FOLIA PARASITOLOGICA 38: 29–32, 1991.

A NEW HUFFMANELA SPECIES, H. SCHOUTENI SP. N. (NEMATODA: TRICHOSOMOIDIDAE) FROM FLYING FISHES IN CURAÇAO

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Abstract. A new nematode species, *Huffmanela schouteni* sp. n., has been established on the basis of its egg morphology and biological characters (adult nematodes are unknown). The dark-shelled eggs of this histozoic parasite occur in masses in the abdominal cavity, serose covers of internal organs and in the liver of the flying fishes *Hirundichthys affinis* Günther (type host) and *Cypselurus cyanopterus* Cuvier et Valenciennes in Curaçao. The eggs of *H. schouteni* sp. n. differ from those in other congeneric species mainly in the absence of small spines on the surface of the transparent envelope enclosing the egg proper, measurements (size of eggs 0.069—0.075 × 0.027—0.030 mm) and their localization in the host. A key to *Huffmanela* species based on egg morphology has been provided.

In 1968, Schouten et al. (1968) detected in the stools of six patients in Curaçao trichuroid ova "more or less resembling *Capillaria hepatica*" which they designated as "C-eggs". They were able to locate the source of these eggs: cooked fish-soup prepared from the flying fishes (local names "Bulado" or "Fleerchi") bought at the local market. Investigation of patients after fishless diets revealed that these eggs passed the human intestinal tract in about seven days. Examining the flying fishes (*Hirundichthys affinis*), they found that all but one had in their abdominal cavity large black masses containing countless "C-eggs" and these were present also in the liver. The same eggs were also recorded from the larger flying fish *Cypselurus cyanopterus*. Later Suriel-Smeets and Schouten (1972) mention that the examination of about 150 flying fishes did not reveal the presence of any nematodes in connection with "C-eggs".

A reexamination of these eggs, provided kindly by Dr. H. Schouten, has shown that they belong to a hitherto undescribed species of the recently erected genus *Huffmanela* Moravec, 1987 (family Trichosomoididae). Since the majority of species of these histozoic parasites are known by their eggs only, we consider it reasonable to establish also this new species on the basis of its egg morphology and biological characters (which is in accordance with the International Code of Zoological Nomenclature), despite the fact that conspecific adult nematodes are hitherto unknown.

MATERIALS AND METHODS

The present material originated from the flying fish *Hirundichthys affinis* Günther from Curaçao and consisted of several pieces of the host's intestine containing numerous nematode eggs at its serose cover. The hosts' tissues along with eggs of the parasite were fixed and later stored in 5% formalin. For examination in the light microscope the eggs were cleared with glycerine. Drawings were made with the aid of a Zeiss microscope drawing attachment, microphotographs with the photomicroscope DOCUVAL (Zeiss, Jena). After examination some eggs were mounted as permanent preparation in glycerine-jelly, some have been stored in 70 % ethanol. This type material has been deposited in the collection of the Institute of Parasitology, Czechoslovak Academy of Sciences, in České Budějovice.

For examination in SEM, the nematode eggs were dehydrated through an ethanol series and amylacetate and then subjected to critical point drying. The eggs were coated with gold and examined with the Tesla BS-300 electron microscope at an accelerating voltage of 15 kV. All measurements are in millimetres.

RESULTS

Huffmanela schouteni sp. n. Fig. 1, Plts. I—IV

Hosts: Flying fishes, *Hirundichthys affinis* Günther (type host) and *Cypselurus cyanopterus* Cuvier et Valenciennes (fam. Exocoetidae).

Localization: eggs in serose cover of intestine (in abdominal cavity and also in liver according to Schouten et al. (1968)).

Type locality: Curaçao — fish market (15 August 1967), Netherlands Antilles.

Etymology: This species has been named in honour of Dr. H. Schouten of the St. Elisabeth Hospital, Curaçao, who first discovered the parasite's eggs.

