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(Nematoda: Ascaroidea) from Fishes in the Northern Gulf of
Mexico and Eastern U.S. Seaboard**

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THYNNASCARIS RELIQUENS SP. N. AND *T. HABENA* (LINTON, 1900) (NEMATODA: ASCARIDOIDEA) FROM FISHES IN THE NORTHERN GULF OF MEXICO AND EASTERN U. S. SEABOARD*

Donald E. Norris† and Robin M. Overstreet‡

ABSTRACT: *Thynnascaris reliquens* sp. n. is described from the type host, the sheepshead, *Archosargus probatocephalus* (Walbaum), and other fishes of the northern Gulf of Mexico and southern Florida, including the Gulf toadfish, *Opsanus beta* (Goode and Bean); the spiny boxfish, *Chilomycterus schoepfi* (Walbaum); the slippery dick, *Halichoeres bivittatus* (Bloch); and the Atlantic croaker, *Micropogon undulatus* (Linnaeus). Its salient characters are: length up to approximately 12.5 cm; lips broad, with pedunculate pulp and equatorially constricted flanges; esophagus 8 to 12% and spicules 3 to 6% of body length; preanal and postanal papillae up to 33 and 6 pairs, respectively. In the type host, some adults attained a considerably greater size than in other hosts, and their labial morphology changed as the maximum length was approached. *Thynnascaris habena* is redescribed from the oyster toadfish, *Opsanus tau* (Linnaeus), its type host, on the basis of examination of specimens collected from Massachusetts, Virginia, and Georgia. *Thynnascaris melichthysi* (Olsen, 1952) and *T. ogcocephali* (Olsen, 1952) are transferred from the genus *Contracaecum* as new combinations.

During a survey of parasites of estuarine fishes in Mississippi Sound and adjacent waters, an undescribed species of *Thynnascaris* Dollfus, 1933, was recovered from the stomach and intestine of the sheepshead, *Archosargus probatocephalus* (Walbaum); the Gulf toadfish, *Opsanus beta* (Goode and Bean); the striped burrfish, *Chilomycterus schoepfi* (Walbaum); and other fishes. A review of species of *Thynnascaris* from similar hosts showed *T. habena* (Linton, 1900) to be inadequately described, and specimens for study were collected from the oyster toadfish, *O. tau* (Linnaeus), from the type locality, Woods Hole, Massachusetts, and from Gloucester Point, Virginia, and Savannah, Georgia.

Dollfus (1933) erected the genus *Thynnascaris* for *Contracaecum*-like ascaridoids of fishes; he later (1935) emended the genus and reduced it to a subgenus of *Contracaecum* Railliet and Henry, 1912. Hartwich (1957)

raised *Thynnascaris* to generic level and emended it to encompass all valid species of *Contracaecum* described from piscine definitive hosts. Members of *Thynnascaris* differ from those of *Contracaecum* in lacking a ribbonlike widening of the excretory system and in having an excretory pore which opens near the level of the nerve ring, rather than between the subventral lips. On the basis of those features, species of *Thynnascaris* are limited as adults to fishes and those of *Contracaecum* to birds and mammals.

MATERIALS AND METHODS

Worms were removed from the gastrointestinal tracts of hosts, fixed in glacial acetic acid, and cleared either in a mixture of 5% glycerine in 70% alcohol subsequently evaporated to glycerine; in lactic acid; or in lactophenol. Within the description of spicules below, the term "equal" denotes spicules differing less than 5% in length; "subequal," from 5 to 10%; and "unequal," more than 10%. Figures within parentheses in the description of *T. habena* refer to measurements of the lectotype. All measurements are in microns, unless otherwise stated. Figures were drawn with the aid of a camera lucida.

Thynnascaris reliquens sp. n.

(Figs. 1-11)

Type host: *Archosargus probatocephalus* (Walbaum), sheepshead (Sparidae).

