

A reappraisal of the genus *Criconema* Hofmänner & Menzel, 1914 (Nematoda : Criconematidae)

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SUMMARY

Taxonomic implications of the rediscovery and redescription of *Criconema giardi* (Certes, 1889) Micoletzky, 1925, type species of the genus *Criconema* Hofmänner & Menzel, 1914, are reported. A broader concept of this genus is proposed which implies the synonymisation with it of the following genera: *Lobocriconema* De Grisse & Loof, 1965; *Nothocriconema* De Grisse & Loof, 1965; *Merocriconema* Raski & Pinochet, 1976, n. syn.; *Nenocriconema* Darekar & Khan, 1981, n. syn.; *Notholetus* Ebsary, 1981, n. syn.; *Nothocriconemella* Ebsary, 1981, n. syn.; *Paracriconema* Ebsary, 1981, n. syn.; *Amphisbaenema* Orton Williams, 1982, n. syn., and *Cerchnotocriconema* Bernard, 1981, n. syn. The genus *Criconema* is rediagnosed and a list of species is given.

RÉSUMÉ

Réévaluation du genre *Criconema* Hofmänner & Menzel, 1914 (Nematoda : Criconematidae)

Les conséquences taxonomiques de la redécouverte et de la redescription de *Criconema giardi* (Certes, 1889) Micoletzky, 1925, espèce type du genre *Criconema* Hofmänner & Menzel, 1914, sont rapportées. Une plus large acception du genre est proposée qui conduit à synonymiser avec lui les genres suivants: *Lobocriconema* De Grisse & Loof, 1965; *Nothocriconema* De Grisse & Loof, 1965; *Merocriconema* Raski & Pinochet, 1976, n. syn.; *Nenocriconema* Darekar & Khan, 1981, n. syn.; *Notholetus* Ebsary, 1981, n. syn.; *Nothocriconemella* Ebsary, 1981, n. syn.; *Paracriconema* Ebsary, 1981, n. syn.; *Amphisbaenema* Orton Williams, 1982, n. syn., and *Cerchnotocriconema* Bernard, 1981, n. syn. Une nouvelle diagnose du genre *Criconema* est donnée, de même qu'une liste des espèces.

Andrássy (1979) considered the genus *Criconema* Hofmänner & Menzel, 1914 a *genus dubium* but the redescription of *Criconema giardi* (Certes, 1889) Micoletzky, 1925 by Raski, Luc and Valenzuela (1984) led to reestablishment of this genus as valid. However these actions also raise questions on the identity of the genus.

C. giardi fits conveniently with the basic morphological characters used in the original diagnosis of the genus *Nothocriconema* De Grisse & Loof, 1965, i.e.: i) low rounded lip region with six lips; no submedian lobes; ii) lip region sometimes set-off and collar-like; second (or second and third) annule(s) narrower than first and 3rd (or 4th); iii) body annules smooth, with round outline; iv) female tail mostly conoid to pointed; v) vulva with large anterior lip, lacking ornamentation; vi) juveniles with eight to twelve longitudinal rows of scales (smooth edged or dentated); vii) males with bursa and three latera lines.

The only point in which *C. giardi* differs from the species included in *Nothocriconema* is the particular extracuticular incrustation of females, composed of

dot-like incrustations on the anterior margin of the annules and an irregular fringe projecting from the posterior margin. The posterior fringe appears definitely of cuticular nature and originates from the cuticle proper. However, the incrustations appear extracuticular either from excretions of the cuticle or biochemical deposits from external organisms but not an extension of the cuticle itself.

A decision could have been taken to emphasize the value of this ornamentation as a generic diagnostic character and consequently to restrict the genus *Criconema* to those species showing similar incrustations and/or fringe. This was the way followed by other authors when creating the genera *Cerchnotocriconema* Bernard, 1982 and *Amphisbaenema* Orton Williams, 1982, both close to *Nothocriconema* but showing variously formed incrustations.

We prefer to follow the opinion of Jairajpuri and Southey (1984) when describing *Nothocriconema shepherdae* which shows incrustation similar to that of *C. giardi* but developed on the entire body. These authors considered that this character was not

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sufficient to allow a generic separation from other *Nothocriconema* species without incrustations; they emphasized the similarities that suggested *Amphisbaenema* and *Cerchnotocriconema* were closely related to *Nothocriconema*, as well as *Paracriconema* Ebsary, 1981 and *Merocriconema* Raski & Pinochet, 1976. Thus we consider such extracuticular incrustation as a good specific character, and not more. Consequently *Nothocriconema* is considered a junior synonym of *Criconema*.

A species recently described as *Bakernema velatum* Mehta, Raski & Valenzuela, 1983, shows an ornamentation of the female body annules similar to that observed in *C. giardi*: a thin membranous fringe projects from the posterior part of each body annule, with an irregular wavy edge. As all other female and juvenile characters are close to those of *C. giardi*, we propose the name *Criconema velatum* (Mehta, Raski & Valenzuela, 1983) nov. comb. for this species.

This group of criconematids has been subject to great systematic activity during recent years. Andr assy (1979) synonymized *Lobocriconema* with *Nothocriconema* whereas Ebsary (1981a, 1981b) divided *Nothocriconema* into four genera (*Nothocriconema s. str.*, *Nothocriconemella*, *Paracriconema* and *Notholetus*). The relationships of these genera to *Criconema* (= *Nothocriconema*), as well as those of other closely related genera (*Cerchnotocriconema*, *Amphisbaenema*, *Merocriconema* and *Nenocriconema* Darekar & Khan, 1981) will be examined in detail and their validity checked.

Genus *Cerchnotocriconema* Bernard, 1982

The genus *Cerchnotocriconema*, with type and only species *C. psephinum* Bernard, 1982, was considered most closely related to *Seriespinula* Mehta & Raski, 1971. The distinguishing characters supporting the new taxon include: *i*) external structure of the lip region being similar to *Seriespinula*; *ii*) cuticular ornamentation (longitudinal rows of dentate scales on 3rd and 4th stage juveniles) also being similar to *Seriespinula*; *iii*) highly developed plate-like or pebble-like protuberances surrounding the body and present on both anterior and posterior edges of the annules (weakly developed on anterior margin of annules in *Seriespinula*); *iv*) cuticular scales on second-stage juveniles not in longitudinal rows.

In fact the single lip annule, set off by narrower collar, and the external structure *en face* are more characteristic of *Criconema*. The same is true for the dentate cuticular scales of juveniles arranged in rows on 3rd and 4th stages. The degree of development of the rounded plate-like or pebble-like protu-

berances is not so different from what was observed on *C. giardi* females, which weakens the case for a separate taxon based primarily on such protrusions. In view of its closer relationship we propose *Cerchnotocriconema* be designated a junior synonym of *Criconema* and *C. psephinum* be renamed *Criconema psephinum* (Bernard, 1982) nov. comb.

Genus *Amphisbaenema* Orton Williams, 1982

The genus *Amphisbaenema* Orton Williams, 1982 was proposed for two new species (*A. amicorum* and *A. paradoxiger*) from Western Samoa and Tonga; Transfer of *Nothocriconema lamellatum* (Raski & Golden, 1966) De Grisse, 1967 to the new genus was also proposed; in the meantime, this latter species has been made the type species of *Paracriconema* Ebsary, 1981 (see below). Diagnostic characters of *Amphisbaenema* included: *i*) outer layer of cuticle forming a pattern of platelets; *ii*) subspherical or cap-like head, without submedian lobes, labial plates or pseudolips; *iii*) "features of juveniles and males" (not specified).

