of four male sexual papillae has already been noted by Ditlevsen (1911). In this same species a case has been described of abnormal development of six preanal papillae in the female (Paramonov, 1925). A. A. Paramonov also noted in his specimen the presence of undeveloped spicules. According to Prof. A. A. Paramonov's written communication, he often observed the same or similar intersexes in species of Trilobus from the river Klyaz'ma (1937).

Intersexes in T. gracilis were further noted by Schneider (1922). According to communications of the American investigators Cobb and Thorne, intersexes in this same species are encountered often in the USA (Steiner, 1923). A single gynandromorphic individual of the species Trilobus longus Leidy (T. diversipapillatus Daday) was observed by Daday (1905).

In other groups of nematodes, the presence of intersexes is generally a very rare phenomenon. In addition there are isolated data about such forms among free-living marine nematodes. For example, intersexes were described in Thoracostoma figuratum Bast., Chromadora poecilosoma de Man (de Man, 1893), and Enoplus michaelsoni Linst. (de Man, 1904), according to Steiner, 1923; and in the genera Halichoanolaimus and Sphaerolaimus and also in the species Desmodora greenpatchi Allgén (Allgén, 1953). In the recently published work of Allgén (1958) several cases of gynandromorphism in the marine Rhabdodemanina scandinavica Schuurmans Stekhoven, 1946 and Sphaerolaimus latilaimus Allgén, 1958 are described.

Up to this time among plant nematodes, and particularly in the order of the tylenchids, intersexes have been described only in Ditylenchus triformis (Hirschmann & Sasser, 1955). From what has been stated it is evident that intersexes are most often encountered only among certain classes of nematodes. Among these, the species Trilobus gracilis constitutes an aggregate and has been split into a group of very close forms or species. These species undoubtedly interbreed among themselves.

In the opinion of Steiner (1923), the origin of intersexes in nematodes can be associated with hybridization between such close breeds or genotypes.

The discovery described above of an intersex in Aphelenchoides parietinus conforms the opinion cited from Steiner, since this species also consists of a whole group of very close forms (resp. species). As far as we know, in the genus Aphelenchoides (and, it seems, generally within the superfamily Aphelenchoidea) intersexes have not been described up to this time.

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NEUE UND WENIG BEKANNTE TYLENCHIDEN (*NEMATODA, TYLENCHIDA*)
NEBST EINER BESCHREIBUNG DES GYNANDROMORPHISMUS IN DER
GATTUNG *APHELENCHOIDES*

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Zusammenfassung

Zwei neue Tylenchiden aus Estland — *Tylenchorhynchus tartuensis* n. sp. und *Aphelenchus avenae* Bast. f. *tricaudatu* f. nov. werden im Artikel beschrieben und abgebildet.

Tylenchorhynchus tartuensis n. sp. (Fig. 1) ist *T. ornatus* Allen, 1955 am nächsten verwandt. Die neue Art ist etwas grösser, ihre Lippen sind stärker kutikularisiert und die Lippenregion ist vom Körper deutlich abgesetzt (set off by a constriction). Von *T. tessellatus* Goodey, 1952 weicht sie durch das Fehlen der Ringelung am Schwanzende

wohl ab. Die neue Art steht noch *T. quadrifer* Andrassy, 1952 sehr nahe, unterscheidet sich aber von dieser durch die kleinere Anzahl der auf dem Körper vorhandenen Längsstreifen (24 bis 28 statt 60) und auch dadurch, dass sie auf dem Kopfende nicht 5, sondern 6 Ringe besitzt. Von *T. lenorus* Brown, 1956 weicht die neue Art durch ihre grössere Länge, kürzeren Schwanz und stärker ausgebildete Kutikularisierung der Kopfregion ab. 3 Weibchen von *T. tartuensis* n. sp. wurden im Boden eines Kartoffelfeldes (Umgebung von Tartu) in Horizonten von 0 bis 10 und 10 bis 20 cm gesammelt.