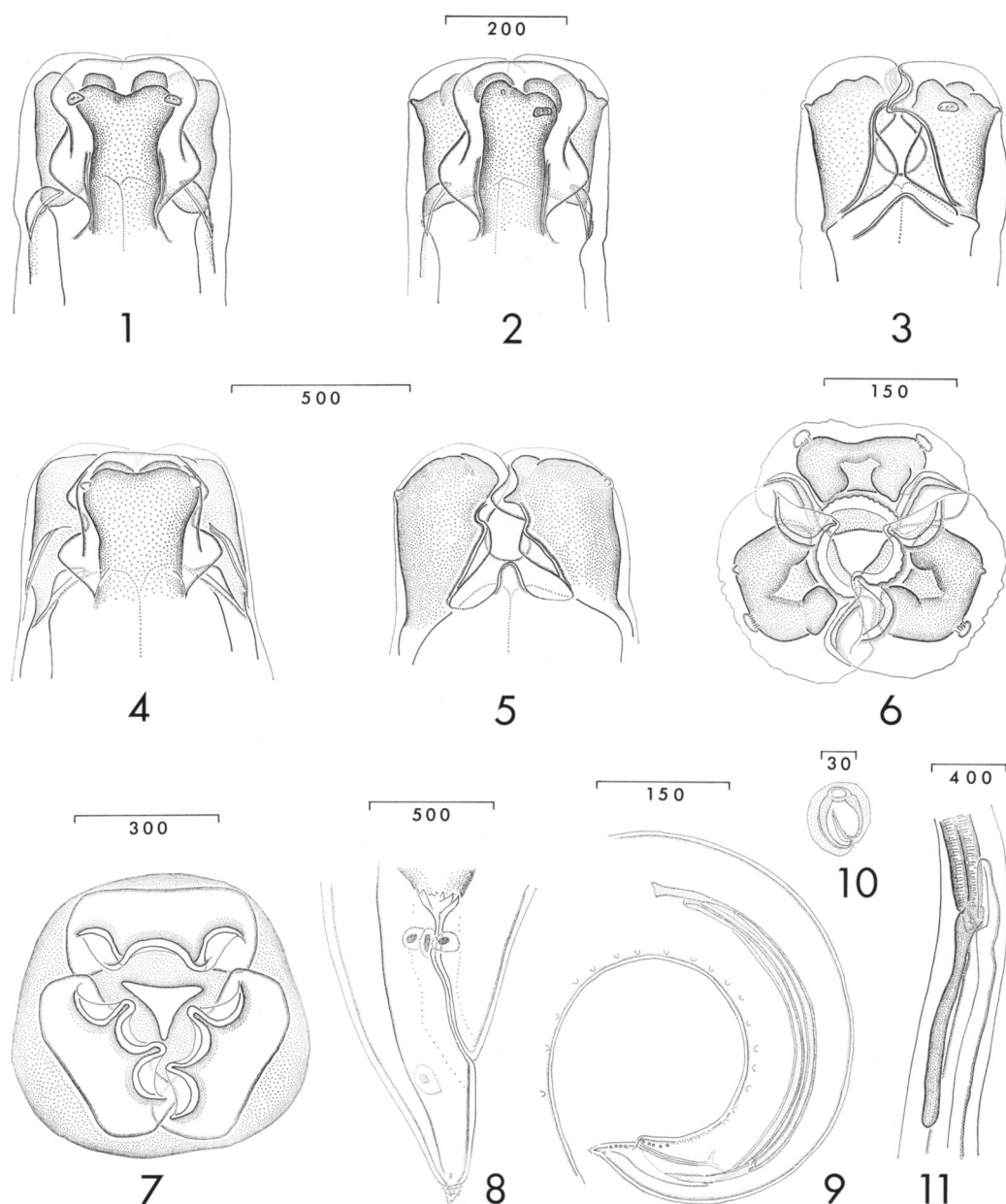
Other hosts: *Opsanus beta* (Goode and Bean), Gulf toadfish (Batrachoididae); *Chilomycterus schoepfi* (Walbaum), striped burrfish (Diodontidae); *Halichoeres bivittatus* (Bloch), slippery dick (Labridae); *Micropogon undulatus* (Linnaeus), Atlantic croaker (Sciaenidae).

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FIGURES 1-11. *Thynnascaris reliquens* sp. n. 1-7. Lips. 1-3. Lateral, frontal views of lips of small adult. 1. Dorsal lip. 2. Right subventral lip. 3. Interlabium between left subventral and dorsal lips. 4, 5. Mid-lateral views of lips of large adult. 4. Dorsal lip. 5. Interlabium between subventral lips. 6, 7. *En face* views of lips. 6. Lips of small specimen. 7. Surficial view of lips of large specimen. 8, 9. Caudal region, lateral views. 8. Female caudal region. 9. Male caudal region. The smallest papillae, proximal to the cloaca, are diagrammatically rendered proportionally larger than their actual size to facilitate visualization of their position. The caudal region of both sexes may be proportionally broader in the largest adults. 10. Spicule and sheath, cross section. 11. Body at level of intestinal cecum and ventricular appendage, lateral view of small specimen; in the largest adults the intestinal cecum may be proportionally broader and the ventricular appendage proportionally narrower.

