

Chondronema passali (Leidy, 1852) Christie and Chitwood, 1931, Redescribed with Observations on Its Early Development

W. R. NICKLE AND PATRICIA A. PILITT

Nematology Investigations, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland 20705

Leidy (1852) found a larval nematode parasite in the abdominal cavity of the betsy-beetle, *Popilius disjunctus* (Ill.). He described the nematode as *Nematoideum cavitatis abdominis Passali cornuti* and in the same paper referred to it as *Nematoideum passali*. At the same time, he also described from the thorax of the beetle a younger larval stage, which appears to be the infective stage of this same nematode and called it *Nematoideum thoracis cavitatis Passali cornuti*. In 1861 Deising renamed Leidy's nematodes from the betsy-beetle, calling those from the abdomen *Uracanthus brevispinosis* and those from the thorax *Agamonematodum Passali cornuti*. In his large collective work, von Linstow (1878) accepted Diesing's name of *A. Passali cornuti*. Chitwood (1932) pointed out that the generic name *Uracanthus* Diesing was a junior homonym and the specific epithet *brevispinosis* Diesing, 1861 was a synonym of *passali* Leidy, 1852. Christie and Chitwood (1931) found the adult nematodes in the beetle frass, described the various stages and probable life history, and placed the nematode in a new genus *Chondronema*. Chitwood (1932) suggested that *Chondronema* be placed in the Sphaerulariinae, which is now in the Tylenchoidea. Other workers have studied this association from an entomological point of view (Pearse et al., 1936, Gray, 1946), and they noted the presence of up to 4260 larval nematodes in one adult beetle. Contrary to the usual sphaerulariid life cycle, only larval stages, and not adults are found in the body cavity of the adult beetles. This difference, along with the apparent rarity of adult specimens, prompted the writers to pursue the current study in an attempt to determine its correct taxonomic status.

Materials and Methods

A rotting log containing a colony of adult betsy-beetles was obtained from the Plant Industry Station grounds and placed in a glass cage in the laboratory. Almost 100% of the

Beltsville beetle population was parasitized, with hundreds of larval nematodes in various stages of development within the body cavities of the beetles. Frass was periodically obtained from the galleries and examined microscopically in attempts to find adult nematodes. Specimens were fixed and permanently mounted in glycerine.

Results

Fifty *C. passali* adults (40 ♀♀, 10 ♂♂) were collected over a period of one year from the frass of the caged laboratory population of beetles. The females were usually replete with larvae of various forms (Fig. 2), including one larval stage which could be confused with an egg (Fig. 1). This stage, which appeared as an oval capsule with unique digitate appendages, was found for the first time in a ruptured female and later observed in other females. After more extensive investigation, it became apparent that the appendage was the cast cuticle of an earlier larval stage. This idea was further substantiated by the presence of remnants of a moulted stoma and rectum (Figs. 1, 2C, 3C), visible in the cast cuticle. The larvae are coiled within the cast cuticle in the same manner as unhatched nematodes, thus causing confusion with eggs. The extra cuticle, perhaps, serves as protection from the digestive juices of the beetle larvae and adults after ingestion.

The larva inside the cast cuticle had a stylet-like stoma with coalesced rhabdions, 2 μ in length, reminiscent of certain rhabditids. On several occasions these rhabdions were observed to be separated from each other, which does not occur in the shaft of a stylet. The esophagus of this larval stage was not discernible. In the same broken female specimen and within the body cavity of other older females, several larvae were seen re-entering the cast cuticle (Fig. 2D). This sequence was determined on the basis of the morphology of the stoma. Other female specimens contained



Figure 1. Egglike larvae of *Chondronema passali*.

larvae, as seen in Fig. 2B, which had an open panagrolaimoid stoma and a cylindrical esophagus. The youngest female recovered from the frass contained larvae which were in the first stage of development (Fig. 2A). The morphology of the female and male adults was studied and illustrated (Fig. 3A, B). The generic diagnosis is emended.

Genus: *Chondronema* Christie and Chitwood, 1931

DIAGNOSIS (Emended): Head with four distinct papillae. Amphidial openings lateral, slightly closer to oral opening than to papillae; amphidial pouches large. Stoma unarmed, not prominent. Esophagus with well developed dorsal esophageal gland overlapping intestine; dorsal gland orifice prominent; ampulla packed with esophageal secretions. Excretory pore just posterior to nerve ring. Caudal pores large, lateral, present in both sexes.

MALE: Testis short and flexed, with two spicules. Gubernaculum and caudal alae absent. Tail with four postanal papillae.

