

## THE FINDING OF NEMATODES AND ACANTHOCEPHALANS IN EGYPTIAN BATS

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**Abstract.** A description is given of four nematode species recovered from Egyptian bats, i.e., *Spinostromylus spinosus*, *Rictularia macdonaldi*, *Physaloptera* sp. (larvae), *Cyrnea* sp. (larvae), and of two acanthocephalans — *Pachisentis* sp. and *Moniliformis* sp. (both acanthellae). Characteristics of the morphology and measurements are given for *S. spinosus* and *R. macdonaldi*, with an evaluation of their range of hosts and their geographical distribution (including a list of genera and species of the subfamily Spinostromylinae). In addition, an evaluation is given of the phenomenon of reservoir parasitism of larval nematodes and acanthellae in the bat.

The first data on the fauna of parasitic nematodes of Chiroptera from Egypt were published by Jägerskiöld (1909) and Boulenger (1926). Of the numerous reports on bat parasitism in Egypt, the admirable key catalogue prepared by Stiles and Nolan (1931) constitutes the most detailed account noted in the literature. Extensive information on helminths of bats from Egypt with an illustrated key to the common fluke has been presented by Heyneman and Macy (1962); Myers, Kuntz and Wells (1962) published a check list of nematodes from reptiles, birds and mammals in Egypt. According to the literature a total of 8 nematode species (3 of these at the larval stage) were recovered from bats in Egypt and the Sudan.

### MATERIAL

Nematodes and acanthocephalans were obtained from a total of 102 bats inspected in post-mortem; these belonged to 6 species, i.e., *Rousettus aegyptiacus* (18—none was infected with either nematodes or acanthocephalans); *Rhinopoma hardwickei cystops* (23/3/0); *Nycteris thebaica* (15/0/0); *Rhinolophus clivosus* (3/1/0); *Otonycteris hemprichi* (16/4/1); *Taphozous nudiventris* (26/13/1). The material was obtained by courtesy of Professor B. Ryšavý, D.Sc., and Dr. J. Groschaft, C.Sc. We identified a total of 6 helminth species (of these 4 at the larval stage), i.e., 4 nematode species and 2 acanthocephalan species. On the basis of the results obtained we were able to add important complementary information on the morphology of two nematode species (*S. spinosus* and *R. macdonaldi*) and evaluate zoogeographical distribution of the complete subfamily Spinostromylinae. In addition, a provisional evaluation was made of the phenomenon of reservoir parasitism of larval nematodes and acanthocephalans in this group of hosts.

### SYSTEMATIC SURVEY

#### Nematoda

#### Fam. Rictulariidae Railliet, 1916

#### *Rictularia macdonaldi* (Dobson, 1880)

Host: *Otonycteris hemprichi* Peters, 1859. Location: small intestine. Localities: El Fayoum (Fayoum Province); Abu Rawash (Giza Province).

Of the 16 bats examined, nematodes of this species were found in 3 hosts (one male, 2 females — one of them juvenile).

The original description of this species was given by Dobson (1880) from the host *Lavia frons* (Megadermatidae) from Ghana. Jägerskiöld (1909) recovered it from the typical host in the Sudan, Stiles and Nolan (1931), Heyneman and Macy (1962) from Algiers and Egypt. Myers et al. (1962) reported findings of this species from *Plecotus auritus* and *Otonycteris hemprichi*. These data indicate that *R. macdonaldi* is a typical member of the fauna of the Ethiopian region. Tiner's (1948) finding of this species in bats from the nearctic region evoked certain doubts. The reports by Caballero (1943), Douvres (1956) and Quentin (1969) support my opinion and Tiner must evidently have made a mistake in the determination of this nematode.

Data are added on the morphological signs and measurement of two adults from our material (Fig. 1). (Measurements in mm.)

