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PREFACE

This is an attempt to assemble in one book all the species of the Criconematidae (Nematoda: Tylenchida), the first attempts being De Grisse (1969) and Ivanova (1976). Ivanova (1976) listed almost 170 species; 34 years later such a list contains almost 600 species.

This remarkable group of nematodes, called ring nematodes, has been studied all over the world by many nematologists, but some taxonomists excelled in the description and redescription of Criconematid species, a.o. I. Andr  ssy (Hungary), A. Bello (Spain), M. Brzeski (Poland), Y. Choi (Korea), R. Crozzoli (Venezuela), A. De Grisse (Belgium), B.A. Ebsary (Canada), A.S. Eroshenko (Russia), M. Escuer (Spain), P. Loof (The Netherlands), M. Luc (France), U. Mehta (India), N. Minagawa (Japan), D. Raski (USA), E. Van den Berg (South Africa), N. Vovlas (USA) and W. Wouts (New Zealand).

Obtaining the articles that contain the descriptions was not always easy; Dr. Hongmei Li from Nanjing University helped with some Chinese papers; Dr. J. Zograf from Vladivostok forwarded a copy of Eroshenko's & Volkova's work. Translation of some Chinese articles was done by Y. Mei, and of some Russian papers by E. Guzeeva and N. Grushko, all Nematology students at Ghent University. I thank all of them.

I thank my wife, hon. prof. dr. Nicole Rowan for her patience and support during the preparation of this book.

INTRODUCTION

In this book about 600 nominal species of Criconematidae are mentioned; some of them are generally accepted synonyms of other species, some of them are species inquirendae, some of them are nomina nuda. This reduces the number of species to be treated to a little more than 470 species; of these 470 more than 50 species will be mentioned as possible synonyms of other species, reducing the amount of 'good species' to about 400. I did not undertake any synonymization knowing that further study in the future will clarify the situation.

It is a problem to know to what genus all these species belong. In Siddiqi (2000) the following 44 genera/subgenera are mentioned:

1. *Acrozostron* Orton Williams, 1981
2. *Amphisbaenema* Orton Williams, 1982
3. *Bakernema* Wu, 1964
4. *Blandicephalanema* Mehta & Raski, 1971
5. *Cerchnotocriconema* Bernard, 1982
6. *Criconema* Hofmänner & Menzel, 1914
7. *Criconemella* De Grisse & Loof, 1965
8. *Criconemoides* Taylor, 1936
9. *Crosserinema* Khan, Chawla & Saha, 1976
10. *Crossonema* Mehta & Raski, 1971
11. *Crossonemoides* Eroshenko, 1981
12. *Discocriconemella* De Grisse & Loof, 1965
13. *Hemicriconemoides* Chitwood & Birchfield, 1957
14. *Homogma* Siddiqi, 1986
15. *Lobocriconema* De Grisse & Loof, 1965
16. *Macrocriconema* Minagawa, 1986
17. *Madinema* Khan, Chawla & Saha, 1976
18. *Merocriconema* Raski & Pinochet, 1976
19. *Mesocriconema* Andrassy, 1965
20. *Nenocriconema* Darekar & Khan, 1982
21. *Neobakernema* Ebsary, 1981
22. *Neocriconema* Diab & Jenkins, 1965
23. *Neocriconema* Diab, 1966
24. *Neocrossonema* Ebsary, 1981
25. *Neolobocriconema* Mehta & Raski, 1971
26. *Nothocriconema* De Grisse & Loof, 1965
27. *Nothocriconemella* Ebsary, 1981
28. *Nothocriconemoides* Maas, Loof & De Grisse, 1971
29. *Notholetus* Ebsary, 1981
30. *Ogma* Southern, 1914
31. *Orphreyus* Siddiqi, 2000
32. *Pakcriconemoides* Shahina & Maqbool, 1993
33. *Paracriconema* Ebsary, 1981
34. *Paralobocriconema* Minagawa, 1986
35. *Pateracephalanema* Mehta & Raski, 1971
36. *Pellipecten* Siddiqi, 1986
37. *Pseudocriconema* Minagawa, 1984

38. *Seriespinula* Mehta & Raski, 1971
39. *Seshadriella* Darekar & Khan, 1981
40. *Syro* Orton Williams, 1985
41. *Variasquamata* Mehta & Raski, 1971
42. *Xenocriconemella* De Grisse & Loof, 1965

Two genus names will not be used:

Iota Cobb, 1913 as it is preoccupied by *Iota* Saussure, 1855 (Hymenoptera)

Macroposthonia de Man, 1880 as Coomans *et al.* (1990) considered the type species *M. annulata* as species dubia.