The most remarkable feature of these species is, here too, the outer covering of the cuticle of females composed of innumerable small dots and irregular patches, highly refractive platelets, larger in *A. amicorum* than in *A. paradoxiger*; in *A. lamellatum* this covering is mainly composed of longitudinal breaks. The nature of the labial region is rather different between *A. paradoxiger* and *A. amicorum*; in the latter species it is composed of a larger first annule and a narrower, shorter second, the anterior end being broadly rounded and protruding forward; *A. paradoxiger* has a single basal annule and more narrowly rounded anterior end projecting forward. The absence of pseudolips, submedian lobes or plates (single specimen of *A. amicorum* permitted lateral view only) may be the result of being obscured by the outer covering but even so it is not strong evidence of separate generic status, given the other apparent close relationships to *Criconema*. Males of *A. paradoxiger* have no notable characteristics which would suggest generic difference from other *Criconema* species. The circular swelling surrounding the cloacal opening provided with a single spine on the posterior edge is acceptable as a specific differentiation but no more. Males are not known for *A. lamellatum* or *A. amicorum*. Juveniles of *A. paradoxiger* have the usual, basic longitudinal rows of cuticular protuberances characteristic of *Criconema*, complicated by an incompletely defined layer of backwardly directed spines (?): this may be similar to the extracuticular incrustation found in females of *Criconema giardi*. Juveniles are not known for *A. amicorum*.

The unusual appearance of the outer layer of the cuticle of these forms is not very different from that observed on *C. giardi* and does not warrant a separate generic taxon. Therefore *Amphisbaenema* is proposed a junior synonym of *Criconema* and the three species included there are transferred to *Criconema* (see species list).

Genus *Paracriconema* Ebsary, 1981

The genus *Paracriconema* Ebsary, 1981 contains five species: *P. lamellatum* (Raski & Golden, 1965), Ebsary, 1981, type species; *P. dubium* (De Grisse, 1967) Ebsary, 1981; *P. duplicivestitum* (Andrássy, 1963) Ebsary, 1981; *P. rarum* (Boonduang & Ratanaprapa, 1974) Ebsary, 1981 and *P. solitarium* (De Grisse, 1967) Ebsary, 1981. All these species were formerly placed in *Nothocriconema*, with the exception of *P. rarum* which was placed in *Lobocriconema*, and they are said to constitute an entity different from *Nothocriconema* (now *Criconema*) by virtue of: *i*) their shorter and rounded post-vulval body portion of 4-8 annules instead 8-15 in *Criconema* where it is conical-pointed (Ebsary cites as a differential character the value of the ratio VL/VB which is 0.7-1.1 in *Paracriconema* and 1.1-2.0 in *Criconema*; this is not independent of the character of the shape of post-vulval part since a "rounded" shape is generally shorter than a conical one.); *ii*) the smooth scales on the cuticle of juveniles compared with spine-tipped scales in *Criconema*.

We judge such characters do not justify creation of a separate genus. All intermediate forms can be found between the "rounded" post-vulval part and the "typical" conical post-vulval part of *Criconema*. Besides, the type of ornamentation of the scales on the juvenile cuticle appears to be a good character for recognition of species but to have no value at generic level.

Consequently we judge that the genus *Paracriconema* must be considered as a junior synonym of *Criconema*, and the five species transferred to the latter genus (see species list).

Genus *Notholetus* Ebsary, 1981

The genus *Notholetus* Ebsary, 1981 also contains five species: *N. spicalus* Ebsary, 1981, type species; *N. corbelli* (De Grisse, 1967) Ebsary, 1981; *N. spinicaudatus* (Raski & Pinochet, 1976) Ebsary, 1981; *N. victoriae* (Heyns, 1970) Ebsary, 1981 and *N. zae* (van den Berg & Heyns, 1977) Ebsary, 1981. With the exception of the type species and of *N. zae* (originally *Lobocriconema zae*) these species had been transferred from *Nothocriconema*.

The character used to justify that action was that on adult females the post-vulval part of the body cuticle shows, instead of smooth annules, some deformities or bears lobes or "scales".

Among these species, *N. zae* excepted, because on all body annules the posterior margin of annules is slightly scalloped, the cuticular scales increase in definition in the posterior part, and on the last six to nine annules form rounded scales disposed in eight rows. The outline of the terminus is roughly rounded.

N. corbelli is an intermediate species in which the outline of the terminus is roughly rounded also but the last three or four annules show only some irregularities, not very pronounced.

The three remaining species (*N. victoriae*, *N. spicalus*, *N. spinicaudatus*) share a common post-vulval body shape which narrows abruptly about half-way followed by a tail-like, narrowly conoid posterior portion with finely rounded terminus. The ornamentation of the posterior annules increases progressively within these three species: in *N. victoriae* only three or four annules anterior to the spicate portion are deformed giving them a "bizarre appearance"; in *N. spicalus* the differentiation begins slightly anterior to the vulva, the annules bearing short scales not arranged in rows; in *N. spinicaudatus* the differentiation begins at mid-body by slight undulations and cuticular indentations followed, at one body-width anterior to vulva, by scales arranged in twelve rows.

Juveniles are known only for two species, *N. corbelli* and *N. spinicaudatus*; they bear rows of scales, at least twelve in the former species (smooth?) and 17-18 (spiny) in the latter species.

Is this grouping of species in a separate genus justified? We do not think so for the reason that the grouping appears artificial. *N. zae* has ornamentation of a type different from that of the other four species; *N. corbelli* shows a differentiation involving only three or four posterior annules but is perfectly linked with the remaining species which in turn show a progressive increase in ornamentation of the posterior annules.

We judge such a character is not more important than the fact that, for example in *Criconemella*, the posterior edge of annules may be smooth or provided with small regular ornamentation. This shows only a tendency in the group to the ornamentation of annules and in this case it concerns only a relatively few numbers of annules.

Thus we consider that the genus *Notholetus* should be considered a junior synonym of *Criconema* and its five species transferred to the latter genus (see species list).

Genus *Nothocriconemella* Ebsary, 1981

The proposal for the genus *Nothocriconemella* Ebsary, 1981 proceeded from the splitting of *Nothocriconema*. *Nothocriconemella* with *N. sphagni* (Micoletzky, 1925) Ebsary, 1981 as the type species, contained the majority (17) of the species⁽¹⁾ whereas *Nothocriconema sensu* Ebsary, 1981 includes not more than eight species⁽²⁾ and has *N. annuliferum* (de Man, 1921) De Grisse & Loof, 1956 as type species.

The main character taken into consideration for separating the two genera is the profile of the so-called "head" annule(s) : in *Nothocriconemella* there are two head annules, set off, the first being narrower than the second and slightly separated ; in *Nothocriconema sensu* Ebsary (= "*Nothocriconema*" hereinafter) there are, usually, two head annules, set off, the first being wider than the second and separated. Other characters retained are the structure of body annules (retrorse and 4-6 μm thick in *Nothocriconemella* ; rounded and 8-12 μm thick in "*Nothocriconema*"), and the structure of cuticular scales in the juveniles (smooth in *Nothocriconemella*, with the exception of *N. orientalis* ; spine-tipped in "*Nothocriconema*").