**Male:** Overall length 2.48, maximum width 0.22. Cuticle with distinct transverse striation. Mouth subterminal (dorsal) armed with small teeth. Wall of buccal capsule highly sclerotized. Buccal capsule 0.058 deep. Muscular oesophagus 0.23 long, glandular oesophagus 0.88. Nerve ring at 0.11 from anterior end. Cuticular combs (43 pairs) arranged in two longitudinal subventral rows. Posterior end of body rounded. Two spicules of unequal length, longer spicule (0.138) with a sharply pointed distal end, shorter spicule (0.068) with a rounded distal end. Gubernaculum 0.020 long. Cloaca at 0.073 from end of tail. Caudal alae indistinct. Praecloacal cuticular comb formed by four rounded processes. A total of 8 pairs of caudal papillae—2 pairs praecloacal, one pair paraclacal, 5 pairs postcloacal. First two postcloacal pairs close to cloaca, 2 pairs in the middle third of tail, last pair near tip of tail.

**Female:** Overall length 14.50, maximum width 0.44. Muscular oesophagus 0.48 long, glandular 3.65. Nerve ring at 0.25 from anterior end, vulva at 2.33. Cuticular combs (74 pairs) arranged in two longitudinal rows; of these 34 praevulval, one pair at vulva level, 39 postvulval. Body terminating in a conical tail. Anus at 0.13 from tail end. Eggs  $0.036 \times 0.018$ .

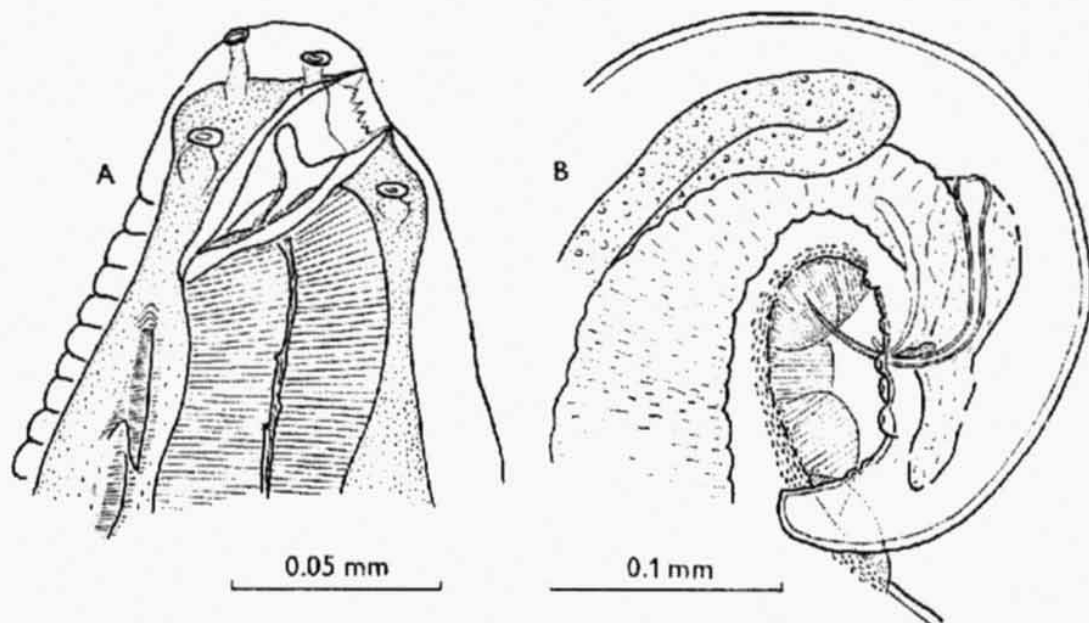


Fig. 1. *Rictularia macdonaldi* (Dobson, 1880) from the host *Otonycteris hemprichi*. A — anterior body end of the male (lateral view); B — posterior body end of the male (lateral view). Orig.

## Family Trichostrongylidae Leiper, 1912

### 2. *Spinostromylus spinosus* (Boulenger, 1926)

Host: *Taphozous nudiventris* Cretzschmar, 1831. Location: intestine. Localities: Abu Rawash, Sakkara, Giza (Giza Province).

