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Revision of the Subfamily Criconematinae Taylor, 1936 (Nematoda)

By

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Abstract. The present study analyzes the validity of both nominal taxa, the genus *Criconema* and the species *C. guernei*. *Criconema* should be considered as "genus dubium" and *C. guernei* as "species dubia". For the other species hitherto belonging to *Criconema*, the genus *Ogma* Southern, 1914 is re-established.

According to the four presumably evolutionary trends within Criconematidae, the family is divided into four subfamilies: Hemicycliophorinae, Macroposthoniinae, Criconematinae and Hemicriconemoidinae. From the subfamilies the study particularizes Criconematinae. The diagnoses of the 9 genera belonging to it are given and the species of each genus are enumerated. Besides, keys are added for determining all the species of Criconematinae. Seven new species are described: *Nothocriconema orientale*, *Neolobocriconema cataracticum*, *Ogma spinosum*, *Seriespinula melanesica*, *Seriespinula cactus*, *Pateracephalanema pellitum* and *Crossonema abies* n. spp. A new genus, *Colbranium* n. gen. is erected for a species of *Hemicycliophora* and for the genus *Hemicriconemoides* a new subfamily, Hemicriconemoidinae n. subfam. is proposed. Several new combinations and some new synonyms are established.

Notwithstanding our increasing knowledge concerning the systematization of the family Criconematidae, especially due to examinations performed in the last years by De Grisse, Loof, Raski, and Mehta, there are a good many questions still awaiting for answers. To add some new concepts to the taxonomy of this group of Nematoda, in this paper I propose some modifications on setting up the family Criconematidae and give a revision of the subfamily Criconematinae.

During this study I examined several hundred microscopic slides containing a number of species of Criconematinae originating from twenty countries, viz. *Europe:* Belgium, Holland, Hungary, France, Yugoslavia, Bulgaria; *Asia:* India, Japan; *Africa:* Ghana, Tanzania, Congo Republic, Réunion; *America:* Brazil, Ecuador, Chile, Paraguay; *Oceania:* Australia, New Britain, New Caledonia, Marion Coral Reef. In the rich material I have found seven species which proved to be new to science.

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Criconema, the type genus of the family Criconematidae

In 1889 CERTES described under the name *Eubostrichus guernei* a fresh-water nematode species collected in Tierra del Fuego. Since the genus *Eubostrichus* had been erected by GREEFF (1869) for a group of marine nematodes and CERTES' *guernei* has not proved to be congeneric with the representatives of *Eubostrichus*, HOFMÄNNER and MENZEL established in 1914 the genus *Criconema* for *C. guernei* CERTES, 1889 and the newly described species *C. morgense* HOFMÄNNER in HOFMÄNNER & MENZEL, 1914. In fact, the Swiss authors have created the genus for a third species, too, their "*Criconema guernei*", which represented a separate species and was not congeneric with the one described by CERTES. Unfortunately, HOFMÄNNER and MENZEL committed the error not to name the type of *Criconema*. Observing this, STILES and HASSAL (1920) designated then *Criconema guernei* as type species.

STILES and HASSAL's selection was not a lucky one. They designated such a species to be type of a genus which had been described rather insufficiently and has never been observed since the original description. CERTES characterized his species as follows: „*Eubostrichus guernei* est caracterisée par les ornements de la cuticle, qui la rapprochent des *Eubostrichus* décrits par M. GREEFF, et par le dard dont la bouche est armée. Ce dard est porté sur une longue tige protractile. Le tégument est formé d'anneaux symétriques présentant des angles rentrants et sortants, armés d'épines de manière à former le long du corp six rangées parallèles. La longeur paraît être au maximum de $0^{mm},4$; la largeur varie de $0^{mm},02$ à $0^{mm},4$ et même a $0^{mm},1$, suivant la taille et l'état de concentration des individus examinés."

It was pointed out by TAYLOR (1936), DE GRISSE (1969) and MEHTA & RASKI (1971) that we knew too little about *Criconema guernei*. Studying CERTES' figures the following facts can be gleaned from the original description: body length 0.4 mm, a = 11 – 12; annules of cuticle numerous (about 100, calculated by TAYLOR after the illustrations) and ornamented by spine-like projections arranged in six longitudinal rows; head consisting of a simple rounded annule, spines beginning on the second annule; posterior body end conoid with pointed terminus. Type habitat and locality: detritus from a fresh-water biotope, Tierra del Fuego. From his collections on two Antarctic islands (Kerguelen and Heard Islands), RICHTERS (1908) mentioned later also a species under the name *Eubostrichus guernei*, but he had not enough informations to settle whether his nematodes were actually identical with CERTES' species.

From the description of CERTES it does even not come to light whether his animal was a young or a mature specimen; he has reported nothing about the vulva or the genital organs.

Revising the genus *Criconema* s. lato, MEHTA and RASKI (1971) underlined, that what was known about *C. guernei* was too little for recognizing the species. Even, it is questionable that the spines were in fact arranged in six longitudinal rows, since such number of rows was never observed in any known species of *Criconema* s. lato! At least 8 rows of spines or other appendages are found both on adults and on juveniles. Although KIRJANOVA (1947) described a species showing 4 rows of spines (*Ogma minuta*), the validity of this number is, however, rather uncertain. It seems to be much more probable that the smallest number of

rows is 8 in Criconematidae. It is supposed therefore that CERTES' nematode also bore at least 8 rows of cuticular outgrowths.

Another thing that makes the species of CERTES practically unrecognizable is that the exact number of cuticle annules is unknown. Being specifically fairly constant, the total number of annules serves in recognition of species as a characteristic of the first rank. In his revision TAYLOR (1936) supposed 100 annules on *guernei*, in a key, however, he said to be "probably 100—120" annules.

Last but not least there is another circumstance that causes *C. guernei* to be questionable: it has remained quite uncertain whether CERTES has described his species on the basis of a mature or only of a young specimen. The position of vulva and the number of postvulvar annules are indispensable in characterising a species. CERTES has mentioned and illustrated, however, neither vulva nor genital organs, so that we can suppose with good reason that CERTES' specimen was a juvenile form. And if so, the structure of cuticle illustrated by him (shape of spines and number of longitudinal rows) was characteristic only for a larval stage of the species *guernei* and not for the mature. When juveniles bear appendages on the cuticle, they do differ in this respect in almost every case from the adults.

From the foregoing it may be established that *Criconema guernei* must be regarded as "species dubia". No type specimen is available and there is no chance whatever that *C. guernei* can ever be identified. And this is not all! Let us inspect *Criconema* more closely as a generic taxon.

As mentioned above and as supposed by HOFMÄNNER & MENZEL (1914), DE GRISSE (1969) and MEHTA & RASKI (1971), it is most likely that *C. guernei* has been described after an immature specimen. And if so, it is hardly to be expected that CERTES' *guernei* would be congeneric with the other species having been described in or transferred to the genus *Criconema*. Even, young animals in this family carry spines or other appendages in such cases, too, when the adults of the same species are smoothly annulated, devoid of any cuticular ornamentation. That case is to be found in the nominal genera *Nothocriconema* DE GRISSE & LOOF, 1965, *Lobocriconema* DE GRISSE & LOOF, 1965 and *Hemicriconemoides* CHITWOOD & BIRCHFIELD, 1957. Owing to the alternating rows of spines, *Hemicriconemoides* has hardly to be taken into considerations but *Nothocriconema* (and *Lobocriconema)* has. There have been described species there, the number of annules on which is near to 100 or more, e. g. *Nothocriconema mutabile* (TAYLOR, 1936) or *N. sphagni* (MICOLETZKY, 1925). At the same time young animals of this genus are ornamented by spine-like scales similar to the ominous species of CERTES.

Let us proceed further. Presuming that the specimen examined by CERTES was yet an adult, it may, because of the number of cuticle annules, scarcely be regarded as congeneric with the other species enlisted up to now in the genus *Criconema*. In these *Criconema* species the number of annules is always less — 51 to 88 — and never reaches one hundred. In the majority of the cases 60—70 annules occur. And what is more, this number is in every case smaller than 100 also in related genera *(Crossonema, Seriespinula, Neolobocriconema, Paracephalanema, Blandicephalanema)*. Summing up all these, the followings can be concluded: *1. C. guernei* was described on the basis of a young animal; *2.* it represents a genus holding spines on cuticle in immature stages only; *3.* it is not congeneric with the other "*Criconema*" species.

It follows that not only the species *guernei* is uncertain but also the genus *Criconema* erected on it. According to our present knowledge this genus can be

identified with none of genera of the subfamily Criconematinae or of the family Criconematidae. Only a single fact seems to be certain, namely that it belongs to the family mentioned above and nothing else. That is all the more reason not to handle *Criconema* longer for "taboo" but to regard it as a "genus dubium". In consequence of the uncertain taxonomic position of *C. guernei*, the type species, all the other species desginated hitherto with the name "*Criconema*" must be provided with other generic name(s).

In the revision of the genus *Criconema* and related genera MEHTA and RASKI (1971) similarly refused to believe *guernei* to be congeneric with other "*Criconema*" species and distinguished therefore two subgenera within *Criconema: Criconema (Criconema* HOFMÄNNER & MENZEL, 1914) and *Criconema (Variasquamata* MEHTA & RASKI, 1971); the former exclusively for *guernei*, the latter for every other *Criconema* species. Thus we have a new generic (subgeneric) name, *Variasquamata*, which could be available – having been *Criconema* rejected and declared as "dubium", respectively – for species named formerly as "*Criconema*", except *guernei*. Nevertheless, many years ago both COBB (1913) and SOUTHERN (1914) erected each a genus for species belonging to this ominous group. COBB proposed his genus *Iota* for the species *I. squamosum*. Unfortunately COBB's animal was likewise a juvenile as CERTES' *guernei* and belonged probably not to *Criconema* in our sense but to *Hemicriconemoides*. Furthermore, the name *Iota* was a homonym, having been already used by SAUSSURE (1855) for a genus of wasps (Vespidae).

However, an other generic name has been published: *Ogma* SOUTHERN, 1914, which must be regarded now as valid. SOUTHERN proposed it for the nematode *O. murrayi*. The name was hitherto out of use since TAYLOR (1936) and most subsequent authors have rejected it thinking its type to be congeneric with *Criconema guernei*. (*Criconema* was described in the same year as *Ogma* but a few months before.) We know, however, that the nominal genus *Criconema* does contain only its uncertain type species, the *guernei*. Other species may not be ranged into it, the genus of SOUTHERN, however, can and must be used for them. *Variasquamata*, being its type – *Criconema (Variasquamata) decalineatum* CHITWOOD, 1957 – congeneric with *Ogma murrayi* SOUTHERN, 1914, must be regarded now as junior synonym of *Ogma*.

Describing *Ogma murrayi*, SOUTHERN proposed simultaneously a new family for it, the Ogmidae. Although this name takes priority of Criconematidae TAYLOR, 1936, I propose in accordance with the Rules of Nomenclature to keep and use TAYLOR's family name also in the future.

Family **Criconematidae** TAYLOR, 1936

Female body small and stout, cigar- or sausage-shaped, straight to curved slightly ventrally, anteriorly blunt, tapering sometimes posteriorly. Cuticle broadly and heavily annulated, annules often retrorse, smooth to finely crenate, or ornamented by scales, spines or other appendages often arranged in longitudinal rows. Annules 24 to 430 in number. Head consisting of one or two annules. Lips minucious, fused into a labial disc, connected with 6 more or less developed elevations, the pseudolips. Spear very long and strong, 45–142 μ. Basal knobs large, metenchium several times as long as telenchium. Median bulb unusually

large, isthmus very short, hardly separated from terminal bulb. Rectum and anus inconspicuous. Ovary prevulvar, mostly straight, without postvulvar sac. Receptaculum seminis present. Vulva far back, well behind 3/4 of total body length.

Male much more slender than female and reduced in organization. Cuticle finely annulated, never possessing appendages. Spear lacking, digestive tract non-functioning. Spicules long and slender. Bursa strongly reduced or absent. Males very rare.

Cuticle of juveniles coarsely annulated, with or without scales or spines; if these are present, they are arranged in longitudinal rows generally more numerous than those of mature females.

Soil inhabiting animals, on or near plant roots, preferring sandy biotopes. Some of the species aquatic or semi-aquatic.

Type genus: *Criconema* TAYLOR, 1936.

The taxonomy of the family Criconematidae has been searched by several authors, but we are especially indebted to DE GRISSE and LOOF. They were, and beside them TAYLOR, too, who have done fundamental works regarding the modern systematization of this very interesting group of Nematoda. In the present article I did not set an aim to give a history of the family or to discuss its system in detail, but I should like only to expound some concepts referring to the subject, and afterwards, I wish to give a somewhat more exhaustive view of the subfamily Criconematinae.

As it was mentioned, DE GRISSE and LOOF gave a good survey about the genera and species of the family Criconematidae. Grouping the species and genera in this family may be arranged from different points of view, keeping however the presumable ways of evolution to the fore, so four evolutionary trends can be distinguished within the Criconematidae. The most ancient way is probably represented by the genera *Hemicycliphora* and *Caloosia*. Tail of both sexes is here generally long (a primitive feature); annules of cuticle not so prominent as in the other groups and smooth both in larval stages and in adults; bursa still present, relatively well developed. As peculiarities the double cuticle on mature females and the strongly curved spicules may be mentioned.

The second trend is represented by genera having coarsely annulated cuticle being however smooth both on larvae and females, or, at most, finely crenate but without scales or spines. Other characteristics: tail already short, bursa reduced, spicules almost straight, cuticle not surrounded by a sheath. *Criconemella*, *Xenocriconemella*, *Criconemoides*, *Macroposthonia*, *Nothocriconemoides* and *Discocriconemella* belong to this group.

The third natural group resembles in several respects to the second one but cuticle is ornamented at least in larval stages but mostly in adults, too, by scale- or spine-like outgrowths arranged on larvae in every case, on females frequently in longitudinal rows. This evolutionary trend is incarnated by *Nothocriconema*, *Neolobocriconema*, *Blandicephalanema*, *Ogma*, *Seriespinula*, *Pateracephalanema*, *Crossonema* and *Croserinema*. Since the very fine, transparent appendages of cuticle and the fact that these outgrowths are not definitely arranged in longitudinal rows on larvae, *Bakernema* differs from the above mentioned genera. It may be supposed, however, that *Bakernema* evolved along the same phylogenetical tendency.

Finally, the fourth line is represented by a single genus, *Hemiriconemoides*. In certain characteristics it seems to show affinities to the first, in other respects to the second or third group. Concerning the shape of the head, the annulation of cuticle and the presence of a cuticular sheath it resembles the *Hemicycliophora*-line, but the spear knobs are already of the type of the other two groups. Larvae have spines not arranged in continuous rows as in the *Ogma* group but being alternate. This latter phenomenon is unique within the whole family. Considering the presumed phylogenetical trends as taxonomic categories, the family Criconematidae can be divided into the following four subfamilies*:

a) Subfamily **Hemicycliophorinae** SKARBILOVICH, 1959. – Criconematidae. Body almost in every case surrounded by a more or less loose external sheath. Annules 140–430, relatively fine, smooth, not retrorse. Lateral field maybe present. Head generally not separate, lips simple, no submedian lobes. Spear very long and slender, knobs rounded, sloping backward. Tail similar in both sexes, usually elongate conoid to filiform, rarely short and rounded. Although males are rudimentary in inner organisation, they resemble more their females than in other subfamilies. Bursa relatively well developed, spicules mostly curved ventrally, semicircular. Cuticle of larvae smooth, without appendages.

Three genera:

Caloosia SIDDIQI & GOODEY, 1963

Colbranium n. gen.

Hemicycliophora DE MAN, 1921
Syn. *Procriconema* MICOLETZKY, 1925

The genus *Colbranium* n. gen. is proposed for *Hemicycliophora truncata* described by COLBRAN (1965) from Australia. By means of the unusually loose cuticle on posterior body region, and, mainly, of the peculiar head separated sharply by a deep incisure from body, this species differs from every other member of *Hemicycliophora*. Type species of the new genus: *Hemicycliophora truncata* COLBRAN, 1965 = *Colbranium truncatum* (COLBRAN, 1965) n. comb.

Key to the genera of Hemicycliophorinae

1 Head narrow with simple annules, not set off, not or only slightly differing from following body annules; cuticular sheath present; spicules semicircularly curved 2
Hemicycliophora DE MAN

– Head broad, set off, conspicuously differing from following body annules; cuticular sheath maybe absent; spicules straight. 2

2 Two cephalic annules set off with hook-like posteriad bent outlines; anterior vulval lip covering flap-like the posterior lip; tail filiform; cuticular sheath maybe absent. .....
Caloosia SIDDIQI & GOODEY

– Only one cephalic annule set off with simple curved outline; anterior vulval lip not forming a flap; tail very short, rounded; cuticular sheath present, unusually loose. . . . **Colbranium** n. gen.

* I cannot agree with *Khan, Chawla* and *Saha* (1976) in separating the two subfamilies Macroposthoniinae and Criconematinae at family level. Both groups are quite closely related each to the other and have also representatives that serve as connecting links between them. Moreover the family name "Madinematidae" proposed by the Indian authors for the first mentioned group is not correct nomenclaturally; instead it the subfamily name Macroposthoniinae *Skarbilovich*, 1959 should be raised to family rank as "Macroposthoniidae".

b) Subfamily **Macroposthoniinae** SKARBILOVICH, 1959. – Criconematidae. Cuticle coarsely annulated, annules 42–200, retrorse, smooth or finely crenate. No cuticular sheath and lateral field on female. Head usually set off, oral disc surrounded by pseudolips often forming four submedian lobes. Spear knobs directed forward. Tail short, conoid or rounded, on male more slender than on female. Bursa strongly reduced or completely absent. Spicules curved slightly ventrally. Males strongly differing in appearance from females. Larval cuticle smooth, at most waved or slightly fringed, without scales or spines arranged in longitudinal rows.