The high number of genera did not simplify taxonomy, on the contrary, during the last decades numerous species have been transferred to five or more different genera. So it seems that there is a chaotic situation in the taxonomy of the Criconematidae.

In taxonomy there is a tendency to make genera not too big; therefore you need to have clear cut differences between the genera. Such clear cut differences are not always available in the Criconematidae; several species show transitional characters when smaller taxonomical units (= smaller genera) are proposed. The result being that large genera are unavoidable. For the use of the generic names I took into consideration Siddiqi (2000), Brzeski *et al.* (2002), Wouts (2006) and Andr  ssy (2007). These authors slightly differ in their ideas about the genera; I nevertheless tried to obtain some conformity among the various proposals. In total 18 generic names will be used, 9 of them containing the bulk of the species.

Subfamily concept

The subdivision of the family Criconematidae into three subfamilies is not satisfying as only cuticular "differences" are used. Cuticular differences do exist but the use of the head structure and even of some measurements will consolidate the present subdivision by adding two subfamilies.

MORPHOLOGY AND MORPHOMETRY

A. GENERAL MOPHOLOGY

In the Criconematidae the annuli can be very large and prominent, the curvature in these annuli being such that the annuli are forwardly directed, not inclined or posteriorly inclined (= retrorse). Anastomoses occur in the juveniles and females when the thick body annuli do not form contiguous rings: the dorsal half-annuli interconnect with the ventral half-annuli often resulting in a laterally situated, longitudinal zigzag line. A lateral field can also be visible by the presence of a line or by whatever discontinuity of the annuli on the lateral side. The ultrastructure of the cuticle can be found in Decraemer *et al.* (2003) and in Geraert (2006).

The nervous system in the Criconematidae has been thoroughly studied by De Grisse (1977) and a review of the nematode sensilla in general is found in Coomans & De Grisse (1981). In the Criconematidae all the head sensilla are deeply embedded in the cephalic cuticle or lie free in the cephalic tissue and do not give rise to cuticular pits or papillae. Under the Light Microscope (LM) and under the Scanning Electron Microscope (SEM) only one nerve ending can be observed: the amphidial aperture. It usually consists of small apertures laterally of the oral disc, but in *Hemicriconemoides* large apertures are found on both sides of the band-like oral region. Deirids and phasmids are lacking.

The head shows a well developed head framework that is not as distinct as in some other Tylenchida. Sclerotization is not as heavy (except in *Bakernema*) and the basal plate is often absent; as a result it is not always easy to see the end of the head framework (and to see the extent of the head). The I-shaped prestoma aperture is typical, the prestoma cavity usually being covered by four flaps (two laterals, one dorsal, one ventral). Some Criconematidae can show around the oral disc and the small amphidial slits six slightly elevated regions, called pseudolips; several Criconematidae show much more complicated heads: with submedian lobes (close to or adhering to the oral disc or more separated from it), lateral and medial plates. It could be that the cephalic nerves influence the cuticular surface structure: the submedian lobes are found above these nerves.

The stylet in the Criconematidae is long to very long and often shows a more or less constant shaft length of 8-10 μm ; Wouts (2000) established, however, that in some *Criconema* species the length of the shaft is directly related to the size of the knobs. The knobs are usually very large and anchor-shaped; they can also be rounded or variable. The pharynx consists of its usual parts: the procorpus widens without constriction into the median pharyngeal bulb which is large and oval and contains elongate thickenings of the lumen; procorpus and isthmus can be very short, the terminal bulb is small and offset. The lumen of the procorpus can be heavily convoluted, particularly when the stylet is elongated, the lumen straightening when the stylet is protracted. The opening of the dorsal gland is at some distance from the stylet knobs but is often indistinct and so may not be represented in the drawings. Structure of intestine is not known, cells and lumen are indistinct. Rectum and anus are not always distinct.

The female reproductive system consists of only one branch, anteriorly directed with the opening near the posterior end. The vulva can be situated in a depression, called the 'open vulva', can be at the surface ('closed vulva') or can be protruded; the vulva can be covered by an outgrowth of the anterior lip; the anterior lip can be smooth or dentate. The vagina is forwardly directed and can be rather long; its shape can have

taxonomic importance (sigmoid vagina). The vagina is followed by a uterine sac and the uterus-spermatheca-complex: the spermatheca is found at the anterior ventral corner and has 12 nuclei; the cells of the uterus are not in rows and a lumen is often distinguishable. The oviduct is formed by a constriction of two rows of four cells. The ovary can be very long; it is usually straight but can be twisted or curved.

