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CUCULLANUS PALMERI N. SP. (NEMATODA: CUCULLANIDAE) FROM THE BATFISH OGCOCEPHALUS NASUTUS IN THE GULF OF MEXICO

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ABSTRACT: Cucullanus palmeri n. sp. is described from the shortnose batfish, Ogcocephalus nasutus, in the Gulf of Mexico. This species is anatomically most similar to Cucullanus gendrei but differs from it in having a shorter esophagus and longer tail. Males differ in having a smaller gubernaculum and a different arrangement of a lateral caudal papilla. Cucullanus palmeri is readily distinguished from Cucullanus lophii, also from a lophiform fish host, in that the deirids and excretory pore are not posterior to the posterior end of the esophagus like in C. lophii.

Specimens of the shortnose batfish, Ogcocephalus nasutus (Valenciennes), collected from the Gulf of Mexico for display and drug studies (Schleser and Alvarado, 1992) at the Dallas Aquarium contained nematodes in their intestine. These nematodes, collected by David M. Schleser and Tom Alvarado at the Aquarium, were sent initially to Dr. John Greve of Iowa State University, who determined them to be Cucullanus sp. (see Chabaud, 1978) and then sent them to the Gulf Coast Research Laboratory for species identification. Following that, David Schleser sent us fixed batfishes for both identification and examination for additional nematodes. No cucullanid nematodes are known from batfishes, and this report describes the new species from a batfish in the Gulf of Mexico.

MATERIALS AND METHODS

Specimens were fixed in 10% formalin and preserved in 70% ethyl alcohol. Some were subsequently cleared by evaporating the alcohol from a 5-part glycerine:95-part alcohol solution. Specimens for study using scanning electron microscopy (SEM) were sonicated, hydrated, buffered in 0.1 M sodium cacodylate (NaCaC), postfixed in OsO4, rinsed in 0.1 M NaCaC, dehydrated, critical point dried, and sputter-coated with gold. These worms were examined in a JEOL JSM-T330 scanning electron microscope. Because of the poor quality of photographs of some dirty, prefixed material, some were retouched to hide debris and charging. One specimen was sectioned in paraffin and stained with hematoxylin and eosin. Line drawings were prepared with the aid of a drawing tube. All nematodes used for measurements were mature males with spermatzoa or females with eggs. All measurements are given in micrometers unless otherwise indicated. Mean measurements are enclosed in parentheses and follow the ranges of all specimens.

DESCRIPTION

Cucullanus palmeri n. sp.
(Figs. 1–23)

General: Body short, slender for cucullanid nematodes, widest near base of esophagus, decreasing slightly in width at anal region and then narrowing to tip of pointed tail. Cuticle 7–10 thick near midbody, with fine closely spaced transverse striations. Anterior region straight, with cephalic end rounded. Oral opening shaped as dorsoventrally elongate funnel, with eggs. All measurements are given in micrometers unless otherwise indicated. Mean measurements are enclosed in parentheses and follow the ranges of all specimens.

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FIGURES 1–8. Cucullanus palmeri n. sp. from Ogygecephalus nasutus. 1. En face view, showing relationship among mouth, denticular collarette, and external lateral amphids. 2. Optical section, showing buccal frame (esophastomal ring), ventral plate, lateral extensions, and muscle attachments. Scale bar = 100 μm; same scale for Figures 1 and 2 and Figures 6–8. 3. Anterior end, dorsal view. 4. Anterior end, lateral view. 5. Anterior end, ventral view. Letters A, B, and C indicate where cross-sections were observed. Scale bar = 300 μm; same scale for Figures 3–5. 6. Cross-section of esophagus at level near middle of esophastome, anterior to posterior hiatus, at level A. 7. Cross-section of esophagus near posterior end of esophastome near posterior hiatus, at level B. 8. Cross-section of posterior esophagus, at level C.