Recovered from 12 of the 26 hosts examined (from 1—11 nematodes per host).

The species was described first by Boulenger (1926) from the host *Taphozous perforatus* (fam. Emballonuridae) from Egypt and arranged to the genus *Histiostrongylus* Molin, 1861. Travassos (1935) rearranged it to the new genus *Spinostromylus* (*S. spinosus*) as the *typus generis*. Heyneman and Macy (1962), and Myers et al. (1962) recorded findings from the same host and territory, but found it also in *Taphozous nudiventris* without giving details of its morphological characteristics in the latter host.

In the material from *T. nudiventris*, our observations do not agree fully with the original description by Boulenger (1926). Differences of morphological character were found in the shape of the dorsal rib (Boulenger did not mention the presence of a median extension) and in the shape of the distal spicule end (Fig. 2). In view of the fact that the morphology of this species is known only from the original description by Boulenger (1926) from the typical host, we are adding a redescription on the basis of our material from the host *T. nudiventris*.

**Description:** Reddish nematodes, cuticle with fine striation. Cephalic end encircled by a small vesicle bearing 16 sclerotized spines, 4 of these ending in one peak, 12 in a branched peak (a shorter and a longer branch). Mouth small, funnel-shaped, with one dorsal tooth. Cervical body portion with 22-24 longitudinal rows of small spines.

**Male:** Overall length 6.34—7.02, maximum width 0.21—0.27. Cephalic spines 0.087—0.10 long, cervical spines 0.007-0.010, the latter extending to a distance of 0.61-0.87. Dorsal tooth 0.007-0.010 high. Oesophagus 0.44—0.50 long, maximum width 0.12-0.17. Nerve ring at 0.19-0.21 from anterior body end, excretory pore at 0.28-0.33. Copulatory burse with small dorsal lobe and wide lateral lobes. Distal portion of mediadorsal rib divided into 5 extensions, which do not overlap the margin of the copulatory burse. Three groups of lateral ribs present; the postero- and mediolateral ribs divert from their common course at the peaks; the antero-lateral rib is massive, its course is independent of that of the foregoing ribs. Ventral ribs massive, analogous in size, diverting from their common course from about half their length onwards. Genital cone distinctly developed. Gubernaculum 0.16-0.17 long. Two spicules of equal length 0.31-0.38; their distal end divided into two branches (dorsal branch short, terminating in a point, ventral branch thick, indistinctly divided into two parts).

**Female:** Overall length 8.35—9.98, maximum width 0.36—0.39. Dorsal tooth 0.008 to 0.010 high. Length of cephalic spines 0.12-0.15, of cervical spines 0.009-0.021. Cervical spines at 0.87-1.02 from anterior end of body. Oesophagus 0.48-0.55 long, maximum width 0.15-0.17. Nerve ring at 0.17-0.25 from anterior end of body, excretory pore at 0.21-0.37. Vulva, a transverse slit with rounded margins, at 2.96 to 3.27 from posterior body end. Eggs 0.131-0.153 × 0.087-0.102, inside a coiled larva. Posterior end of body conical. One pair of caudal papillae at 0.029—0.036 from tip of tail.

Baruš and Ryšavý (1971) placed a total of 4 genera of nematodes parasitizing bats from mainly tropical and subtropical regions of the Old and New World to the subfamily Spinostromylinae Travassos, 1935: The genera *Spinostromylus*, *Histiostrongylus* (syn. *Parahistiostrongylus*) and *Neohistiostrongylus* have one diagnostic sign in common, i.e., the presence of sclerotized spines on the cephalic end arranged

in a circle. In members of the genus *Cheiropteronema*, arranged provisionally to this group, this sign is missing and their relationship with the remaining genera is indicated by the shape of the dorsal rib (the presence of a medial process). We observed this medial process of the dorsal rib also in the typus generis of the genus