There is a strong sexual dimorphism. In the males the pharynx is reduced. The body annuli are weakly developed and a lateral field of 2, 3 or 4 lines is present. The cloacal opening is usually on a cloacal tube (also called penial tube). Slightly curved, elongated and delicate spicules are guided by a weakly developed gubernaculum. A bursa with caudal alae is usually present but can be very small.

Juveniles can have a very different appearance in comparison with the females: the juveniles are not or slightly different in two subfamilies and distinctly different in the other three subfamilies. Moreover the several juvenile stages can also be different from each other, but these differences will not be mentioned in this book. When juveniles are described it is usually the fourth stage that is given.

B. DETAILS IN THE HEAD STRUCTURE

On the basis of the head structure five types, representing five subfamilies can be distinguished.

1. The head in the subfamily Hemicriconemoidinae Andr ssy, 1979

Decraemer & Geraert (1992b) found several head-types in *Hemicriconemoides*; comparison with the head-types found in the remaining Criconematidae prompted me to transfer *H. obtusus* to *Criconema* (following an earlier proposal of Siddiqi, 1986) and *H. coronatus* to *Discocriconemella* (as a new combination). This leaves only a single head type in *Hemicriconemoides* that is reminiscent of the Hemicycliophoridae and that is not found in the remaining Criconematidae: a narrow, oval oral disc raised or not, with dorso-ventrally orientated slit-like oral opening, with laterally the amphids with usually large apertures and protruding plug, the whole embraced by the first head annulus. The head is well annulated but there are neither pseudolips nor submedian lobes.

2. The head in the subfamily Discocriconemellinae new subfamily

Loof & De Grisse (1989) discovered that the genera *Discocriconemella* and *Xenocriconemella* have the first head annulus reduced, lying on the front and so not visible from the usual lateral view; what is seen from the lateral side as the "first" head annulus is in fact the second annulus (that surrounds the first one). The head is well annulated but there are neither pseudolips nor submedian lobes.

3. The head in the Macroposthoniinae Skarbilovich, 1959

The head is well annulated, but not offset and is provided with submedian lobes accompanied or not by plates and ridges. (For the moment several species, mainly in the genus *Mesocriconema*, having not these head structures will remain included in the subfamily).

4. The head in the Criconematinae Taylor, 1936

The head annulation can be as simple as in the foregoing subfamily, but this subfamily comprises all the species with a large disc-shaped first head annulus; all these

species have pseudolips; submedian lobes are absent in most genera but present in two genera.