If we consider the fifteen species⁽³⁾ attributed to *Nothocriconemella* we can make the following obser-

⁽¹⁾ *Nothocriconemella acricula* (Raski & Pinochet, 1976) Ebsary, 1981 ; *N. calva* (Raski & Golden, 1966) Ebsary, 1981 ; *N. coorgi* (Khan & Nanjappa, 1972) Ebsary, 1981 ; *N. degrissei* (Baqri, 1979) Ebsary, 1981 ; *N. demani* (Micoletzky, 1925) Ebsary, 1981 ; *N. grassator* (Adams & Lapp, 1967) Ebsary, 1981 ; *N. kovacsi* (Andrássy, 1963) Ebsary, 1981 ; *N. longula* (Gunhold, 1953) Ebsary, 1981 ; *N. macilentata* (Raski & Pinochet, 1976) Ebsary, 1981 ; *N. mutabilis* (Taylor, 1936) Ebsary, 1981 ; *N. orientalis* (Andrássy, 1979) Ebsary, 1981 ; *N. pacifica* (Andrássy, 1965) Ebsary, 1981 ; *N. paraguayensis* (Andrássy, 1968) Ebsary, 1981 ; *N. pastica* (Raski & Pinochet, 1976) Ebsary, 1981 ; *N. permista* (Raski & Golden, 1966) Ebsary, 1981 ; *N. psammophila* (Krnjaic & Loof, 1963) Ebsary, 1981 ; *N. sphagni* (Micoletzky, 1925) Ebsary, 1981, type species.

⁽²⁾ *Nothocriconema annuliferum* (de Man, 1921) De Grisse & Loof, 1965, type species ; *N. cardamomi* Khan & Nanjappa, 1972 ; *N. crotaloides* (Cobb, 1924) De Grisse & Loof, 1965 ; *N. jaejuense* Choi & Geraert, 1975 ; *N. loofi* De Grisse, 1967 ; *N. petasum* (Wu, 1965) De Grisse & Loof, 1965 ; *N. princeps* (Andrássy, 1962) De Grisse & Loof, 1965 ; *N. sanctifrancisci* van den Berg & Heyns, 1977.

⁽³⁾ We consider *N. kovacsi* as a junior synonym of *N. mutabilis* and *N. grassator* as a junior synonym of *N. sphagni*.

variations : 1) some of the species have only one annule sufficiently differentiated from succeeding annules to enable its distinction as a "head" annule. Included here are *macilentata*, *mutabilis*, *pacifica* (= *arcanum*), *paraguayensis*, and *pastica* ; 2) among the remaining species with more than one "head" annule : i) four have a first annule wider than the second one : *calva*, *coorgi*, *psammophila*, *longula*⁽⁴⁾ (= *elegantula*) and *demani* ; ii) two present first and second annules of about the same diameter : *acricula* and *permista* ; iii) three have the first head annule narrower than the second one : *degrissei*, *orientalis* and *sphagni*. Note that in *degrissei* three head annules are present which is a unique case.

Summarizing these observations we can state that among the fifteen species that constitute the genus *Nothocriconemella*, only the last three cited species present the character given as the main one to separate this genus from "*Nothocriconema*" i.e. a first head annule narrower than the second one. All other species have only one head annule or have two (exceptionally three in *degrissei*), the first one being of the same diameter or larger than the second one.

If we consider now the statement that in *Nothocriconemella* the two head annules are "slightly separated" from each other whereas they are "strongly separated" in "*Nothocriconema*", the following observations can be made : 1) As stated above, this character cannot be applied to species having only one head annule ; among these species the simplest structure appears in *mutabile* where the head annule is straight ; in other species, *paraguayensis*, *pacifica*, *pastica*, *macilentata* and *longula*, this annule is slightly forwardly directed. 2) Among the remaining species lines can be drawn from *coorgi* (two annules, equal and straight) to : i) *acricula* (two annules equal, both forwardly directed) ; ii) *sphagni* (first annule narrower, forwardly directed ; second annule straight) \rightarrow *orientalis* (two annules forwardly directed, first narrower) ; iii) *permista*, *calva*, *demani*, *psammophila*, *loofi* (first annule forwardly directed and larger than second, second straight). In all these species the two head annules appear close to each other because the first annule is not differentiated into two parts as in the remaining species. 3) In this last group of species, the first annule is more or less differentiated in two parts : an anterior one cup-shaped with thin edges, and a posterior part, narrower, often called the "collar" ; this differentiation is more or less pronounced and a line can be drawn from *princeps* \rightarrow

⁽⁴⁾ Following supplementary description given by Minagawa (1981).

jaeuense → *cardamomi* → *sanctifrancisci* → *crotaloides* → *annuliferum* → *petasum*. Note : *i*) this line could begin with *demani-loofi*; *ii*) in *petasum*, only the first annule is differentiated, the succeeding annule being identical to those of the body, if narrower than normal; *iii*) *degrissei* is set apart because the description states that there are three head annules; existence of the first one (very thin and narrow) appears doubtful; if it pertains to the pseudolips area, then the two "true" head annules are of the *orientalis*-type (both forwardly directed, first narrower than second).

If we consider now the body annules of adult females, they can be said to be "non-retrorse" or "rounded" only in *annuliferum*, *jaeuense*, *crotaloides*, *loofi*, *demani* and *psammophila*. The four first cited species pertain to "*Nothocriconema*" but this character, said to be important for the redefinition of that genus, does not apply to the four other species, and is present in two species of *Nothocriconemella* (*demani* and *psammophila*) where the annules are said to be retrorse.

The thickness of the annule also has been taken into consideration to separate these two genera, "*Nothocriconema*" having annules of 8-11 μm thickness and *Nothocriconemella* of 4-6 μm . Taking into consideration the figures given in the description or, if lacking, calculating this value from the ratio L/R (on holotype or lectotype), we see that a considerable overlap exists between the two genera: annule thickness in *Nothocriconemella* species ranges from 3.0 μm (*mutabile*, *pastica*) to 7-8 μm (*degrissei*) whereas in "*Nothocriconema*" species it ranges from 6.0 μm (*sanctifrancisci*) to 12.0 μm (*princeps*). Of 24 species, twelve have mean values ranging from 5-7 μm .

Juveniles: in "*Nothocriconema*", where the juvenile cuticular scales are said to be spine-tipped, juveniles are known in three of eight species, two of them having spine-tipped scales (*annuliferum*) or scales with refractive elements at their extremity (*princeps*), the third smooth scales (*loofi*). In *Nothocriconemella* juveniles are known in five species out of sixteen; three of them have cuticular scales smooth (*mutabile*, *pastica*, *psammophila*), said to be characteristic of the genus, whereas the other two (*orientalis*, *acricula*) have spine-tipped scales (*orientalis*) or refractive elements present at the extremity of these scales (*acricula*) as in *princeps* above.

Taking into consideration the above careful reexamination of the characters used to separate "*Nothocriconema*" from *Nothocriconemella* we are obliged to conclude that none of these characters, or combinations of them, are sufficiently reliable to draw a firm line between two groups of species. A "tendency"

exists towards this difference. Evolutionary (?) lines concerning some characters, mainly the structure of the head annule(s), can be hypothesized, but are not sufficient in our opinion to justify two different genera.

Consequently species classified in *Nothocriconemella* and *Nothocriconema sensu* Ebsary are considered to be as congeneric; *Nothocriconemella* therefore follows *Nothocriconema* in being regarded as a junior synonym of *Criconema*, and all species of both genera are transferred to this latter genus (see species list).

Genus **Merocriconema** Raski & Pinochet, 1976

Genus **Nenocriconema** Darekar & Khan, 1982

The genera *Merocriconema* Raski & Pinochet, 1976 and *Nenocriconema* Darekar & Khan, 1982 are both monotypic and set a little bit apart from the "normal" *Criconema* by two characters: *i*) the lower number of body annules (38-43 in *M. braziliense*; 38-42 in *N. dorgeski*); and *ii*) the ornamentation of cuticle in adult females.

The ornamentation is quite different in the two genera: 1) in *Merocriconema* the body annules are smooth in the anterior half of the body (except a lateral indentation and scallops are present on posterior margin of annules); the scallops increase in size posteriorly being longer on the ventral side and are disposed in eight rows; 2) in *Nenocriconema* all the body annules are marked by a fringe of continuous serration on the posterior edge. This continuous serration is present also in *Criconema sanctifrancisci* (a "*Nothocriconema*").