Aphelenchus avenae Bast. f. *tricaudata* f. nov. (Fig. 3) ist nur durch die eigentümliche Schwanzform charakterisiert, namentlich ist das Schwanzende dorsal und ventral eingefurcht. Ein einziges Weibchen dieser neuen Form wurde auf der Insel Saaremaa in einer normalen Population von *A. avenae* in einer faulenden Kartoffelpflanze gefunden ($L = 835 \mu$, $a = 26,0$, $\beta = 8,8$, $\gamma = 41,7$, $V = 80,2\%$). Die Typenexemplare der neuen Nematoden befinden sich im Institut für Zoologie und Botanik der Akademie der Wissenschaften der Estnischen SSR.

Es ist dem Verfasser bisher nur einmal gelungen, Männchen von *A. avenae* zu beobachten. Diese kamen vereinzelt in faulenden Kartoffelwurzeln in Tartu vor (Fig. 2, 3). Die Männchen besitzen einen konischen Schwanz mit gutentwickelter Bursa, sowie vier Papillenpaare. Die Länge der Spicula ist $27,5 \mu$. Gubernaculum vorhanden. In derselben kleinen Probe fanden sich noch einige Männchen einer anderen Art, und zwar der *Acrobeles ciliatus* v. Linst.

Was *A. limberi* Steiner, 1936 anbetrifft, so kam diese Art in drei Bezirken an eingekellerten Kartoffelknollen vor (Fig. 4). Die estnischen Exemplare waren etwas grösser als von Steiner angegeben, übrigens stimmten sie aber mit der Beschreibung der Steinerschen Art gut überein. Der Meinung des Verfassers nach können die Grössenunterschiede bei dieser Art auf die Verschiedenheit der Lebensbedingungen zurückgeführt werden. In der UdSSR ist *A. limberi* bisher nur in der Tschuwaschischen ASSR gefunden worden (Sudakowa, 1958). Hierbei wird noch auf die Tatsache aufmerksam gemacht, dass in dem Schneiderschen Bestimmungsbuch (1939) S. 432, Fig. 239 statt *A. limberi* irrtümlich das Hinterende von *Aphelenchus avenae* abgebildet ist.

Im Artikel werden noch Fälle des Gynandromorphismus bei einzelnen Nematodenarten und -gruppen behandelt. Nach Literaturangaben sind Intersexe bei nur wenigen Nematodengruppen, und zwar bei den Mermithiden und bei der freilebenden *Trilobus gracilis* wiederholt beobachtet worden. Ausserdem kommen solche Formen bei einigen marinen Arten selten vor.

Nach Steiner (1923) kann die Entstehung der Intersexe bei Nematoden mit Hybridisation zwischen nahestehenden Rassen bzw. Genotypen im Zusammenhang stehen. Durch den im vorliegenden Artikel behandelten Fund eines gynandromorphen Weibchens von *Aphelenchoides parietinus* s. lat. (Fig. 5) wird dieser Standpunkt bestätigt, denn auch diese Art besteht aus mehreren Rassen bzw. sehr nahe verwandten Arten. Bei den letzteren aber ist die Kreuzungsmöglichkeit am wahrscheinlichsten.

Das in einer faulenden Kartoffelknolle gefundene gynandromorphe Weibchen stimmte mit der von Franklin (1955) gegebenen neuen Beschreibung für *A. parietinus* nicht überein, jedoch war es näher nicht zu bestimmen. Wahrscheinlich waren bei diesem Individuum einige Kennzeichen mit denjenigen von *A. helophilus* oder einigen anderen nahestehenden Arten gemischt.

Das gefundene Weibchen hatte ganz normale weibliche Gonaden. Im Uterus befand sich ein vollkommen entwickeltes, normales Ei ($46,7 \times 21,0 \mu$). Ein anderes Ei im Ovidukt war noch nicht reif. *Receptaculum seminis* und der postvulvare Uterus waren voller Spermatozoen. Ausser den weiblichen Gonaden hatte dieses Exemplar noch einen gut entwickelten Spicularapparat und zwei Paar postanale Schwanzpapillen. Man konnte auch den reduzierten Hinterteil des männlichen Geschlechtsrohres beobachten.

Soweit es dem Verfasser bekannt ist, sind Fälle von Gynandromorphismus in der Gattung *Aphelenchoides* und überhaupt in der Superfamilie *Aphelenchoidea* bisher nicht beschrieben worden.

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