Depositon of type specimens: Eggs (syntypes) deposited in the helminthological collection of the Institute of Parasitology, Czechoslovak Academy of Sciences, České Budějovice, Czechoslovakia (Helm. Coll. Cat. No. N — 462).

Description of eggs: Advanced eggs dark-brown to black, elongate-oval, with two-layered shell; inner layer thin, light in colour, outer layer dark, thick, with smooth surface. Light-coloured polar plugs protruding, height of polar plug 0.009—0.012, width 0.006—0.009, height of its protruding part 0.003. Eggs containing developed larva with body width 0.006 (larva 0.210 long and 0.004—0.006 wide according to Schouten et al. (1968)). Whole egg including polar plugs covered by thin transparent layer (envelope) with very fine, dense superficial sculpture (protuberances), size without superficial envelope 0.069—0.075 × 0.027—0.030. Thickness of egg wall (without superficial envelope) 0.003—0.005.

Adult nematodes: unknown.

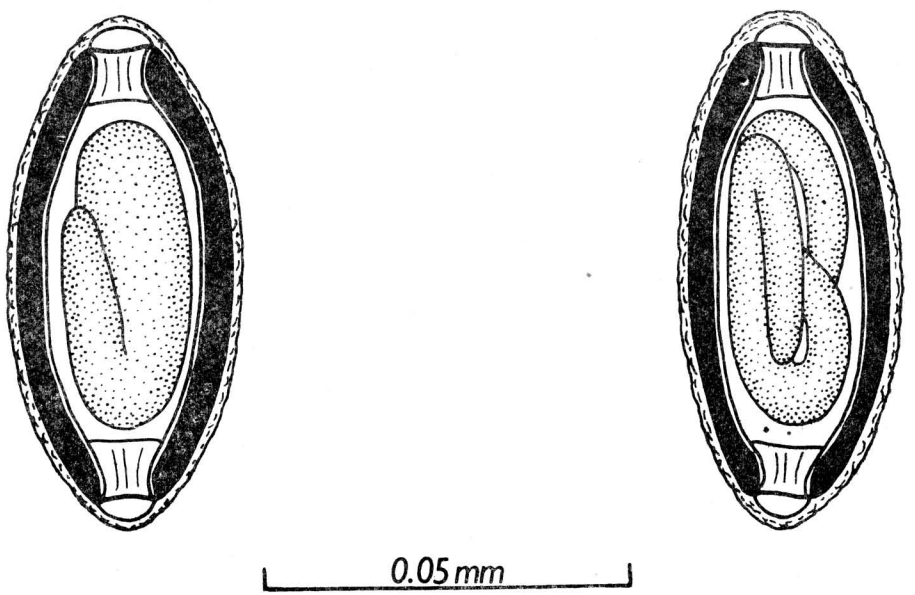

Fig. 1. Mature eggs of *Huffmanela schouteni* sp. n. from the intestinal serosa of the flying fish, *Hirundichthys affinis*.

Key to the species of *Huffmanela* (based on eggs):

1 Eggs large, their length at least 0.090 mm; eggs localized in skin, mucosa of gill archs or muscles of marine fishes 2
— Eggs smaller, their length at most 0.075 mm; eggs localized in abdominal cavity and viscera of marine and freshwater fishes 3

2 Eggs thick-walled, thickness of wall being 0.006—0.009 mm; polar plugs high (0.012—0.018 mm); eggs localized in skin and mucosa covering connective tissue of gill archs of requiem sharks (*Carcharhinus*) . . . . . ***H. carcharhini***
— Eggs thin-walled, thickness of wall being 0.003 mm; polar plugs low (0.004 to —0.006 mm); eggs localized in muscles of tonguefishes (*Cynoglossus*) . . . . . ***H. banningi***

3 Eggs small and relatively broad, their length being 0.054—0.063 mm, width 0.030—0.039 mm; superficial transparent envelope spinose; eggs localized in swimbladder of freshwater fishes of fam. Centrarchidae (*Lepomis, Ambloplites, Micropterus*) . . . . . ***H. huffmani***
— Eggs longer and narrower, their length being 0.069—0.075 mm, width 0.027 to 0.030 mm; superficial transparent envelope aspinose; eggs localized in abdominal cavity and some inner organs (intestinal surface, liver) of marine fishes (flying fishes of fam. Exocoetidae — *Hirundichthys, Cypselurus* . . . . . ***H. schouteni*** sp. n.)