Six genera:

Criconemella DE GRISSE & LOOF, 1965

Criconemoides TAYLOR, 1936

Discocriconemella DE GRISSE & LOOF, 1965
Syn. *Neocriconema* DIAB & JENKINS, 1965

Macroposthonia DE MAN, 1880
Syn. *Mesocriconema* ANDRÁSSY, 1965
Madinema KHAN, CHAWLA & SAHA, 1976 (n. syn.)*

Nothocriconemoides MAAS, LOOF & DE GRISSE, 1971

Xenocriconemella DE GRISSE & LOOF, 1965

Key to the genera of Macroposthoniinae

1 Head annule disc- or saucer-shaped, pseudolips fused; body annules often showing anastomoses. ..... **Discocriconemella** DE GRISSE & LOOF
– Head annule(s) normal, not disc- or saucer-shaped, pseudolips not fused; body annules only exceptionally showing anastomoses. 2

2 Spear very long and flexible, about 40% of total body length; body very small, 0.2–0.3 mm. ..... **Xenocriconemella** DE GRISSE & LOOF
– Spear compared to body length shorter, well under 40% of total body length, mostyl inflexible. 3

3 Body small, about 0.3 mm, densely annulated; number of annules 100–200; no submedian lobes. ..... **Criconemella** DE GRISSE & LOOF
– Body moderate ot large, coarsely annulated; number of annules 40–150; submedian lobes present. 4

4 Vulva open. ..... **Macroposthonia** DE MAN
– Vulva closed. 5

5 Head consisting of three annules: the first very thin and narrow, the second broad and the third narrow again, colar-like; vulva with overhanging anterior lip. ..... **Nothocriconemoides** MAAS, LOOF & DE GRISSE
– Head consisting of a single annule; anterior vulval lip not overhanging. . . **Criconemoides** TAYLOR

c) Subfamily **Criconematinae** TAYLOR, 1936. – Criconematidae. Cuticle broadly and coarsely annulated, without an external sheath. Annules 24–134, retrorse, ornamented – at least in juvenile stages – by scales, spines or finger-

* The characteristics of the type species, *Madinema maglia* Khan, Chawla & Saha correspond well to the criteria of the genus *Macroposthonia*.

like appendages arranged either in longitudinal rows or in continuous transversal fringes. No lateral field on female. Head usually set off, pseudolips present, frequently forming lobes. Spear knobs directed forward. Tail short, conical or rounded, on male slimmer than on female. Bursa reduced, spicules curved slightly ventrally. Males strongly differing in habit from females. Larvae bearing scales or spines on cuticle arranged in longitudinal rows and differing from those of matures in kind and/or in number of rows.

Nine genera*:

Bakernema Wu, 1964

Blandicephalanema Mehta & Raski, 1971

Croserinema Khan, Chawla & Saha, 1976

Crossonema Mehta & Raski, 1971**

Neolobocriconema Mehta & Raski, 1971

Nothocriconema De Grisse & Loof, 1965
Syn. *Lobocriconema* De Grisse & Loof, 1965

Ogma Southern, 1914
Syn. *Criconema* (*Variasquamata* Mehta & Raski, 1971)
Variasquamata (Mehta & Raski, 1971) Khan, Chawla & Saha, 1976

Pateracephalanema Mehta & Raski, 1971

Seriespinula (Mehta & Raski, 1971) Khan, Chawla & Saha, 1976
Syn. *Crossonema* (*Seriespinula* Mehta & Raski, 1971)

Genus dubium:

Criconema Hofmänner & Menzel, 1914

Key to the genera of Criconematinae

1 Annules on mature females smooth, without any appendages, at most their posterior margin finely crenate. ..... **Nothocriconema** De Grisse & Loof
– Annules on both juveniles and mature females with scale-, spine, finger- or fringe-like appendages. 2

2 Annules on anterior body region striated with crenate margin, on posterior end ornamented by lobes or other appendages; outgrowths arranged in longitudinal rows may also be present; annules 36 – 52, very broad. ..... **Neolobocriconema** Mehta & Raski
– Annules not striated or crenate, bearing appendages of the same type over entire length of body 3

3 Appendages of cuticle arranged in longitudinal rows. 4
– Appendages of cuticle not arranged in longitudinal rows. 8

4 Appendages mostly in alternating rows, palmate with finger-shaped lobes. ..... **Croserinema** Khan, Chawla & Saha
– Appendages in continuous rows, not alternating, not palmate 5

* The recently described new genus *Merocriconema* Raski & Pinochet, 1976 is closely related to *Neolobocriconema* and most likely identical with it.

** Khan, Chawla and Saha (1976) unnecessarily raised *Crossonema* (*Crossonema*) Mehta & Raski, 1971 to generic rank and proposed superfluously a number of new combinations, since this taxon has been erected already Mehta and Raski on a genus level.

5 Head with submedian lobes ..... **Ogma** SOUTHERN
– Head without submedian lobes. 6

6 Head, compared to body, unusually small, convex with backward bent outline, consisting of one annule. ..... **Blandicephalanema** MEHTA & RASKI
– Head normally large with forward or laterally directed outline, consisting of one, or, mostly of two annules. 7

7 Two head annules; vulval lips closed. ..... **Seriespinula** (MEHTA & RASKI)
– One head annule (only exceptionally two); vulval lips open. .....
Pateracephalanema MEHTA & RASKI

8 Outgrowths of cuticle transparent, membraneous, hardly discernible; head not separate, bearing similar appendages as the other body annules. ..... **Bakernema** WU

– Outgrowths of cuticle definite, well discernible; head separate, smooth or fringed. .....
Crossonema MEHTA & RASKI

d) Subfamily **Hemicriconemoidinae** n. subfam. – Criconematidae. Female body surrounded by double cuticle; annules 50 – 158, not retrorse, fairly flat in outline, without any appendages. No lateral field on female. Head usually not separate, pseudolips hardly developed, not forming median lobes. Spear knobs directed forward. Tail conoid to rounded, short, on male more slender. Cuticle of male simple. Bursa reduced or absent, spicules moderately curved ventrally. Larval cuticle ornamented by scales generally arranged in alternating rows.

One genus:

Hemicriconemoides CHITWOOD & BIRCHFIELD, 1957
Syn. *Iota* COBB, 1913, nec SAUSSURE, 1855

The genera of the subfamily Criconematinae Taylor, 1936

As mentioned above, the genera of the subfamily Criconematinae are especially characterized by the larval cuticle which bear scale- or spine-shaped appendages arranged in longitudinal rows in such cases, too, when the cuticle of mature specimens is devoid of any ornamentation. And it is worth mentioning that, within the same species, the cuticular appendages are very often different in shape and/or in number of rows both on larvae and on adults. Young animals can differ from mature ones in the number of annules, too, being generally greater on the former.

Nothocriconema DE GRISSE & LOOF, 1965

Syn. *Lobocriconema* DE GRISSE & LOOF, 1965.

Criconematinae. Body small to rather large (0.24 – 0.74) mm). Annules 24 – 134, smooth, only exceptionally finely crenate, on the posterior body end very rarely lobed or fringed; outline of annules rounded. Head consisting of one or two annules, the first annule often hat-like and wider than the second annule. Submedian lobes hardly developed or absent. Spear 40 – 132 μ. Vulva on the 4th to 21st annule from terminus, slit-like or completely closed by the overhanging anterior lip. Tail mostly conoid and pointed, sometimes bluntly rounded.

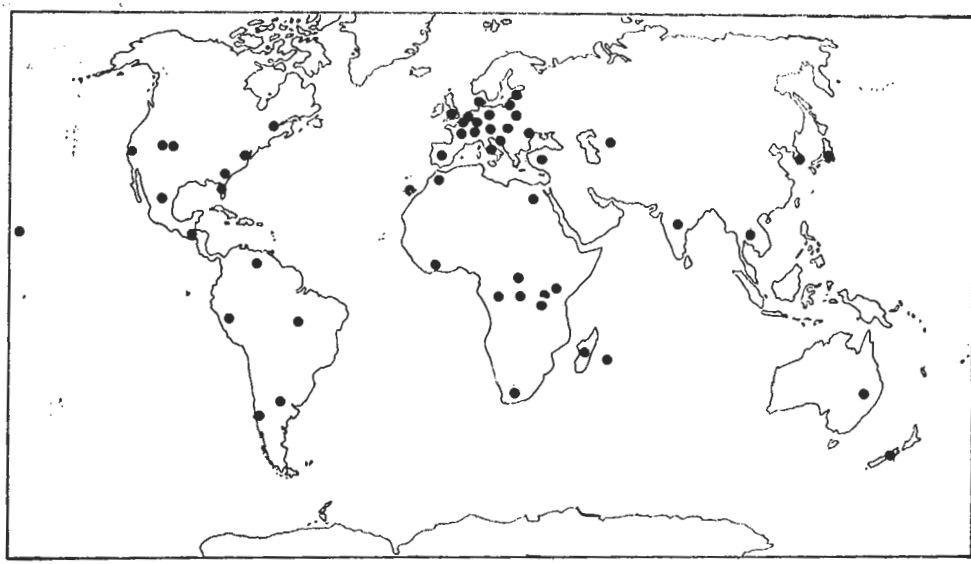

Fig. 1. Distribution of the genus *Nothocriconema* De Grisse & Loof, 1965

Males rare, known in 11 species. Lateral lines 2 – 4. Bursa quite small, strongly reduced.

Up to now the larval forms have been described in 21 species. Cuticle always ornamented by scale-like, mostly pointed appendages arranged in 8 – 24 longitudinal rows.

Mode of life: Most of the species live in the soil though some prefer marshy or swampy biotopes.

Distribution: Except the Antarctic *Nothocriconema* species occur in every continent (Fig. 1). According to our present-day knowledge their distribution shows the following picture: in Europe 10 species *(annulifer, crotaloides, demani, duplicivestitum, longulum, loofi, mutabile, princeps, psammophilum, sphagni)*, in Asia 9 species *(brevicaudatum, cardamomi, demani, jaejuense, kovacsi, mukovum, mutabile, orientale, rarum)*, in Africa 9 species *(corbetti, crassianulatum, dubium, lamellatum, mutabile, pauperum, sabiense, solitarium, victoriae)*, in the Americas 14 species (10 species in North America: *acriculum, crotaloides, demani, kovacsi, lamellatum, longulum, mutabile, permistum, petasum, sphagni;* 6 species in South America: *arcanum, calvum, duplicivestitum, kovacsi, mutabile, pacificum)*, in Australia 4 species *(macilentum, mutabile, pasticum, spinicaudatum)*. The widest distributed species is *N. mutabile*, it has been reported from 22 countries and islands: Holland, England, Italy, Yugoslavia, Spain, Moldavia, Turkey; India; Kenya, Egypt, Marocco, South Africa, Canary Islands, Réunion, Madagascar; United States, Hawaii, Mexico, El Salvador, Venezuela, Peru; Australia. It is followed by *N. annuliferum* from 10 countries: Holland, Belgium, Denmark, Germany, Switzerland, Hungary, France, Yugoslavia, Poland, Estonia and *N. demani* from 11 countries: Holland, Belgium, Denmark, Estonia, Lithuania; Uzbekistan, Korea; United States, Canada, Mexico; Australia. There are six species

that have been observed in three or more countries: *crassianulatum, crotaloides, kovacsi, longulum, princeps, sphagni:* the other *Nothocriconema* species have been found so far from one or two countries only.

Type species: *Hoplolaimus annulifer* DE MAN, 1921 = *Nothocriconema annuliferum* (DE MAN, 1921) DE GRISSE & LOOF, 1965. — 35 species:

N. acriculum RASKI & PINOCHET, 1976

N. annuliferum (DE MAN, 1921) DE GRISSE & LOOF, 1965
Syn. *Hoplolaimus annuliferus* DE MAN, 1921
Criconema annuliferum (DE MAN, 1921) MICOLETZKY, 1925
Criconemoides annulifer (DE MAN, 1921) TAYLOR, 1936
Criconema annuliferum hygrophilum ANDRÁSSY, 1952
Criconemoides hygrophilus (ANDRÁSSY, 1952) OOSTENBRINK, 1960
Nothocriconema hygrophilum (ANDRÁSSY, 1952) DE GRISSE & LOOF, 1965
Criconema stygium SCHNEIDER, 1940 (n. syn.)
Criconemoides stygius (SCHNEIDER, 1940) ANDRÁSSY, 1959
Nothocriconema stygium (SCHNEIDER, 1940) DE GRISSE & LOOF, 1965
Macroposthonia annulata apud KISCHKE, 1956

N. arcanum (RASKI & GOLDEN, 1966) DE GRISSE, 1967
Syn. *Criconemoides arcanus* RASKI & GOLDEN, 1966

N. brevicaudatum (SIDDIQI, 1961) n. comb.
Syn. *Criconema brevicaudatum* SIDDIQI, 1961
Mesocriconema brevicaudatum (SIDDIQI, 1961) ANDRÁSSY, 1965
Criconemoides brevicaudatus (SIDDIQI, 1961) RASKI & GOLDEN, 1966
Lobocriconema brevicaudatum (SIDDIQI, 1961) DE GRISSE, 1967

N. calvum (RASKI & GOLDEN, 1966) DE GRISSE, 1967
Syn. *Criconemoides calvus* RASKI & GOLDEN, 1966

N. cardamomi KHAN & NANJAPPA, 1973

N. corbetti DE GRISSE, 1967
Syn. *Criconemoides corbetti* (DE GRISSE, 1967) LUC, 1970
Lobocriconema patelliferum HEYNS, 1970 (n. syn.)

N. crassianulatum (DE GUIRAN, 1963) n. comb.
Syn. *Criconemoides crassianulatus* DE GUIRAN, 1963
Lobocriconema crassianulatum (DE GUIRAN, 1963) DE GRISSE & LOOF, 1965
Criconemoides deconincki DE GRISSE, 1963

N. crotaloides (COBB, 1924) DE GRISSE & LOOF, 1965
Syn. *Iota crotaloides* COBB, 1924
Criconemoides crotaloides (COBB, 1924) TAYLOR, 1936
Criconema crotaloides (COBB, 1924) SCH. STEKHOVEN & TEUNISSEN, 1938

N. demani (MICOLETZKY, 1925) DE GRISSE & LOOF, 1965
Syn. *Criconema demani* MICOLETZKY, 1925
Criconemoides demani (MICOLETZKY, 1925) TAYLOR, 1936
Criconemoides ravidus RASKI & GOLDEN, 1966

N. dubium De Grisse, 1967
Syn. *Criconemoides dubius* (De Grisse, 1967) Luc, 1970

N. duplicivestitum (Andrássy, 1963) De Grisse & Loof, 1965
Syn. *Criconemoides duplicivestitus* Andrássy, 1963

N. jaejuense Choi & Geraert, 1975

N. kovacsi (Andrássy, 1963) De Grisse & Loof, 1965
Syn. *Criconemoides kovacsi* Andrássy, 1963
Criconemoides siddiqii Khan, 1964 (n. syn.)
Criconemoides californicus Diab & Jenkins, 1966 (n. syn.)

N. lamellatum (Raski & Golden, 1966) De Grisse, 1967
Syn. *Criconemoides lamellatus* Raski & Golden, 1966

N. longulum (Gunhold, 1953) De Grisse & Loof, 1965
Syn. *Criconema longulum* Gunhold, 1953
Criconemoides longulus (Gunhold, 1953) Oostenbrink, 1960
Criconema elegantulum Gunhold, 1953
Criconemoides elegantulus (Gunhold, 1953) Oostenbrink, 1960
Criconemoides quasidemani Wu, 1965
Nothocriconema quasidemani (Wu, 1965) De Grisse & Loof, 1965

N. loofi De Grisse, 1967
Syn. *Criconemoides loofi* (De Grisse, 1967) Luc, 1970

N. macilentum Raski & Pinochet, 1976

N. mukovum Khan, Chawla & Saha, 1976

N. mutabile (Taylor, 1936) De Grisse & Loof, 1965
Syn. *Criconemoides mutabilis* Taylor, 1936
Criconemoides raskii Goodey, 1963
Criconemoides magnoliae Edward & Misra, 1964

N. orientale n. sp.

N. pacificum (Andrássy, 1965) Andrássy, 1967
Syn. *Criconemoides pacificus* Andrássy, 1965

N. paraguayense Andrássy, 1968
Syn. *Criconemoides paraguayensis* (Andrássy, 1968) Luc, 1970

N. pasticum Raski & Pinochet, 1976

N. pauperum (De Grisse, 1967) n. comb.
Syn. *Lobocriconema pauperum* De Grisse, 1967
Criconemoides pauper (De Grisse, 1967) Luc, 1970

N. permistum (Raski & Golden, 1966) De Grisse, 1967
Syn. *Criconemoides permistus* Raski & Golden, 1966

N. petasum (Wu, 1965) De Grisse & Loof, 1965
Syn. *Criconemoides petasus* Wu, 1965

N. princeps (Andrássy, 1962) De Grisse & Loof, 1965
Syn. *Criconemoides princeps* Andrássy, 1962
Criconemoides tribulis Raski & Golden, 1966

N. psammophilum Krnjaic & Loof, 1973

N. rarum (Boonduang & Ratanaprapa, 1974) n. comb.
Syn. *Lobocriconema rarum* Boonduang & Ratanaprapa, 1974

N. sabiense (Heyns, 1970) n. comb.
Syn. *Lobocriconema sabiense* Heyns, 1970

N. solitarium De Grisse, 1967
Syn. *Criconemoides solitarius* (De Grisse, 1967) Luc, 1970

N. sphagni (Micoletzky, 1925) De Grisse & Loof, 1965
Syn. *Criconema sphagni* Micoletzky, 1925
Criconemoides sphagni (Micoletzky, 1925) Taylor, 1936
Criconemoides grassator Adams & Lapp, 1967

N. spinicaudatum Raski & Pinochet, 1976

N. victoriae Heyns, 1970

Note: Because of its head shape *Nothocriconema coorgi* Khan & Nanjappa, 1973 does probably not belong to this genus. Recently Ivanova has described two further species: *Nothocriconema alticola* Ivanova, 1976 and *N. vallicola* Ivanova, 1976; on basis of the structure of head, vulva and larval cuticle they seem, however, to belong to the genus *Criconemoides*.

Nothocriconema can be distinguished from all genera of the subfamily Criconematinae by having no appendages on the cuticle in mature stage. At most, the annules are finely striated with crenate margin or, very rarely, lobed or fringed on the posterior body end. On the other hand, *Nothocriconema* differs from the other smooth-annuled genera (Macroposthoniinae) in having cuticular outgrowths on larvae arranged in longitudinal rows.

In a book on the systematization of nematodes (1976) I mentioned the genus *Lobocriconema* De Grisse & Loof, 1965 as a junior synonym of *Nothocriconema;* today I am of the same opinion. De Grisse and Loof have established *Lobocriconema* for such *Nothocriconema*-like species which have small submedian lobes on the oral field and relatively few annules. Meanwhile, a part of the species enlisted here has been transferred to the genus *Nothocriconema* but the remaining species also cannot be separated in my opinion from the representatives of *Nothocriconema*. The submedian lobes mentioned above are namely extremely small, hardly perceptible from even frontal view, too. Similar small lobes can be observed also on some *Nothocriconema* species. Some species have described which serve as connecting link between both nominal genera, e. g. *Nothocriconema lamellatum* (Raski & Golden, 1966) and *Lobocriconema patelliferum* Heyels, 1970. The former has few annules but no submedian lobes, whereas the latter many annules and small submedian lobes, too. Moreover there exist two species — one have been described in the genus *Nothocriconema*, the other in *Lobocriconema* — which cannot be separated from each other: *N. corbetti* De Grisse, 1967 and *L. patelliferum* Heyns, 1970; they must be regarded as synonyms. On the basis of all these I do not think it justified to separate *Lobocriconema* from *Nothocriconema*.