Sites: Intestine pyloric ceca, and occasionally stomach.

Locality: Mississippi Sound, Mississippi, except single specimens of *Halichoeres bivittatus* and *Opsanus beta* from Biscayne Bay, Florida.

Specimens deposited: Holotype (male) USNM Helm. Coll. No. 73700; allotype (female) No. 73701; paratypes (2 males and 2 females) No. 73702, 73703.

Description: Based on 23 mature males (15 from *Archosargus probatocephalus*, 4 from *Opsanus beta*, and 4 from *Chilomycterus schoepfi*) and 24 gravid females (15 from *A. probatocephalus*, 4 from *O. beta*, and 5 from *C. schoepfi*).

General: Raphidascarinae Hartwich, 1957; *Thynnascaris* Dollfus, 1933 (*sensu* Hartwich, 1957). Body medium-sized, relatively slender to large and stout, reaching greatest width in posterior $\frac{1}{2}$ and gradually tapering anteriorly, up to about 12.5 cm long and 2 mm wide. Cuticle with inconspicuous annulations, and minute lateral ridge on each side of body; lateral ridges (not alae) extending length of body, becoming more apparent and often dorsolateral at levels posterior to rectum. Lips broader than long; character of lips changing with increasing size of adult worms, as follows: worms up to about 8 cm (Figs. 1–3): labial pulp pedunculate, approximately twice as long as greatest width, expanding laterad and bluntly projecting anterolaterad at level of anterior $\frac{1}{3}$; anterior lobes of pulp anterior to anterolateral in position, rounded to bluntly angular, projecting inward and anteriorly usually well beyond anterior margin of pulp; labial flanges equatorially constricted, with basal portion forming broad triangular laterad projections with margins shorter than base and approximately equal and convex, with anterior portion expanding anterolaterad usually well beyond margin of pulp and having rounded margin; interlabia triangular, with base greater than height, with alate margins; lips of worms longer than about 8 cm (Figs. 4, 5) differing from those of smaller specimens in following respects: pulp relatively robust, expanding and projecting anterolaterad at level of anterior $\frac{1}{2}$; anterior lobes of pulp wider; margin of equatorial constriction of and anterior margin of labial flanges more closely approximating margin of pulp; interlabia with height greater than base. Pulp of subventral lips narrower at level of anterior $\frac{1}{3}$ than that of dorsal lip, asymmetrical, with greatest anterior expansion proximal to dorsal lip; adjacent lips fitting together by means of interdigitating projections and depressions of anterolateral corners. Esophagus clavate, with length usually 8 to 12% of length of body. Ventriculus irregularly shaped, broader than long, but narrower than widest level of esophagus. Ventricular appendage of specimens from type host 1.8 to 3.6 times longer than intestinal cecum. Nerve ring and excretory pore at level of approximately 15 to 21% of distance from anterior extremity to base of esophagus; excretory pore usually at or slightly posterior to level of nerve

ring. Rectum with thick cuticular lining flaring at junction with intestine. Tail short, conical, with mucronate extremity covered with minute spines.

Male: Body 21 to 79 mm long, 519 to 1,880 wide at level of greatest width, with level of greatest width within posterior $\frac{1}{3}$ of body; ratio of greatest width to length 1:36 to 51. Lips 148 to 382 long, 168 to 490 wide. Excretory pore opening 480 to 1,568 distal to anterior extremity. Esophagus 2.2 to 9.7 mm long. Ventriculus 64 to 392 long, 140 to 529 wide. Ventricular appendage 940 to 3,360 long. Intestinal cecum 255 to 1,400 long. Ratio of length of intestinal cecum to that of ventricular appendage 1:2.4 to 5.8. Testis usually extending anteriorly of level within anterior $\frac{1}{4}$ of body. Seminal vesicle thin-walled, generally looping about intestine. Spicules ventrally alate with double alae, 1.24 to 3.38 long or 3 to 6% of length of body, 36 to 52 wide dorsoventrally, equal in 12 of 15 specimens, subequal in 3 of 15; length of left spicule 92 to 105% of that of right. Papillae 24 to 33 pairs preanal; adanal usually lacking, rarely 1 pair; postanal 4 to 6 pairs; papillae low, generally decreasing in size and becoming more closely approximated and ventral at levels approaching cloaca, inapparent at levels proximal to cloaca. Body abruptly narrowing at level of cloaca; tail conical, 120 to 235 long.