DISCUSSION

The general morphology of *H. schouteni* eggs (presence of markedly thick, dark-brown to black shells, eggs including polar plugs embedded in thin transparent envelope) indicates that this species belongs to the genus *Huffmanela* Moravec, 1987, as it has recently been redefined by Huffman and Moravec (1988).

The genus *Huffmanela* was erected by Moravec (1987) to accommodate some histozoic trichuroids known at that time by their eggs only; the genus was based on the specific structure of eggs and peculiarities in the biology of these species. Moravec (1987) assigned provisionally this genus to the Capillariinae (some species were originally described within the genus *Capillaria* s.l.), but he has remarked that these forms may be close to the family Trichosomoididae.

Later Huffman and Moravec (1988) described for the first time the morphology of adults of a *Huffmanela* species, *H. huffmani*, which showed that this genus could be placed in the family Trichosomoididae rather than in the Capillariidae.

Until now, the genus *Huffmanela* has been represented by the following three species, two of them being known by their eggs only: *H. carcharhini* (MacCallum, 1925) (syn.: *Capillaria spinosa* MacCallum, 1926) (type species) described from the eggs located in the skin and the mucosa covering connective tissue of gill archs of requiem sharks from the Atlantic Ocean off the coast of the southern USA (MacCallum 1925, 1926, Moravec 1987), *H. banningi* Moravec, 1987 known by eggs from the body musculature of the pleuronectiform fish *Cynoglossus browni* from the Atlantic Ocean off the coast of northern Africa (Senegal) (Banning 1980, Moravec 1987), and *H. huffmani* Moravec, 1987 the eggs and adult nematodes of which occur in the tissue of the swimbladder of freshwater centrarchids in the southern USA (Underwood and Dronen 1984, Moravec 1987, Huffman and Moravec 1988). All these species can be easily distinguished from *A. schouteni* sp. n. on the basis of their egg morphology, site of localization of the eggs in the host's body,

and by the host types (see key to species on p. 30). In contrast to previously described species, the transparent envelope enclosing the egg proper in *H. schouteni* is without spines on its surface.

Thus, at present the genus *Huffmanela* comprises altogether four valid species. It is probable that the trichuroid eggs found by Grabda and Slósarczyk (1981) in the musculature of an unidentified marine fish (probably *Genypterus blacodes*) in New Zealand waters and reported as *Capillaria* sp. also belonged to this genus, probably to another new species; unfortunately the eggs were only illustrated but not described and the materials are no longer available (personal communication of Prof. Grabda).

From the theoretical point of view, all *Huffmanela* species are very interesting, especially as to their biology; in our opinion further studies on these peculiar parasites may contribute considerably in understanding of the inter-relationships among trichuroid nematodes.

Acknowledgements. The authors' thanks are due to Dr. H. Schouten of the St. Elizabeth Hospital, Curaçao, for his kindness in providing the eggs of *H. schouteni* and some necessary literature.