1 Annules 85–134. 2
– Annules 24–84. 11

2 Spear 110–130 μ long. 3
– Spear shorter than 100 μ 4

3 Number of annules 104–134; vulva on the 18th–21st annule from posterior end. – L = 0.44–0.57 mm; V = 82–88%; R = 104–134; RV = 18–21; spear = 122–132 μ ..... **macilentum** RASKI & PINOCHET
– Number of annules 87–103; vulva on the 13rd–17th annule from posterior end. – L = 0.30–0.56 mm; V = 84–89%; R = 87–103; RV = 13–17; spear = 110–130 μ. ..... **sphagni** (MICOLETZKY)

4 Tail elongate-conoid, terminus with string-like arranged small annules; spear under 60 μ L = 0.36–0.41 mm; V = 86–89%; R = 83–92; RV = 13–16; spear = 50–58 μ. ..... **acriculum** RASKI & PINOCHET
– Tail not so elongate, last annules not string-like; spear 60 μ or more (only exceptionally shorter). 5

5 Head with two annules, the second annule directed forward or aside. 6
– Head with one annule, the second annule directed backward. 8

6 Spear short, smaller than 50 μ; vulva on the 7th–8th annule. – L = 0.34–0.45 mm; V = 90–93%; R = 105–111; RV = 7–8; spear = 40–48 μ. **mukovum** KHAN, CHAWLA & SAHA
– Spear longer than 60 μ; vulva on the 10th–15th annule. 7

7 Vulva closed, with overhanging anterior lip; spear between 80 and 100 μ. – L = 0.47–0.59 mm; V = 87–91%; R = 85–97; RV = 10–14; spear = 81–101 μ. ..... **psammophilum** KRNJAIC & LOOF
– Vulva open, anterior lip not overhanging; spear shorter than 75 μ. – L = 0.37–0.49 mm; V = 87–89%; R = 90–95; RV = 13–15; spear = 62–74 μ. . . **arcanum** (RASKI & GOLDEN)

8 Spear 73–82 μ long. – L = 0.27–0.39 mm; V = 87–90%; R = 94–111; RV = 12–17; spear = 73–82 μ. ..... **pasticum** RASKI & PINOCHET
– Spear 48–70 μ long 9

9 Postvulval portion of body twice as long as body diameter at vulva; annules 93. – L = 0.47 mm; V = 88%; R = 93; RV = 14; spear = 62 μ. ..... **pacificum** (ANDRÁSSY)
– Postvulval portion of body at most one and a half times as long as body diameter at vulva; annules more. 10

10 Vulva on the 8th–12th annule; scales on larval cuticle arranged in 15–17 longitudinal rows. – L = 0.25–0.58 mm; V = 89–95%; R = 95–123; RV = 8–12; spear = 48–70 μ. ..... **mutabile** (TAYLOR)
– Vulva on the 12th–15th annule; scales on larval cuticle arranged in 24 longitudinal rows. – L = 0.30–0.51 mm; V = 86–93%; R = 97–118; RV = 12–15; spear = 59–70 μ. ..... **kovaesi** (ANDRÁSSY)

11 Head annule hat-like, conspicuously wider than the 2nd annule. 12
– Head annule not wider than the 2nd annule, often even narrower 20

12 Annules 39–42, with finely crenate margin. 13
– Annules 50–78, with smooth margin. 14

13 Outline of head annule curved backward. – L = 0.47 mm; V = 87%; R = 39; RV = 5; spear = 62 μ. ..... **sabiense** (HEYNS)*
– Outline of head annule curved forward. – L = 0.49 mm; V = 92–95%; R = 42; RV = 5; spear = 58 μ. ..... **brevicaudatum** (SIDDIQI)*

14 Spear long, between 86 and 120 μ 15
– Spear short, between 50 and 85 μ. 18

15 Postvulval body region elongate, twice as long as vulval body diameter. 16
– Postvulval body region about one and a half times as long as vulval body diameter. 17

* It might well be that *brevicaudatum* and *sabiense* are one and the same species.

16 Last 5–7 annules arranged in a string-like file, small; number of annules 60–65. – L = 0.44–0.62 mm; V = 84–89%; R = 60–65; RV = 10–12; spear = 100–120 μ. ..... **cardamomi** KHAN & NANJAPPA

– Last annules of the usual form, not string-like; number of annules 68–76. – L = 0.59–0.74 mm; V = 84–89%; R = 68–76; RV = 11–14; spear = 95–108 μ. .. **crotaloides** (COBB)

17 On both sides of body each annule is marked by an inverted V. – L = 0.29–0.57 mm; V = 80–91%; R = 50–63; RV = 9–11; spear = 86–113 μ. ..... **princeps** (ANDRÁSSY)

– No such inverted V present on annules. – L = 0.40–0.68 mm; V = 87–92%; R = 55–78; RV = 7–11; spear = 89–113 μ. ..... **annuliferum** (DE MAN)

18 Tail conoid, pointed. 19

– Tail blunt. – L = 0.41 mm; V = 90%; R = 52; RV = 6; spear = 59 μ. **solitarium** DE GRISSE

19 Spear 50–53 μ; annules more than 60; vulva on the 6th to 8th annule from the posterior end. – L = 0.31–0.40 mm; V = 88–90%; R = 61–66; RV = 6–8; spear = 50–53 μ..... **victoriae** HEYNS

– Spear 75–85 μ; annules less than 60; vulva on the 11th to 12th annule from the posterior end. – L = 0.42–0.49 mm; V = 87%; R = 53–58; RV = 11–12; spear = 75–85 μ. .... **jaejuense** CHOI & GERAERT

20 Annules either on the whole body finely striated and crenate or at most on the posterior end lobed or fringed. 21

– Annules smooth. 25

21 Annules finely striated and crenate in total length of body. 22

– Annules mostly smooth, only on the posterior body region lobed and fringed, respectively. ... 24

22 Number of annules small: 24–25. – L = 0.32–0.53 mm; V = 95–97%; R = 24–25; RV = 3; spear = 78–90 μ. ..... **pauperum** DE GRISSE

– Number of annules more than 30. 23

23 Annules 33–43; larva with 8 rows of spines. – L = 0.24–0.45 mm; V = 91–94%; R = 33–43; RV = 4–7; spear = 51–85 μ. ..... **crassianulatum** (DE GUIRAN)

– Annules 49–56; larva with 13 rows of spines. – L = 0.40–0.47 mm; V = 93–95%; R = 49–56; RV = 4–5; spear = 80–84 μ. ..... **lamellatum** (RASKI & GOLDEN)

24 Posterior body end cupola-shaped with abruptly narrowing tail; vulva on the 10th–12th annule; spear longer than 70 μ. – L = 0.36–0.50 mm; V = 89–92%; R = 76–86; RV = 10–12; spear = 70–82 μ. ..... **spinicaudatum** RASKI & PINOCHET

– Posterior body end conoid, tail not narrowing abruptly; vulva on the 6th–7th annule; spear shorther than 60 μ. – L = 0.33–0.41 mm; V = 92–94%; R = 62–74; RV = 6–7; spear = 45–58 μ. ..... **corbetti** DE GRISSE

25 Spear shorter than 60 μ. 26

– Spear longer than 60 μ. 27

26 Head consisting of two annules; tail strongly drawn out; anterior vulval lip overhanging. – L = 0.34–0.42 mm; V = 83–85%; R = 79–84; RV = 14–16; spear = 51–53 μ. ..... **orientale** n. sp.

– Head consisting of one annule only; tail not drawn out; anterior vulval lip not overhanging. – L = 0.39–0.44 mm; V = 84–87%; R = 76–79; RV = 12–14; spear = 53–58 μ..... **paraguayense** ANDRÁSSY

27 50–60 annules. 28

– 65–80 annules. 29

28 Oral field standing out from the outline of the head annule; vulva on the 8th–9th annule; larva with 8 rows of scales. – L = 0.34–0.40 mm; V = 88–90%; R = 55–60; RV = 8–9; spear = 66–72 μ. ..... **duplicivestitum** (ANDRÁSSY)

– Oral field not standing out of the outline of head annule; vulva on the 10th–12th annule; larva with 12 rows of scales. – L = 0.55–0.58 mm; V = 82%; R = 50–55; RV = 10–12 spear = 73–75 μ. ..... **petasum** (WU)

29 Posterior end of body rounded, postvulval region about as long as vulval body diameter. – L = 0.35–0.43 mm; V = 93%; R –73–74; RV = 8; spear = 81 μ. .. **dubium** DE GRISSE

– Posterior end of body conoid, terminus pointed, postvulval region 2–3 times as long as vulva body diameter. 30

30 Last 5–6 annules string-like, rounded; postvulval region two and a half to three times as long as vulval body diameter. – L = 0.30–0.57 mm; V = 81–89%; R = 67–85; RV = 13–18; spear = 62–87 μ. ..... **longulum** (Gunhold)
– Only the last 2 (–3) annules string-like, rounded; postvulval region twice as long as vulval body diameter. 31

31 Body over 0.5 mm; vulva on the 8th–13th annule. – L = 0.51–0.63 mm; V = 87–90%; R = 68–75; RV = 8–13; spear 89–99 μ. ..... **loofi** De Grisse
– Body under 0.5 mm; vulva on the 12th–16th annule. 32

32 Spear 60–75 μ long. – L = 0.38–0.50 mm; V = 84–86%; R = 65–77; RV = 12–15; spear = 60–75 μ. ..... **demani** (Micoletzky)
– Spear 77–106 μ long. 33

33 Oral field more or less plain, submedian pseudolips somewhat lobiform. – L = 0.34–0.46 mm; V = 83–85%; R = 79–81; RV = 15–16; spear = 92–106 μ. ..... **calvum** (Raski & Golden)*
– Oral field convex, submedian pseudolips not lobiform. – L = 0.27–0.40 mm; V = 84–88 %; R = 75–87; RV = 12–15; spear = 77–102 μ. ..... **permistum** (Raski & Golden)*

Nothocriconema orientale n. sp.

(Fig. 2 A–G)

23 ♀: L = 0.34–0.42 mm; a = 10.5–13.4; b = 3.8–4.3; c = 9.0–10.2; V = 83–85%.

Holotype ♀: L = 0.37 mm; a = 11.7; b = 3.8; c = 9.0; V = 85%.

Body slightly curved ventrally, consisting of 79–84 (in most of cases of 82) annules. From head to posterior end of oesophagus 20–23, to vulva 65–71 (mostly 68) annules are present. Spear 11–12 annules long. Annules smooth, sloping backward, in the middle region of body 5–6 μ thick and 31–34 μ wide.

Head consisting of two annules with forward directed margins; they are thinner than 3rd annule (4.5–6.5 μ thick together). The first annule is always somewhat narrower than second one, viz. 9–11 μ and 12–13 μ, respectively. Third annule 15–18 μ wide. Oral field flat, bearing small, weakly developed submedian lobes.

Spear strong, relatively short, 51–53 μ, 12–15 per cent of the total body length. Basal knobs 5.5–6.5 μ broad; metenchium 82–84%. Middle bulb about as long as isthmus and terminal bulb together. Excretory pore difficult to observe, on the 24th–25th annule from the anterior end.

Vulva on the 14th–16th annule from the tail terminus, closed with overhanging anterior lip. It seems very characteristic to be for the species that from lateral view the prevulval annule sits as a small papilla on the anterior vulva lip (Figs. 2 E–F). Receptaculum seminis oviform, filled with sperms. Vulval diameter 27–29 μ, postvulval body portion 2.2–2.5 times as long as this diameter. Anus on the 9th–11th annule from the terminus. Tail 37–43 μ long, conoid. Terminus with 4–5 small, rounded, string-like annules.

Male not observed.

In the material I have found two larvae. The 3rd-stage larve 0.31 mm long with 85 annules, the 4th-stage larve bearing 91 annules. Cuticle ornamented by double-pointed scales beginning on the 3rd annule and arranged in 14 longitudi-

* Probably identical species; it is very difficult to separate them.

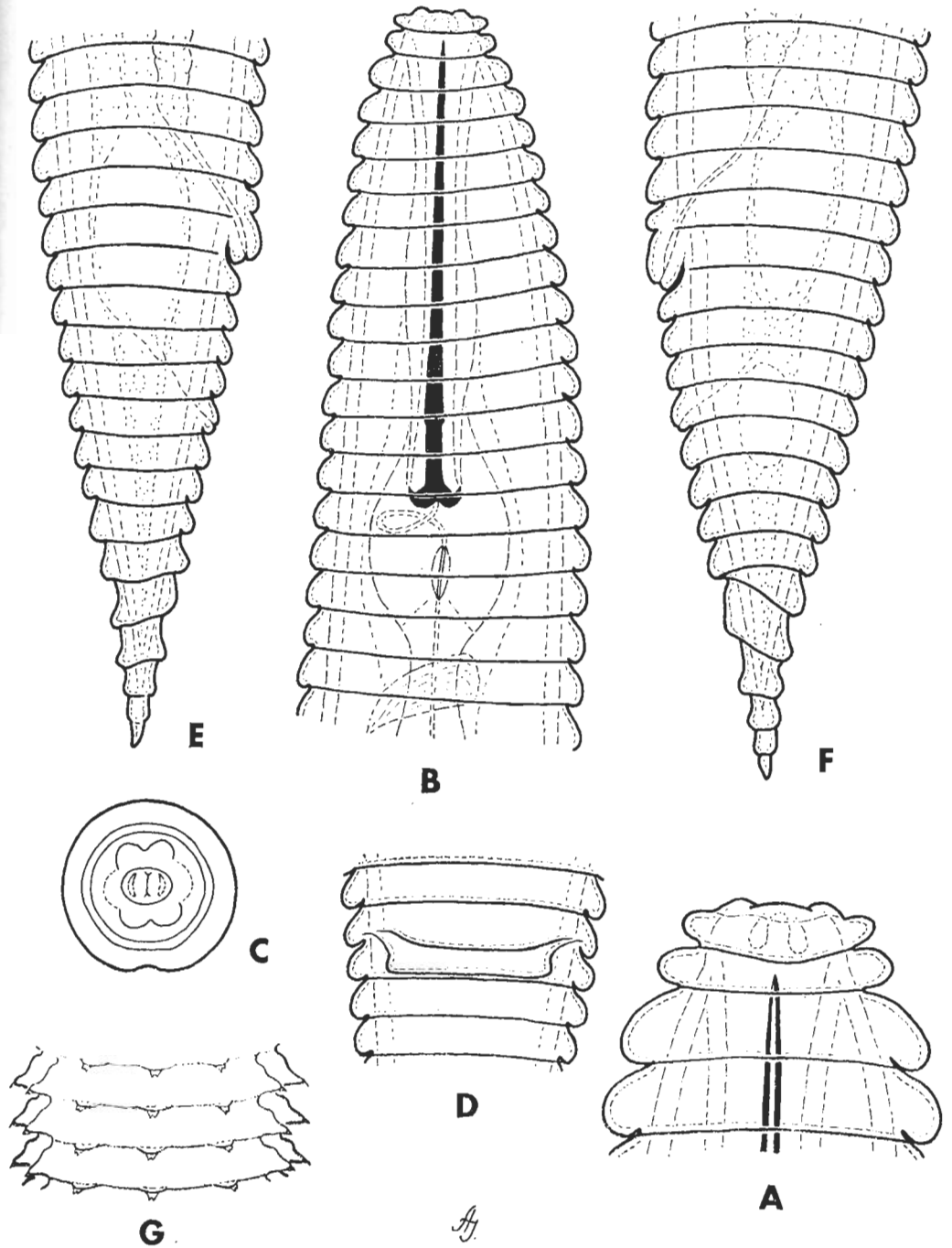

Fig. 2. *Nothocricotopus orientale* n. sp. *A:* Head (2500×); *B:* Anterior end of body (1250×); *C: En face* view (2500×); *D:* Vulva region, ventral view (1250×); *E – F:* Posterior end, females (1250×); *G:* Surface of annules on mid-body, 4th-stage larve

nal rows. Scales standing out from the contour of cuticle only on the 4th-stage larve, on the 3rd-stage they are covered by a fine cuticular sheath left over from the last moulting.

Holotype: ♀ on slide Nr. A – 8373. Holotype and paratypes (20 ♀♀ and 2 juveniles) in the collection of the author, and one paratype each in the collection of Dr. De Grisse (Rijkslandbouwhogeschool, Leerstoel voor Dierkunde, Gent, Belgium) and of Dr. P. A. A. Loof (Laboratorium voor Nematologie, Wageningen, Holland), respectively.

Type habitat and locality: Fallen leaves in an *Abies-Tsuga-Betula*-forest in 2200 m height above sea level, Mt. Yokodake, Nagamo Prefecture, Japan; collected by Prof. Dr. H. Franz (Wien), June, 1974.

In the number of cuticle annules and the relatively short spear *Nothocriconema orientale* n. sp. is most closely related to *N. paraguayense* Andrássy, 1968, but it can be separated from the South American species by the double-annuled head (one annule on *paraguayense)*, the overhanging anterior vulval lip, the strongly narrowing tail, the number of the small, string-like terminal rings (4 – 5 at *orientale* and 1 – 2 at *paraguayense*, respectively) and the somewhat shorter spear (55 – 58 μ at *paraguayense)*. On the basis of its long tail, double-ringed head and number of annules *N. orientale* resembles also *N. longulum* (Gunhold, 1953), its spear is however much shorter (62 – 87 μ at *longulum)*, the posterior portion of oesophagus longer and the larva has more numerous rows of scales (11 rows at *longulum)*. Besides, the prevulval annule, shifted papilliform on the anterior lip of vulva, is a characteristic feature by which the new species can easily be recognized.

Neolobocriconema Mehta & Raski, 1971

Criconematinae. Robust species of medium size (0.34 – 0.75 mm). Body with few annules: 36 – 52, these broad with sloping margin, and with fine striae or incisures. Annules either on the whole body finely or heavily serrated or fringed, or at most on the posterior end irregularly lobed. Besides these markings longitudinal grooves or bulges can also occur on the cuticle. Head of one annule with smooth, laterally or slightly forward directed margin. The second annule is attached to the other body annules. Oral field showing small submedian lobes. Spear 65 to 122 μ long. Vulva closed, on the 3rd-8th annule from the tail terminus, its lips conical. Posterior body region blunt or blunt-conoid.