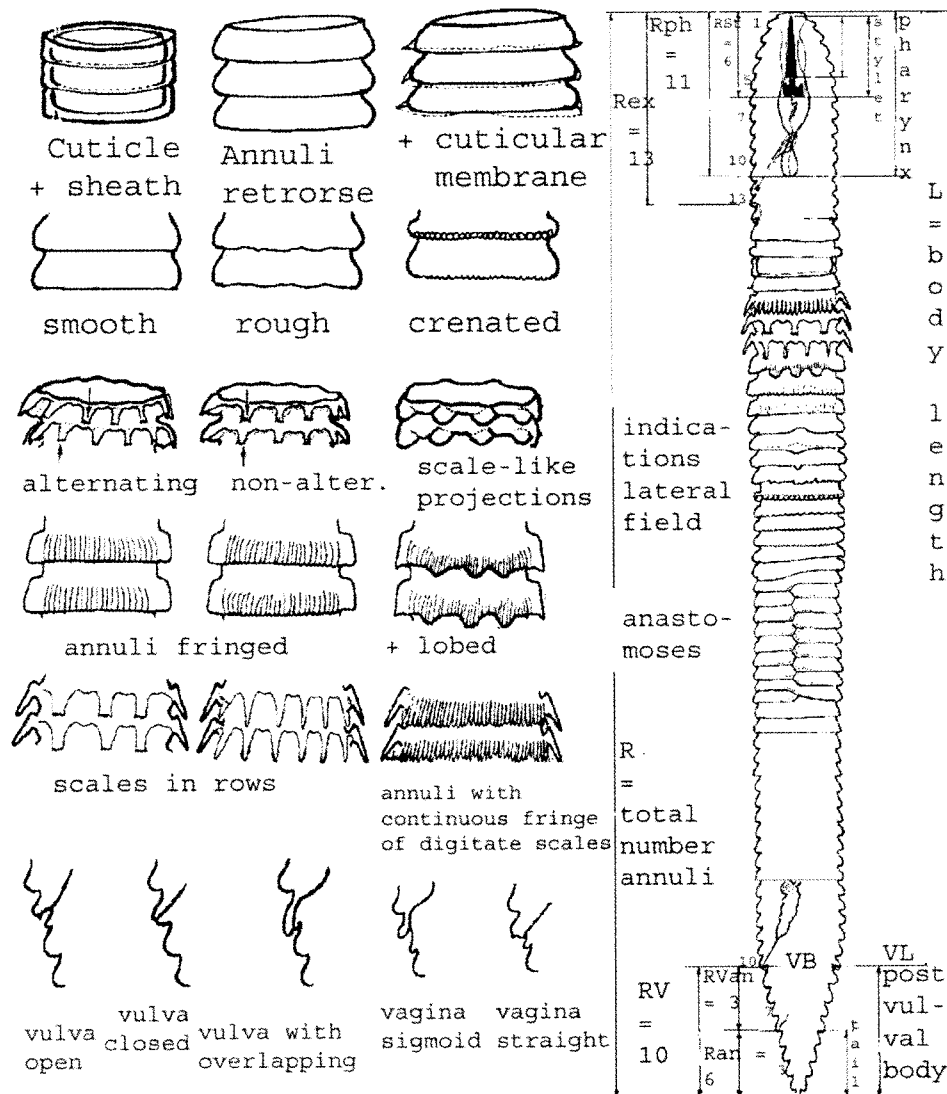


Fig. 1. Morphological and morphometrical details in the Criconematidae (based on De Grisse, 1969).

5. The head in the Blandicephalanematinae new subfamily

The genera *Blandicephalanema* and *Amphisbaenema* have a rounded, dome-shaped head showing no pseudolips, no submedian lobes nor any other outer structure. The dome-shaped head can be followed by a small basal head annulus.

C. DETAILED CUTICLE STRUCTURE IN FEMALES

The cuticle in female Criconematoidea is different from that in female Tylenchoidea mainly by the presence of a multi-layered cortex (only distinct at sub-microscopic level). Criconematidae suffer from an excessive cuticle formation in juveniles and females. This disease occurs in several steps.

1. Cuticle structure in the Hemicriconemoidinae

In *Hemicriconemoides* an outer cortical layer (or outer layers) is loosened and forms a cuticular sheath attached to the main body at head, vulva and sometimes tail tip. This cuticle never shows scales, spines or other appendages, but can show scratches. The cuticular annuli are more rounded or flattened than retrorse. A lateral field is absent. The single genus *Hemicriconemoides* shows one of the highest body annuli number in the family.

2. Cuticle structure in the Discocriconemellinae

Annuli thin and often numerous; the two genera included show with the foregoing subfamily the highest body annuli number in the family. Anastomoses can occur. The annuli are smooth to crenate.

3. Cuticle structure in the Macroposthoniinae

The relatively thinnest cuticle permits that underlying nerve endings result in cuticle formation at the front of the head resulting in submedian lobes; at the vagina there is not enough cuticle to close the vulva so the vulva is found in a depression, the situation is called "open vulva"; the open vulva is often accompanied by a slight growth of the anterior vulva lip showing two posteriorly directed spines. Species with these characteristics are assembled in *Mesocriconema*. Slightly more cuticle at the vagina results in a more closed vulva: a grouping called *Criconemoides*. In all these species the cuticle shows no surface structure (called 'smooth') or some wrinkling occurs ('crenate, rough, scratched...'); the lateral field is often indicated, mostly by anastomoses. This subfamily has a similar number of body annuli or slightly less than the foregoing subfamilies.

Also included are the much smaller genera *Bakernema*, *Neobakernema* and *Nothocriconemoides*.

4. Cuticle structure in the Criconematinae

In this subfamily the excessive additional cuticular material is found at the head, at the vulva and over the body. At the head it results in the formation of a larger head annulus (or annuli) and at the vulva in an elongation of the anterior vulva lip that overlays the vulva. The body annuli can be smooth or variously ornamented. Species showing such characteristics are assembled in *Criconema*. A more ornamented cuticle, a large disc-shaped head annulus and projecting vulval lips are found in five genera. The species in which the ornaments are situated in rows are assembled in *Ogma*; the species in which the ornaments are long, finger-like scales continuous around the body are assembled in *Crossonema*. In *Croserinema* the scales are also in rows but the scales alternate; in *Orphreyus* the long, finger-like scales are discontinuous and alternate around the body; in *Pateracephalanema* flat scales cover the entire body. The five genera listed above are hardly different from *Criconema*; they are kept as separate genera because it probably helps in identification. *Criconema* contains apart from the species with more or

less smooth cuticle also all the species with a variety of cuticular ornaments that do not fit into the five genera. In *Criconema* there are distinctly less annuli than in the foregoing subfamilies and the number is still smaller in *Ogma* and *Crossonema*. A lateral field is rarely indicated.

