A Redescription of the Bark Beetle Nematode Contortylenchus brevicomi: Synonym Contortylenchus barberus (Nematoda : Sphaerulariidae)

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Abstract: Contortylenchus barberus is synonymized with *C. brevicomi* because their original separation was based on minor morphometric variations that are considered here to be intraspecific rather than interspecific. The ranges of body length and body width in measured specimens of *C. brevicomi* encompass those of the original description of *C. brevicomi* and *C. barberus*. The presence or absence of the caudal mucro is considered not a valid criterion for species differentiation. Several of the morphometric details of the two species overlap and thus are not considered suitable for species differentiation. Such variation may be due to stresses of the host-parasite relationship. The respective hosts of the two nematodes, *Dendroctonus brevicomis* and *D. barberi*, have been synonymized into the former species. The description of the larval stages of *C. brevicomi* is presented. *Key word*: taxonomy.

Contortylenchus brevicomi and *C. barberus* were first described by Massey (3) and named *Aphelenchulus brevicomi* and *A. barberus*, respectively. Rühm (5) placed both species under the genus *Contortylenchus*. The two host bark beetles, *Dendroctonus brevicomis* Leconte and *D. barberi* Hopkins, respectively, were synonymized into the single species *D. brevicomis* by Wood (6). Massey used mainly intraspecific variations in morphometry as criteria for the separation of *C. brevicomi* and *C. barberus*. He also stated that the *C. barberus* female had a prominent caudal mucro, and that this was sometimes absent from the tail of the *C. brevicomi* female. In our opinion, this is insufficient evidence to justify two distinct species.

In this paper, we redescribe *C. brevicomi* and synonymize *C. barberus* with it. The reasons for synonymy are discussed. Some aspects of the biology of *C. brevicomi* are presented.

MATERIALS AND METHODS

Specimens of *Dendroctonus brevicomis* were obtained from logs of *Pinus ponderosa* from Lytton, British Columbia. The emerging beetles were dissected in insect saline, and the nematodes in the hemocoel killed and fixed in hot T.A.F. (2). The nematodes were stained in 0.01% cotton blue in lactophenol and processed through Baker's solutions (2). Measurements and drawings were done using normal light and phase contrast microscopy. Measurements follow the de Man formula except for V_1, which represents the length of the ovary expressed as a percentage of body length, and T_v, which represents the distance of the vulva from the tail terminus.

DESCRIPTION AND DIAGNOSIS

Contortylenchus brevicomi (Massey, 1957) Rühm, 1960.

Syn. *Contortylenchus barberus* (Massey, 1957) Rühm, 1960.

Females (16) : L = 3.61 mm (2.82 - 4.82); w = 87 μ (70 - 100); a = 41.8 (32.8 - 60.0); V = 95.9% (94.7 - 97.0); V_1 = 93.5% (88.5 - 96.5); T_v = 147 μ (110 - 180).

The mature female nematodes are found only in the hemocoel. Female long and slender, with body slightly bent dorsally. Cuticle finely striated except at extreme anterior where it becomes annulated (Fig. 1B). Buccal stylet very distinct in egg-producing females, but degenerate in older specimens. Stylet short and slender, with small basal knobs. Esophagus straight, non-bulbous; esophageal glands

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indistinct. Excretory pore and nerve ring not visible. Posterior end of female broad at vulva, with rounded terminus ending abruptly in a mucro (Fig. 1A). Mucro not apparent in all specimens. Anal opening not visible. Intestine appears to end in the mucro. Phasmids present just posterior to vulva. Ovary monodelphic, prodelphic, and occasionally reflexed. Length of gonad variable, occasionally reaching head end of nematode. Post-uterine sac present only in some specimens. Vulva a transverse slit at posterior end of body. The more posteriorly positioned eggs in the uterus have a thick wall. Spermatozoa not observed in spermathecae.