Male is known in one species only. Lateral incisures 4. Bursa present but rudimentary.

Young animals generally with more annules than adults. Cuticular scales arranged in 8, 12 or 16 rows.

Mode of life: Soil inhabiting animals.

Distribution (Fig. 3): Most of species have been described or recorded from Asia, viz. 3 species from India *(aberrans, laterale, serratum)*, 3 from Korea *(aberrans, insulicum, serratum)* and 1 from Uzbekistan *(insulicum)*. Recently I have found a species in South America *(cataracticum)*.

Type species: *Criconema laterale* Khan & Siddiqi, 1964 = *Neolobocriconema laterale* (Khan & Siddiqi, 1964) Mehta & Raski, 1971.

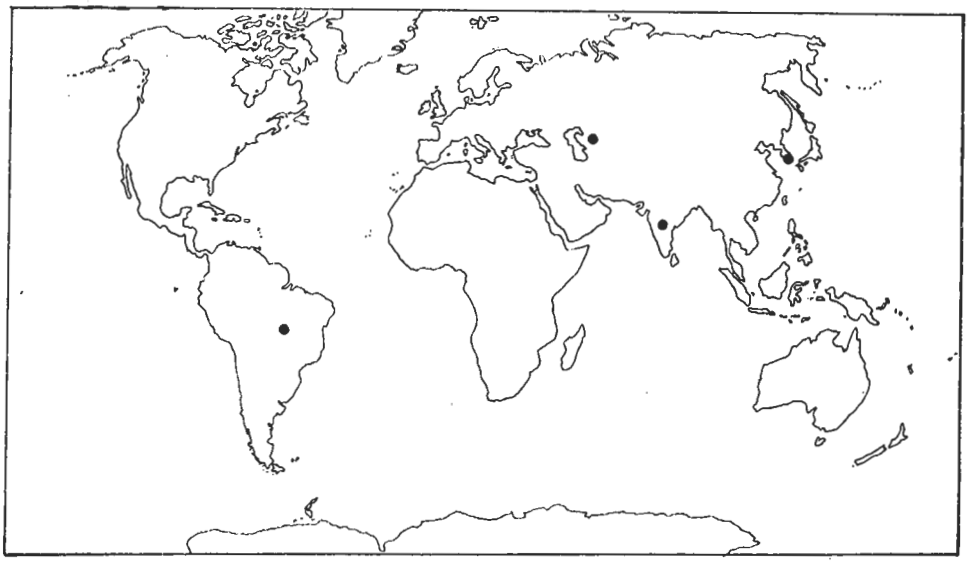

Fig. 3. Distribution of the genus *Neolobocriconema* MEHTA & RASKI, 1971

5 species:

N. aberrans (JAIRAJPURI & SIDDIQI, 1963) n. comb.
Syn. *Criconemoides aberrans* JAIRAJPURI & SIDDIQI, 1963
Lobocriconema aberrans (JAIRAJPURI & SIDDIQI, 1963 (DE GRISSE & LOOF, 1965

N. cataracticum n. sp.

N. insulicum CHOI & GERAERT, 1975

N. laterale (KHAN & SIDDIQI, 1964) MEHTA & RASKI, 1971
Syn. *Criconema laterale* KHAN & SIDDIQI, 1964
Lobocriconema laterale (KHAN & SIDDIQI, 1964) DE GRISSE & LOOF, 1965
Criconemoides lateralis (KHAN & SIDDIQI, 1964) RASKI & GOLDEN, 1966

N. serratum (KHAN & SIDDIQI, 1963) MEHTA & RASKI, 1971
Syn. *Criconema serratum* KHAN & SIDDIQI, 1963
Lobocriconema serratum (KHAN & SIDDIQI, 1963) DE GRISSE & LOOF, 1965
Criconemoides serratus (KHAN & SIDDIQI, 1963) RASKI & GOLDEN, 1966
Criconema sulcatum GOLDEN & FRIEDMAN, 1964
Lobocriconema sulcatum (GOLDEN & FRIEDMAN, 1964) DE GRISSE & LOOF, 1965
Criconemoides sulcatus (GOLDEN & FRIEDMAN, 1964) RASKI & GOLDEN, 1966

Neolobocriconema occupies a place between the genus *Nothocriconema* (annules of mature specimens still smooth, without ornamentation, or, very rarely, with a few lobes on the posterior end only) and the other genera of Criconematinae (annules of mature specimens marked by scales or spines in the whole length of body).

Key to the species of Neolobocriconema

1 Annules with bulges or lobes arranged in 12–16 longitudinal rows. 2
– Annules without definite lobes, only with small fringes not arranged in longitudinal rows. 3

2 Number of annules about 50; cuticular lobes on the posterior body region long, single-pointed; spear shorter than 80 μ. – L = 0.45–0.54 mm; V = 88–90%; R = 48–52; RV = 5–6; spear = 73–75 μ. ..... **insulicum** (CHOI & GERAERT)
– Number of annules under 40; cuticular lobes on the posterior body region short, multi-pointed; spear about 90 μ. – L = 0.50–0.60 mm; V = 90–94%; R = 36–38; RV = 4–5; spear = 90–96 μ. ..... **serratum** (KHAN & SIDDIQI)

3 Head saucer-shaped (*Discocriconemella*-like); vulva on the 3rd annule from terminus. – L = 0.34–0.44 mm; V = 94%; R = 39–42; RV = 3; spear = 94–102 μ. ..... **cataracticum** n. sp.
– Head normal, not saucer-shaped; vulva on the 4th–5th annule from terminus. 4

4 Margins of annules heavily fringed with small irregular finger-like appendages interrupted by deep lateral grooves; spear above 100 μ. – L = 0.55–0.75 mm; V = 91–94%; R = 37–41; RV = 4–5, spear = 110–122 μ. ..... **laterale** (KHAN & SIDDIQI)
– Margins of annules only slightly crenate and not interrupted by lateral grooves; spear under 80 μ. – L = 0.45–0.54 mm; V = 92–95%; R = 38–43; RV = 4–5; spear = 68–78 μ. **aberrans** (JAIRAJPURI & SIDDIQI)

Neolobocriconema cataracticum n. sp.

(Figs. 4 A–D and 5 A–C)

3 ♀: L = 0.34–0.44 mm; a = 5.5–6.8; b = 2.5–3.2; c = ?; V = 94%.

Body small and very plump with 39–42 annules. Annules 8.5–11 μ thick and 62–65 μ wide on the middle region of body. They are ornamented by fine longitudinal incisures and numerous short lobes or appendages numbering 120–150 on one annule. First 5–6 annules still without appendages, only waved, lobes beginning to separate after these annules. The lobules are as long to twice as long as wide but on the last 5–6 annules becoming enlarged, finger-shaped. Owing to the adhered soil particles each annule seems to be darker in its posterior half.

Head of unusual shape for the subfamily Criconematinae: disc-like or saucer-shaped like in the genus *Discocriconemella*, consisting of a thick annule (6–8 μ thick and 19–21 μ wide). Second annule directed backward and nearly as wide as the first annule. The last two annules on tail become irregular, tri-lobed; lobes of terminal annule bearing 3–5 finger-shaped lobules.

Spear 94–102 μ (12–13 annules) long, 23–27% of the total body length. Basal knobs 12–13 μ wide; metenchium 79–80% of the spear length. Middle bulb comparatively small, about as long as isthmus and terminal bulb together. Between head and proximal oesophagus end 15–17 body annules. Excretory pore on the 16th annule from the anterior end.

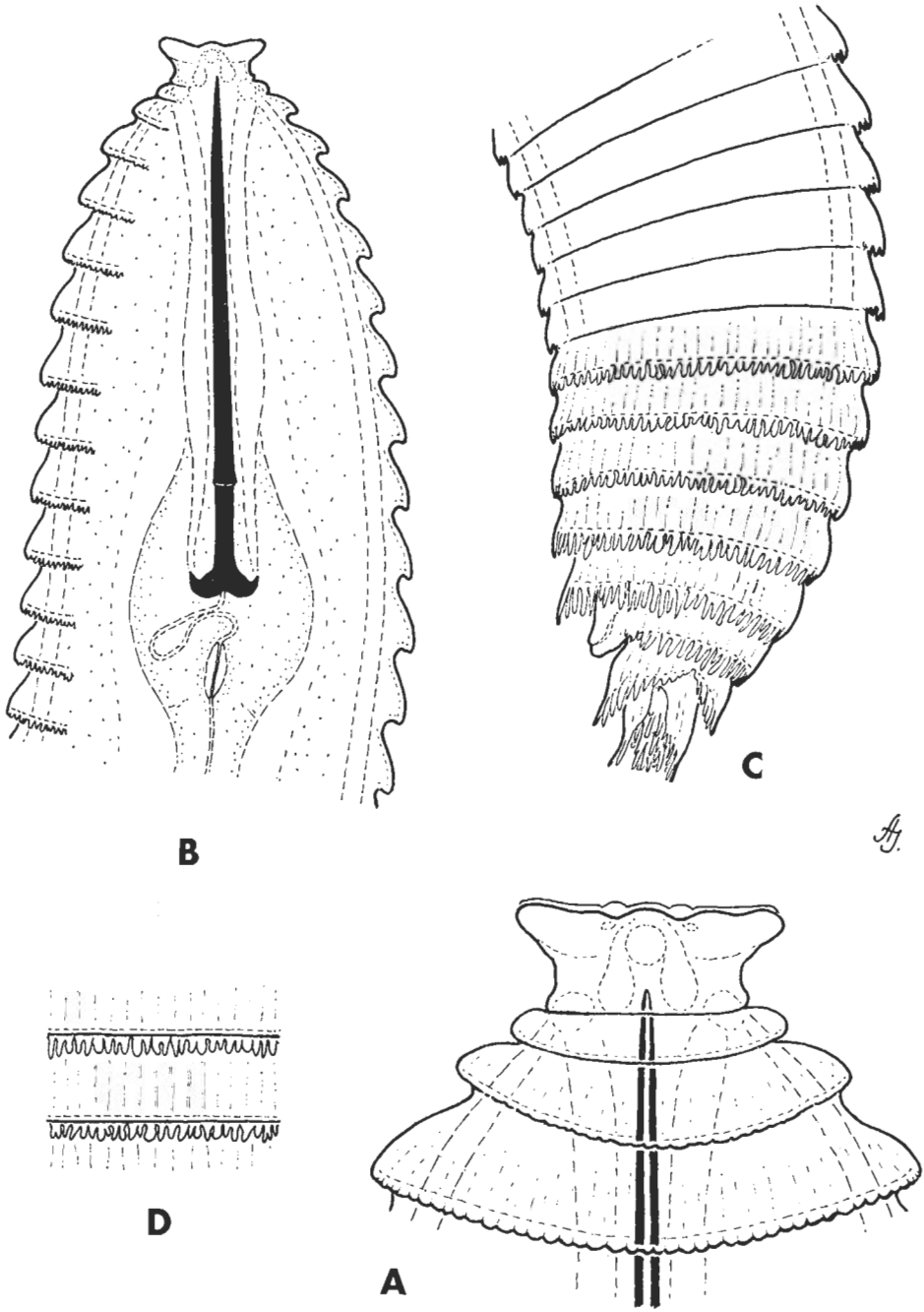

Fig. 4. *Neolobocriconema caturacticum* n. sp. *A:* Head (1650×); *B:* Anterior end of body (700×); *C:* Posterior end of body (700×); *D:* Annules showing fine longitudinal striae and short lobes, mid-body

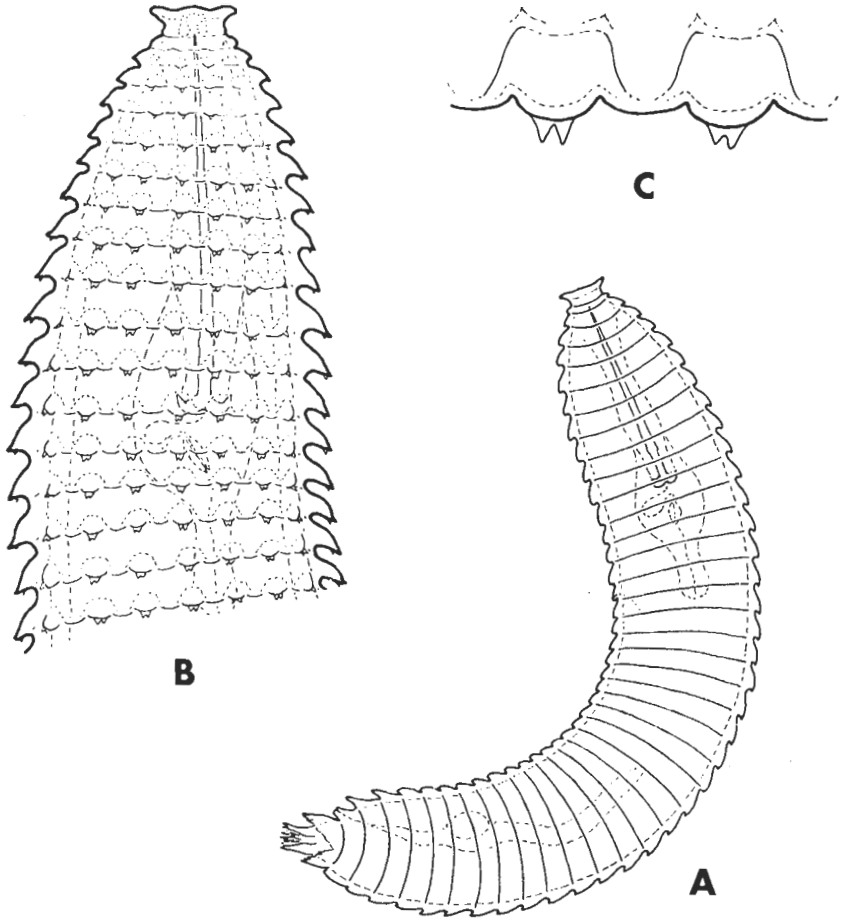

Fig. 5. *Neolobocriconema cataracticum* n. sp. *A: In toto* view (270×); *B:* Anterior end of the 4th stage larve (700×); *C:* Scales of the same larve

Vulva conical, closed, on the 3rd annule from terminus, its posterior lip a little longer than the anterior one. Anus between the two last annules. Postvulval body portion 20 – 24 μ long.

Male unknown.

Body of the fourth-stage larva consisting of 45 – 46 annules, somewhat more than that of mature. Annules ornamented by double-tipped scales arranged in 16 longitudinal rows. On the third-stage larve there are however only 12 rows of scales.

Holotype: ♀ on slide Nr. A – 6215. Holotype and paratypes (2 ♀♀ and 3 juveniles) in the collection of the author.

Type habitat and locality: Red rain forest soil in the Iguaçu National Park, in the vicinity of the world-famous cataracts of the River Iguaçu, Brazil. Collected in December, 1965 by the author.

In the new species, *Neolobocriconema cataracticum* n. sp., the characteristics of the genera *Discocriconemella* De Grisse & Loof, 1965 and *Neolobocriconema*

MEHTA & RASKI, 1971 are curiously combined. In the construction of head it resembles *Discocriconemella*, in the small number and ornamentation of annules however it seems to be a *Neolobocriconema*. Just these latter characteristics, furthermore the very plump body shape, the far back standing vulva and scales-bearing larval cuticle support my placing this interesting nematode into the genus *Neolobocriconema*. The new species can be distinguished from all known members of the genus by the peculiar head, the structure of cuticle, the long spear and the back position of vulva.

Ogma SOUTHERN, 1914

Syn. *Criconema* (*Variasquamata* MEHTA & RASKI, 1971); *Variasquamata* (MEHTA & RASKI, 1971) KHAN, CHAWLA & SAHA, 1976.

Criconematinae. Body small to moderate (0.27 – 0.86 mm), stout; straight or only slightly curved ventrally. Number of annules 51 – 88. Annules ornamented by scales or rounded or pointed (single-tipped) appendages arranged in 8 – 18 longitudinal rows. The number of rows may decrease towards both ends of body, the appendages remain, however, of the same shape throughout the entire body. At most the outgrowths of the last annules on the posterior region may be a little modified. Head consisting of two annules narrower than subsequent body annules and devoid of appendages. Both head annules are generally of the same width, the first annule is only exceptionally wider than the second. Pseudolips with submedian lobes more or less developed. Spear 48 to 116 μ Vulva conical, closed, on the 5th – 19th annule from terminus; anterior vulval lip seldom longer than the posterior one. Posterior end of body conoid, pointed or more or less rounded.

Male is known only in a single species. Head flattened. Lateral field bearing 4 incisures. No bursa.

Young animals also possess scales on cuticle which are arranged in 8 – 16 longitudinal lines. It is a common phenomenon that the number of rows is greater on the larvae than on adults.

Mode of life: Definitely soil inhabiting nematodes living on plant roots.

Distribution (Fig. 6): Representatives of *Ogma* have been recorded hitherto from four continents: 5 species from Europe (*murrayi, octangulare, rhombosquamosum, spasskii, zernovi*), 9 species from Asia (*coffeae, decalineatum, fotedari, murrayi, octangulare, rhosimum, querci, simlaense, spinosum*), 5 species from Africa (*chrisbarnardi, decalineatum, lentiforme, octangulare, squamiferum*), 4 species from America (3 from North America: *decalineatum, murrayi, octangulare*, and 2 from South America: *decalineatum, duodevigintilineatum*). The three widest distributed species are *O. murrayi* (in 9 countries: Holland, England, Ireland, Austria, France, Yugoslavia, India, Java, United States), *O. octangulare* (in 8 countries: Austria, Germany, Poland, India, Ivory Coast, United States, Canada, Guadeloupe) and *O. decalineatum* (in 8 countries: India, Réunion*, Tanzania, Congo Republic, United States, Cuba, Paraguay, New Britain*). As for the number of species, the most representatives of the genus *Ogma* have been hitherto recorded from India (7 species: *coffeae, decalineatum, fotedari, murrayi, octangulare, simlaense* and *spinosum*) and from the United States (3 species: *decalineatum, murrayi, octangulare*).

* New records after specimens in my collection.