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Received 5 March 1990

Accepted 4 April 1990

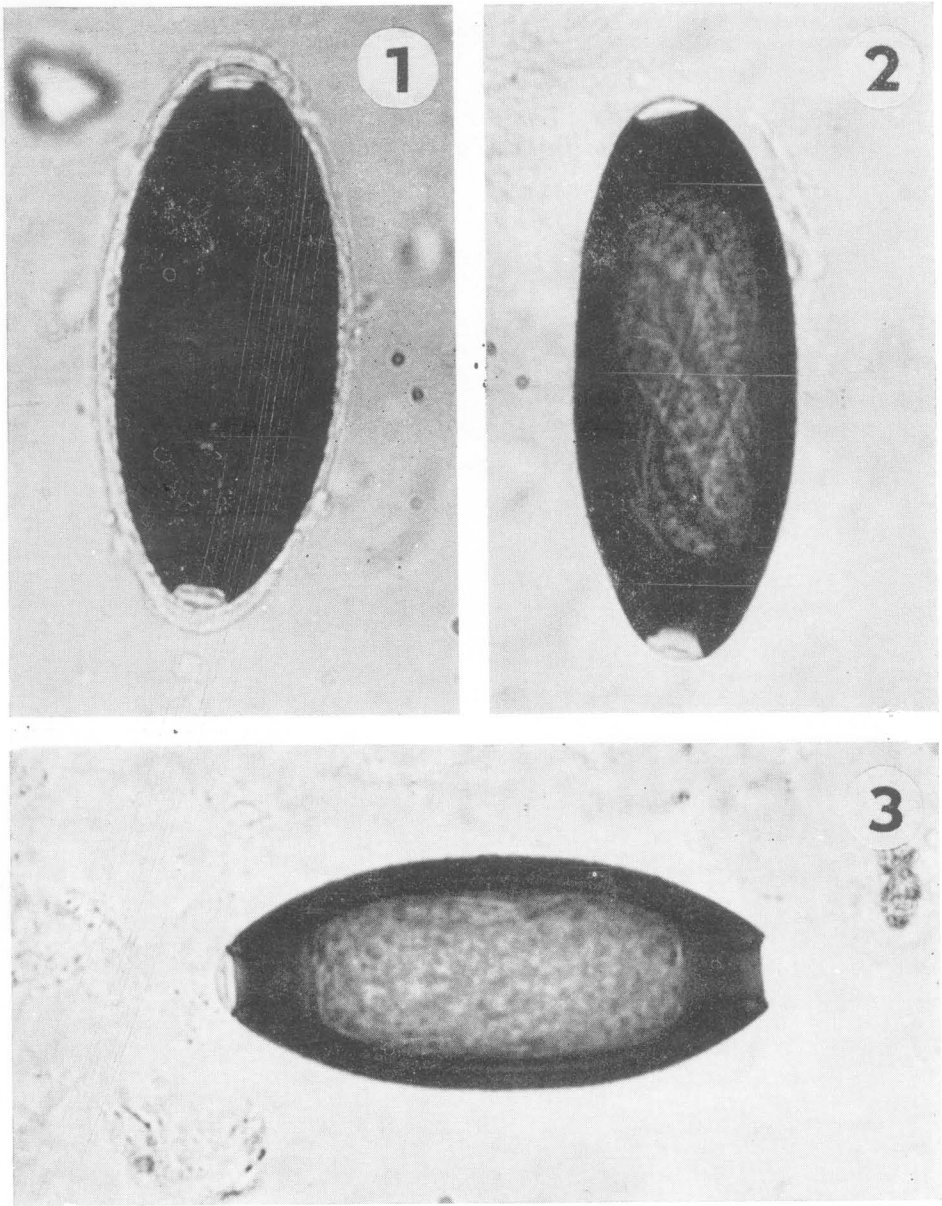

Fig. 1—3. *Huffmanela schouteni* eggs from intestinal serosa of flying fish, *Hirundichthys affinis*. **Fig. 1.** Fully developed, larvated egg embedded in transparent envelope (× 1000). **Fig. 2.** Fully developed egg without transparent envelope (× 1000). **Fig. 3.** Advanced, still unembryonated egg without transparent envelope (× 1000).