Female: Body 23 to 127 mm long, 480 to 2,440 wide at level of greatest width, with greatest width within posterior $\frac{1}{2}$ of body; ratio of greatest width to length 1:38 to 57. Lips 164 to 510 long, 196 to 686 wide. Excretory pore 480 to 2,019 distal to anterior extremity. Esophagus 2.4 to 11.6 mm long. Ventriculus 76 to 421 long, 136 to 588 wide. Ventricular appendage 880 to 4,450 long. Intestinal cecum 260 to 1,800 long. Ratio of length of intestinal cecum to that of ventricular appendage 1:1.8 to 4.9. Vulva without salient lips, opening 7.6 to 33.0 mm posterior to anterior extremity or 29 to 34% of length of body from anterior extremity. Ovary extending anteriorly beyond level of vulva. Tail 300 to 686 long. Uterine eggs with smooth thin shell, 48 to 60 long by 44 to 52 wide.

REMARKS

The specific name is the present participle of the Latin verb *relinquo*, to abandon or to leave behind, and refers to the proclivity of these nematodes to actively migrate from the mouth, opercular openings, or anus of physiologically stressed hosts.

DISCUSSION

Linton (1901) described an "*Ascaris* sp." from the red drum, *Sciaenops ocellata* (Linnaeus), from Woods Hole, Massachusetts, which his figures illustrated as having a constricted labial flange and wide-based interlabia similar to those of *T. reliquens*. His sparse

TABLE I. *Comparative morphometric data for mature specimens of Thynnascaris reliquens sp. n., T. melichthysi (Olsen, 1952), T. ogcocephali (Olsen, 1952), T. habena (Linton, 1900), and "Ascaris sp." Linton, 1901 (from Sciaenops ocellatus).*

	<i>T. reliquens</i>	<i>T. melichthysi</i>	<i>T. ogcocephali</i>	<i>T. habena</i> *	" <i>Ascaris sp.</i> "
Length of body in mm					
Male	21–79	28–68	20–30	26–53	27†
Female	23–127	48–86	30–55	28–57	56†
Length of esophagus in mm	2.2–11.6	4.0–8.2	3.8, 4.7†	4.7–9.5	2.3, 6.5†
As % of body length	8–12	—	14.5, 9.0†	13–20	11.3, 11.6†
Level of vulva as % of body length from anterior extremity	29–34	about 25	27.5†	31–37	—
Length of tail in mm					
Male	0.14–0.24	0.15–0.18	0.13†	0.08–0.16	—
Female	0.30–0.69	0.63–1.06	0.37†	0.23–0.34	0.65†
Length of spicules in mm	1.24–3.38	2.80–4.23	0.52–0.66	2.4–6.1	about 2
As % of body length	3–6	—	—	9–14	—
Number of pairs of papillae					
Preanal	24–33	22–26	18–26	21–31	29†
Adanal	0–1	1	0	0–1	0†
Postanal	4–6	3†	1–2	4–6	2–4†

* Based on data from examined specimens.

† Representative measurements.

morphometric data are within the ranges for our specimens (Table I). The status of Linton's specimens remains unknown.

