

The *Xiphinema americanum* group (Nematoda : Dorylaimida). 1. Comments upon the key to species published by Lamberti and Carone (1992)

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Accepted for publication 9 December 1992.

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.

Résumé – Le groupe *Xiphinema americanum* (Nemata : Dorylaimida). 1. Commentaires sur la clé des espèces publiée par Lamberti et Carone (1992) – Les défauts, théoriques et pratiques, de la clé de détermination des espèces du groupe *Xiphinema americanum*, clé publiée par Lamberti et Carone (1992), sont relevés par les auteurs et des suggestions énoncées visant à améliorer les possibilités d'identification spécifique dans ce groupe.

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. neolongatum* 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). 12 b 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-

gion set off by depression and contained *X. americanum*, *X. oxycaudatum*, *X. intermedium*, *X. tenuiculis*, *X. utahense* and *X. peruvianum*. In the key *X. intermedium* has an expanded lip region, in *X. americanum*, *X. oxycaudatum* and *X. tenuiculis* 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. lambertii*, *X. neoelongatum*, *X. citricolum*, *X. georgianum* and *X. tarjanense*. The key gives no information about *X. lambertii* and *X. georgianum*, 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. rivosi* is continuous. Actually, Dalmasso (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 topotype 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 topotype 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 topotypes, 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 topotypes 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. RIVESI*

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. rivosi*. This

does not give much help: "a" was given for *X. rivesi* as 37-49 (Dalmasso, 1969), 37-50 (Lambert & Bleve-Zacheo, 1979), 32-52 (Ebsary *et al.*, 1984), 39-54 (Wojtowicz *et al.*, 1982); in *X. luci* it was given as 47-60. Actually, as said above, the lip region of *X. rivesi* is set off by a slight depression. In *X. luci* it was described as continuous, and the diagnosis says: "continuous and less expanded than in *X. diffusum*" which throws doubt on the exact meaning of the term "continuous": an expanded lip region is by definition set off at least by a depression. The illustration of *X. luci* shows a lip region marked off by a slight depression.

X. OCCIDUUM 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 μ m) than in *X. thornei* (75-89 μ m) 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, Lamberti 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. tenuicutis*. The original descriptions give 48-54 resp. 58-65. Both species are said to have odontostyle length under 85 μ m. Bos and Loof (1985) described a population which they attributed to *X. oxycaudatum* having c = 50-67 and odontostyle length 85-94 μ m. 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 Lamberti 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. bricolense*, *X. rivesi* and *X. pacificum*, was recently published by Vrain *et al.* (1992). Results were promising though not yet conclusive.

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