The Xiphinema americanum group (Nematoda: Dorylaimida).

1. Comments upon the key to species published by Lamberti and Carone (1992)

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Summary - The theoretical and practical shortcomings of the key to the Xiphinema americanum group published by Lamberti and Carone (1992) are pointed out, and some suggestions are given to improve the possibilities of identifying species in this group.


Key-words : Xiphinema, X. americanum-group, specific identification.

Loof and Luc (1990) pointed out that no comprehensive key to the species of the Xiphinema americanum group was ever published. Lamberti and Carone (1992) mentioned that Lamberti had published such a key in 1980. This key was known to us, but it was in the Proceedings of the meeting held September 8-12, 1980 (7th Meeting of the International Council for the Study of Viruses and Viruslike Diseases of the Grapevine, Niagara Falls, Canada). Dr. B. Weischer (Münster, Germany), who attended this meeting, informed us that the scripts of the lectures were edited by E. G. McGinnis; the volume was sent to the participants in 1982 but after Dr. T. C. Vrain (Vancouver, Canada, in litt. October 8, 1991) it was probably not distributed among public libraries though it is available on request from Agriculture Canada, Ottawa. It is therefore not sure whether it is a “publication” in the sense of the Rules.

In their paper of 1979 Lamberti and Bleve-Zacheo grouped the species into six groups, but this did not aid much in identification. Ebsary et al. (1989) gave a key to the seventeen species reported from North America, suggesting that X. intermedium, X. oxycaudatum and X. tenuicutis could be possibly identical with X. americanum. A key was finally produced by Lamberti and Carone (1992), dealing with 38 species (X. neoelongatum Bajaj & Jairajpuri, 1977 was considered a separate species). It was a valorous and probably laborious undertaking to compose such a key; unfortunately the result is not satisfying. The key has serious shortcomings, theoretical and practical. In order to assist to the production ultimately of a comprehensive key we enter upon these shortcomings.

Theoretical shortcomings

**TAIL SHAPE**

Illustrations were given for tails only, one for each species, implying that all specimens of any species have exactly the same tail shape, though there may be intraspecific variation, see e.g. Wojtowicz et al. (1982). Moreover it is even not sure that these drawings are always correct. For X. taylori the tail (Fig. 19) appears more elongate (c’ = 1.2) than reported and illustrated in the original (unique) description (c = 0.8-1.1) (Lamberti et al., 1992); in the key it is characterized as having c’ over 1.0 but under 1.5.

**LIP REGION SHAPE**

There is also considerable interspecific diversity in shape of the lip region, but this was covered only by the terms: “continuous” (3, 7, 12), “set off” (7, 12), “set off by constriction” (27), “expanded” (3, 27). 12b says: “set off” but without qualification as to expansion, constriction or depression; the term “depression” is never used in the key (it is mentioned in the Introduction on p. 341, where a depression is said to separate the lip region from the rest of the body) though a lip region offset by depression is by far the commonest in the group. These terms should have been elucidated by exact, detailed drawings. The confusion is well illustrated by a comparison between some of the six groups of Lamberti and Bleve-Zacheo (1979) and the present key. Group I contained species with the lip re-
region set off by depression and contained *X. americanum*, *X. oxycaudatum*, *X. intermedium*, *X. tenuicuts*, *X. utahense* and *X. peruvianum*. In the key *X. intermedium* has an expanded lip region, in *X. americanum*, *X. oxycaudatum* and *X. tenuicuts* it is set off by constriction, in *X. peruvianum* and *X. utahense* it is set off without further qualification. Group VI has the lip region "clearly set off" and contains *X. lamberti*, *X. neoelongatum*, *X. citricolum*, *X. geogianum* and *X. tarjanense*. The key gives no information about *X. lamberti* and *X. geogianum*, offset without qualification for *X. tarjanense*, set off by constriction for *X. neoelongatum* and expanded for *X. citricolum*. Much more could be made of shape of lip region, which is indeed very constant within species (Alkemade & Loof, 1990). The key moreover repeats the old error that the lip region of *X. riveti* is continuous. Actually, Dalmaso (1969) wrote: "profil céphalique non souligné par une constriction" and this illustration clearly shows a lip region offset by a depression, which was confirmed by study of paratypes (Alkemade & Loof, 1990). Then, when one compares the lip region of *X. pachtaicum* and *X. neoelongatum*, the shapes are identical (Luc et al., 1985 considered *X. neoelongatum* a junior synonym of *X. pachtaicum*), but in the key *X. pachtaicum* comes under "lip region expanded" (27 a → 32), *X. neoelongatum* under "lip region set off by constriction" (27 b → 36).