11.8–14.4% (13.4%) of body length; anterior dilation 182–255 (211) wide, posterior dilation 194–290 (224) wide; esophastome 386–431 (416) long. Esophageal–intestinal valve 38–50 (44) in length. Nerve ring 305–420 (345) surrounding esophagus at posterior hiatus of esophageal lining. Deirids 519–625 (599) from cephalic end. Excretory pore near base of esophagus, 643–842 (706) from anterior end. Vulva usually salient, 2.7–3.9 mm (3.3 mm) or 52–60% (56%) of body length from anterior end; ovejector muscular; vagina anteriorly directed, weakly muscular; uterus didelphic, amphidelphic, reflexed; each uterine sac associated with single ovary; gonoducts reflexed extending to 1.1–1.8 mm (1.4 mm) from anterior end of body, 400–993 (850) from posterior end. Eggs (those containing cleaving embryos in distal portion of uterus) 71–81 (77) long by 46–52 (49) wide. Intestinal–rectal valve muscular, forming constriction of digestive tract directly anterior to rectum; rec-
Crites and Overstreet—New Cucullanid Nematode from Batfish

Figures 9–13. Cucullanus palmeri n. sp. from Ogcocephalus nasutus. 9. Male posterior end, ventral view showing disposition of caudal papillae in relationship to ventral sucker, spicules, gubernaculum (g), phasmid (p), and open anus. Papillae numbered using the system of Petter (1974). 10. Male posterior end, lateral view showing relationship of papillae, ventral sucker, spicules, gubernaculum, phasmids, and open anus. 11. Female lateral view demonstrating the relationship of ovejector complex, anteriorly directed vagina, and amphidelphic uteri. 12. Posterior end of female, lateral view, showing intestinal-rectal valve, rectum, anal muscles, and phasmid. Scale bar = 300 μm; same scale for Figures 9–12. 13. Eggs freed from uterus. Scale bar = 50 μm.

Crites and Overstreet—New Cucullanid Nematode from Batfish


Taxonomic summary

Type host: Ogcocephalus nasutus (Valenciennes, 1837) (Pisces: Ogcocephalidae) shortnose batfish.

Site: Intestine.

Type locality: Gulf of Mexico. Hosts were caught by shrimp trawler, probably offshore from Louisiana or Texas.

Specimens deposited: Holotype (male), National Museum Parasite Collection, USNPC no. 86403; allotype (female), USNPC no. 86404; paratypes (4 males, 4 females), USNPC no. 86405; and H. W. Manter Laboratory, University of Nebraska State Museum, HWML no. 38984 (1 male and 1 female).

Etymology: This species honors Ronnie G. Palmer, whose superb technical assistance has contributed greatly toward advancing marine parasitology at the Gulf Coast Research Laboratory.

Remarks

On the basis of overlap of most measurements in both sexes and in the male the general arrangement of caudal papillae, position of caudal sucker, and approximate relationship between spicules, C. palmeri seems most anatomically similar to Cucullanus gendrei described by Campana-Rouget (1957) from the bothid flounder Sylacum micrum Ranzani off West Africa. We obtained from the Museum National D’Histoire Naturelle (Paris) for comparison with this incompletely understood species 1 mature female specimen and 1 immature female specimen that were used for the description of C. gendrei by Campana-Rouget. Cucullanus palmeri has a collarette with 60–80 (71) denticles; the collarette of C. gendrei has 55 (range unknown). The esophagus of C. palmeri in both sexes is shorter than that of C. gendrei, 12–16% of the body length compared with 19–22%. The esophastome of C. gendrei is more shallow and the lumen narrows more anteriorly than in C. palmeri. Males of C. palmeri are generally larger in size with a longer tail than those of C. gendrei. Distal tips of the subequal and usually longer spicules are sharply pointed in C. palmeri (Figs. 9, 10, 17, 19, 20) but are illustrated (Campana-Rouget, 1957) as broadly rounded for those of near equal length in C. gendrei. The gubernaculum is smaller (43–62 vs. 145–1,160 μm) in C. palmeri. The fourth pair of papillae in C. palmeri, using the system of Petter (1974), is typically dorsolateral to the sixth pair rather than the seventh pair like in C. gendrei. Females of C. palmeri have a salient rather than nonsalient vulva like C. gendrei. Eggs average larger (71–81 by 46–52 rather than 60–75 by 40–45 μm). The rectum is longer and more thickly sclerotized in C. palmeri, and the tail is usually longer compared with that in C. gendrei.