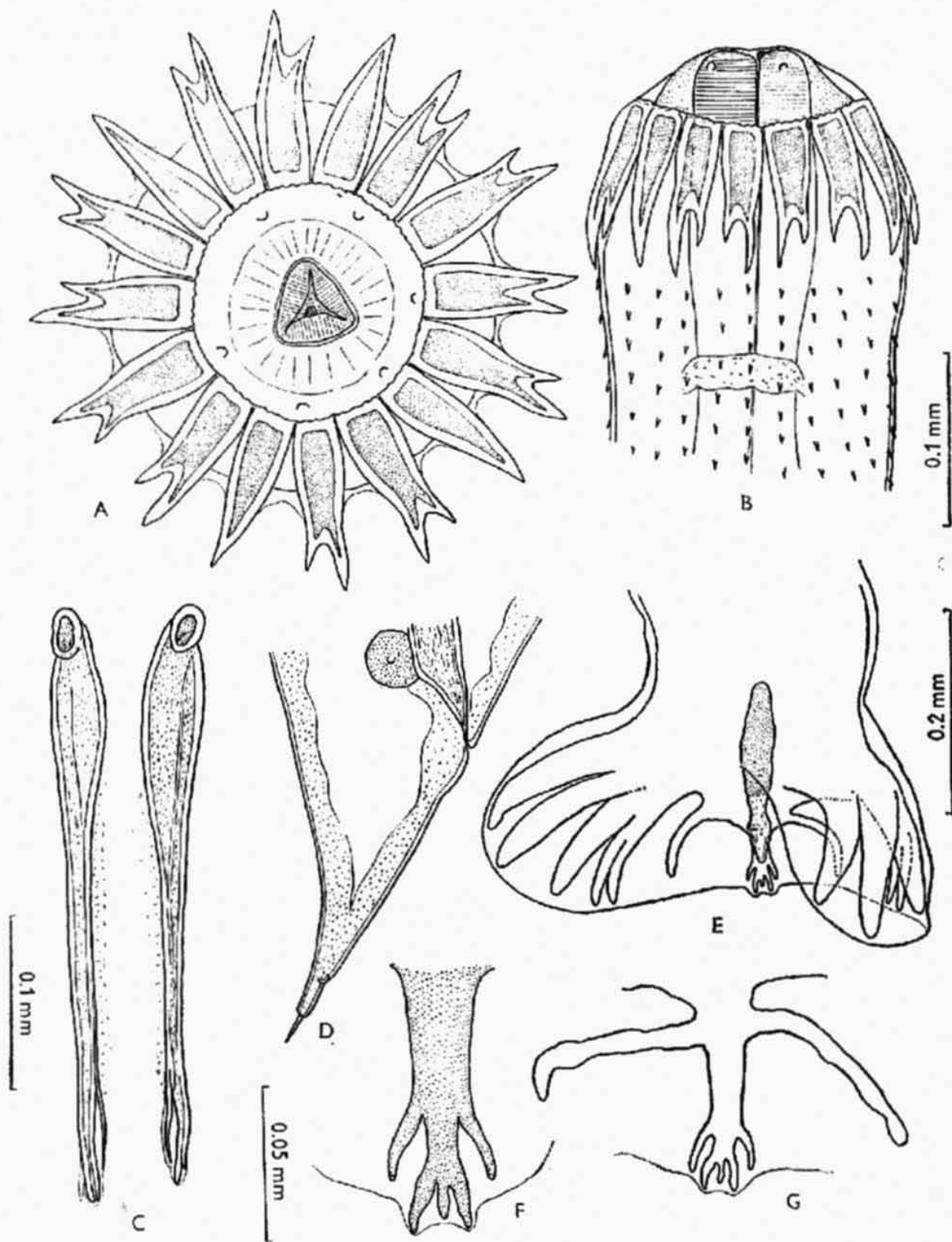


Fig. 2. *Spinostrongylus spinosus* (Boulenger, 1926) from the host *Taphozous nudiventris*. A — anterior portion of the female (apical view); B — anterior portion of the female (lateral view); C — spicules; D — posterior portion of the female (lateral view); E — bursa copulatrix (ventral view); F, G — dorsal rib. Orig.