**Metric characters**

For all metric characters only vague indications are given: odontostyle under 100 μm, over 70 μm, etc.; a around 50, around 40, etc.; c around 80, less than 70, etc. v more than 55, around 50, definitely postequatorial, etc. These indications insufficiently take into account the variation within, and especially between, populations. Moreover, the values given might be averages of type populations, but i) within type populations there is variation; ii) other populations may not fit in. Small samples may have different averages.

The consequence is, that an investigator trying to identify a small population may be misled by this way of presentation. Any species does not consist only of the type population, but all populations considered conspecific with it should be taken into account. When this is not done, the key becomes a means of identification of type populations, which is quite unnecessary.

**Practical shortcomings**

*X. americanum*

For this species the key says: odontostyle under 100 μm (1 b) and over 70 μm (9 b). The toptype population described by Lamberti and Bleve-Zacheo (1979) has odontostyle length 68 μm (63-73); the South Carolina population has 70 μm (64-77); the Louisiana population has 67 μm (63-69). Another toptype population (Lamberti & Golden, 1984) had 80 μm (74-83), but they also reported on Cobb's specimens which had 69 μm (65-73). It is thus clear that: i) within *X. americanum* there exist populations with odontostyle length under 70 μm; ii) in other populations, which have mean odontostyle length over 70 μm, many specimens may occur having odontostyles shorter than 70 μm. Then in the key *X. americanum* is characterized by c' being over 1.7 (33 a). Indeed the Lamberti and Golden (1984) population has c' = 1.9 (1.7-2.2), but Lamberti and Bleve-Zacheo (1979) reported c' as 1.7 (1.5-1.9) in tootypes, 1.7 (1.4-1.9) in a population from South Carolina, whereas Ebsary et al., (1984) gave 1.4-2.0. So, though the mean in all these populations is 1.7 or more, many specimens have lower values.

The same holds for body length, which is given in the key as over 1.5 mm (16 b). The South Carolina population had L = 1.4-1.6; Wojtowicz et al. (1982), Ebsary et al. (1984), and Lamberti and Golden (1984) gave 1.4-1.7.

Finally, a serious mistake is that the lip region of *X. americanum* is said to be offset by constriction; in fact it is offset by a depression (Siddiqi, 1973; Lamberti & Bleve-Zacheo, 1979).

*X. sheri* and *X. pseudoguirani*

In the key (8) these two species are distinguished only by the distance of the fixed guiding ring to the anterior body end: over 90 μm in *X. sheri*, under 90 μm in *X. pseudoguirani*. Indeed the type population of *X. sheri* has GR = 92-96 μm, but the second population recorded by Lamberti and Bleve-Zacheo (1979) has GR = 84 (68-89), wholly under 90 μm! In *X. pseudoguirani* GR = 84-93 μm, which is wholly within the range of *X. sheri* and extends to over 90 μm.

*X. brevicolle*

This species was characterized by having odontostyle length over 100 μm (1) and c "around 80" (5). The original description gives odontostyle length = 95-106 μm, c = 63-93; Carvalho (1955): 91 μm (corrected value) and 46-75; in tootypes we found 89-110 μm and 68-90; Loof and Sharma (1979) gave 90-110 μm and 70-88.