Neither of these types of ornamentation cause difficulty in placing these species in *Criconema*. The ornamentation of *M. braziliense* is quite similar to that observed in *C. zae* (formerly *Notholetus*), the only peculiarity being the dissymmetry between ventral and dorsal sides, more exaggerated on juveniles. The rather discrete serration in *N. dorgeski* is similar to that of numerous species of *Criconemella*, a genus in which are placed species with smooth annules and species with finely fringed annules.

The low number of annules is more reminiscent of species formerly placed in *Lobocriconema* than in *Nothocriconema*, similarly the "tail" has a roughly rounded profile. Anyway, as we accepted the synonymization proposed by Andr assy (1979) of *Lobocriconema* with *Nothocriconema* (see below), both *Merocriconema* and *Nenocriconema* are considered as junior synonyms of *Criconema* and two species involved transferred to this latter genus (see species list).

Genus *Lobocriconema* De Grisse & Loof, 1965

The genus *Lobocriconema* De Grisse & Loof, 1965 contained originally seven species; six others have, at one time or another, been transferred or attributed to this genus. De Grisse and Loof (1965) diagnosed this taxon as having: *i*) body annules 50 [later Loof and De Grisse (1973) defined the number as 24-43], very coarse; *ii*) body annules smooth or ornamented irregularly; *iii*) submedian lobes present, small (on six pseudolips); *iv*) "head" annules offset more or less distinctly, sometimes collar-like (differentiated); *v*) juveniles with longitudinal rows of scales (eight) on posterior edge of annules.

The diverse nature of the above thirteen species suggests that the taxon has been used as a catch-all and needs redefinition. For the most part, but not entirely, assignments to this genus have been based upon the low number of coarse body annules. Secondly, presence of distinct submedian lobes is a character identifying some species but these lobes are indistinct, obscure, or not mentioned in others. These are the reasons why we accept the proposal of Andr ssy (1979) to consider *Lobocriconema* as a junior synonym of *Nothocriconema* (now *Criconema*). He transferred six of the species (*brevicaudatum*, *crassiannulatum*, *patelliferum*, *pauperum*, *rarum* and *sabiense*) to *Nothocriconema* (now *Criconema*) and one (*squamifer*) to *Ogma*, transfers which are equally accepted. We propose to transfer also to *Criconema* three species which were considered as *Lobocriconema*, in some cases provisionally, as *Criconema neoaxeste* (Jairajpuri & Siddiqi, 1963) nov. comb., *C. hlagum* (van den Berg, 1979) nov. comb., *C. thornei* (Knobloch & Bird, 1978) nov. comb. Andr ssy did not transfer *Lobocriconema neoaxeste* (Jairajpuri & Siddiqi, 1963) De Grisse, 1967 to *Nothocriconema* in his 1979 revision (personal communication) because the juvenile characters in the original description showed a fine, irregular fringe on posterior margin of the annules, but no spines or scales. De Grisse (1967) examined the original material and concluded "in agreement with Dr. S. Jairajpuri, that the described male and larvae were respectively the male and larvae of another species, probably *C. informis*, which occurred in the same population." The other characteristics agree with *Lobocriconema* including rounded head without submedian lobes.

The case of *Lobocriconema zae* van den Berg & Heyns, 1977, transferred to *Notholetus* by Ebsary (1981) has been treated above. On the other hand, the synonymization of *Lobocriconema patelliferum* Heyns, 1970 with *Criconema corbelli* (De Grisse, 1967) nov. comb. proposed by Andr ssy (1979) is not accepted here as the first species was described with

distinct submedian lobes whereas the second was described as lacking such lobes.

Genus *Criconema* Hofm nner & Menzel, 1914

Synonymization of the nine above-cited genera with *Criconema* somewhat enlarges the definition of the genus, but not excessively. One synonymization (*Nothocriconema*) is due to the reestablishment of the type species of *Criconema*; *Lobocriconema* had been previously synonymized (Andr ssy, 1979); three of Ebsary's genera (*Notholetus*, *Nothocriconemella*, *Paracriconema*) proceeded from the splitting of *Nothocriconema* itself.

This broader concept of the genus *Criconema* proceeds from the facts that: *i*) we consider the extracuticular incrustation as a valid character at species level only, as all intermediate steps are found between species having a limiter and/or discrete extracuticular incrustation (*C. giardi*, *C. psephinum*) and those where this layer covers the entire body (*C. shepherdae*, *C. amicum*); this excludes the genera *Cerchnotocriconema* and *Amphisbaenema* and includes *Bakernema velatum*; *ii*) we admit a certain range of variation in the shape and structure of the cuticular spines of juveniles, as well as in the shape of the post-vulvar part of the body; this excludes *Paracriconema*; we admit also, even though females of *Criconema* species basically have a cuticle without spines, outgrowths etc., that some species may show some limited cuticular ornamentation but only in the posterior part of the body; this excludes *Mero-criconema* and *Notholetus*; *iv*) a monotypic genus, *Nenocriconema*, shows a very fine crenation on all body annules, but this is not considered a generic distinction; *v*) presence or absence of submedian lobes is not considered here as a generic character; this excludes *Lobocriconema* [already synonymized by Andr ssy (1979)]; *vi*) finally, characters used to separate *Nothocriconema* s. Ebsary from *Nothocriconemella* have been demonstrated as non-valid since they are not consistent in these genera.

The combination of characters which can be used to separate *Criconema* from the closest genera (*Criconemella* and *Ogma*) are: *i*) the presence of cuticular scales or spines in juveniles; *ii*) the absence of such ornamentation in adult females except in the posterior part of the body of some species; *iii*) the differentiation of the head annules, usually larger and thicker than the body annules.

Criconema Hofm nner & Menzel, 1914

= *Lobocriconema* De Grisse & Loof, 1965

= *Nothocriconema* De Grisse & Loof, 1965

- = *Merocriconema* Raski & Pinochet, 1976 n. syn.
- = *Nenocriconema* Darekar & Khan, 1981 n. syn.
- = *Notholetus* Ebsary, 1981 n. syn.
- = *Nothocriconemella* Ebsary, 1981 n. syn.
- = *Paracriconema* Ebsary, 1981 n. syn.
- = *Amphisbaenema* Orton Williams, 1982 n. syn.
- = *Cerchnolocriconema* Bernard, 1982 n. syn.

DIAGNOSIS EMEND.

Criconematidae. *Female* : Body small to rather large (0.24-0.74 mm). Annules 24-134; smooth or variously ornamented : *i*) finely crenate ; *ii*) scale-like projections, if present, only on posterior part of body ; *iii*) irregular plate-like coverings on cuticle over entire body (*paradoxiger*, *shepherdiae*) or on part of annules (*lamellatum*) ; *iv*) ruffled, ribbon-like ornamentation encircling annule on anterior surface (*giardi*) or both anterior/posterior surfaces (*psephinum*) ; or *v*) cuticular fringe extending from posterior margin of annules (*brevicaudatum*, *giardi*). Annules of labial region smooth ; usually with one annule wider and clearly set off from next succeeding body annule ; occasionally separation is not distinct and labial region appears to bear two annules. Labial region usually with six pseudolips rounded and projecting forward from first annule ; submedian lobes absent or weakly developed. Stylet 40-132 μ m. Vulva on 4th-21st annule from terminus, slit-like or completely closed by overhanging anterior lip. Tail conoid-pointed to bluntly rounded. *Male* : two to four lateral lines ; bursa small, strongly reduced or lacking. *Juveniles* : cuticle with scale-like cuticular appendages over entire body, usually with refractive elements or spine-like extensions at distal ends, arranged in 8-24 longitudinal rows.