*Spinostrongylus* (*S. spinosus*) from our material (this sign has not been mentioned in the original description). This shows that this sign is present in all species listed to the four genera (see foregoing text) except the species *S. sinensis*.

Species of the genus *Spinostrongylus* (number of cephalic spines 14-16; two small cuticular spines in the cervical part of the body) are, according to the literature, distributed in Egypt (*S. spinosus*—specific of definitive hosts of the genus *Taphozous*), and China (*S. sinensis* Wu et Liu, 1940—no exact identification of the pertinent host species available).

The genus *Neohistiostrongylus* (number of cephalic spines 8, no spines on cervical part of body) is typical of the family Vespertilionidae from the Old World. The only species received in this genus—*N. viguerasi* (López Neyra, 1946)—was recorded from *Myotis myotis* in Spain.

The remaining two genera are known from bats of the New World only. The genus *Histiostrongylus* (number of cephalic spines 8, cervical body portion without spines) received two species—*H. coronatus* and *H. octacantha*. The first (*H. coronatus*) was found in Brazil (see Molin 1861) and Cuba (see Pérez Vigueras 1941; Baruš and del Valle 1967) in bats from the genera *Phyllostomus*, *Phyllonycteris* and *Chilonycteris*. An exceptional finding is that by Díaz-Ungria (1965-1966) of this parasite in the host *Myotis* sp. (fam. Vespertilionidae) from Venezuela. *H. octacantha* has been reported only from hosts of the genus *Phyllostomus* in Brazil (Lent and Freitas 1940).

It is of interest that Webster (1971) described a new species—*Histiostrongylus parnelli*—from the host *Chilonycteris parnelli* from Jamaica. The characteristic sign of this species is the presence of two spine-like elements on the cephalic vesicle only. This sign prevents the arrangement of this species to the genus *Histiostrongylus* (8 spines in a ring). The number of spines and the shape of the cephalic processes, the shape of the vesicle and spicules (see Webster's description 1971) indicate that *H. parnelli* is a member of the genus *Tricholeiperia* Travassos.

The genus *Cheiropterionema* is monotypical with the species *Ch. globocephala* Sandground, 1929. It has been found only in Yucatan in the host *Artibeus jamaicensis* (fam. Phyllostomatidae). This infers that members of the subfamily Spinostrongylinae and its genera are well-characterized not only by morphological signs, but also by their zoogeographical distribution and specificity to hosts of the family Emballonuridae (genus *Spinostrongylus*), Vespertilionidae (*Neohistiostrongylus*) and Phyllostomatidae (the genera *Histiostrongylus* and *Cheiropterionema*).

## Fam. Physalopteridae Leiper, 1908

### 3. *Physaloptera* sp. — larvae

Hosts: *Rhinopoma hardwickei cystops* Thomas, 1903; *Otonycteris hemprichi* Peters, 1859.  
Location: in cysts on the wall of the stomach and gut. Localities: Giza and Abu Rawash (Giza Province).

Of the 24 *R. hardwickei cystops* examined, one host harboured a larva of the genus *Physaloptera* Rudolphi, 1819; of the 16 *O. hemprichi* examined, one was positive (8 larvae).

The arrangement of the third-stage larvae to the genus *Physaloptera* was made on the basis of the characteristic dentation and the morphology of the anterior body end. The two bat species are utilized as reservoir hosts of these larvae. Morphological (Fig. 3A, B) and metrical characteristics are added.

**Description:** Larval body reddish, cuticle with distinct transverse striation. Mouth armed with two lips with a unipeaked tooth on each lip and one triple tooth inside. Height of terminal tooth 0.008, of triple tooth 0.003. Overall length of body

2.49-3.12, maximum width 0.31-0.37. Length of muscular oesophagus 0.13-0.22, of its glandular portion 0.55-1.16. Nerve ring at 0.10-0.20 from anterior body end, excretory pore at 0.25-0.47. Cervical papillae not observed. Posterior termination of body, a conical tail with a rounded peak. Intestine straight, direct. A group of rectal cells present. Anus at 0.14-0.16 from tip of tail.