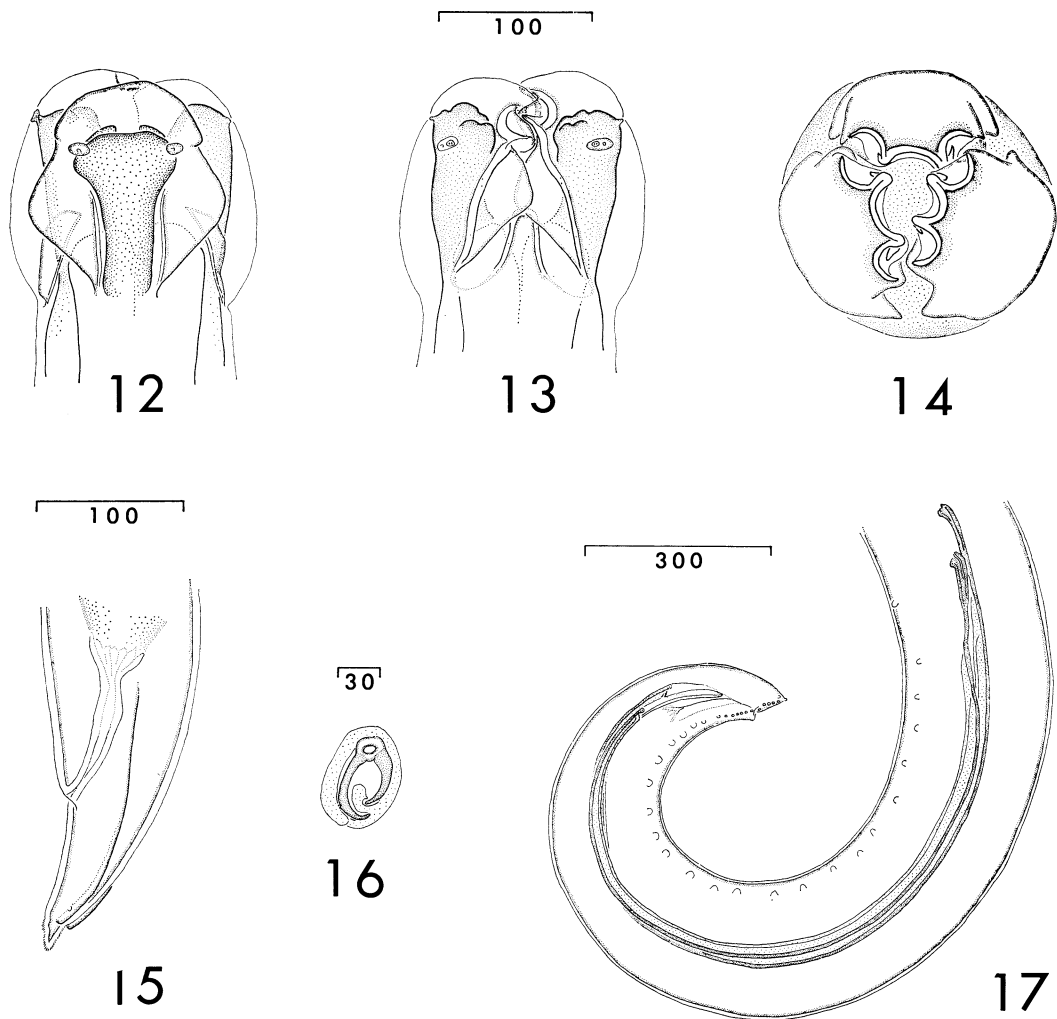
Thynnascaris reliquens most resembles *T. melichthysi* (Olsen, 1952) comb. n. and *T. ogcocephali* (Olsen, 1952) comb. n., which we transfer from the genus *Contracaecum* on the basis of their having clearly defined characteristics of the genus *Thynnascaris*. The lips of these species are unusual because the elongate pulp is bordered by lateral flanges constricted into basal and anterior portions. In *T. reliquens* the constriction is equatorial, the margins of the triangular basal extensions of the flange are approximately equal, and these extensions are broad; in the two similar species the constriction is at an anterior level of the lip, the posterior margins of the triangular basal extensions of the flange are much longer than the anterior margins, and these extensions are comparatively narrow. The lips of *T. reliquens* are broader than long, but elongate in the other two species. Most specimens of *T. reliquens* also differ from those of *T. melichthysi* in having a shorter tail in the female; a vulva opening farther posteriad; shorter spicules; and a differing number of pairs of preanal and postanal papillae. *Thynnascaris reliquens* differs from *T. ogcocephali* in having a greater maximum length and corresponding width;

longer spicules; and a different number of pairs of preanal and postanal papillae. Comparative data for these species appear in Table I.