TYPE SPECIES

- Criconema giardi* (Certes, 1889) Micoletzky, 1925
 - = *Dorylaimus giardi* Certes, 1889
 - = *Eubostrichus guernei* Certes, 1889
 - = *Criconema guernei* (Certes, 1889) Menzel in Hofmänner & Menzel, 1914
 - = *Hoplolaimus guernei* (Certes, 1889) Menzel, 1917
 - = *Iola guernei* (Certes, 1889) Micoletzky, 1925
 - = *Ogma guernei* (Certes, 1889) Schuurmans Stekhoven & Teunissen, 1938.

OTHER SPECIES

- Criconema acriculum* (Raski & Pinochet, 1976) n. comb.
 - = *Nothocriconema acriculum* Raski & Pinochet, 1976

- = *Nothocriconemella acricula* (Raski & Pinochet, 1976) Ebsary, 1981

Criconema amicorum (Orton Williams, 1982, n. comb.

- = *Amphisbaenema amicorum* Orton Williams, 1982

Criconema annuliferum (de Man, 1921) Micoletzky, 1925

- = *Hoplolaimus annulifer* de Man, 1921
- = *Criconemoides annulifer* (de Man, 1921) Taylor, 1936
- = *Criconema annuliferum hygrophilum* Andrassy 1952
- = *Nothocriconema annuliferum* (de Man, 1921) De Grisse & Loof, 1965
- = *Criconemoides hygrophilus* (Andrassy, 1952) Oostenbrink, 1960
- = *Nothocriconema hygrophilum* (Andrassy, 1952) De Grisse & Loof, 1965
- = *Criconema stygium* Schneider, 1940
- = *Criconemoides stygius* (Schneider, 1940) Andrassy, 1959
- = *Nothocriconema stygium* (Schneider, 1940) De Grisse & Loof, 1965
- = *Macroposthonia annulata apud* Kischke, 1956

Criconema bellatum (Minagawa, 1981) n. comb.

- = *Nothocriconema bellatum* Minagawa, 1981

Criconema braziliense (Raski & Pinochet, 1975) n. comb.

- = *Merocriconema braziliense* Raski & Pinochet, 1975

Criconema brevicaudatum Siddiqi, 1961

- = *Mesocriconema brevicaudatum* (Siddiqi, 1961)
- = *Criconemoides brevicaudatus* (Siddiqi, 1961) Raski & Golden, 1966
- = *Lobocriconema brevicaudatum* (Siddiqi, 1961) De Grisse, 1967
- = *Nothocriconema brevicaudatum* (Siddiqi, 1961) Andrassy, 1979

Criconema calvum (Raski & Golden, 1966) n. comb.

- = *Criconemoides calvus* Raski & Golden, 1966
- = *Nothocriconema calvum* (Raski & Golden, 1966) De Grisse, 1967
- = *Nothocriconemella calva* (Raski & Golden, 1966) Ebsary, 1981

Criconema cardamomi (Khan & Nanjappa, 1972) n. comb.

- = *Nothocriconema cardamomi* Khan & Nanjappa, 1972

- Criconema coorgi* (Khan & Nanjappa, 1972) n. comb.
 = *Nothocriconema coorgi* Khan & Nanjappa, 1972 •
 = *Nothocriconemella coorgi* (Khan & Nanjappa, 1972) Ebsary, 1981
- Criconema corbelli* (De Grisse, 1967) n. comb.
 = *Nothocriconema corbelli* De Grisse, 1967
 = *Criconemoides corbelli* (De Grisse, 1967) Luc, 1970
 = *Notholetus corbelli* (De Grisse, 1967) Ebsary, 1981
 = *Lobocriconema patellifer* Heyns, 1970
- Criconema crassianulatum* (de Guiran, 1963) n. comb.
 = *Criconemoides crassianulatus* de Guiran, 1963
 = *Lobocriconema crassianulatum* (de Guiran, 1963) De Grisse & Loof, 1965
 = *Nothocriconema crassianulatum* (de Guiran, 1963) Andr ssy, 1979
 = *Criconemoides deconincki* De Grisse, 1963
- Criconema crotaloides* (Cobb, 1924) Schuurmans Stekhoven & Teunissen, 1938
 = *Iola crotaloides* Cobb, 1924
 = *Criconemoides crotaloides* (Cobb, 1924) Taylor, 1936
 = *Nothocriconema crotaloides* (Cobb, 1924) De Grisse & Loof, 1965
- Criconema degrissei* (Baqri, 1979) n. comb.
 = *Nothocriconema degrissei* Baqri, 1979
 = *Nothocriconemella degrissei* (Baqri, 1979) Ebsary, 1981
- Criconema demani* Micoletzky, 1925
 = *Criconemoides demani* (Micoletzky, 1925) Taylor, 1936
 = *Nothocriconema demani* (Micoletzky, 1925) De Grisse & Loof, 1965
 = *Nothocriconemella demani* (Micoletzky, 1925) Ebsary, 1981
 = *Criconemoides ravidus* Raski & Golden, 1966
- Criconema dorgeski* (Darekar & Khan, 1981) n. comb.
 = *Nenocriconema dorgeski* Darekar & Khan, 1981
- Criconema dubium* (De Grisse, 1967) n. comb.
 = *Nothocriconema dubium* (De Grisse, 1967) Luc, 1970
 = *Paracriconema dubium* (De Grisse, 1967) Ebsary, 1981
- Criconema duplicivestitum* (Andr ssy, 1963) n. comb.
 syn. = *Criconemoides duplicivestitus* Andr ssy, 1963
 = *Nothocriconema duplicivestitum* (Andr ssy, 1963) De Grisse & Loof, 1965
 = *Paracriconema duplicivestitum* (Andr ssy, 1963) Ebsary, 1981
- Criconema hlagum* (van den Berg, 1979) n. comb.
 = *Macroposthonia hлага* van den Berg, 1979
 = *Lobocriconema hlagum* (van den Berg, 1979) Ebsary, 1981
- Criconema ina* (Skwiercz, 1983) n. comb.
 = *Nothocriconemella ina* Skwiercz, 1983
- Criconema jaejuense* (Choi & Geraert, 1975) n. comb.
 = *Nothocriconema jaejuense* Choi & Geraert, 1975
- Criconema lamellatum* (Raski & Golden, 1966) n. comb.
 = *Criconemoides lamellatus* Raski & Golden, 1966
 = *Nothocriconema lamellatum* (Raski & Golden, 1966) De Grisse, 1967
 = *Paracriconema lamellatum* (Raski & Golden, 1966) Ebsary, 1981
 = *Amphisbaenema lamellatum* (Raski & Golden, 1966) Orton Williams, 1982
- Criconema lanxifrons* (Orton Williams, 1982) n. comb.
 = *Nothocriconema lanxifrons* Orton Williams, 1982
- Criconema longulum* Gunhold, 1953
 = *Criconemoides longulus* (Gunhold, 1953) Oostenbrink, 1960
 = *Nothocriconema longulum* (Gunhold, 1953) De Grisse & Loof, 1965
 = *Nothocriconemella longula* (Gunhold, 1953) Ebsary, 1981
 = *Criconema elegantulum* Gunhold, 1953
 = *Criconemoides elegantulus* (Gunhold, 1953) Oostenbrink, 1960
 = *Criconemoides quasidemani* Wu, 1965
 = *Nothocriconema quasidemani* (Wu, 1965) De Grisse & Loof, 1965

• Andr ssy (1979) was doubtful whether this species was a *Nothocriconema* because of the head shape as illustrated. It does bear some similarity to *N. acriculum* and without opportunity to examine type specimens it seems best to leave it as proposed but transferred to *Criconema*.