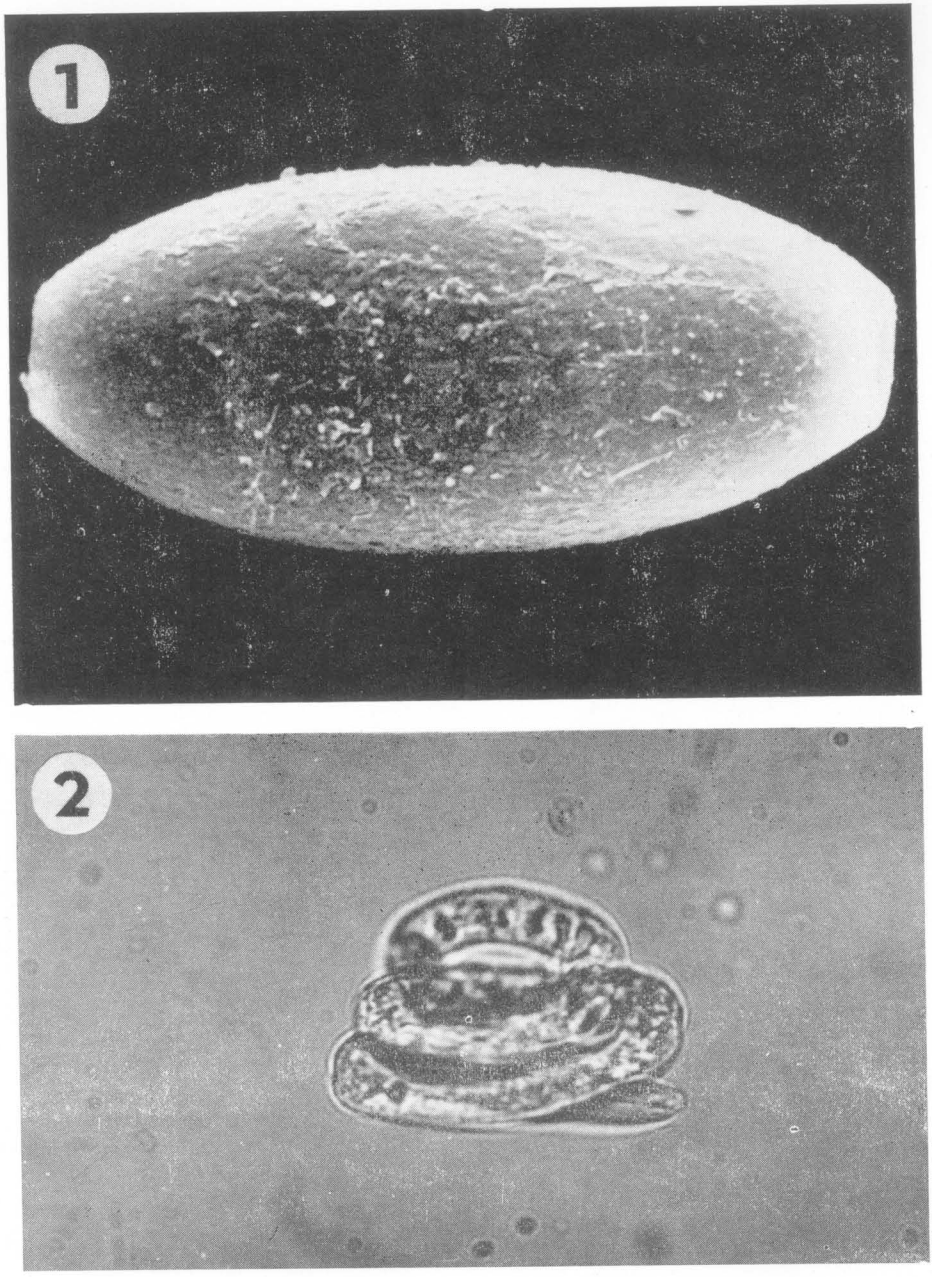

Fig. 1—2. *Huffmanela schouteni*. **Fig. 1.** Egg in SEM (× 1,700). **Fig. 2.** Larva expressed from egg shell (× 1,300).