Two genera, *Lobocriconema* and *Neolobocriconema*, have the lowest number of annuli in the Criconematidae, but they do not fit in the evolutionary line suggested above. The cuticle can be smooth or slightly ornamented (*Lobocriconema*) to variously ornamented (*Neolobocriconema*). The main character differentiating these genera is the presence of submedian lobes, a structure absent in the foregoing Criconematinae.

5. Cuticle structure in the Blandicephalanematinae

The genus *Blandicephalanema* shows a cuticle covered with crust that may form spines or scales; crust easily rubs off in species with few scales. The genus *Amphisbaenema* shows at the outside an extracuticular incrustation of minute scales.

D. CUTICLE STRUCTURE IN JUVENILES

1. Juveniles in Hemicriconemoidinae

The cuticle of the juveniles differs considerably from that of the females as there is no sheath; external scales are present that can occur in rows but usually are in alternating rows or irregularly arranged.

2. Juveniles of the Discocriconemellinae

3. Juveniles of the Macroposthoniinae

The cuticle of the juveniles does not differ very much from that of the females; it sometimes shows more crenation, but never scales in rows.

4. Juveniles of the Criconematinae

Juveniles show spines or scales in longitudinal rows, even when adults have a smooth or differently shaped cuticle. As a result some species considered belonging to either *Criconema* or *Criconemoides* will have to be transferred the moment the structure of the juveniles is known.

5. Juveniles of the Blandicephalanematinae

Juveniles of *Blandicephalanema* show 8-12 rows of scales at mid-body; body and scales covered with thin crust of refractive particles. Juveniles of *Amphisbaenema* bear large, imbricate scales that easily disconnect from the body.

E. MORPHOMETRICS

E1. Relationship L (body length) and R (number of annuli)

A remarkable difference is found in the body length between the subfamily Discocriconemellinae and all the other subfamilies: the mean body length in the Discocriconemellinae is at the beginning of 300 μm ; all the other genera show mean body lengths 100 to 200 μm more. The number of body annuli being about the same in *Discocriconemella* and *Criconemoides* gives a mean annular thickness of about 3 μm in *Discocriconemella* and about 4.5 μm in *Criconemoides*.

The mean number of annuli is the largest in the Hemicriconemoidinae, with slightly less annuli in the Macroposthoniinae and still less in the Criconematinae.