FEMALE: Body replete with eggs or larvae.

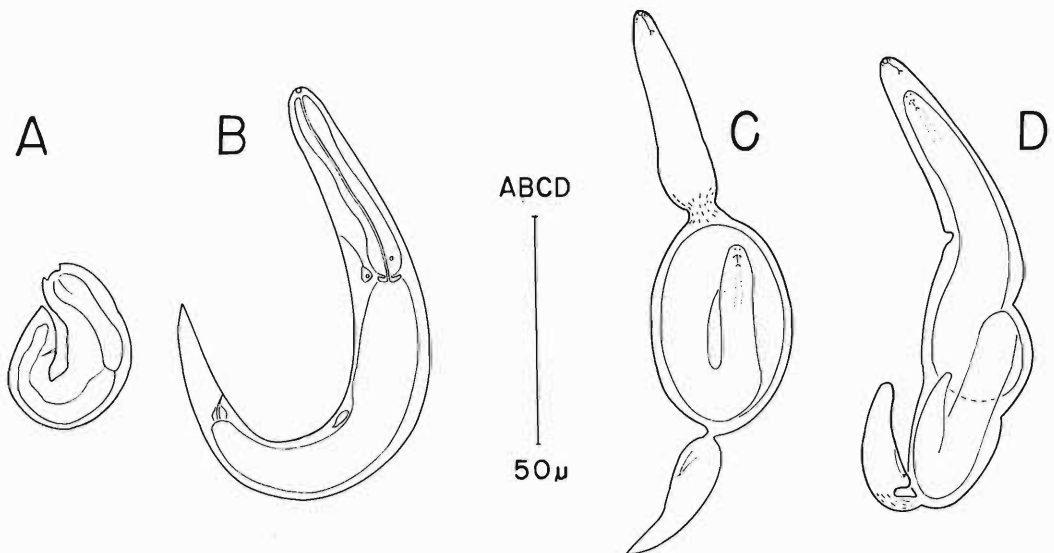
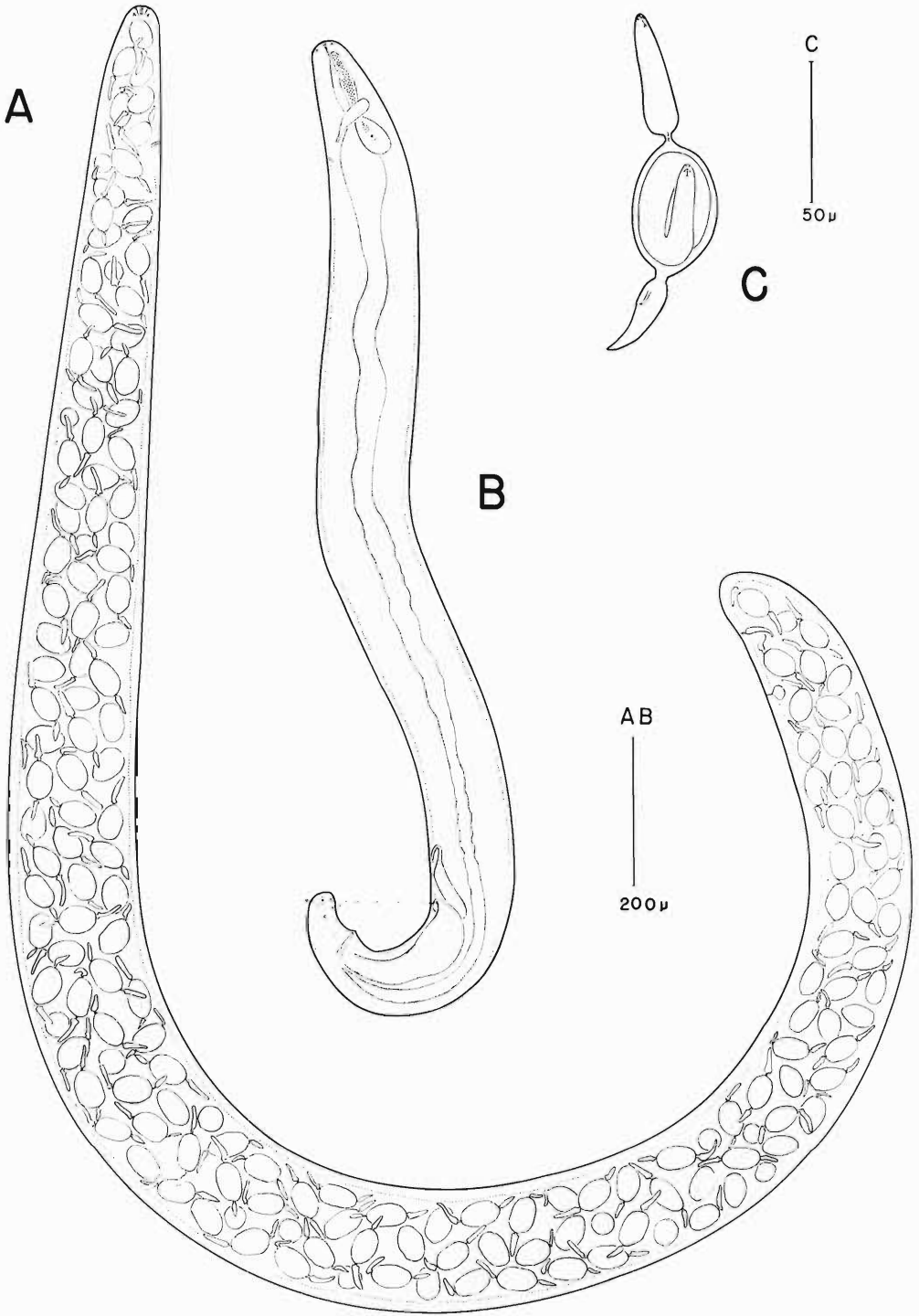