Previously, the only cucullanid nematode known from fish of the order Lophiformes, which includes the batfish, was Cucullanus lophii Campana-Rouget and Chabaud, 1956, reported by Campana-Rouget and Chabaud (1956) from the monkfish Lophius piscatorius Linnaeus in the French Mediterranean area. Cucullanus lophii can readily be distinguished from C. palmeri because the deirids and excretory pore of C. lophii are posterior to the posterior end of the esophagus. Males and females of C. lophii have a salient rather than nonsalient vulva like C. gendrei. Eggs average larger (71–81 by 46–52 rather than 60–75 by 40–45 μm). The rectum is longer and more thickly sclerotized in C. palmeri, and the tail is usually longer compared with that in C. gendrei.

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FIGURES 14–20. Optical sections of Cucullanus palmeri n. sp. from Ogcocephalus nasutus. 14. Esophastome, ventrolateral view, showing relationship among buccal ring, denticular collarette, and roughened walls with sutures and processes extending into esophageal muscles. 15. Anterior end, showing relationship of buccal ring to denticular collarette and roughened wall of the esophastome. 16. En face showing denticular collarette. 17. Pointed ends of extended spicules. 18. Caudal end, lateral view, showing open anus with thickened lips and posterior relative to gubernaculum and posterior papillae 8, 9, and 10 (see Figs. 9, 10). 19. Male, caudal end, ventral view, at level of anus showing relationship of spicular canals and gubernaculum. 20. Male, posterior end, ventral view showing left adanal papillae 5, 6, and 7, and open anus.
DISCUSSION

The anatomy of the head and esophagus of C. palmeri conforms in a general manner to that described by Berland (1970) for Cucullanus cirratus Müller, 1777, Cucullanus heterochrous Rudolphi, 1802, and Cucullanus minutus Rudolphi, 1819. There are 4 larger outer papillae and 4 smaller inner papillae, with 2 lateral amphids (Figs. 1, 14, 16). Using SEM, we revealed the cephalic papillae of C. palmeri to be single and not double as described by Baker (1984) for the cucullanid Dichelyne (Cucullanellus) cotylophora (Ward and Magrath, 1917). The esophastome (pseudobuccal capsule) consists of a sclerotized, anterior, dorsoventrally elongate, shield-shaped ring having strong, extraordinary muscle attachments. Laterally, there are short extensions from the ring over the anterior surface of the esophageal muscle, and, ventrally, the ring ends as a transverse plate provided with very strong muscle attachments. The ring supports the denticular collarette externally and extends posteriorly forming the lining of the esophageal lumen (Figs. 1–8, 14–16). The funnel-like lumen of the esophastome remains dorsoventrally elongate (Fig. 6) until just anterior to the posterior hiatus where it becomes triangular (Fig. 7). Posterior to the posterior hiatus, the lumen becomes triradiate (Fig. 8). The internal surface of the lumen lining is roughened, and each wall appears to be composed of plates separated by sutures. At the posterior end of the esophastome, in the narrow area of the esophagus surrounded by the nerve ring there is a prominent suture that Berland (1970) termed the hiatus. The esophastome of C. palmeri has this usual hiatus, but it also has a more anterior hiatus that was consistently present in all specimens examined (Figs. 3–5, 14). At present, C. palmeri is the only species known to have a second hiatus anterior to the nerve cord.