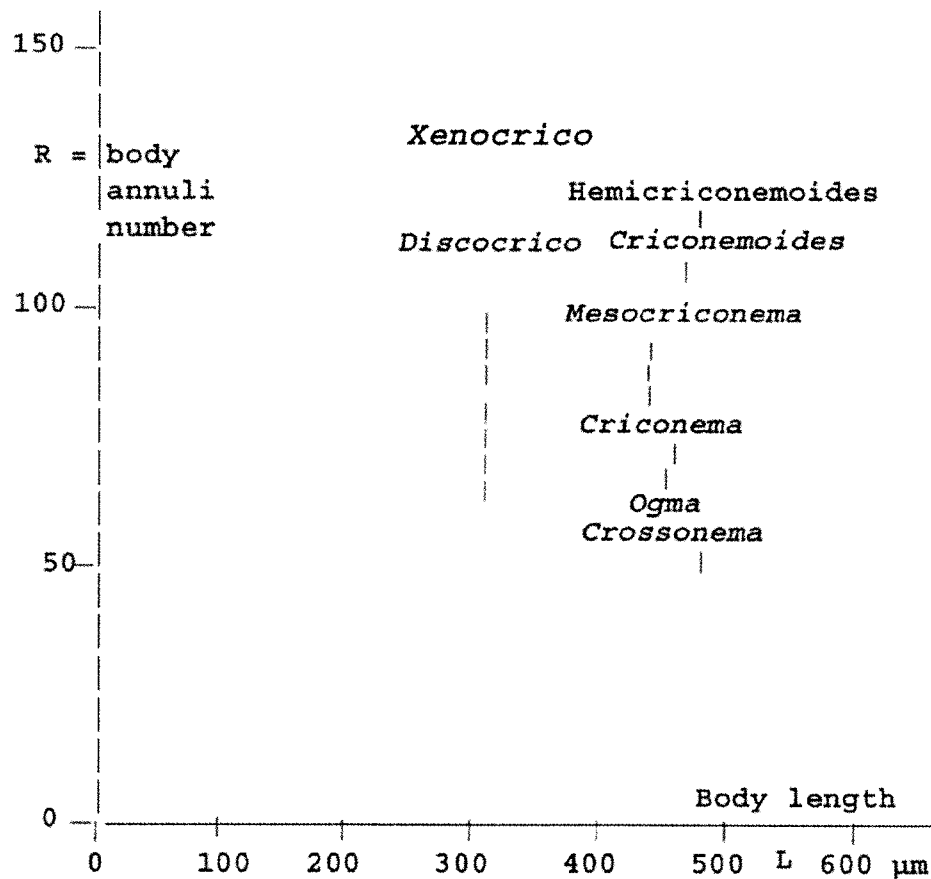


Fig. 2. Comparison between mean body length L and mean annuli number R in the Criconematid genera mentioned.

E2. Relationship L (body length) and stylet length

In the Discocriconemellinae similar stylet lengths are found as in the other sub-families, but because of their short bodies the stylet occupies a larger part of the body (up to 40 % in *Xenocriconemella*).

The mean stylet length in the several genera of the Criconematinae and the Macroposthoniinae is not as divergent as the differences noticed for annular thickness. Nevertheless the reverse is noticed: the genera with the lowest number of R have the longest stylet and vice versa.

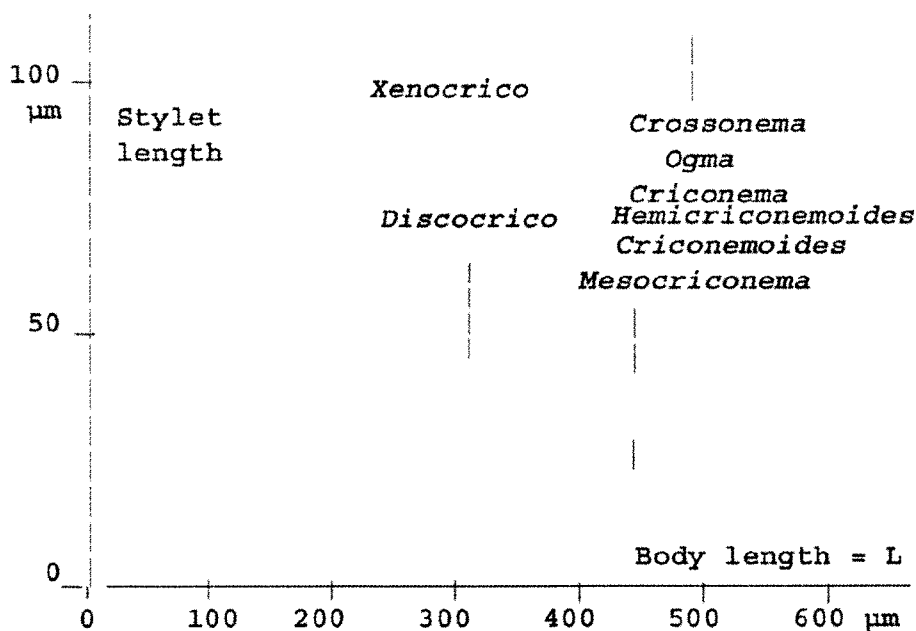


Fig. 3. Comparison between mean body length L and mean stylet length in the Cricone-matid genera mentioned.

E3. Rapid Identification Charts

For the larger genera Rapid Identification Charts are produced; they are added at the end of the genera concerned. Two items not related to each other, stylet length and RV (annuli number between vulva opening and body end) give usually a good spread of the several species over the diagram. In *Mesocriconema* a second chart has been added because too many species have a similar stylet length and RV; in *Lobocriconema* and *Neolobocriconema* another chart has been used as RV is similar among the species.

F. MOLECULAR EVIDENCE

In Subbotin *et al.* (2005) the species belonging to the subfamily Criconematinae, Macroposthoniinae and Hemicriconemoidinae form distinct clusters; *Xenocriconemella* is in a separate position, sustaining the introduction of a separate subfamily.

G. SYMBOLS AND ABBREVIATIONS

De Grisse (1964) introduced several new symbols to be used in the description of the Criconematidae of which the following ones will be used. The annulus counts were made on the ventral side of the body.