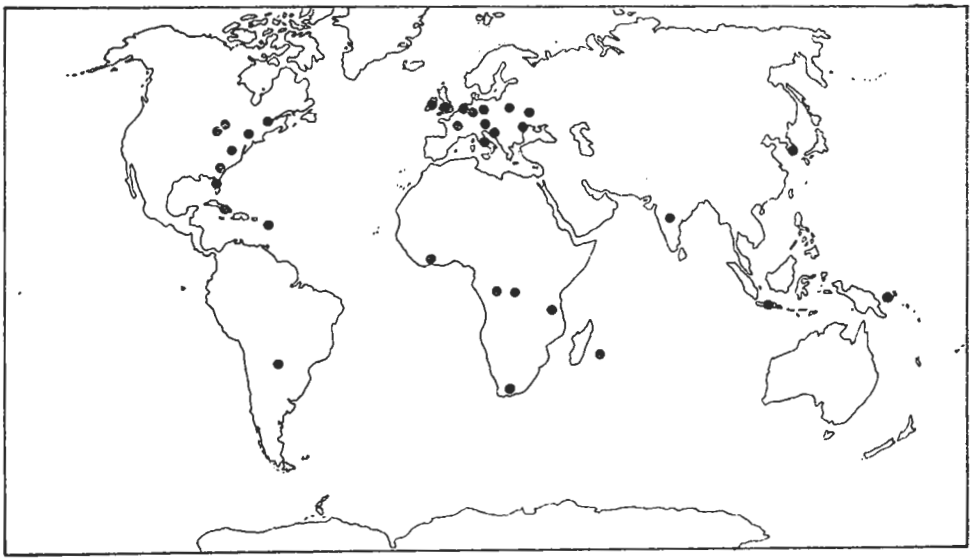

Fig. 6. Distribution of the genus *Ogma* SOUTHERN, 1914

Type species: *Ogma murrayi* SOUTHERN, 1914.
15 species:

O. chrisbarnardi (HEYNS, 1970) n. comb.
Syn. *Criconema chrisbarnardi* HEYNS, 1970
Crossonema (Seriespinula) chrisbarnardi (HEYNS, 1970) LOOF & DE GRISSE, 1973

O. coffeae (EDWARD, MISRA & RAI, 1970) n. comb.
Syn. *Criconema coffeae* EDWARD, MISRA & RAI, 1970

O. decalineatum (CHITWOOD, 1957) n. comb.
Syn. *Criconema decalineatum* CHITWOOD, 1957
Criconema (Varisquamata) decalineatum CHITWOOD, 1957 (MEHTA & RASKI, 1971)
Variasquamata decalineata (CHITWOOD, 1957) KHAN, CHAWLA & SAHA, 1976
Criconema (Variasquamata) gracile MEHTA & RASKI, 1971 (n. syn.)*
Variasquamata gracilis (MEHTA & RASKI, 1971) KHAN, CHAWLA & SAHA, 1976

O. duodevigintilineatum (ANDRÁSSY, 1968) n. comb.
Syn. *Criconema duodevigintilineatum* ANDRÁSSY, 1968
Criconema (Variasquamata) duodevigintilineatum ANDRÁSSY, 1968 (MEHTA & RASKI, 1971)
Variasquamata duodevigintilineata (ANDRÁSSY, 1968) KHAN CHAWLA & SAHA, 1976

* On the basis of the description *C. gracile* differs from *O. decalineatum* only by its smooth head annules. I think however, that this difference is too little to separate *gracile* from *decalineatum*. I have often observed within one and the same population of *decalineatum* specimens, some having finely crenate, others completely smooth head annules.

O. fotedari (MAHAJAN & BIJRAL, 1973) n. comb.
Syn. *Criconema (Variasquamata) fotedari* MAHAJAN & BIJRAL, 1973

O. lentiforme SCH. STEKHOVEN & TEUNISSEN, 1938
Syn. *Criconema lentiforme* (SCH. STEKHOVEN & TEUNISSEN, 1938) DE CONINCK, 1943
Criconema (Variasquamata) lentiforme (SCH. STEKHOVEN & TEUNISSEN, 1938) DE CONINCK, 1943 (MEHTA & RASKI, 1971)
Variasquamata lentiformis (SCH. STEKHOVEN & TEUNISSEN, 1938) KHAN, CHAWLA & SAHA, 1976
Ogma tripus SCH. STEKHOVEN & TEUNISSEN, 1938
Criconema tripus (SCH. STEKHOVEN & TEUNISSEN, 1938) DE CONINCK, 1945

O. murrayi SOUTHERN, 1914
Syn. *Criconema murrayi* (SOUTHERN, 1914) TAYLOR, 1936
Criconema (Variasquamata) murrayi (SOUTHERN, 1914) TAYLOR, 1936 (MEHTA & RASKI, 1971)
Variasquamata murrayi (SOUTHERN, 1914) KHAN, CHAWLA & SAHA, 1976
Hoplolaimus murrayi (SOUTHERN, 1914) MENZEL, 1917
Iota murrayi (SOUTHERN, 1914) MICOLETZKY, 1925

O. octangulare (COBB, 1914) SCH. STEKHOVEN & TEUNISSEN, 1938
Syn. *Iota octangulare* COBB, 1914
Hoplolaimus octangularis (COBB, 1914) MENZEL, 1917
Criconema octangulare (COBB, 1914) TAYLOR, 1936
Criconema (Variasquamata) octangulare (COBB, 1914) TAYLOR, 1936 (MEHTA & RASKI, 1971)
Variasquamata octangularis (COBB, 1914) KHAN, CHAWLA & SAHA, 1976
Criconema punici EDWARD, MISRA, PETER & RAI, 1971 (n. syn.)
Seriespinula punici (EDWARD, MISRA, PETER & RAI, 1971) KHAN, CHAWLA & SAHA, 1976

O. querci (CHOI & GERAERT, 1975) n. comb.
Syn. *Criconema (Variasquamata) querci* CHOI & GERAERT, 1975

O. rhombosquamatum (MEHTA & RASKI, 1971) n. comb.
Syn. *Criconema (Variasquamata) rhombosquamatum* MEHTA & RASKI, 1971
Variasquamata rhombosquamata (MEHTA & RASKI, 1971) KHAN, CHAWLA & SAHA, 1976

O. rhosimum (KHAN, CHAWLA & SAHA, 1976) n. comb.
Syn. *Variasquamata rhosima* KHAN, CHAWLA & SAHA, 1976

O. simlaense (JAIRAJPURI, 1963) n. comb.
Syn. *Criconema simlaense* JAIRAJPURI, 1963
Criconema (Variasquamata) simlaense JAIRAJPURI, 1963 (MEHTA & RASKI, 1971)
Variasquamata simlaensis (JAIRAJPURI, 1963) KHAN, CHAWLA & SAHA, 1976

O. spinosum n. sp.

O. squamiferum (HEYNS, 1970) n. comb.

Syn. *Lobocriconema squamiferum* HEYNS, 1970
Criconema squamiferum (HEBNS, 1970) LOOF & DE GRISSE, 1973

O. zernovi KIRJANOVA, 1948

Syn. *Criconema zernovi* (KIRJANOVA, 1948) CHITWOOD, 1957
Criconema (Variasquamata) zernovi (KIRJANOVA, 1948) CHITWOOD, 1957 (MEHTA & RASKI, 1971)
Variasquamata zernovi (KIRJANOVA, 1948) KHAN, CHAWLA & SAHA, 1976

Species inquirenda: *O. spasskii* (NESTEROV & LISETSKAYA, 1965) n. comb. – Syn. *Criconema spasskii* NESTEROV & LISETSKAYA, 1965.

Key to the species of Ogma

1 Cuticular appendages arranged in 16 – 18 rows. 2
– Cuticular appendages arranged in 8 – 12 rows. 3

2 Scales triangular; tail elongate-conoid, pointed with some smooth terminal annules. – L = 0.5 mm; V = 90%; R = 67; RV = 14; spear = 77 μ. ..... **duodevigintilineatum** (ANDRÁSSY)
– Scales blunt with smooth or crenate edge; tail stout with scaled annules. – L = 0.75 – 0.86 mm; V = 85 – 90%; R = 51 – 60; RV = 5 – 6; spear = 112 – 115 μ. ..... **querci** (CHOI & GERAERT)

3 Edge of scales crenate or waved, scales in 8 – 10 longitudinal rows. – L = 0.28 – 0.41 mm; R = 75 – 85; RV = 11 – 14; spear = 58 – 68 μ. ..... **coffeae** (EDWARD, MISRA & RAI)
– Edge of scales smooth, scales in 8, 10 or 12 longitudinal rows. 4

4 Scales in 8 rows. 5
– Scales in 10 or 12 rows. 8

5 First head annule distinctly wider than second; appendages on the poesterior body region longer than the foregoing ones and bifurcate; vulva on the 5th annule from terminus. – L = 0.35 mm; V = 92%; R = 59; RV = 5; spear = 72 μ. ..... **chrisbarnardi** (HEYNS)
– Both head annules of equal size; appendages on the posterior body region not strikingly longer than the foregoing ones and not bifurcate; vulva on the 7th – 15th annule. 6

6 Scales slender, much longer than wide, finely rounded or pointed; head annules crenate. – L = 0.42 – 0.51 mm; V = 83 – 87%; R = 68 – 75; RV = 14 – 15; spear = 78 – 84 μ. ..... **murrayi** SOUTHERN
– Scales wider than long and broadly rounded; head annules smooth. 7

7 Last 5 – 6 annules much narrower than the foregoing ones lending the tail an elongate shape. – L = 0.39 – 0.49 mm; V = 84 – 85%; R = 64 – 72; RV = 11 – 12; spear = 82 μ (?). **lentiforme** SCH. STEKHOVEN & TEUNISSEN
– Body end regularly conoid, tail not elongate. – L = 0.30 – 0.49 mm; V = 80 – 90%; R = 64 – 83; RV = 10 – 14; spear = 60 – 70 μ. ..... **octangulare** (COBB)

8 Vulva on the 7th – 10th annule from terminus; scales in 10 – 12 rows. 9
– Vulva on the 12th – 19th annule from terminus; scales in 10 rows. 11

9 Spear shorter, about 70 μ – L = 0.39 – 0.40 mm; V = 95 – 96%; R = 59 – 65; RV = 7 – 9; spear = 67 – 72 μ. ..... **rhosimum** (KHAN, CHAWLA & SAHA)
– Spear longer, 90 μ or more. 10

10 Body small, 0.4 mm; spear about 90 μ. – L = 0.39 mm; V = 85%; R = 66; RV = 9; spear = 92 μ. ..... **zernovi** KIRJANOVA
– Body longer, 0.6 – 0.7 mm; spear about 100 μ. – L = 0.62 – 0.70 mm; V = 88 – 90; R = 66 – 71; RV = 8 – 10; spear = 102 – 108 μ. ..... **squamiferum** (HEYNS)

11 Number of annules more than 70. 12
– Number of annules less than 70. 14

12 Vulva far ahead, on the 19th annule from terminus; posterior body end strongly elongate. – L = 0.57 mm; V = 84%; R = 86; RV = 19; spear = 80 μ. ..... **spinosum** n. sp.
– Vulva on the 12th – 15th annule from terminus; posterior body end not elongate. 13

13 Spear about 110 μ; tail with blunt terminus. – L = 0.33 – 0.40 mm; V = 85 – 90%; R = 74 – 83; RV = 13 – 15; spear = 107 – 116 μ. ..... **rhombosquamatum** (MEHTA & RASKI)
– Spear under 90 μ; tail with pointed terminus. – L = 0.35 – 0.54 mm; V = 84 – 88%; R = 75 – 86; RV = 13 – 15; spear = 61 – 85 μ. ..... **decalineatum** (CHITWOOD)

14 First head annule strikingly wider than second; vulva on the 12th – 13th annule from terminus. – L = 0.27 – 0.30 mm; V = 87 – 89%; R = 60 – 63; RV = 12 – 13; spear = 55 – 60 μ. **fotedari** (MAHAJAN & BIJRAL)
– Both head annules uniform; vulva on the 15th annule from terminus. – L = 0.36 – 0.50 mm; V = 82 – 85%; R = 65; RV = 15; spear = 68 μ. ..... **simlaense** (JAIRAJPURI)

Ogma spinosum n. sp.

(Fig. 7 A – B)

Holotype ♀: L = 0.57 mm; a = 12; b = 4.8; c = 9.2; V = 84%.

Body with 86 annules. On mid-body, annules 7 – 7.5 μ thick and 48 μ wide. They are ornamented by large, triangular scales arranged in 10 longitudinal rows. On the third annule only 6 scales are present, on the fourth and subsequent annules, however, already 10. Behind vulva the number of scales decreases again, the last appendages can be found on the 8th annule from terminus. Last 7 annules smooth or with small papilliform bumps. Distance between tips of scales of the same annule 14 – 15 μ.

Head of two annules with forward directed and finely waved margins. 1st annule 15 μ, 2nd 19 μ, 3rd 23 μ wide. Sublateral lobes present, well developed.

Spear 80 μ (14 annules) long, 14 per cent of total length of body. Basal knobs 7 μ wide; metenchium 85 per cent of spear length. Middle bulb distinctly longer than isthmus and terminal bulb together. 19 body annules between head and proximal end of oesophagus. Excretory pore on the 25th annule.

Vulva conical, closed, on the 68th annule from anterior end and on the 19th annule from terminus, respectively. Postvulval body portion 92 μ long. Anus on the 13th annule from terminus. Posterior end of body elongate-conoid, terminus pointed.

Male and larval forms unknown.

Holotype: ♀ on slide Nr. A – 7559 in the collection of the author.

Type habitat and locality: Moss from forest, 1600 m above sea level, Cherrapunji, Assam, India, collected in November, 1967 by Dr. GY. TOPÁL (Budapest).

Ogma spinosum n. sp. belongs to those members of the genus whose cuticle is ornamented by 10 longitudinal rows of scales. In the number of annules, length of spear and the crenate head annules it is most closely related to *O. decalineatum* (CHITWOOD, 1957), but differs from CHITWOOD' species and at the same time from all the other members of the genus by the strong, pointed scales, the elongate posterior end and the position of vulva (this latter lies on other *Ogma* species maximum on the 15th annule from terminus).

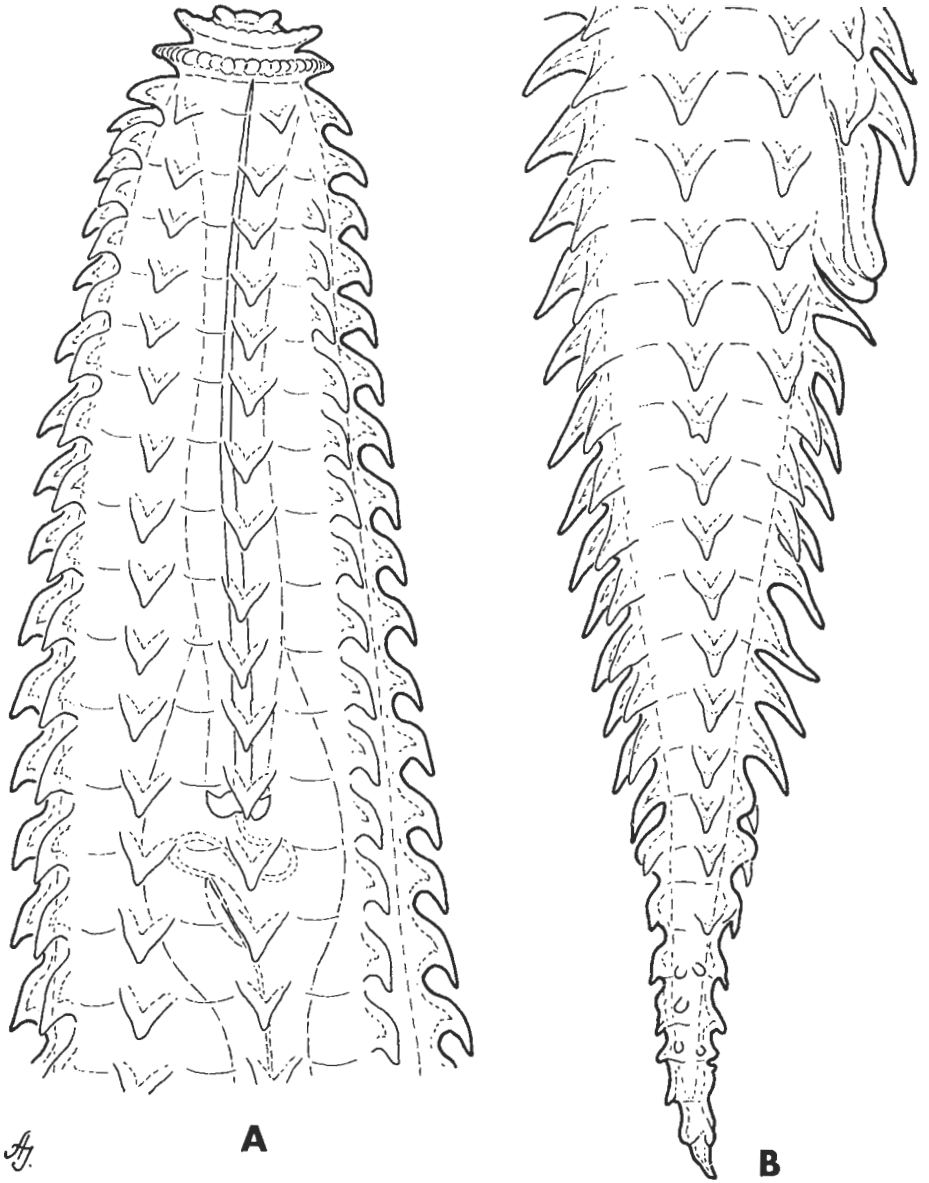

Fig. 7. *Ogma spinosum* n. sp. *A:* Anterior end (1250×); *B:* Posterior end (1250×)

Seriespinula (Mehta & Raski, 1971) Khan, Chawla & Saha, 1976

Syn. *Crossonema* (*Seriespinula* Mehta & Raski, 1971).

Criconematinae. Body small to moderate (0.30 – 0.64 mm), stout. Cuticle with 44 – 90 annules drawn out posteriad. Annules ornamented by scales or spi-

Fig. 8. Distribution of the genus *Seriespinula* (MEHTA & RASKI, 1971) KHAN, CHAWLA & SAHA, 1976

nes arranged in 9 – 20 (exceptionally 27) longitudinal lines. All appendages or at least a great number of them bi- or multipointed (2 – 7 tipped). Some of the first annules not scaled but crenate or lobed, last body annules similar in ornamentation to the foregoing annules, except in one species. Head annules two, equally wide, smooth or rarely crenate or fringed. No submedian lobes. Length of spear between 63 and 125 μ. Vulva on the 6th to 15th annule from tail tip, with conical, closed lips. Posterior body end generally conoid, rarely blunt.

Male is known in a single species only. Lateral field marked by 3 incisures. Bursa very weakly developed.