- Criconema loofi* (De Grisse, 1967) n. comb.
 = *Nothocriconema loofi* De Grisse, 1967
 = *Criconemoides loofi* (De Grisse, 1967) Luc, 1970
- Criconema macilentum* (Raski & Pinochet, 1976) n. comb.
 = *Nothocriconema macilentum* Raski & Pinochet, 1976
 = *Nothocriconemella macilenta* (Raski & Pinochet, 1976) Ebsary, 1981
- Criconema miscanthi* (Minagawa, 1982) n. comb.
 = *Nothocriconema miscanthi* Minagawa, 1982
- Criconema mutabile* (Taylor, 1936) n. comb.
 = *Criconemoides mutabilis* Taylor, 1936
 = *Nothocriconema mutabile* (Taylor, 1936) De Grisse & Loof, 1965
 = *Nothocriconemella mutabilis* (Taylor, 1936) Ebsary, 1981
 = *Criconemoides raskii* Goodey, 1963
 = *Criconemoides kovacsi* Andrassy, 1963
 = *Nothocriconema kovacsi* (Andrassy, 1963) De Grisse & Loof, 1965
 = *Nothocriconemella kovacsi* (Andrassy, 1963) Ebsary, 1981
 = *Criconemoides magnoliae* Edward & Misra, 1964
 = *Criconemoides siddiqii* Khan, 1964
 = *Criconemoides californicus* Diab & Jenkins, 1966
 = *Nothocriconema mukovum* Khan, Chawla & Saha, 1976
 = *Criconemoides kashmirensis* Mahajan & Byral, 1973
- Criconema neoaxeste* (Jairajpuri & Siddiqi, 1963) n. comb.
 = *Criconemoides neoaxestis* Jairajpuri & Siddiqi, 1963
 = *Lobocriconema neoaxeste* (Jairajpuri & Siddiqi, 1963) De Grisse, 1967
 = *Criconemella neoaxestis* (Jairajpuri & Siddiqi, 1963) Ebsary, 1982
- Criconema neopacificum* (Mehta, Raski & Valenzuela, 1983) n. comb.
 = *Nothocriconema neopacificum* Mehta, Raski & Valenzuela, 1983
- Criconema orientale* (Andrassy, 1979) n. comb.
 = *Nothocriconema orientale* Andrassy, 1979
 = *Nothocriconemella orientalis* (Andrassy, 1979) Ebsary, 1981
- Criconema pacificum* (Andrassy, 1965) n. comb.
 = *Criconemoides pacificus* Andrassy, 1965
 = *Nothocriconema pacificum* (Andrassy, 1965) Andrassy, 1967
- = *Nothocriconemella pacifica* (Andrassy, 1965) Ebsary, 1981
 = *Criconemoides arcanus* Raski & Golden, 1966
 = *Nothocriconema arcanum* (Raski & Golden, 1966) De Grisse, 1967
- Criconema palliatum* (Minagawa, 1981) n. comb.
 = *Nothocriconema palliatum* Minagawa, 1981
- Criconema paradoxiger* (Orton Williams, 1982) n. comb.
 = *Amphisbaenema paradoxiger* Orton Williams, 1982
- Criconema paraguayense* (Andrassy, 1968) n. comb.
 = *Nothocriconema paraguayense* Andrassy, 1968
 = *Criconemoides paraguayensis* (Andrassy, 1968) Luc, 1970
 = *Nothocriconemella paraguayensis* (Andrassy, 1968) Ebsary, 1981
- Criconema pasticum* (Raski & Pinochet, 1976) n. comb.
 = *Nothocriconema pasticum* Raski & Pinochet, 1976
 = *Nothocriconemella pastica* (Raski & Pinochet, 1976) Ebsary, 1981
- Criconema patellifer* (Heyns, 1970) n. comb.
 = *Lobocriconema patellifer* Heyns, 1970
 = *Criconemoides patellifer* (Heyns, 1970) Luc, 1970
 = *Nothocriconema patellifer* (Heyns, 1970) Andrassy, 1979
- Criconema pauperum* (De Grisse, 1967) n. comb.
 = *Lobocriconema pauperum* De Grisse, 1967
 = *Criconemoides pauperus* (De Grisse, 1967) Luc, 1970
 = *Nothocriconema pauperum* (De Grisse, 1967) Andrassy, 1979
- Criconema permistum* (Raski & Golden, 1966) n. comb.
 = *Criconemoides permistus* Raski & Golden, 1966
 = *Nothocriconema permistum* (Raski & Golden, 1966) De Grisse, 1967
 = *Nothocriconemella permista* (Raski & Golden, 1966) Ebsary, 1981
- Criconema petasum* (Wu, 1965) n. comb.
 = *Criconemoides petasus* Wu, 1965
 = *Nothocriconema petasum* (Wu, 1965) De Grisse & Loof, 1965
- Criconema polynesianum* (Orton Williams 1982) n. comb.
 = *Nothocriconema polynesianum* Orton Williams, 1982

- Criconema princeps* (Andrássy, 1962) n. comb.
 = *Criconemoides princeps* Andrássy, 1962
 = *Nothocriconema princeps* (Andrássy, 1962) De Grisse & Loof, 1965
 = *Criconemoides tribulis* Raski & Golden, 1966
- Criconema psammophilum* (Krnjaic & Loof, 1973) n. comb.
 = *Nothocriconema psammophilum* Krnjaic & Loof, 1973
 = *Nothocriconemella psammophila* (Krnjaic & Loof, 1973) Ebsary, 1981
- Criconema psephinum* (Bernard, 1982) n. comb.
 = *Cerchnotocriconema psephinum* Bernard, 1982
- Criconema rarum* (Boonduang & Ratanaprapa, 1974) n. comb.
 = *Lobocriconema rarum* Boonduang & Ratanaprapa, 1974
 = *Nothocriconema rarum* (Boonduang & Ratanaprapa, 1974) Andrássy, 1979
 = *Paracriconema rarum* (Boonduang & Ratanaprapa, 1979) Ebsary, 1981
- Criconema sabiense* (Heyns, 1970) n. comb.
 = *Lobocriconema sabiense* Heyns, 1970
 = *Nothocriconema sabiense* (Heyns, 1970) Andrássy, 1979
- Criconema sabulosum* (Eroshenko, 1981) n. comb.
 = *Criconemoides sabulosus* Eroshenko, 1981 *
- Criconema sanctifrancisci* (van den Berg & Heyns, 1977) n. comb.
 = *Nothocriconema sanctifrancisci* van den Berg & Heyns, 1977

* Eroshenko (1981) described *Criconemoides sabulosus* as a new species distinguished from *C. amorphus* by its labial region (six pseudolabia vs. four submedian lobes in *amorphus*); stronger stylet in *sabulosus*; and undulate edges of cuticular rings. In fact the report and illustrations indicate this species is related to the genus *Criconema*: first annule is set off, saucer-shaped, forward-directed; six pseudolips; annules with smooth or irregularly undulating edges; conoid-rounded tail. The only conflicting characteristic is the fact that juvenile annules are said to be smooth with irregular undulate edges. However, no illustrations are given to indicate the nature of the undulations.

This is a curious non-conformity which needs to be corroborated by further examination of the juveniles to establish more exactly the nature of these cuticular undulations and/or confirmation that no mixtures of species are present in that locality. Meantime, it is judged more prudent to transfer this species to the genus *Criconema*.