R = total number of annuli

Rex = annulus on which excretory pore is located, beginning from anterior end

RV = annulus on which vulva is located, counting from terminus

Ran = annulus on which anus is located, counting from terminus

RVan = number of annules between vulva and anus

VL/VB = distance from terminus to vulva divided by body width at vulva

The a, b, c values introduced by de Man will not be used, following the compendia of *Mesocriconema* and *Criconemoides* (Brzeski, 2002). As measurements L (= body length in mm), stylet length in μm and as ratio V (= relative position of the vulva in % of L) will be used.

As abbreviations LM (= Light Microscope) and SEM (= Scanning Electron Microscope) will be used.

TAXONOMY

The family Criconematidae can be subdivided into five subfamilies using morphological and morphometrical characters.

1. The subfamily Hemicriconemoidinae is characterized by a cuticle with a sheath; the annuli are more rounded than retrorse; the total number of annuli is the largest in the family. The head shows a narrow, oval oral disc raised or not, with dorso-ventrally orientated slit-like oral opening, with laterally the amphids with usually large apertures and protruding plug, the whole embraced by the first head annulus. The head is well annulated but there are neither pseudolips nor submedian lobes. The cuticle of the juveniles differs considerably from that of the females as there is no sheath; external scales are present that can occur in rows but usually are in alternating rows or irregularly arranged.

Subfamily Hemicriconemoidinae Andr ssy, 1979

Type genus: *Hemicriconemoides* Chitwood & Birchfield, 1957

No other genus.

2. The subfamily Discocriconemellinae is characterized by a mean body length at the beginning of 300 μm instead of 400-500 μm , resulting in annuli of about 3 μm and the stylet occupying a larger part of the body (up to 40 % in *Xenocriconemella*). Annuli thin and often numerous; the two genera included show with the foregoing subfamily the highest body annuli number in the family. Anastomoses can occur. The annuli are smooth to crenate. First head annulus reduced, lying on the front and so not visible from the usual lateral view; what is seen from the lateral side as the "first" head annulus is in fact the second annulus (that surrounds the first one). The head is well annulated but there are neither pseudolips nor submedian lobes. The cuticle of the juveniles does not differ very much from that of the females; it sometimes shows more crenation, but never scales in rows.

Subfamily Discocriconemellinae new subfamily

Type genus: *Discocriconemella* De Grise & Loof, 1965

Syn.: *Acrozostron* Orton Williams, 1981

Type species: *D. caudaventer* Orton Williams, 1979

Other genus: *Xenocriconemella* De Grise & Loof, 1965

3. The subfamily Macroposthoniinae is characterized by a smooth or slightly ornamented cuticle; in some genera a thin cuticular membrane is present; a lateral field is often indicated, mostly by anastomoses. Vulva open or closed or covered by an elongation of the anterior vulva lip. The cuticle of the juveniles does not differ very much from that of the females; it sometimes shows more crenation, but never scales in rows.

Subfamily Macroposthoniinae Skarbilovich, 1959

Type genus: *Mesocriconema* Andr ssy, 1965

Syn.: *Madinema* Khan, Chawla & Saha, 1976
 Type species: *M. maglia* (Khan, Chawla & Saha, 1976)
Seshadriella Darekar & Khan, 1981
 Type species: *M. magnilobatum* (Darekar & Khan, 1981)
Pakcriconemoides Shahina & Maqbool, 1993
 Type species: *M. anastomoides* (Maqbool & Shahina, 1985)

Other genera:

Bakernema Wu, 1964

Criconemoides Taylor, 1936

Syn.: *Criconemella* De Grisse & Loof, 1965

Type species: *C. parvus* Raski, 1952

Neocriconema Diab & Jenkins, 1965

(= *Neocriconema* Diab, 1966)

Type species: *C. adamsi* (Diab & Jenkins, 1965)

Neobakernema Ebsary, 1981

Syn.: *Crossonemoides* Eroshenko, 1982

Type species: *N. calvatum* (Eroshenko, 1982)

Nothocriconemoides Maas, Loof & De Grisse, 1971

4. The subfamily Criconematinae is characterized by a variety of cuticular ornaments although several species have a non-ornamented cuticle. In *Criconema* there are distinctly less annuli than in the foregoing subfamilies and the number is still smaller in *Ogma* and *Crossonema*. A lateral field is rarely indicated. The head annulation can be as simple as in the foregoing subfamily, but this subfamily comprises all the species with a large disc-shaped first head annulus; all these species have pseudolips; submedian lobes are absent in most genera but present in two genera. Juveniles show spines or scales in longitudinal rows, even when adults have a smooth or differently shaped cuticle.