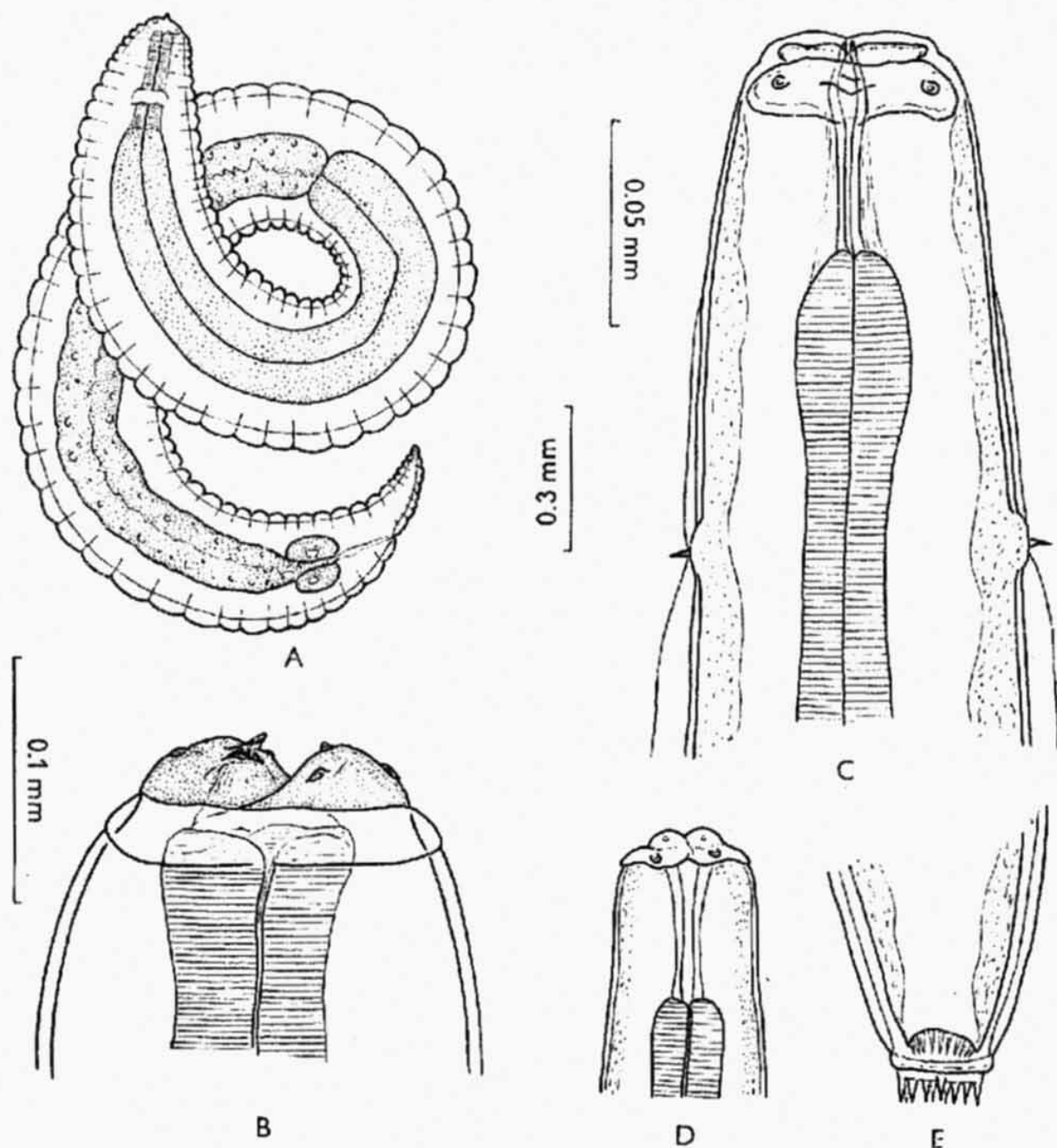


Fig. 3. *Physaloptera* sp. larvao (A, B); *Cyrnea* sp. larvae (C, D, E). A — larva (general view); B — anterior end of body (lateral view); C, D — anterior end of body (dorsal and lateral view); E — posterior portion of body (detail). Orig.