In our collections adult reproducing *T. reliquens* varied considerably in intensity of infection and in size, depending upon the host. In the type host, the sheepshead, *T. reliquens* occurred in greater numbers (up to 137 adult individuals in one fish) and attained a greater size than in other fishes, suggesting that the sheepshead is the normal definitive host. No more than nine individuals, up to about 4 cm long, were recovered from the striped burrfish, and a maximum of four individuals, up to about 6 cm long, were found in the Gulf toadfish. Two individuals, the largest about 4.5 cm, were recovered from the slippery dick; egg-producing adults rarely occurred in over 2,500 Atlantic croaker.

Other morphologic differences occurred among specimens from the three main host species for this study. The ratio of length of the intestinal cecum to the ventricular appendage was rarely more than 1:2.9 in specimens from the sheepshead, from 1:2.3 to 3.6 in the striped burrfish, but never less than 1:3.6 in specimens from the Gulf toadfish.

The lips of adults changed significantly as body length approached and exceeded approximately 8 cm. The labial pulp of larger in-



FIGURES 12–17. *Thynnascaris habena* Linton (1900) Hartwich, 1957. 12–14. Lips. 12, 13. Midlateral views of lips. 12. Dorsal lip. 13. Interlabium between subventral lips. 14. Surficial *en face* view of lips. 15, 17. Caudal region, lateral views. 15. Female caudal region. 16. Spicule and sheath, cross section. 17. Male caudal region. The smallest papillae, proximal to the cloaca, are diagrammatically rendered proportionally larger than their actual size to facilitate visualization of their position.

dividuals expanded to occupy a greater proportion of the lip, and the anterior portion of the labial flange and the interlabia changed shape. However, in the largest adults other proportions, such as the length of esophagus and spicules to body length, remained within the range of those of smaller worms.

***Thynnascaris habena* (Linton, 1900)
Hartwich, 1957
(Figs. 12–17)**

Host: *Opsanus tau* (Linnaeus), oyster toadfish (Batrachoididae).

Site: Intestine.

Locality: Woods Hole, Massachusetts; Gloucester Point, Virginia; Savannah, Georgia.

Specimens deposited: USNM Helm. Coll. No. 73704.

Redescription: Based on lectotype and on 10 mature males and 10 mature females from Virginia.

General: Body relatively slender, reaching greatest width within posterior $\frac{1}{2}$ and gradually tapering anteriorly, up to 5.7 cm long and about 1 mm wide. Cuticle with fine annulations and fine lateral ridge on each side of body; lateral ridge extending length of body, expanding as low cervical alae generally for distance of about 2 to 3 mm and

within level of anterior $\frac{2}{3}$ of esophagus, gradually attenuating at posterior levels of body, but becoming relatively prominent posterior to extremity of intestine and extending dorsolaterad at level of tail. Lips broader than proximal level of body, usually broader than long. Labial pulp pedunculate, about twice as long as greatest width, expanding and projecting anterolaterad at level of anterior $\frac{1}{3}$; pulp of subventral lips asymmetrical, with greatest anteriad extension proximal to dorsal lip; anterior lobes of pulp usually anterolateral in position, low, with anterior margin generally parallel to that of anterior extension of pulp, projecting inward and anteriad. Labial flanges expanded equatorially as broad triangular projections, slightly constricted near level of lateral expansion of pulp, with rounded anterior margin projecting well beyond anterior margin of pulp. Interlabia triangular, with height greater than base, with alate margins. Esophagus slender, clavate, with length approximately 13 to 20% of length of body. Ventriculus irregularly shaped, usually broader than long but narrower than widest level of esophagus. Ventricular appendage generally 1.5 to 3 times longer than intestinal cecum. Excretory pore at level of 8 to 11% of distance from anterior extremity to base of esophagus, usually 40 to 60 posterior to nerve ring. Rectum with cuticularized lining flaring at junction with intestine. Tail short, conical, with stout mucron.