Scales of young animals arranged in 10 – 18 longitudinal lines. The number of scale rows is either identical both on larvae and adults of the same species or less on larvae. The number of annules is, however, mostly greater on juveniles.

Mode of life: Generally terricolous animals but some of the species may occur on swampy fields, too.

Distribution (Fig. 8): Except the Antarctic *Seriespinula* species have been found on every continent: in Europe 2 species *(cobbi, hungarica)*, in Asia 4 species *(impar, octozonalis, sokliensis, tenuicaudata)*, in Africa 2 species *(coronata, hungarica)*, in North America 4 species *(cobbi, hungarica, seymouri, venusta)*, and in Australia 2 species *(cactus, melanesica)*. *Seriespinula* species have been recorded in greatest number from the United States (4 species: *cobbi, hungarica, seymouri, venusta)*. The widest distributed species is *S. cobbi* (in 10 countries: Holland, Belgium, Denmark, Austria, Hungary, Romania, France, Spain, Estonia, United States).

Type species: *Iota cobbi* MICOLETZKY, 1925 = *Seriespinula cobbi* (MICOLETZKY, 1925) KHAN, CHAWLA & SAHA, 1976.

11 species:

S. cactus n. sp.

S. cobbi (Micoletzky, 1925) Khan, Chawla & Saha, 1976
Syn. *Iota cobbi* Micoletzky, 1925
Criconema cobbi (Micoletpky, 1925) Taylor, 1936
Crossonema (Seriespinula) cobbi (Micoletzky, 1925) Mehta & Raski, 1971
Criconema cobbi duplex De Coninck, 1945
Criconema cobbi multiplex De Coninck, 1945
Criconema schuurmansstekhoveni De Coninck, 1943

S. coronata (Sch. Stekhoven & Teunissen, 1938) n. comb.
Syn. *Ogma coronatum* Sch. Stekhoven & Teunissen, 1938
Criconema coronatum (Sch. Stekhoven & Teunissen, 1938) De Coninck, 1943
Crossonema coronatum (Sch. Stekhoven & Teunissen, 1938) Mehta & Raski, 1971

S. hungarica (Andrássy, 1962) Khan, Chawla & Saha, 1976
Syn. *Criconema hungaricum* Andrássy, 1962
Crossonema (Seriespinula) hungaricum (Andrássy, 1962) Mehta & Raski, 1971

S. impar Khan, Chawla & Saha, 1976

S. melanesica n. sp.

S. octozonalis (Momota & Ohshima, 1974) Khan, Chawla & Saha, 1976*
Syn. *Crossonema (Seriespinula) octozonale* Momota & Ohshima, 1974

S. seymouri (Wu, 1965) Khan, Chawla & Saha, 1976
Syn. *Criconema seymouri* Wu, 1965
Crossonema (Seriespinula) seymouri (Wu, 1965) Mehta & Raski, 1971

S. sokliensis (Choi & Geraert, 1975) Khan, Chawla & Saha, 1976
Syn. *Crossonema (Seriespinula) sokliense* Choi & Geraert, 1975

S. tenuicaudata (Siddiqi, 1961) Khan, Chawla & Saha, 1976
Syn. *Criconema tenuicaudatum* Siddiqi, 1961
Crossonema (Seriespinula) tenuicaudatum (Siddiqi, 1961) Mehta & Raski, 1971

S. venusta (Mehta & Raski, 1971) Khan, Chawla & Saha, 1976
Syn. *Crossonema (Seriespinula) venustum* Mehta & Raski, 1971

The genus *Seriespinula* is closely related to *Ogma* Southern, 1914 and *Crossonema* Mehta & Raski, 1971. It can be distinguished *a)* from *Ogma:* submedian lobes absent and at most some of the cuticular spines bi- or multifurcate; *b)* from *Crossonema:* scales arranged in longitudinal rows, less in number on one annule and bi- or multipointed; scales of juveniles 10–18 at *Seriespinula* and generally 8 at *Crossonema.*

* Unfortunately I was not able to obtain the original description of this species, thus, I am not quite sure in its taxonomic position.

Key to the species of Seriespinula

1 Scales arranged in 16–20 longitudinal rows, on the posterior body region strongly modified, scattered by small papilliform elements; annules less than 50. – L = 0.44–0.64 mm; V = 90–92%; R = 44–49; RV = 6–8; spear = 82–92 μ. ..... **coronatum** (Sch. Stekhoven & Teunissen)

– Scales arranged in 9–16 longitudinal rows, on the posterior body region not modified strikingly, without "papillae"; annules 50 or more. 2

2 Annules 74–90. 3

– Annules 50–64. 4

3 Annules with triangular or semicircular scales packed by several thin and sharp spines; fine intermediate spines also between the scales; tail long drawn out; spear under 100 μ. – L = 0.44–0.58 mm; V = 88–90%; R = 74–81; RV = 11–15; spear = 89–94 μ. .. **cactus** n. sp.

– Annules with rounded spines arranged in groups of 2–4; no intermediate spines; tail not drawn out; spear well over 100 μ. – L = 0.42–0.60 mm; V = 86–89%; R = 76–90; RV = 10–15; spear = 111–125 μ. ..... **venusta** (Mehta & Raski)

4 Spear length under 80 μ. 5

– Spear length over 90 μ. 6

5 Vulva on the 8th annule from terminus; scales 5–6-tipped. – L = 0.29–0.35 mm; V = 85–86%; R = 57–60; RV = 8; spear = 70–71 μ. ..... **melanesica** n. sp.

– Vulva on the 13th annule from terminus; scales 2–3-tipped. – L = 0.45–0.47 mm; V = 85–87%; R = 63–64; RV = 13; spear = 63–65 μ. ..... **seymouri** (Wu)

6 Scales in 9 or 10 rows. 7

– Scales in 12, 14 or 16 rows. 8

7 First head annule distinctly wider than second and both smooth; scales bifurcate. – L = 0.40–0.46 mm; V = 83–85%; R = 50–60; RV = 11–12; spear = 109 μ. ..... **soklicnsis** (Choi & Geraert)

– Both head annules of the same widths and waved; scales 2–5-furcate. – L = 0.35–0.55 mm; V = 82–87%; R = 52–63; RV = 10–14; spear = 95–111 μ. .. **hungarica** (Andrássy)

8 Scales in 12 rows. – L = 0.41–0.50 mm; V = 85–90%; R = 52–59; RV = 8–10; spear = 112–120 μ. ..... **impar** Khan, Chawla & Saha

– Scales in 14–16 rows. 9

9 Every scale furcate, 2–3- (or rarely 4-) pointed. – L = 0.43–0.49 mm; V = 86–88% R = 59–61; RV = 10–11; spear = 106–110 μ. ..... **tenuicaudata** (Siddiqi);

– Majority of scales simple, only some furcate, 2- or 3-pointed. – L = 0.32–0.52 mm; V = 80–85 %; R = 58–65; RV = 11–14; spear = 96–113 μ. ..... **cobbi** (Micoletzky)

Seriespinula melanesica n. sp.

(Fig. 9 A–D)

2 ♀: L = 0.29–0.35 mm; a = 8.0–8.7; b = 2.7–3.2; c = 12; V = 85–86%.

Body very small and plump, consisting of 57–60 annules. Annules drawn out posteriad, 5–7 μ thick and 36–41 μ wide on mid-body, ornamented by finger-shaped spines arranged in groups of 5–6 (rarely 4) and in 10 longitudinal rows, respectively. Spines 3–4 μ long and converging to one another in each group. They appear on the 3rd annule and are modified: on the posterior body region: strongly elongate.

Head of two annules, the first 6 μ high and 17–18 μ wide, the second 16 μ wide. Both with fringed margin. Oral field flattened, without submedian lobes. Third annule 22–23 μ wide.

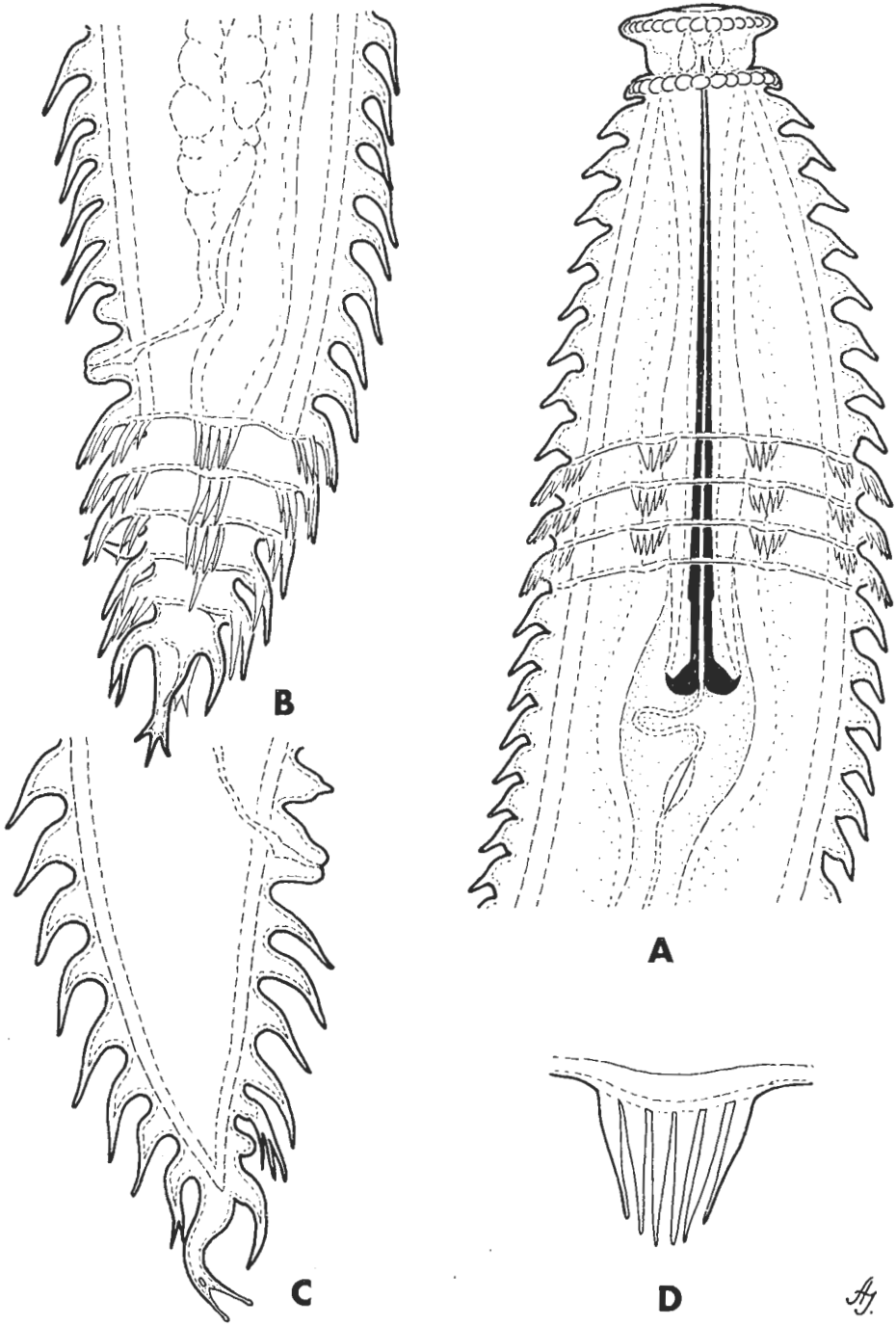

Fig. 9. *Seriespinula melanesica* n. sp. *A:* Anterior end (1250×); *B–C:* Posterior end, different females (1250×); *D:* A group of spines on mid-body

Spear 70 – 71 μ (16 – 17 annules) long, 20 – 24 per cent of the total body length. Basal knobs 8 – 9 μ wide; metenchium 83 – 84 per cent of the spear length. Proximal part of oesophagus slender, middle bulb a little shorter than isthmus and terminal bulb together. Distance between head and proximal end of oesophagus with 21 – 23 body annules. Excretory pore on the 19th-20th annule from the anterior end.

Vulva conoid, closed, on the 50th – 53rd annule from head and the 8th annule from terminus, respectively. Postvulval body portion 44 – 50 μ long. Anus inconspicuous, on the 4th annule from terminus. Tail conoid and pointed with elongate terminal annule (13 – 15 μ).

Male and larval forms unknown.

Holotype: ♀ on slide 8842 in the collection of the author. Paratype on the same slide.

Type habitat and locality: Humus from a three years old secondary rain forest, Macaranga, New Britain, collected in September, 1969 by Prof. Dr. J. BALOGH (Budapest) .

In shape of scales and the number of scale rows *Seriespinula melanesica* n. sp. resembles *S. hungarica* (ANDRÁSSY, 1962), *S. seymouri* (WU, 1965), *S. sokliensis* (CHOI & GERAERT, 1975), and *S. venusta* (MEHTA & RASKI, 1971). It differs *a)* from *hungarica:* head annules higher and fringed, spines more regular and longer, especially on the posterior body end, spear much shorter (95 – 111 μ at *hungarica)* vulva more to the back (on the 10th – 14th annule at *hungarica): b)* from *seymouri:* head of different shape and fringed, scale rows regular, 5 – 6 spines in a group, vulva more to the back (on the 13th annule at *seymouri): c)* from *sokliensis:* head annules fringed, scale rows 10 (9 at *sokliensis),* more spines in a group (generally only 2 at *sokliensis),* terminal spines elongate, spear far shorter (109 μ at *sokliensis),* vulva more to the back (on the 11th – 12th annule at *sokliensis*); *c)* from *venusta:* head annules fringed, scale groups with more members (mostly 3 spines in a group at *venusta),* body annules less in number (76 – 90 at *venusta),* spear much shorter (111 – 125 μ at *venusta),* terminal spines modified, vulva further back (on the 10th – 15th annule at *venusta).*

Seriespinula cactus n. sp.

(Fig. 10 A – C)

7 ♀: L = 0.44 – 0.58 mm; a = 8.2 – 11.5; b = 4.2 – 4.6; c = ?; V = 88 – 90%.

Holotype ♀: L = 0.56 mm; a = 10.8; b = 4.4; V = 90%; annules = 81; spear = 93 μ.

Body of medium size, stout. Cuticle with 74 – 81 annules. Annules 6.5 – 7.5 μ thick and 50 – 55 μ wide on the middle region of body. Scales triangular or semicircular, 3.5 – 4.5 μ long and packed by a number (6 – 10) of thin and sharply pointed "cactus" spines diverging radially. Scales becoming longer (8 – 12 μ) on the posterior body region and carrying spines in greater number (10 – 14) than the scales on mid-body. The scales appear on the third annule but are lacking on the terminal rings (these latter bear at most fine spines) and are arranged in 10 longitudinal rows. Fine and irregularly scattered intermediate spines may occur also on the margins of annules.

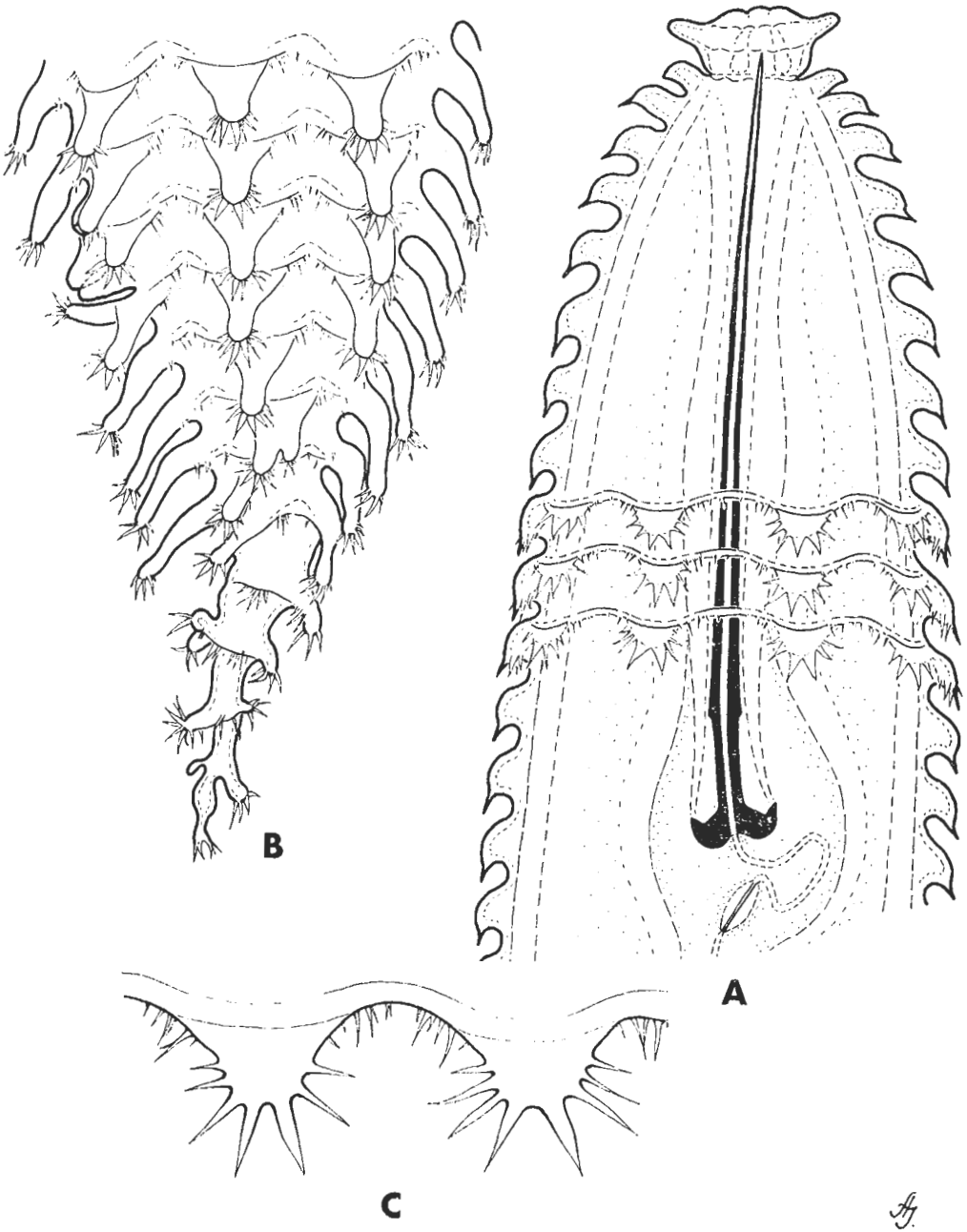

Fig. 10. *Seriespinula cactus* n. sp. *A:* Anterior end of body (1250×); *B:* Posterior end of body (1250× *C:* „Cactus" spines on mid-body

Head annules two with smooth or slightly waved edges. First annule a little narrower (18 – 23 μ) than second (19 – 25 μ). Third annule 26 – 32 μ wide. Oral field slightly convex; submedian lobes lacking.