No males were found in the hemocoel. However, it has been shown that males of the genus *Contortylenchus* generally remain in the galleries of the host and inseminate the female nematodes prior to their entry into the beetle host. No spermatozoa were seen in the spermathecae of the mature female specimens. Massey (3) found males of *C. barberus* but not of *C. brevicomi* in the beetle galleries. *Eggs*: (58-66) X 32 μ. Eggs from the hemocoel of the beetle showed various stages of development up to the formation of the first-stage larva (Fig. 1C, D). The coiled first-stage larva is about 135 μ long, with a rounded tail and body tapering towards the anterior. Buccal stylet very small. Cuticle very finely striated. *Second-Stage Larva* (L_2): L = 170 μ; w = 10 μ. Larva minute and free in host hemocoel. Cuticle very finely striated. Head distinctly set off from rest of body by narrower neck region; head expanded and rounded anteriorly (Fig. 1E). Stylet very small and esophagus not easily discernible. Genital primordium conspicuous in posterior of body (Fig. 1F). Tail rounded. Anal opening 6-7 μ from tail terminus. This stage has been designated L_2 because it is the smallest larval stage found in the hemocoel, and differs from the unhatched larva in its head and tail shape. Furthermore, in most species of nematodes it is the L_2 rather than the L_1 that hatches from the egg. *Third Stage Larva* (L_3): L = 290 μ; w = 16 μ. Larva slender and short. Cuticle finely striated. Distinct neck region and rounded, club-like head region (Fig. 1G). Head with prominent cephalic papillae seen only under phase contrast microscopy. Spear slender and short. Esophagus straight and non-bulbous. Genital primordium conspicuous (Fig. 1H). Tail rounded, anal opening 12-13 μ from tail terminus (Fig. 1I). This larval stage has been designated L_3 as distinct from L_2 because of its larger size, general cephalic structure, and greater tail length. This was the largest larval stage found in the host hemocoel.

DISCUSSION

The taxonomy of the genus *Contortylenchus* was revised by Nickle (4). However, in his list of existing species, *C. brevicomi* and *C. barberus* were recorded as separate species. Massey (3) gave the range of body length for mature parasitic females of *C. barberus* as 2.1-3.9 mm, and that for females of *C. brevicomi* as 3.2-4.2 mm. Our measurements of mature female *C. brevicomi* show the range 2.8-4.8 mm. This large variation in body length invalidates the use of body length as a criterion for the separation of the two species. The greatest width in our specimens varied from 70 to 100 μ, which conforms with Massey's description of *C. barberus* but not with that of *C. brevicomi*. Our impression is that the greatest width, like the body length, varies intraspecifically depending on the degree of development of the female gonad and the number of eggs produced.

In the original description, the distance of the vulva from the tail terminus was used as a feature differentiating the two species. This was 70 μ for *C. barberus* and 90 μ for *C. brevicomi*, but neither the number of specimens measured nor the range of the measurements was given. Our measurements for *C. brevicomi* show the much larger range of 110-180 μ.

The presence of a definite mucro in the tail of *C. barberus*, and the presence or absence of a mucro in the tail of *C. brevicomi*, are, in our opinion, not strong enough criteria for the separation of the two species, because we found that the mucro was sometimes not visible in some specimens of *C. brevicomi* due to variations in the plane of mounting of the nematodes. However, recent examination of the type specimens of *C. brevicomi* showed the mucro to be present.

The eggs we recovered were larger than those of either *C. barberus* or *C. brevicomi* as originally described. We also found two larval stages of *C. brevicomi* within the host hemocoel. Almost all nematode species molt at least once within the egg (1) and, therefore, are at least in their L_2 at hatching. Massey's designation of L_1 to the larva of *C. barberus* in the host hemocoel is possibly erroneous, as the appearance and description of his type L_1 larva is similar to that which we have designated L_3