Figure 2. Larval development of *Chondronema*. A. Youngest larva found, probable first stage larva. B. Second-stage larva, found within body cavity of female nematode. C. Egglike larva, encased in earlier larval cuticle. D. Larva re-entering cuticle.



Cuticle of young specimens thick and smooth, becoming thin and with protruberances in old age. Esophagus degenerate. Vulva vestigial in function, located at 94% of body length. Anus and rectum prominent.

EGGLIKE LARVA: Encased in a retained larval cuticle, which appears to be the second stage larval cuticle.

TYPE SPECIES: *Chondronema passali* (Leidy, 1852) Christie and Chitwood, 1931.

Syn. *Nematoideum cavitatis abdominis Passali cornuti* Leidy, 1852.

***Nematoideum thoracis cavitatis Passali cornuti* Leidy, 1852.**

***Nematoideum passali* Leidy, 1852.**

***Uracanthus brevispinosus* Diesing, 1861.**

***Agamonematodum Passali cornuti* Diesing, 1861.**

***Agamonematodum Passali cornuti* Leidy (in Linstow, 1878).**

MALES (5): L = 1.59 (1.42–1.72) mm; W = 0.115 (0.104–0.126) mm; a = 13.9 (11.9–16.4); c = 19.8 (18.4–22.3); Spicule L = 38.8 (34.9–39.1) μ ; Spicule W = 5.0 (4.2–5.9) μ .

FEMALES (5): L = 3.16 (2.89–3.34) mm; W = 0.165 (0.152–0.182) mm; a = 19.2 (17.3–20.9); c = 41.6 (38.8–47.5); V% = 94.2 (92.4–94.9).

EGGLIKE LARVA (5): Anterior Appendage L = 46.6 (44.1–50.0) μ ; Body L = 45.0 (44.0–47.1) μ ; Posterior Appendage L = 35.5 (33.3–40.0) μ .

Representative specimens are deposited in the U.S.D.A. Nematode Collection, Beltsville, Md., The University of California Survey Collection, Davis, California, and Canada National Collection, Ottawa, Canada.

Discussion

Chondronema passali is a primitive nematode with no close relatives. It had been placed in the family Sphaerulariidae of the Tylenchida on the basis of having a tylenchid stylet. Our observations show that this structure is not a stylet, thus *Chondronema* is temporarily con-

sidered a genus of uncertain position. It has certain characteristics found in the strongylids, rhabditids, spirurids, and even the drilonematids. Further work on this nematode, and future discoveries of other similar worms, will be necessary before its proper status in the classification system can be determined.

Summary

Chondronema passali, parasitic in the betsy-beetle, is unique in its development. Adult nematodes occur, not in the insect, but in the frass from the beetle tunnels. Morphologically different larvae were found within the body cavity of the female nematodes. The egglike larvae are of interest because they are enclosed within an earlier larval cuticle. This enclosure probably serves as protection from the digestive juices of the beetles. *C. passali* is redescribed and illustrated, and the taxonomy and morphology of this primitive nematode are given.

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← **Figure 3.** *Chondronema passali*. **A.** Female, lateral view, containing egglike larvae. **B.** Male, lateral view, showing short gonad and spicules. **C.** Egglike larva, encased in larval cuticle.