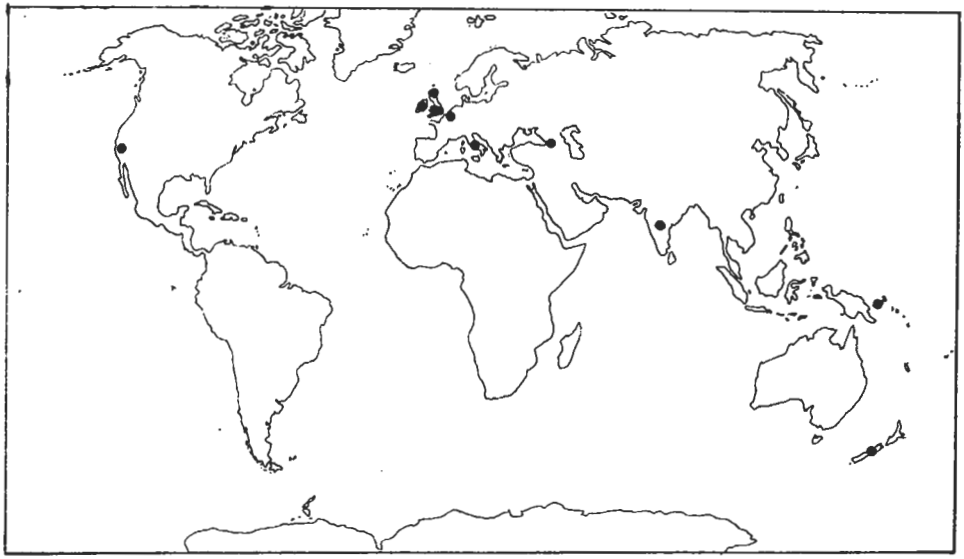

Fig. 11. Distribution of the genus *Croserinema* KHAN, CHAWLA & SAHA, 1976

Spear 89 – 94 μ (13 – 15 annules) long, 4 to 5 times longer than the first heap annule, 16 – 21 per cent of total body length. Basal knobs strong, 9 – 10 μ wide; metenchium 82 – 83 per cent of spear length. Median bulb as long as isthmus and terminal bulb together. Owing to the very heavy structure of cuticle, the exact position of the ecxretory pore and the anus could not be observed.

Vulva conoid, closed, on the 11th – 15th annule from tail tip. Vulval body diameter 35 – 39 μ, postvulval body portion 1.4 – 1.8 times longer than the former. Body end conoid, last 5 – 7 annules strongly drawn out with rudimentary scales but with fine spines.

Male and larvae not found.

Holotype ♀: on slide A – 6861. Holotype and 6 paratypes in the collection of the author.

Type habitat and locality: Virgin soil on the Marion Coral Reef off the Eastern coasts of Australia, collected in January, 1939 (!) by Dr. R. JEANNEL. (The specimens are presented to the author from the old collection of Dr. JEANNEL by the Speleological Institute, Cluj, Romania.)

Seriespinula cactus n. sp. can be separated from all the other species of the genus by its peculiar cuticular structure and the shape of tail. The shape of the cuticular appendages resembles somewhat that of *Croserinema palmatum* (SIDDIQI & SOUTHEY, 1962), but the spines are of different shape and more sharply pointed, and not arranged in alternating rows, the posterior end of body is long drawn out, etc.

Croserinema KHAN, CHAWLA & SAHA, 1976

Criconematinae. Body small (0.4 – 0.6 mm) and thick. Annules 45 – 60, each bearing generally 8 palmate lobes which alternate with those on adjacent annu-

les. Each appendage divided in 2 – 6 (mostly 4 – 5) finger-shaped spines. Beside these outgrowhts also scattered single spines may occur on annules. Head composed of two annules, of which the anterior annule wider than the posterior; both annules fringed on edge. Very small submedian lobes present. Spear 67 – 103 μ long. Vulva closed, on the 4th – 7th annule from terminus. Postvulval portion of body conoid-rounded.

Male unknown.

Cuticular ornamentation of larvae similar to that of females, in the rows of appendages, however, simple spines occur in greater number than palmate structures.

Mode of life: Soil inhabiting species, usually on roots of woody plants.

Distribution: The single species of the genus *Croserinema* is distributed on four continents: Europe (England, Scotland, Ireland, Belgium, Italy), Asia (Armenia, India), North America (United States) and Oceania (New Zealand, New Britain*).

Type species: *Criconema palmatum* SIDDIQI & SOUTHEY, 1962 = *Croserinema palmatum* (SIDDIQI & SOUTHEY, 1962) KHAN, CHAWLA & SAHA, 1976.

One species:

C. palmatum (SIDDIQI & SOUTHEY, 1962) KHAN, CHAWLA & SAHA, 1976

Syn. *Criconema palmatum* SIDDIQI & SOUTHEY, 1962

Crossonema palmatum (SIDDIQI & SOUTHEY, 1962) MEHTA & RASKI, 1971

Pateracephalanema MEHTA & RASKI, 1971

Criconematinae. Body small (0.23 – 0.50 mm) and very plump. Number of annules 55 – 98. Annules drawn out posteriad and often packed by incrusted soil or sand particles; thus, inner organisation can be therefore hardly observed. Annules ornamented by 8 – 16 longitudinally arranged rows of outgrowths; these are either smooth and broad or scale-like, digitiform or densely spined. Scales of the posterior end elongate, lobed or fringed. Head consisting of one or two annules, the first annule wide, somewhat saucer-shaped, well set off. Pseudolips simple, without submedian lobes. Spear not too long, 50 – 90 μ. Vulva open with flattened (only rarely conoid) lips, on the 7th – 8th annule from terminus. Tail blunt.

Males are known in two species. Lateral field marked by 4 incisures. Bursa present but narrow. Tail conoid-pointed.

We have only scanty information about the cuticle structure of the larvae.

Mode of life: Terricolous nematodes, in forest and cultivated soils.

Distribution: All the five species have been described hitherto from Australia (Fig. 12). It is possible that *Pateracephalanema* belongs to the very few known endemic taxa of Nematoda.

Type species: *Criconema imbricatum* COLBRAN, 1965 = *Pateracephalanema imbricatum* (COLBRAN, 1965) MEHTA & RASKI, 1971.

5 species:

* On the basis of specimens preserved in my collection: yet unpublished.

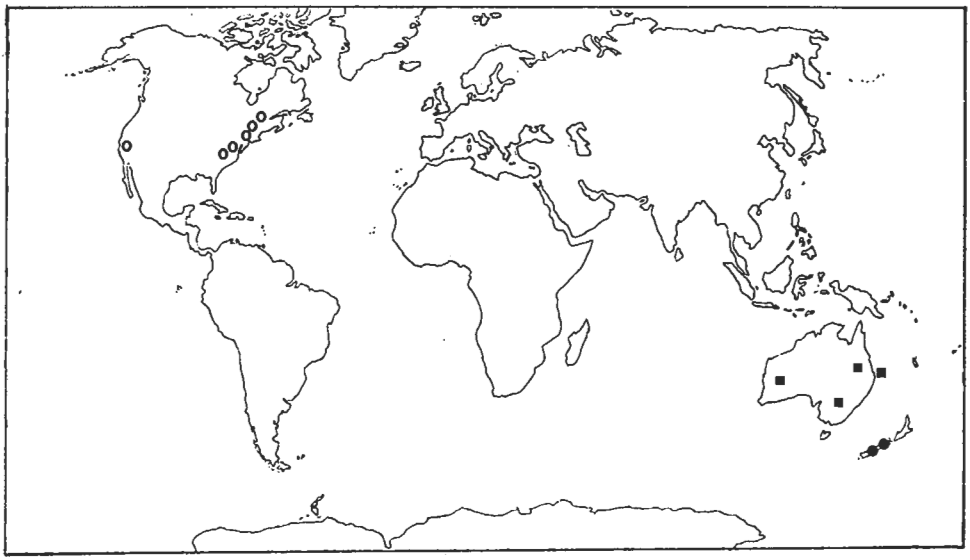

Fig. 12. Distribution of the genera *Bakernema* Wu, 1964 in North America (○), *Pateracephalanema* Mehta & Raski, 1971 in Australia (■) and *Blandicephalanema* Mehta & Raski, 1971 in New Zealand (●)

P. alticola (Colbran, 1965) Mehta & Raski, 1971
Syn. *Criconema alticola* Colbran, 1965

P. australe (Colbran, 1963) Mehta & Raski, 1971
Syn. *Criconema australe* Colbran, 1963

P. imbricatum (Colbran, 1965) Mehta & Raski, 1971
Syn. *Criconema imbricatum* Colbran, 1965

P. pellitum n. sp.

P. pectinatum (Colbran, 1962) Mehta & Raski, 1971
Syn. *Criconema pectinatum* Colbran, 1962

In the genus *Pateracephalanema* the cuticular appendages curved strongly backward and packed close to the body, the saucer-shaped offset head, the open vulva and the bluntly rounded terminus are characteristic features. Because of the very stout body and the blunt tail it seems to be closely allied with *Neolobocriconema* Mehta & Raski, 1971, from which it can be separated by the different structure of cuticle, the enlarged head annule, the greater number of annules (only 36 – 52 annules in *Neolobocriconema)*, the open vulva and by the lack of submedian lobes.

Key to the species of Pateracephalanema

1 Outgrowths of cuticle bearing spine- or finger-like projections; number of annules 55–65. 2
– Outgrowths of cuticle smooth, broad, scale-like; number of annules 70 – 98. 3

2 Cuticular protuberances arranged in 10 longitudinal rows, annules with continuous fringes of spines; head annule much wider than neck annule, spines of second annule directed forward; spear about 80 μ. – L = 0.46–0.50 mm; V = 91%; R = 55–60; RV = 7–8; spear = 84–89 μ. ..... **pellitum** n. sp.

– Cuticular protuberances arranged in 8 longitudinal rows, the digitiform appendages sitting on these protuberances only; head annule not or only slightly wider than neck annule, spines of second annule directed backward; spear 70 μ or less. – L = 0.3–0.39 mm; V = 89–93%; R = 55–65; RV = 7–8; spear = 64–70 μ. ..... **pectinatum** (COLBRAN)

3 Scales in 16 longitudinal rows; number of annules about 100. – L = 0.30–0.49 mm; V = 92–95%; R = 98; RV = 8; spear = 51–61 μ. ..... **alticola** (COLBRAN)

– Scales in 8 longitudinal rows; number of annules between 70 and 80. 4

4 Spear 68–80 μ long; scales semicircular. – L = 0.23–0.41 mm; V = 89–93%; R = 70–72; RV = 8; spear = 68–80 μ. ..... **imbricatum** (COLBRAN)

– Spear 50–56 μ long; scales angular. – L = 0.30–0.38 mm; V = 92–93%; R = 70–77; RV = 8; spear = 50–56 μ. ..... **australe** (COLBRAN)

Pateracephalanema pellitum n. sp.

(Fig. 13 A–B)

3 ♀: L = 0.46–0.50 mm; a = 8.5–9.3; b = 3.0–3.5; c = ?; V = 91%.

Body small and very robust, with 55–60 annules. Annules 7–8 μ thick in the middle region of body. Cuticle with 10 rows of longitudinal swellings. Each annule bearing a continuous fringe of 8–10 μ long, dense, comb-like spines; their exact number is difficult to state but each annule carry at least 150 spines.

Both first annules separated from the other with forward directed spines. Head annule 27–30 μ wide, fringed by a number of spines, second annule 21 μ wide with shorter spines.

Spear 84–89 μ long, 57–61 per cent of total length of oesophagus and 17–18 per cent of whole body length, respectively. Basal knobs 11–12 μ wide; metenchium 82–83 per cent of spear length. Median bulb as long as isthmus and terminal bulb together or somewhat shorter. 19–12 body annules from head to proximal end of oesophagus. Excretory pore not observable.

Vulva conoid, on the 7th or 8th annule from terminus. Posterior body portion stout with lobed-fringed annules.

Male and juveniles unknown.

Holotype ♀: on slide Nr. A–6520. Holotype and two paratypes in the collection of the author.

Type habitat and locality: Forest soil, in the vicinity of Perth, Western Australia, collected in September, 1970 by Prof. Dr. H. FRANZ (Wien).

Crossonema MEHTA & RASKI, 1971

Criconematinae. Body small to relatively long (0.3–0.8 mm), mostly robust. Annules 40–89 with backward curved margin. Each annule ornamented by a continuous row of dense bluntly rounded and uni-pointed spines or scales; they are not arranged in longitudinal rows, their number is between 24 and 90 on one annule on mid-body region. Spines of posterior body portion may be modified. Head annules two, exceptionally one, directed forward with smooth, waved

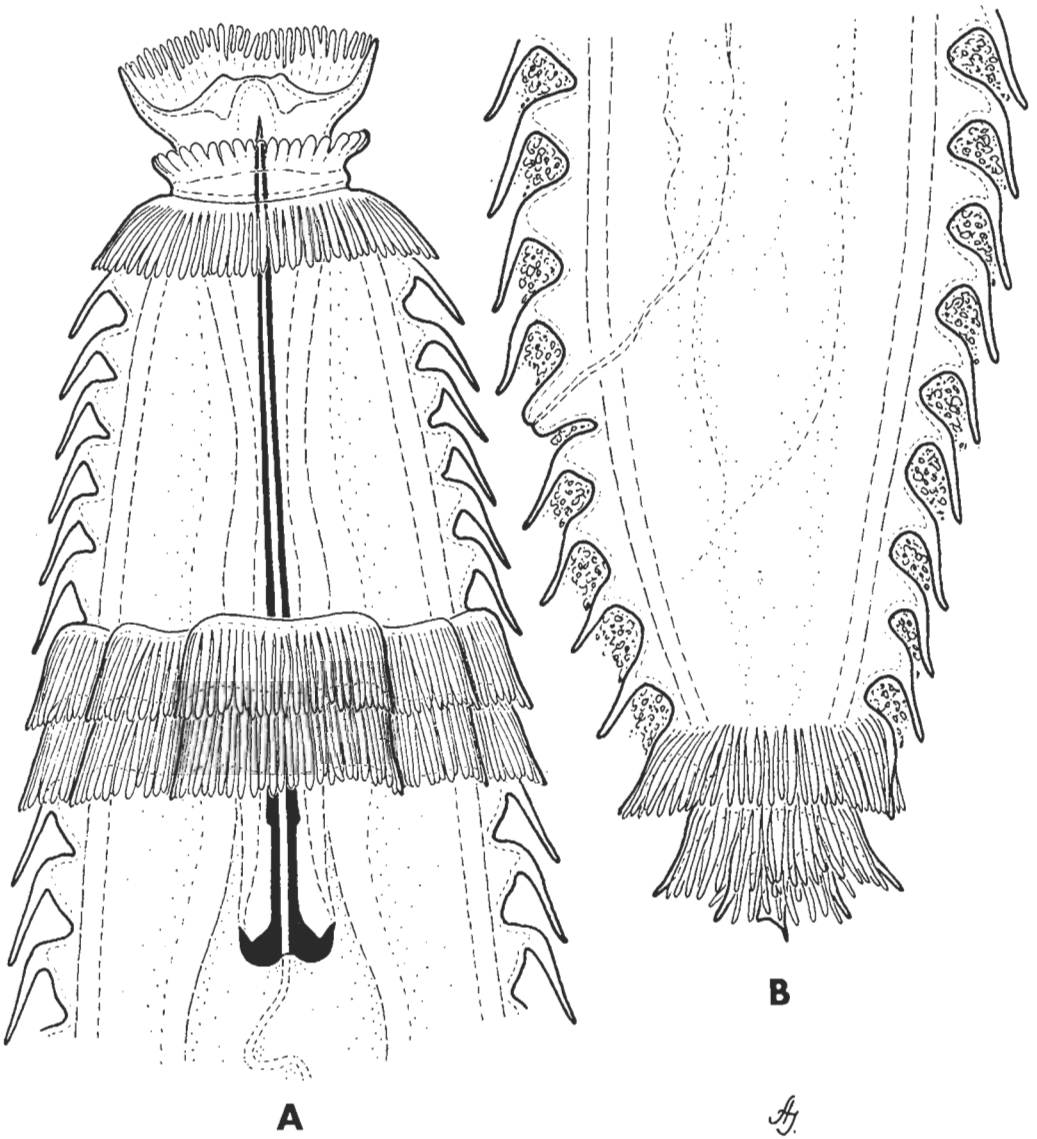

Fig. 13. *Pateracephalanema pellitum* n. sp. *A:* Anterior end (1250×); *B:* Posterior end (1250×)

or fringed edge. First head annule in almost every case strikingly wider than the second. No submedian lobes. Spear 69 – 130 μ long. Vulva closed, on the 3th to 16th annule from tail tip. Posterior end of body generally blount, rarely conoid-pointed.

Males of two species known hitherto. Lateral field marked by 4 incisures. Bursa present but very narrow, rudimentary.

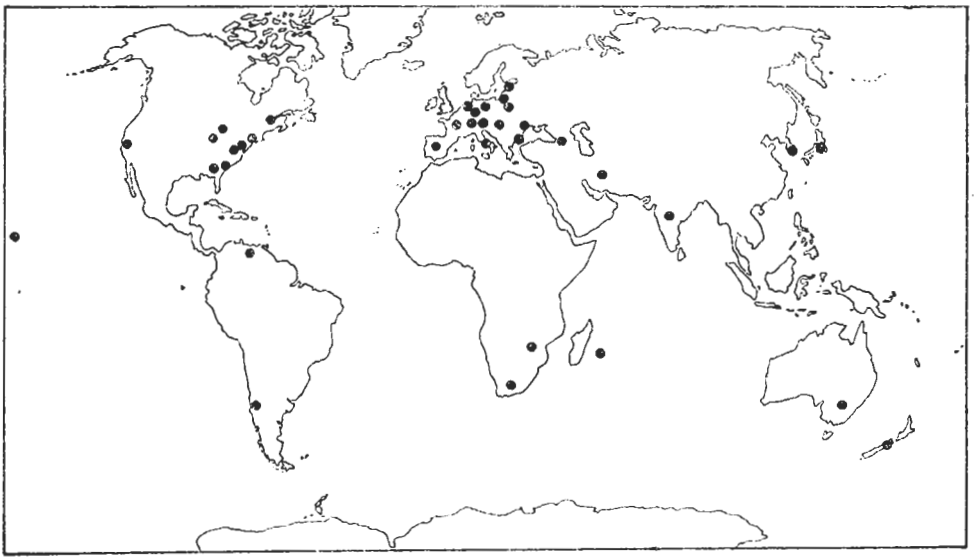

Fig. 14. Distribution of the genus *Crossonema* Mehta & Raski, 1971

Cuticle of larvae ornamented by scales arranged in 8 (exceptionally 9 – 10) rows. They differ in shape from those of adults: bifurcate, finger-like lobed or multi-spinose.