*X. floridae* and *X. peruvianum*

These two species key together under nr. 26, being distinguished by diameter of lip region only. In 1979 Lamberti and Bleve-Zacheo put *X. peruvianum* in group I (lip region offset by depression), *X. floridae* in group III (lip region button-like). Indeed in *X. floridae* the lip region is set off much more strongly than in *X. peruvianum* (cf. Alkemade & Loof, 1990).

*X. luci* and *X. riveti*

These two species key together at nr. 15. The lip region of both species is said to be continuous and the only distinguishing character given is the coefficient a: "around 50" in *X. luci", "around 40" in *X. riveti*. This
X. _AMERICANUM_ and _X. THORNEI_ (22)

Assuming that the original description of _X. occiduum_ was based upon a mixture of _X. occiduum_ and _X. thornei_, authors differentiated these species on body length (over 2 mm in _X. occiduum_, under 2 mm in _X. thornei_). Actual values are 1.9-2.4 mm and 1.8-2.2 mm. There are apparently no other clear-cut differentiating characters; the odontostyle is slightly shorter in _X. occiduum_ (70-83 μm) than in _X. thornei_ (75-89 μm) but there is a large overlap.

_X. PACHTAICUM_ and _X. PACHYDERMUM_

These two species key together at nr. 32 and are differentiated only by vulva position: "around 55" in _X. pachtaicum_, "around 58-60" in _X. pachydermum_. However, Lambert and Bleve-Zacheo (1979) gave for _X. pachtaicum_ a range of 51-61, so this character is insufficient. These species can better be distinguished by structure of female gonads (uteri short, symbionts present in _X. pachtaicum_; uteri long, symbionts absent in _X. pachydermum_) and occurrence of males (very rare in _X. pachtaicum_, numerous in _X. pachydermum_). The structure of the female genital system of _X. pachydermum_ (uteri not reduced, no symbionts in oocytes) indicates that it does not belong in the _X. americanum_ group; it was not included in it by Loof and Luc (1990).

_X. OXYCAUDATUM_ and _X. TENUICUTIS_

These two species are separated (37) by the index c: "around 50" in _X. oxycaudatum_, "around 60" in _X. tenuiicuts_. The original descriptions give 48-54 resp. 58-65. Both species are said to have odontostyle length under 85 μm. Bos and Loof (1985) described a population which they attributed to _X. oxycaudatum_ having c = 50-67 and odontostyle length 85-94 μm. This population is not mentioned.

_X. CALIFORNICUM_

This species was separated from _X. pachtaicum_ and _X. pachydermum_ by vulva position (31) : "around 50" vs "definitely postequatorial". The original description of _X. californicum_ gives V as 48-55, Alkemade and Loof (1990) found V = 53 (51-57). Since the range in _X. pachtaicum_ is 51-61 (see under 7) this is not a good character.

_X. UTAHENSE_

This species was characterized (23) by "a" being over 60. This holds for the type population, but Lambert and Golden (1986) gave a range of 45-63 for two other populations.

**Conclusion**

The conclusion must be that a key using such simple divisions and relying on few characters does not work. When all known populations are considered, several species (e.g. _X. americanum_) would appear more than once in the key. Several characterizations are unreliable. A dichotomous key may be more practical than a polytomous one (p. 341) in that a polytomous key would be extremely difficult to construct due to many overlaps. But this illustrates clearly that the species problem in this group is far from solved.

Another way to specific determination could be the use of biochemical or molecular techniques. But the problem remains to assert beforehand a correct specific identification of the populations used. A first approach, using rDNA RFLP and dealing with _X. americanum_, _X. brevicolle_, _X. rivesi_ and _X. pacificum_, was recently published by Vrain et al. (1992). Results were promising though not yet conclusive.

**References**