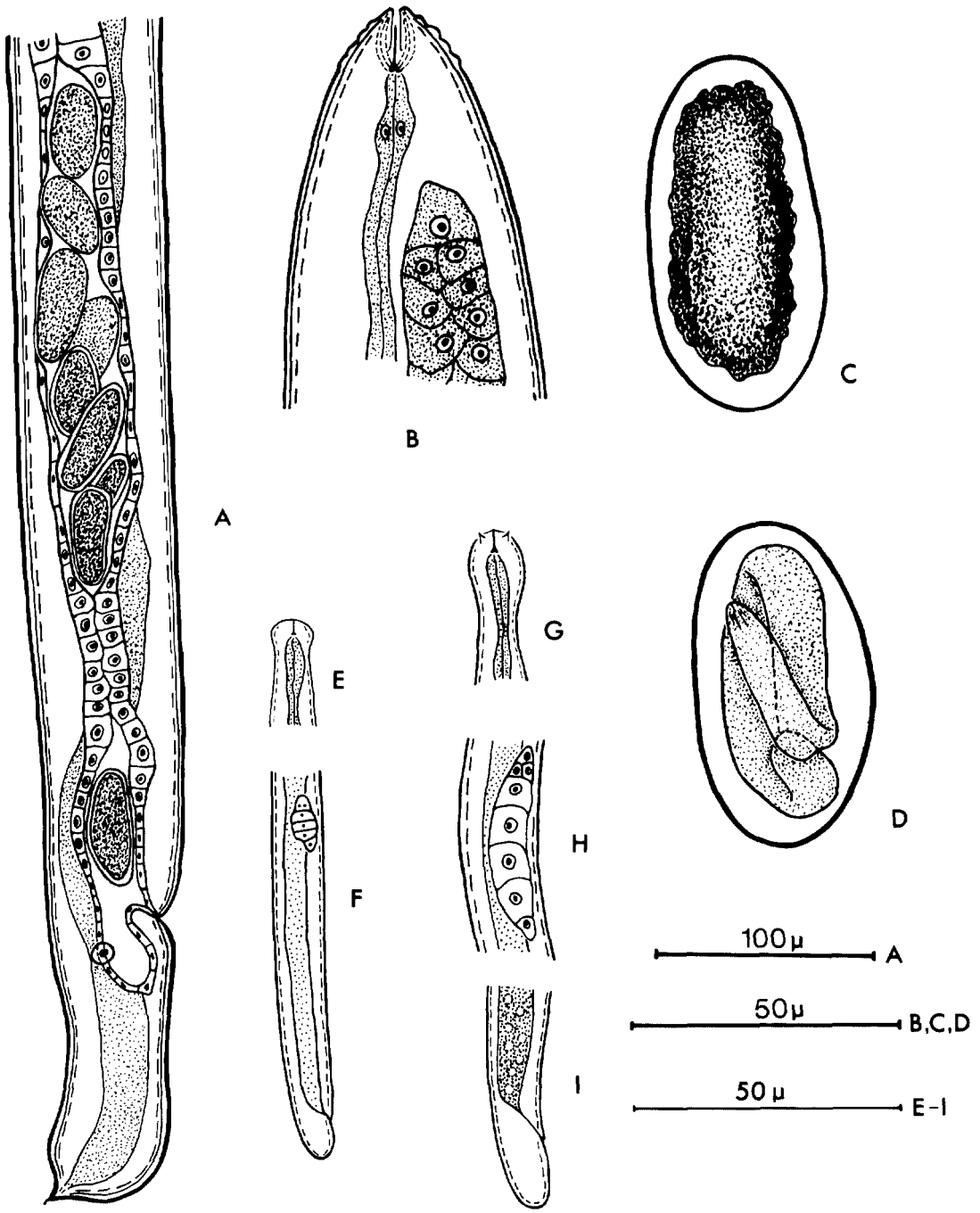

FIG. 1. *Contortylenchus brevicomi.* **A.** Tail of female showing terminal mucro and post-uterine sac. **B.** Head end and anterior of the ovary of female. **C.** Fertilized egg. **D.** Unhatched first-stage larva. **E.** Head end of second-stage larva. **F.** Posterior of second-stage larva showing genital primordium and tail. **G.** Head end of third-stage larva showing cephalic papillae. **H.** Genital primordium of third-stage larva. **I.** Tail of third-stage larva.

by virtue of its size and head shape. Furthermore, the prominent cephalic papillae (which we observed in our larvae and in the type larval specimens) are characteristic of the L_3. The other larval stage we observed, designated L_2, is smaller than the L_3 and has a different cephalic structure, and is differentiated from the unhatched larva by its head and tail shape.

Nematode parasites from different species of host are not necessarily separate species themselves. Thus, *C. reversus* has been shown to occur in *D. rufipennis, D. ponderosae*, and *D. pseudotsugae*. The synonymy of *D. barberi* with *D. brevicomis* (6) is further support for the synonymizing of the two nematode species. Minor intraspecific variations are inevitable in parasitic nematodes, especially when they occur in large numbers in the host. Large numbers lead to competition for nutrients and result in variations in body form. Such variations should not be misinterpreted as interspecific differences and, in such cases, the use of morphometry as the primary criterion for species differentiation should be avoided.

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