Mode of life: Most of the species live in the soil, on or near plant roots, some may occur, however, in swampy biotopes or *Sphagnum* moors.

Distribution: *Crossonema* species are distributed over the five continents (Fig. 13): 5 species in Europe *(aquitanense, boettgeri, fimbriatum, menzeli, multisquamatum)*, 7 species in Asia (*abies, fimcivatum, georgiense, menzeli, multisquamatum, taylatum, taylori)*, 1 species in Africa *(multisquamatum)*, 4 species in the Americas (4 in North America: *fimbriatum, menzeli, multisquamatum, proclive*, and 1 in South America: *multisquamatum)*, and 2 species in Australia *(latens, multisquamatum)*. Most of the species are recorded from the Soviet Union *(fimbriatum, georgiense, menzeli, multisquamatum)*, the United States *(fimbriatum, menzeli, multisquamatum, proclive)* and India *(fimcivatum, multisquamatum, taylatum, taylori)*. In Europe less than 50% of the hitherto described species occur. The most widely distributed representative of the genus *Crossonema* is *multisquamatum* which has been recorded up to now from 15 countries: Hungary, Spain, Georgia, India, Iran, Japan, Réunion*, Rhodesia, South Africa, United States, Canada, Venezuela, Chile*, Hawaii, Australia. An other wide distributed species is *C. menzeli*, it has been found in 13 countries: Holland, Germany, Austria, Hungary*, Poland, Switzerland, France, Latvia, Estonia, Bulgaria, Korea, United States, Canada.

Type species: *Criconema civellae* Steiner, 1949 = *Crossonema multisquamatum* (Kirjanova, 1948) Mehta & Raski, 1971 (n. syn.)

* New records after specimens in my collection.

11 species:

C. abies n. sp.

C. aquitanense (Fies, 1968) Mehta & Raski, 1971
Syn. *Criconema aquitanense* Fies, 1968

C. boettgeri (Meyl, 1954) n. comb.
Criconema boettgeri (Meyl, 1954) De Grisse & Loof, 1965

C. fimbriatum (Cobb in Taylor, 1936) Mehta & Raski, 1971
Syn. *Criconema fimbriatum* Cobb in Taylor, 1936

C. fimcivatum Khan, Chawla & Saha, 1976

C. latens Mehta & Raski, 1971

C. menzeli (Stefanski, 1924) Mehta & Raski, 1971
Syn. *Hoplolaimus menzeli* Stefanski, 1924
Iota menzeli (Stefanski, 1924) Micoletzky, 1925
Criconema menzeli (Stefanski, 1924) Taylor, 1936
Ogma menzeli (Stefanski, 1924) Sch. Stekhoven & Teunissen, 1938
Iota aculeatum Schneider, 1939 (n. syn.)
Criconema aculeatum (Schneider, 1939) De Conick, 1943
Crossonema aculeatum (Schneider, 1939) Mehta & Raski, 1971
Criconema guernei apud Menzel in Hofmänner & Menzel, 1914
Hoplolaimus guernei apud Schneider, 1923

C. multisquamatum (Kirjanova, 1948) Mehta & Raski, 1971
Syn. *Ogma multisquamatum* Kirjanova, 1948
Criconema multisquamatum (Kirjanova, 1948) Chitwood, 1957
Criconema civellae Steiner, 1949 (n. syn.)
Crossonema civellae (Steiner, 1949) Mehta & Raski, 1971
Criconema celetum Wu, 1960
Criconema eurysoma Golden & Friedman, 1964
Criconema vishwanatum Edward & Misra, 1966
Criconema fimbriatum apud Sveshnikova, 1940

C. proclive (Hoffmann, 1973) n. comb.
Syn. *Criconema proclive* Hoffmann, 1973

C. taylatum Khan, Chawla & Saha, 1976

C. taylori (Jairajpuri, 1964) Mehta & Raski, 1971
Syn. *Criconema taylori* Jairajpuri, 1964

Species inquirenda: *Crossonema georgiense* (Kirjanova, 1958) Ivanova, 1976 – Syn. *Criconema georgiense* Kirjanova, 1958.

Crossonema is most closely related to the genera *Ogma* Southern, 1914 and *Seriespinula* (Mehta & Raski, 1971) and can be distinguished from *a) Ogma* by the great number of scales not arranged in longitudinal rows, the lacking submedian lobes and that juveniles bear a less number of scales on each annule than mature specimens do; *b)* from *Seriespinula* by the great number of uni-tipped scales not arranged in longitudinal rows, the generally blunt tail terminus and the mostly 8 rows of scales on juveniles (10 – 18 rows at *Seriespinula*).

1 Annules less than 50; 70 – 90 spines on the annule on mid-body region*. 2
– Annules more than 50 (exceptionally less); 24 – 70 spines on one annule on mid-body region. 4

2 Vulva on the 3rd – 5th annule from tail tip; spines short. – L = 0.54 – 0.60 mm; V = 93 – 97%; R = 41 – 48; RV = 3 – 5; spear = 84 – 105 μ. ..... **fimcivatum** KHAN, CHAWLA & SAHA
– Vulva on the 6th – 8th annule from tail tip; spines long, digitiform. 3

3 Some scales on the posterior body end with lobes, 2-, 3- or multi-pointed; spines smooth. – L = 0.34 – 0.62 mm; V = 87 – 94%; R = 40 – 48; RV = 7 – 8; spear = 80 – 103 μ. ..... **multisquamatum** (KIRJANOVA)
– All scales on the posterior body end simple, uni-pointed; spines serrate. – L = 0.32 – 0.51 mm; V = 88 – 93%; R = 40 – 49; RV = 6 – 7; spear = 75 – 92 μ. ..... **boettgeri** (MEYL)

4 Annules on mid-body region bearing each 24 – 40 scales, some of them irregular on their end. 5
– Annules on mid-body region bearing each 40 – 70 scales, smooth on their ends. 6

5 Number of body annules 42 – 52; 30 – 40 scales on each annule. – L = 0.51 – 0.61 mm; V = 89 – 91%; R = 42 – 52; RV = 3 – 5; spear = 78 – 92 μ. ..... **taylatum** KHAN, CHAWLA & SAHA
– Number of body annules 56 – 57; 24 – 27 scales on each annule. – L = 0.44 – 0.48 mm; V = 91 – 94%; R = 56 – 57; RV = 7; spear = 81 – 82 μ. ..... **latens** MEHTA & RASKI

6 Number of annules above 80. – L = 0.44 – 0.69 mm; V = 82 – 95%; R = 84 – 93; RV = 12 – 16; spear = 101 – 120 μ. ..... **aquitanense** (FIES)
– Number of annules under 80. 7

7 Scales short, as long as wide, 30 – 40 on one annule, on the terminal annules widened, bifurcate; vulva far back, on the 4th – 6th annule from tail tip. – L = 0.46 – 0.56 mm; V = 92 – 94%; 53 – 58; RV = 4 – 6; spear = 80 – 85 μ. ..... **taylori** (JAIRAJPURI)
– Scales long and narrow, 40 – 70 on one annule, on the terminal annules not modified; vulva more forward, on the 10th – 16th annule from tail tip. 8

8 First head annule with long spine-like lobes. 9
– First head annule smooth or only finely crenate. 10

9 Only one head annule directed forward; cuticular spines fir-needle-like, each with two fine longitudinal lines, last body annules spineless. – L = 0.45 mm; V = 80%; R = 68; RV = 16; spear = 102 μ. ..... **abies** n. sp.
– Two head annules directed forward; cuticular spines simple, without longitudinal lines, last body annules also bearing spines. – L = 0.30 – 0.60 mm; V = 80 – 90%; R = 53 – 70 (mostly 60 – 70); RV = 10 – 14; spear = 90 – 103 μ. ..... **menzeli** (STEFANSKI)

10 Annules 53 – 63; spear longer than 90 μ. – L = 0.40 – 0.80 mm; V = 84 – 87%; R = 53 – 63; RV = 10 – 11; spear = 95 – 96 μ. ..... **fimbriatum** (COBB in TAYLOR)
– Annules 67 – 74; spear shorter than 90 μ. – L = 0.30 – 0.41 mm; V = 84 – 87%; R = 67 – 74; RV = 12 – 13; spear = 69 – 81 μ. ..... **proclive** (HOFFMANN)

Crossonema abies n. sp.

(Fig. 15 A – C)

Holotype ♀: L = 0.45 mm; a = 7.5; b = 3.1; c = ?; V = 80%.

Number of body annules 68. Annules 7 – 8 μ thick and 60 μ wide on the middle region of body, each packed with a fringe of about 50 fir-needle-shaped

* In the description of *C. fimcivatum*, Khan, Chawla and Saha speak about "more than 130 reduced spines" on one annule, the Fig. 7 *C* however illustrates only 87 spines on the mid-body cross section.

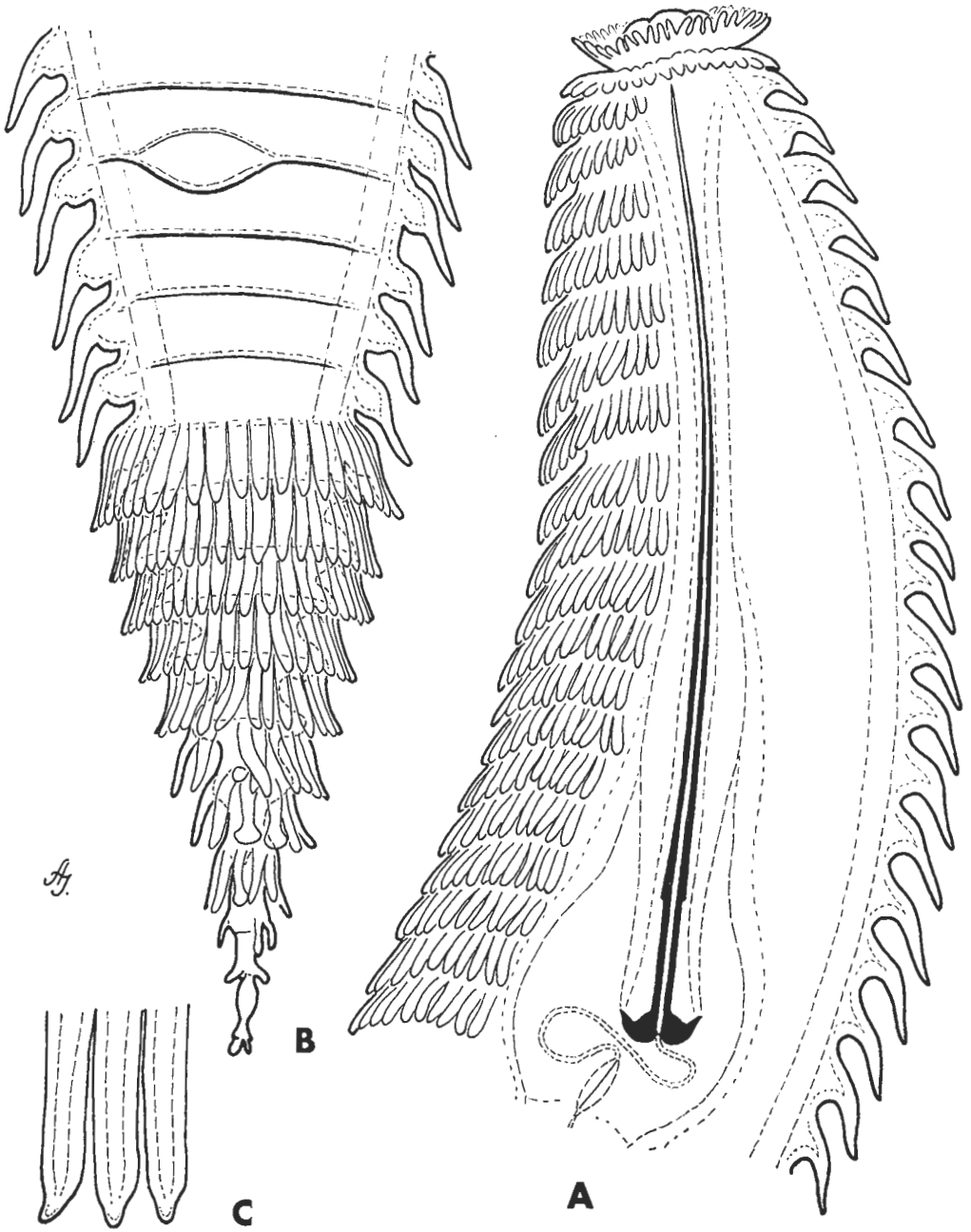

Fig. 15. *Crossonema abies* n. sp. *A:* Anterior region (1250×); *B:* Posterior end of body (1250×); *C:* Fir-tree needle-like spines on mid-body

spines. They are 8 – 9 μ long and peculiarly similar to the neledes of a fir-tree (*Abies alba* Mill.) since they also have two fine longitudinal lines like fir-needles on the back sied. (Hence the specific name "*abies*".) The spines begin on the first annule and they become gradually shorter or rudimentary on the last body annules only.

Head consisting of one annule since the second annule is directed backward. Head annule 20 μ, second annule 22 μ and third annule 27 μ wide. Head annule carrying about 20 spines. No submedian lobes.

Spear 102 μ (19 annules) long, 23 per cent of total length of body. Basal knobs 8 μ wide. Middle bulb about as long as isthmus and terminal bulb together. On the oesophageal region (between head and proximal end of oesophagus) 25 body annules can be counted. Excretory pore on the 20th annule from head end at level with the median bulb.

Vulva conoid, closed, on the 53rd annule from head and on the 16th annule from terminus. Postvulval body portion 88 μ long. Posterior end of body elongate-conoid with pointed terminus. Last 4 annules longer than wide, especially the two terminal rings very thin.

Male and larval forms not observed.

Holotype ♀: on slide Nr. 8257 in the collection of the author.

Type habitat and locality: Soil from an *Abies-Tsuga-Betula*-forest, 2000 – 2400 m above sea level, Mt. Yokodake, Nagamo Prefecture, Japan, collected in June, 1974 by Prof. Dr. H. FRANZ (Wien).

Crossonema abies n. sp. is very similar to *C. menzeli* (STEFANSKI, 1924), it can however be distinguished from the latter species by the one-annuled head, the somewhat thicker spines ornamented by two longitudinal lines, the position of vulva (on the 10 – 14th annule at *menzeli*), the more elongate posterior body region and the naked terminal annules.

Blandicephalanema MEHTA & RASKI, 1971

Criconematinae. Body small (0.36 – 0.56 mm) and robust. Annules 70 – 80, drawn out posteriad, ornamented by appendages arranged in 8 or 28 rows. Scales with broad basis and spine-like tip. Between the scales the margings of annules can be serrate. Scales not modified on posterior body end. Head narrow, with one annule bearing a convex oral region. No submedian lobes. Spear 63 – 90 μ long. Vulva on the 8th – 11th annule from terminus, closed with conoid lips. Tail conoid.

Male marked by three incisures on the lateral field. Spicules longer than tail, bursa very narrow, rudimentary.

On the cuticle of larvae there are 10 longitudinal rows of short scales.

Mode of life: Soil inhabiting nematodes.

Distribution (Fig. 12): Both species, known hitherto, live in New Zealand (an endemic group?).

Type species: *Blandicephalanema serratuma* MEHTA & RASKI, 1971.

Two species:

B. pilatum Mehta & Raski, 1971

B. serratum Mehta & Raski, 1971

Blandicephalanema can be distinguished from all the other genera of Criconematinae by the unusual shape of head.

Key to the species of Blandicephalanema

1 Scales arranged in 8 longitudinal rows; spear shorter than 70 μ. – L = 0.36–0.56 mm; V = 87–89%; R = 70–85; RV = 10–11; spear = 63–67 μ. ..... **serratum** Mehta & Raski
– Scales arranged in 28 longitudinal rows; spear longer than 80 μ. – L = 0.40–0.49 mm; V = 89–92%; R = 75–88; RV = 8–9; spear = 84–90 μ. ..... **pilatum** Mehta & Raski

Bakernema Wu, 1964

Criconematinae. Body moderate to large (0.5–1.0 mm). Annules 61–108 with rounded outline. Cuticle bearing thin, transparent, membraneous outgrowths not arranged in definite longitudinal rows. Appendages on posterior body region generally enlarged. Head with one annule, not set off, ornamented also by membraneous outgrowhts. Submedian lobes weakly developed or lacking. Spear 64–142 μ long. Vulva on the 5th–10th annule from terminus. Tail blunt.

Lateral field of male marked by 4 incisures. Bursa present but rudimentary.

The cuticular structure of larvae is similar to that of adults, the appendages are, however, heavier, cuticularized and not arranged in definite longitudinal rows.

Mode of life: Terricolous nematodes.

Distribution: According to the present status the genus *Bakernema* occur only in North America (Fig. 12). Perhaps, similarly to *Pateracephalanema* and *Blandicephalanema*, the species of this genus inhabit a single continent.

Type species: *Criconema bakeri* Wu, 1964 = *Bakernema inaquale* (Taylor, 1936) Mehta & Raski, 1971.

Two species:

B. inaequale (Taylor, 1936) Mehta & Raski, 1971
Syn. *Criconema inaequale* Taylor, 1936
Criconema bakeri Wu, 1964
Bakernema bakeri (Wu, 1964) Wu, 1964

B. variabile Raski & Golden, 1966

The genus *Bakernema* differs from the other genera of the subfamily by the fine, transparent outgrowths of cuticle, the differentiated head and by the fact that the appendages of the larval cuticle are not arranged in definite longitudinal rows.

Key to the species of Bakernema

1 Membraneous outgrowths of cuticle relatively large, scale-like; spear less than 80 μ; anterior lip of vulva overhanging. – L = 0.42–0.56 mm; V = 91–94%; R = 63–70; RV = 5–6; spear = 64–72 μ. ..... **inaequale** (TAYLOR)

– Membraneous outgrowths of cuticle small, lace-like; spear more than 90 μ; anterior lip of vulva not overhanging. – L = 0.53–0.99 mm; V = 89–95%; R = 92–107; RV = 6–10; spear = 97–142 μ. ..... **variabile** RASKI & GOLDEN

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