Male: Body 26 to 53 mm (29.6 mm) long, 392 to 980 (588) wide at level of greatest width, with level of greatest width within posterior $\frac{1}{3}$ of body; ratio of greatest width to length 1:55 to 64 (1:50). Lips 100 to 196 (132) long, 140 to 234 (152) wide. Excretory pore 470 to 823 (584) posterior to anterior extremity. Esophagus 4.7 to 9.5 mm (6.2 mm) long. Ventriculus 116 to 160 (100) long, 100 to 220 (140) wide. Ventricular appendage 431 to 1,380 (911) long. Intestinal cecum 140 to 666 (320) long. Ratio of length of intestinal cecum to that of ventricular appendage 1:1.6 to 3.8 (1:2.8). Testis usually extending anteriad within level of anterior $\frac{1}{3}$ of body. Seminal vesicle with relatively thick walls and few loops. Spicules ventrally alate with double alae, 2.4 to 6.1 mm (3.4 mm) long or 9 to 14% (12%) of length of body, 32 to 60 wide dorsoventrally, unequal in 5 of 10 specimens, subequal in 4 of 10, equal in 1 of 10; length of left spicule 76 to 128% (95%) of that of right. Papillae, 21 to 31 (30) pairs preanal; adanal lacking or 1 (1) pair; postanal 4 to 6 (5) pairs; papillae low, becoming inapparent and more closely approximated and ventral at levels proximal to cloaca. Body abruptly narrowing at level of cloaca; tail 80 to 160 (76) long, conical, with mucron usually spineless.

Female: Body 28 to 57 mm long, 490 to 921 wide at level of greatest width, with level of greatest width within posterior $\frac{1}{2}$ of body. Lips 116 to 248 long, 128 to 240 wide. Excretory pore 402 to 794 posterior to anterior extremity. Esoph-

agus 4.7 to 7.6 long. Ventriculus 80 to 224 long, 128 to 274 wide. Ventricular appendage 686 to 1,421 long. Intestinal cecum 320 to 940 long. Ratio of length of intestinal cecum to that of ventricular appendage 1:2.0 to 4.2. Level of vulva with few to many tiny (6.5 to 15) rounded cuticular (?) bosses (adherent sperm?) lacking in specimens without patent vulva. Vulva without salient lips, opening 9 to 16 mm posterior to anterior extremity or 31 to 37% of length of body from anterior extremity. Ovary rarely extending anteriad beyond level of vulva. Tail 225 to 343 long, with dorsolateral ridges expanding as low alae reaching greatest width near posterior extremity, with spinous mucron. Uterine eggs with thin smooth shell, 60 to 76 long by 48 to 60 wide.

DISCUSSION

Linton (1900) briefly described *Ascaris habena* from the oyster toadfish, *Opsanus tau*, from Woods Hole, Massachusetts; he later (1934) considered the species to be in the genus *Contracaecum*. The observable characters of Linton's mutilated and opaque type specimens are comparable to those of our specimens, collected from the same host from the type locality, and from Virginia and Georgia. Chandler (1943) redescribed the species from specimens collected from the same host in Maryland, near our collection site in northern Virginia. Discrepancies exist among his redescription and figures, ours, and the lectotype. Chandler failed to note cervical, caudal, or spicular alae and observed no more than "about 24" preanal papillae. He gave as the proportional length of the esophagus to that of the body 20 to 25%; for the lectotype this proportion was 22%, but it was not more than 20% for our specimens. Although Chandler's smallest specimens were 5 to 10 mm shorter than ours, he gave greater minimum lengths for the intestinal cecum (140 vs. 320), the ventricular appendage (431 vs. 740), and the tails (80 vs. 110 in males, 225 vs. 240 in females); these differences may result from our examining a larger series of specimens.

Thynnascaris habena differs from *T. reliquens* in having lips with a relatively narrow peduncle and equatorially expanded, rather than constricted, labial flanges; cervical alae; caudal alae in the female; and in being smaller and having different organ-to-body proportions (Table I).

Thynnascaris habena utilizes as its normal definitive host *O. tau*, which is limited in U. S.

coastal waters to the eastern seaboard as far south as Miami, Florida (Walters and Robins, 1961). We know of no records for *T. habena* in *O. beta*, a host for *T. reliquens*, for which at least Palm Beach, Florida, is the northernmost extension of the geographic range (Walters and Robins, 1961), and we found no *T. reliquens* in *O. tau* from any collection site.

We add to these data a brief description of a pair of *T. habena* fixed in copula, since little is known about this phase of reproduction in ascaridoids. The male, probably now disoriented, encircles the female slightly anterior to the level of the vulva with his tail. The right spicule projects at a right angle to the body of the male and is inserted into the vagina to a level of approximately 2 mm posteriad from the vulva; the left spicule is unverted. A band of "mucoid" material, which may mark the original position of the male, girdles the female at a level just posterior to the vulva. Mature females in our collections commonly are surrounded near the level of the vulva by such a band of material.

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