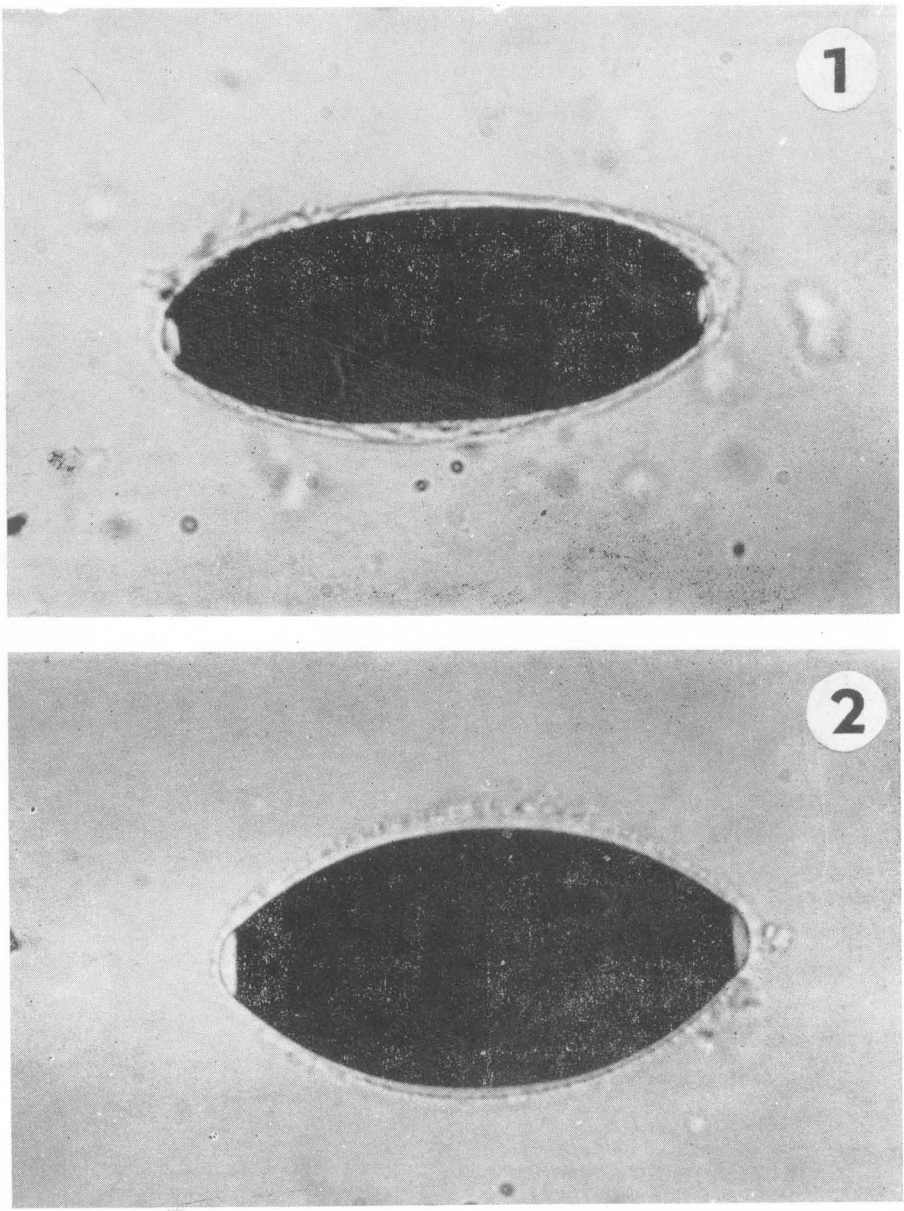

Fig. 1—2. Comparison of shapes of fully developed *Huffmanela schouteni* and *Huffmanela huffmani* eggs. **Fig. 1.** *H. schouteni* egg from intestinal serosa of flying fish, *Hirundichthys affinis* (× 1,000) **Fig. 2.** *H. huffmani* egg from swimbladder of spotted sunfish, *Lepomis punctatus* (× 1,000).