Subfamily Criconematinae Taylor, 1936

Type genus: *Criconema* Hofmänner & Menzel, 1914

Syn.: *Cerchnotocriconema* Bernard, 1982

Type species: *C. psephinum* (Bernard, 1982)

Merocriconema Raski & Pinochet, 1976

Type species: *C. braziliense* (Raski & Pinochet, 1976)

Nenocriconema Darekar & Khan, 1982

Type species: *C. dorgeski* (Darekar & Khan, 1982)

Nothocriconema De Grisse & Loof, 1965

Type species: *C. annuliferum* (de Man, 1921)

Nothocriconemella Ebsary, 1981

Type species: *C. sphagni* Micoletzky, 1925

Notholetus Ebsary, 1981

Type species: *C. spicatum* (Ebsary, 1981)

Paracriconema Ebsary, 1981

Type species: *C. lamellatum* (Raski & Golden, 1966)

Other genera

Croserinema Khan, Chawla & Saha, 1976

Crossonema Mehta & Raski, 1971

Syn.: *Neocrossonema* Ebsary, 1981

Type species: *C. fimbriatum* (Cobb in Taylor, 1936)

Homogma Siddiqi, 1986

Type species: *C. taylatum* Khan, Chawla & Saha,

1976

Lobocriconema De Grisse & Loof, 1965

Neolobocriconema Mehta & Raski, 1971

Pateracephalanema Mehta & Raski, 1971

Ogma Southern, 1914

Syn.: *Macrocriconema* Minagawa, 1986

Type species: *O. querci* (Choi & Geraert, 1975)

Paralobocriconema Minagawa, 1986

Type species: *O. serratus* (Khan & Siddiqi, 1963)

Pellipecten Siddiqi, 1986

Type species: *O. pectinatus* (Colbran, 1962)

Pseudocriconema Minagawa, 1984

Type species: *O. japonicus* (Minagawa, 1984)

Seriespinula Mehta & Raski, 1976

Type species: *O. cobbi* (Micoletzky, 1925)

Syro Orton Williams, 1985

Type species: *O. vexillatrix* (Orton Williams, 1985)

Variasquamata Mehta & Raski, 1971

Type species: *O. decalineatus* (Chitwood, 1957)

Orphreyus Siddiqi, 2000

5. The subfamily Blandicephalanematinae is in the first place characterized by the head structure: a dome-shaped head without pseudolips, submedian lobes or whatever other structure. Cuticle with scales in *Blandicephalanema* and without scales in *Amphisbaenema*. Juveniles with scales.

Blandicephalanematinae new subfamily

Type genus: *Blandicephalanema* Mehta & Raski, 1971

Other genus: *Amphisbaenema* Orton Williams, 1982

KEY TO THE GENERA

1. Cuticle with a sheath, annuli more rounded.....*Hemicriconemoides*
 Cuticle without a sheath, annuli mostly retrorse.....2
2. Head dome-shaped, empty.....3
 Head distinctly annulated.....4
3. Cuticle covered with scales.....*Blandicephalanema*
 Cuticle without large scales.....*Amphisbaenema*
4. Cuticle with scales in distinct rows.....5
 Cuticle with continuous band of finger-like scales.....*Crossonema*
 Cuticle with discontinuous bands of finger-like scales.....*Orphreyus*
 Cuticle entirely covered by flat scales.....*Pateracephalanema*
 Cuticle smooth to variously ornamented.....6
5. Scales alternate.....*Croserinema*
 Scales present on consecutive rings.....*Ogma*
6. Stylet about 40 % of body length.....*Xenocriconemella*
 Stylet not as long.....7
7. Juveniles known.....8
 Juveniles not known.....identification less reliable
8. Juveniles without rows of scales.....9
 Juveniles with rows of scales.....14
9. Disc-shaped head.....10
 Head not disc-shaped (large submedian lobes can give the impression of a disc)....11
10. Without submedian lobes, small species..... *Discocriconemella*
 With submedian lobes, larger species.....*Nothocriconemoides*
11. Vulva open.....12
 Vulva closed.....*Criconemoides*
 Vulva covered by elongated anterior lip.....13
12. Cuticle covered by a thin membrane, very long stylet.....*Neobakernema*
 Cuticle usually not covered by a membrane, stylet smaller..... *Mesocriconema*
13. Body covered by a thin membrane, head without disc.....*Bakernema*
 Body not covered by a membrane, head with disc.....*Nothocriconemoides*
14. Head without submedian lobes.....*Criconema*
 Head with submedian lobes.....15
15. Cuticle smooth to slightly ornamented, vulva usually open.....*Lobocriconema*
 Cuticle distinctly ornamented, vulva usually closed.....*Neolobocriconema*