We find it easier and more understandable in discussing the caudal papillae of the male to use the system proposed by Petter (1974) in her essay on the classification of Cucullanidae, in which she modified a system first used by Campana-Rouget and Chabaud (1956). Petter’s system numbers the papillae pairs from anterior to posterior, 1–10, with papillae pairs 4 and 8 being lateral. Papilla 4 in C. palmeri is preanal (Figs. 9, 10), which is different from many other species of Cucullanus. Petter (1974) also proposed a scheme for demonstrating the evolution of anatomical characters in the family Cucullanidae, and she pointed out that papillae pairs 7 and 9 were always farther apart in species of Cucullanus than in species of other cucullanid genera. The seventh and ninth papillae of C. palmeri fit this pattern (Figs. 9, 10, 18). The gubernaculum of C. palmeri is smaller than in most species of Cucullanus, and its distal tip appears above the anus in ventral view (Figs. 9, 19, 20). The male anus is widely open in C. palmeri, and even though the walls of the cloaca do not appear heavily sclerotized, the lips of the anus are firmly sclerotized and protrude dorsally and ventrally (Figs. 10, 18). According to Tornquist (1931), the male “rectum” of species of Cucullanus is triangular in cross section and has a Y-shaped lumen. He proposed that this condition might be typical in all cucullanid nematodes. Berland (1983), using SEM, demonstrated a Y-shaped lumen between the “rectal lips” protruding through the anus of Cucullanus elongatus Smedley, 1933. Even though the anus of C. palmeri is widely open, we could not directly confirm a Y-shaped cloacal lumen for this species. The proximal, blunt ends of the...
retracted spicules of *C. palmeri* are always anterior to the ventral sucker and to the anterior pair of caudal papillae. This feature aids in distinguishing *C. palmeri* from other species of *Cucullanus*, in which this combination does not occur. The distal ends of the spicules are pointed and appear straight when extended (Fig. 17). When retracted, the spicules are pointed, but they may appear wavy and are contained in definite spicular canals (Fig. 19). The spicular canals reach posteriorly to the gubernaculum, but the gubernaculum is not Y-shaped with sclerotized arms extending into the spicular canals as demonstrated for some other cucullanid species (Berland, 1970, 1983; Petter, 1974).

The vulva of *C. palmeri* is a transverse slit between two slightly salient lips. The vulva leads inside into a chamber with sclerotized cuticular walls and is surrounded by an ovoid mass of firm connective tissue set off from the surrounding hypodermis and provided with its own retractor muscles. The lumen of the antechamber with sclerotized walls enters and continues through a short, anteriorly directed, muscular tube. This muscular tube plus the antechamber make up the ovejector complex. The ovejector complex connects anteriorly with the vagina that continues anteriorly and then divides, forming both an anterior and posterior uterus (Fig. 11). The ovejector complex is seldom noted, but that in *C. palmeri* may be typical of all cucullanids.

The intestinal-rectal valve of both sexes has muscle cells giving it a decided sphincter-like appearance; this valve is best observed in females of *C. palmeri* (Fig. 12). The rectum of the female has a thickly sclerotized lining of the lumen, and it is surrounded by an outer layer of tissue. Muscle cells occur in the lateral body walls dorsal to the anus (Fig. 12); we presume that contraction of these muscle cells opens the anus.

Initial nematode specimens sent to us were obtained from a batfish tentatively identified at the Dallas Aquarium as *Ogcocephalus radiatus* (Mitchill). Of 3 intact specimens of batfish later sent from the Dallas Aquarium, 2 were caught from Tampa Bay, Florida, and we determined them to be uninfected *O. radiatus*. The third, trawled by a shrimper from the northern Gulf of Mexico, was *O. nasutus* and was infected with both *C. palmeri* and the ascarid nematode *Hysterothylacium ogcocephali* (Olsen, 1952), also sent with the initial specimens. Whether *O. radiatus* actually serves as a host of *C. palmeri* has to be confirmed.

*Cucullanus palmeri* is the only nematode of the genus *Cucullanus* to be described from a marine fish host in the Gulf of Mexico. Other cucullanid nematodes reported from fish hosts from the Gulf of Mexico are *Dichelyne* (*Dichelyne*) *fastigatus* Chandler, 1935 from the red drum, *Sciaenops ocellatus* (Linnaeus), and *Dichelyne diplocaeum* Chandler, 1935 from the blue catfish, *Ictalurus furcatus* (Lesueur) by Chandler (1935) and *Dichelyne* (*Cucullanellus*) *bullcki* Stromberg and Crites, 1972 from the killifishes *Fundulus grandis* Baird and Girard and *Fundulus similis* (Baird and Girard) by Overstreet (1983). *Dichelyne diplocaeum* cannot be assigned to a subgenus as it has no described male (Chandler, 1935). The host, *Ictalurus furcatus*, is generally considered a fresh or brackish water fish.

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**LITERATURE CITED**