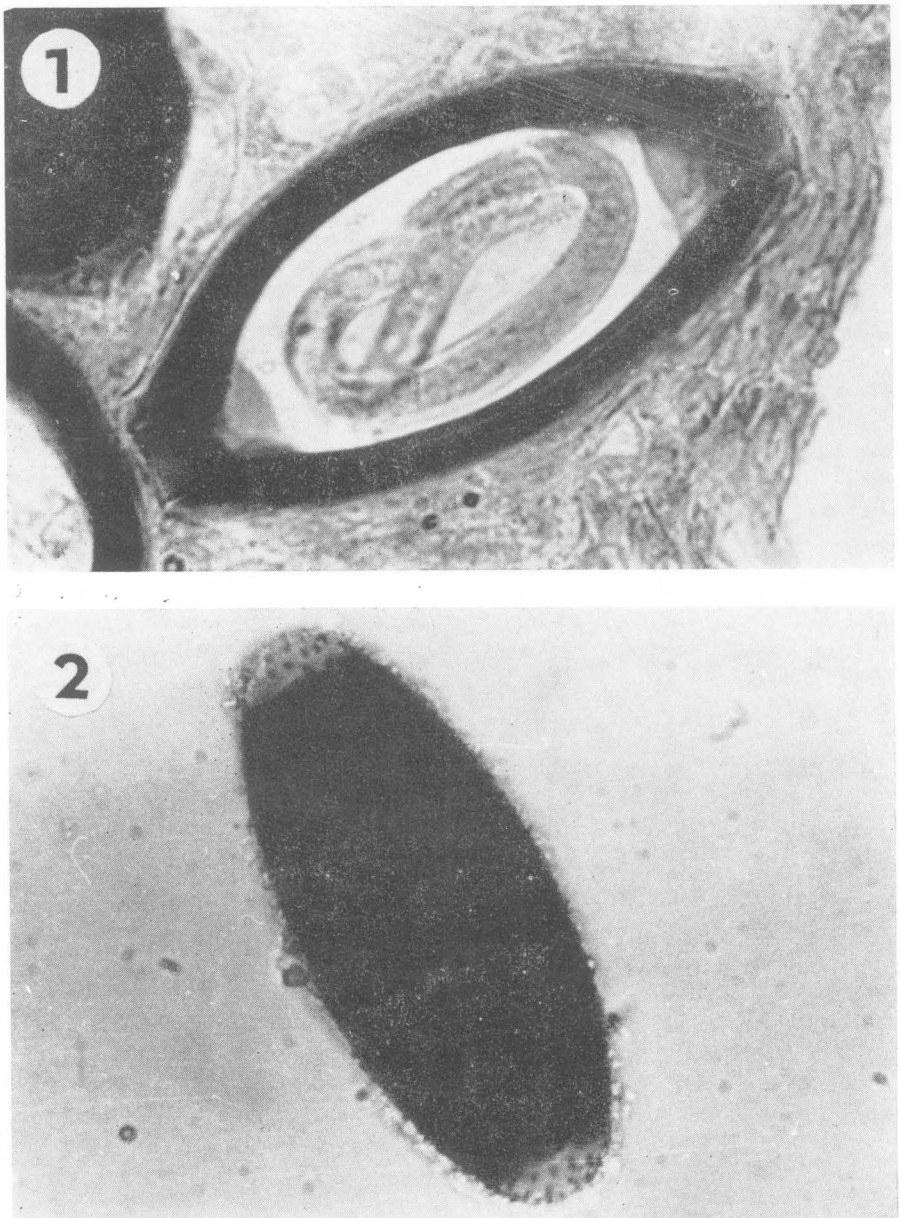

Fig. 1—2. Mature eggs of *Huffmanela carcharhini* and *Huffmanela banningi*. **Fig. 1.** Stained longitudinal section of *H. carcharhini* egg (syntype) in skin of requiem shark, *Carcharhinus commersoni* (× 1,000). **Fig. 2.** Mature egg of *H. banningi* from musculature of tongue sole, *Cynoglossus browni* (syntype) (× 800).