- Criconema shepherdae* (Jairajpuri & Southey, 1984) n. comb.
 = *Nothocriconema shepherdae* Jairajpuri & Southey, 1984
- Criconema solitarium* (De Grisse, 1967) n. comb.
 = *Nothocriconema solitarium* De Grisse, 1967
 = *Criconemoides solitarius* (De Grisse, 1967) Luc, 1970
 = *Paracriconema solitarium* (De Grisse, 1967) Ebsary, 1981
- Criconema sphagni* Micoletzky, 1925
 = *Criconemoides sphagni* (Micoletzky, 1925) Taylor, 1936
 = *Nothocriconema sphagni* (Micoletzky, 1925) De Grisse & Loof, 1965
 = *Nothocriconemella sphagni* (Micoletzky, 1925) Ebsary, 1981
 = *Criconemoides grassator* Adams & Lapp, 1967
 = *Nothocriconema grassator* (Adams & Lapp, 1967) Andrássy, 1979
 = *Nothocriconemella grassator* (Adams & Lapp, 1967) Ebsary, 1981
- Criconema spicatum* (Ebsary, 1981) n. comb.
 = *Notholetus spicatus* Ebsary, 1981
- Criconema spinicaudatum* (Raski & Pinochet, 1976) n. comb.
 = *Nothocriconema spinicaudatum* Raski & Pinochet, 1976
 = *Notholetus spinicaudatus* (Raski & Pinochet, 1978) Ebsary, 1981
- Criconema thornei* (Knobloch & Bird, 1978) n. comb.
 = *Lobocriconema thornei* Knobloch & Bird, 1978
- Criconema velatum* (Mehta, Raski & Valenzuela, 1983) n. comb.
 = *Bakernema velatum* Mehta, Raski & Valenzuela, 1983
- Criconema victoriae* (Heyns, 1970) n. comb.
 = *Nothocriconema victoriae* Heyns, 1970
 = *Notholetus victoriae* (Heyns, 1970) Ebsary, 1981
- Criconema zae* (van den Berg & Heyns, 1977) n. comb.
 = *Lobocriconema zae* van den Berg & Heyns, 1977
 = *Notholetus zae* (van den Berg & Heyns, 1977) Ebsary, 1981

REFERENCES

- ADAMS, R. E. & LAPP, N. A. (1967). *Criconemoides grassator* n. sp. from yellow poplar (*Liriodendron tulipifera*) in West Virginia. *Nematologica*, 13 : 63-66.
- ANDRÁSSY, I. (1952). Freilebende Nematoden aus dem Bukk-Gebirge. *Ann. hist. nat. Mus. natn. hungar.*, 2 : 13-65.
- ANDRÁSSY, I. (1959). Nematoden aus der Tropfsteinhöhle « Baradla » bei Aggtelek (Ungarn), nebst einer Uebersicht der bisher aus Höhlen bekannten freilebenden Nematoden-Arten. *Acta. zool. hungar.*, 4 : 253-277.
- ANDRÁSSY, I. (1962). Neue Nematoden-Arten aus Ungarn. I. Zehn neue Arten der Unterklasse Secernentea (Phasmidia). *Acta. zool. hungar.*, 8 : 1-23.
- ANDRÁSSY, I. (1963). Neue und einige seltene Nematoden-Arten aus Argentinien. *Ann. hist. nat. Mus. natn. hungar.*, 55 : 243-273.
- ANDRÁSSY, I. (1965). Verzeichnis und Bestimmungsschlüssel der Arten der Nematodengattungen *Criconemoides* Taylor, 1936 und *Mesocriconema* n. gen. *Opusc. zool. Bpest.*, 5 : 153-171.
- ANDRÁSSY, I. (1967). Nematoden aus Chile, Argentinien und Brasilien, gesammelt von Prof. Dr. H. Franz. *Opusc. zool. Bpest.*, 7 : 3-34.
- ANDRÁSSY, I. (1968). Fauna paraguayensis. 2. Nematoden aus der Galeriewaldern des Acaray-Flusses. *Opusc. zool. Bpest.*, 8 : 167-315.
- ANDRÁSSY, I. (1979). Revision of the Subfamily Criconematinae Taylor, 1936 (Nematoda). *Opusc. zool. Bpest.*, 16 : 11-57.
- BAQRI, Q. H. (1979). Nematodes from West Bengal (India). VI. Species of Criconematoidea (Tylenchida). *Ind. J. Nematol.*, 8 : 116-121.
- BERNARD, E. C. (1982). Criconematina (Nematoda : Tylenchida) from the Aleutian Islands. *J. Nematol.*, 14 : 323-331.
- BOONDUANG, A. & RATANAPRAPA, D. (1974). Identification of plant parasitic nematodes of Thailand. Systematic study of Criconematidae in Thailand with description of three new species. *Dep. Agric. Bangkok, Thailand, Pl. Prot. Serv. techn. Bull.*, 22 : 1-16.
- CERTES, A. (1889). Protozoaires. Appendice : organismes divers appartenant à la faune microscopique de la Terre de Feu. In : *Mission scientifique du Cap Horn (1882-1883)*, Tome 6, Zoologie. Paris, Gauthier-Villars : L 45-L 50.
- CHOI, Y. E. & GERAERT, E. (1975). Criconematids from Korea with the description of eight new species (Nematoda : Tylenchida). *Nematologica*, 21 : 35-52.
- COBB, N. A. (1924). *Iota crotaloides* n. sp. and the amphids of the Triplonchs. *Proc. helminth. Soc. Wash.*, 11 : 91-122.
- DAREKAR, K. S. & KHAN, E. (1981). *Nenocriconema dorgeski* gen. n., sp. n., (Nematoda : Criconematidae) from Maharashtra, India. *Ind. J. Nematol.*, 11 : 172-175.
- DE GRISSE, A. (1963). *Criconemoides deconincki* n. sp., (Nematoda). *Meded. Landbouwhoges. Opzoekstns Gent*, 28 : 611-617.
- DE GRISSE, A. (1967). Description of fourteen new species of Criconematidae with remarks on different species of this family. *Biol. Jaarb.*, 35 : 66-125.
- DE GRISSE, A. & LOOF, P. A. A. (1965). Revision of the genus *Criconemoides* (Nematoda). *Meded. Landbouwhoges. Opzoekstns Gent*, 30 : 577-603.
- DIAB, K. A. & JENKINS, W. R. (1966). Three new species of *Criconemoides* (Nematoda : Criconematidae). *Proc. helminth. soc. Wash.*, 33 : 5-7.
- EBSARY, B. A. (1981a). *Notholetus spicatus* n. gen., n. sp. (Nematoda : Criconematidae) from Hawaii. *Can. J. Zool.*, 59 : 637-638.
- EBSARY, B. A. (1981b). Generic revision of Criconematidae (Nematoda) : *Nothocriconema* and related genera with proposals for *Nothocriconemella* n. gen. and *Paracriconema* n. gen. *Can. J. Zool.*, 59 : 1227-1236.
- EBSARY, B. A. (1982). *Bakernema yukonense* n. sp. (Nematoda : Criconematidae) with keys to the species of *Criconemella* and *Discocriconemella*. *Can. J. Zool.*, 60 : 3033-3047.
- EDWARD, J. C. & MISRA, S. L. (1964). *Criconemoides magnoliae* n. sp. and *C. juniperi* n. sp. (Nematoda : Criconematidae) from Kumaon Region, Uttar Pradesh, India. *Nematologica*, 10 : 95-100.
- EROSHENKO, A. S. (1981). [*Crossonemoides* n. g. and three new species of ectoparasitic plant nematodes (Nematoda : Criconematidae) from the Primorsk territory]. *Parazitologiya*, 15 : 547-551.
- GOODEY, T. (1963). *Soil and Freshwater Nematodes*. 2nd Ed. revised by J. B. Goodey. London, Methuen & Co., 544 p.
- GUIRAN, G., de (1963). Quatre espèces nouvelles du genre *Criconemoides* (Taylor) (Nematoda : Criconematidae). *Revue Path. vég. Entomol. agric. Fr.*, 42 : 1-11.
- GUNHOLD, P. (1953). Drei neue Nematoden aus den Ostalpen. *Zool. Anz.*, 150 : 35-38.
- HEYNS, J. (1970). South African Criconematinae. Part. I. Genera *Nothocriconema*, *Lobocriconema*, *Criconemella*, *Xenocriconemella* and *Discocriconemella* (Nematoda). *Phytophylactica*, 2 : 49-56.
- HOFMÄNNER, B. & MENZEL, R. (1914). Neue arten freilebender Nematoden aus der Schweiz. *Zool. Anz.*, 44 : 80-91.
- JAIRAJPURI, M. S. & SIDDIQI, A. H. (1963). On three new species of the genus *Criconemoides* Taylor, 1936 (Nematoda : Criconematidae) from North India. *Z. ParasitKde*, 23 : 340-347.

- JAIRAJPURI, M. S. & SOUTHEY, J. F. (1984). *Nothocriconema shepherdae* n. sp. (Nematoda : Criconematidae) with observations on extracuticular layer formation. *Revue Nématol.*, 7 : 73-79.
- KHAN, E., CHAWLA, M. L. & SAHA, M. (1976). Criconematoidea (Nematoda : Tylenchida) from India, with description of nine new species, two genera and a family. *Ind. J. Nematol.*, 5 : 70-100.
- KHAN, E. & NANJAPPA, C. K. (1972). Four new species of Criconematoidea (Nematoda) from India. *Ind. J. Nematol.*, 5 : 59-68.
- KHAN, S. H. (1964). *Criconemoides siddiqii* n. sp. (Nematoda : Criconematidae) from North India. *Zool. Anz.*, 173 : 342-344.
- KISCHKE, U. (1956). Die Nematoden aus der Torf-zone der Hochmoore des Oberharzes nebst Bemerkungen über gewisse Gruppen der terricolen Begleitfauna (Rotatoria, Acarina, Collembola). *Arch. Hydrobiol.*, 52 : 210-277.
- KNOBLOCH, N. & BIRD, G. W. (1978). Criconematinae habitats and *Lobocriconema thornei* n. sp. (Criconematidae : Nematoda). *J. Nematol.*, 10 : 61-70.
- KRNJAIC, D. & LOOF, P. A. A. (1973). Description of *Nothocriconema psammophilum* n. sp. (Nematoda : Criconematoidea) with some data on its ecology. *Meded. Rijksfac. Landbwetenschappen Gent.*, 38 : 73-76.
- LOOF, P.A.A. & DE GRISSE, A. (1973). Interrelationships of the genera of Criconematidae (Nematoda : Tylenchida). *Meded. Rijksfac. Landbwetenschappen Gent.*, 38 : 1303-1328.
- LUC, M. (1970). Contribution à l'étude du genre *Criconemoides* Taylor, 1936 (Nematoda : Criconematidae). *Cah. ORSTOM, Sér. Biol.*, 11 : 69-131.
- MAHAJAN, R. & BYRAL, S. S. (1973). Studies on the Criconematidae (Nematoda : Tylenchida) from India, with the description of two new species. *Zool. Anz.*, 191 : 199-205.
- MAN, J. G., de (1921). Nouvelles recherches sur les nématodes libres terricoles de la Hollande. *Capita zool.*, 1 : 5-62.
- MEHTA, U. K. & RASKI, D. J. (1971). Revision of the genus *Criconema* Hofmänner and Menzel, 1914 and other related genera (Criconematidae Nematoda). *Ind. J. Nematol.*, 1 : 145-198.
- MEHTA, U. K., RASKI, D. J. & VALENZUELA, A. (1983). Five new species of Criconematidae (Nemata) from southern Chile. *Nematologica*, 28 (1982) : 398-411.
- MICOLETZKY, H. (1925). Die freilebenden Süßwasser- und Moor- Nematoden Danemarks. Nebst Anhang : Ueber Amöbospodien und andere Parasiten bei freilebenden Nematoden. *D. Danske vidensk. Selsk. Skr. Naturv. Math., Afd. 8*, 10 : 57-130.
- MINAGAWA, N. (1981). *Nothocriconema* from Mt. Aso, with descriptions of two new species (Tylenchida : Criconematidae). *Jap. J. Nematol.*, 10 : 16-26.
- MINAGAWA, N. (1982). An additional new species of genus *Nothocriconema* from Mt. Aso (Tylenchida : Criconematidae). *Jap. J. Nematol.*, 11 : 24-27.
- OOSTENBRINK, M. (1960). The Family Criconematidae. In : Sasser, J. N. & Jenkins, W. R. (Eds). *Nematology*. Chapel Hill Univ., North Carol. Press : 196-205.
- ORTON WILLIAMS, K. J. (1982). A new genus and four new species of Criconematidae (Nematoda) from the Pacific. *Syst. Parasitol.*, 4 : 239-251.
- RASKI, D. J. & GOLDEN, A. M. (1966). Studies on the genus *Criconemoides* Taylor, 1936 with descriptions of eleven new species and *Bakerinema variabile* n. sp. (Criconematidae : Nematoda). *Nematologica*, 11 (1965) : 501-565.
- RASKI, D. J., LUC, M. & VALENZUELA, A. (1984). Redescription of *Criconema giardi* (Certes, 1889) Micoletzky, 1925, types species of the genus *Criconema* Hofmänner & Menzel, 1914 (Criconematidae : Nematoda). *Revue Nématol.*, 7 : 301-314.
- RASKI, D. J. & PINOCHET, J. (1976). Descriptions of four new species of *Nothocriconema* and the male of *N. sphagni* (Criconematidae : Nematoda). *Nematologica*, 22 : 265-276.
- RASKI, D. J. & PINOCHET, J. (1976). *Meroocriconema braziliensis* g. n., sp. n. (Criconematidae : Nematoda) from *Piper* sp. *Ind. J. Nematol.*, 5 (1975) : 22-25.
- SCHNEIDER, W. (1923). Niederrheinische freilebende Nematoden. *Zool. Anz.*, 66 : 264-281.
- SCHNEIDER, W. (1940). Neue freilebende Nematoden aus Höhlen und Brunnen. 1. Nematoden aus jugoslawischen Höhlen. *Zool. Anz.*, 132 : 84-94.
- SCHUURMANS STEKHOVEN, H. J. & TEUNISSEN, R.J.H. (1983). Nématodes libres terrestres. *Explor. Parc. natn. Albert. Miss. G. F. de Witte*, 22 : 1-229.
- SIDDIQI, M. R. (1961). Studies on species of Criconematinae (Nematoda : Tylenchida) from India. *Proc. helminth. Soc. Wash.*, 28 : 19-34.
- SKWIERCZ, A. T. (1983). *Nothocriconemella ina* sp. n. and observations on *Ogma murrayi* Southern, 1914 from Poland. *Nematologica*, 28 (1982) : 271-276.
- TAYLOR, A. L. (1936). The genera and species of the Criconematinae, a subfamily of the Anguillulidae (Nematoda). *Trans. Am. Microsc. Soc.*, 55 : 391-421.
- VAN DEN BERG, E. (1979). Two new species of the genus *Macrosposhonia* De Man, 1880 (Madinematidae : Nematoda) from southern Africa. *Phytophylactica*, 11 : 173-177.
- VAN DEN BERG, E. & HEYNS, J. (1977). Descriptions of new and little known Criconematidae from South Africa (Nematoda). *Phytophylactica*, 9 : 95-101.
- WU, L. Y. (1965). Five new species of *Criconemoides* Taylor, 1936 (Criconematidae : Nematoda) from Canada. *Can. J. Zool.*, 43 : 203-214.

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