## Fam. Spiruridae

### 4. *Cyrnea* sp. — larvae

Host: *Rhinolophus clivosus* Cretzschmer, 1828. Location: free in the intestine. Locality: Giza (Giza Province).

Of the 3 hosts examined, this type of larva was present in one host (33 larvae).

The provisional arrangement of the third-stage larvae from the host *R. clivosus* to the genus *Cyrnea* Seurat, 1914 was made on the basis of the morphology of the anterior body end, and particularly that of the lips. The bat is utilized as a reservoir host by these larvae. A description of the larvae is added (Fig. 3C, D, E).

**Description:** Larval body of yellowish colour, cuticle with transverse ridges. Overall length 2.62-4.99, maximum width 0.065-0.12. Vestibule length 0.030-0.043. Length of muscular oesophagus 0.15-0.18, of glandular oesophagus 1.02-2.19. Nerve ring at 0.16-0.18 from anterior body end, excretory pore at 0.17-0.22, cervical papillae distinct, 0.080-0.10. Lateral alae extending from the level of the anterior portion of the oesophagus down to the body end. Width of lateral alae 0.010. Posterior part of body attenuating; it terminates in a crown consisting of 9-10 spinelike processes. Length of processes 0.008. Anus at 0.080-0.12 from tip of tail. Group of rectal cells present.

## Acanthocephala

### Fam. Pachisentidae Meyer, 1931

#### 5. *Pachisentis* sp. — acanthella

**Host:** *Taphozous nudiventris* Crotzschmer, 1831. **Location:** in cysts in the body cavity.

**Locality:** Abu Rawash (Giza Province).

Of the 26 hosts examined, one acanthella was found in one of the hosts. The bat is the reservoir host of acanthellae of the genus *Pachisentis* Meyer, 1931.

**Description:** Length of proboscis 0.58, width 0.65. Armature of proboscis: 12 spiral rows of hooks, 6-8 hooks per row. Lemnisci long, 5.15, with 8 nuclei each.

Two species of the genus *Pachisentis* have been recorded from Egypt, i.e., *P. ehrenbergi* Meyer, 1931 and *P. procumbens* Meyer, 1931. The acanthella from our material is similar in its morphology and measurements to *P. procumbens* described from carnivores of the family Canidae.

### Fam. Moniliformidae van Cleave, 1924

#### 6. *Moniliformis* sp. — acanthella

**Host:** *Otonycteris hemprichi* Peters, 1859. **Location:** in cysts in the body cavity. **Locality:** El Fayoum (Fayoum Province).

Of the 16 hosts examined, an acanthella of the genus *Moniliformis* Travassos, 1915 was found in one of them. Although an exact identification was impossible at this stage of development, this form appears to be close to *M. dubius* Meyer, 1933.

**Description:** Overall length 2.77, width 0.45. Proboscis 0.40 long, 0.18 wide. Proboscis sheath 0.33 long. Lemnisci 0.73-0.89 long. Armature of proboscis: 12 longitudinal rows of hooks, from 10-12 hooks per row.

## DISCUSSION

The phenomenon of reservoir parasitism in hosts of the suborder Microchiroptera has been observed with considerable frequency. Often, bats are utilized as reservoir hosts by infective nematode larvae, mainly of the suborder Spirurata, less frequently as reservoirs of larval acanthocephalans (acanthellae). Infective larvae of *Spirocerca lupi* (Rudolphi, 1809) syn. *Spirocerca sanguinolenta* (Rudolphi, 1819) in *Pipistrellus*

*kuhli* and other not specifically identified hosts were recorded many years ago by Stiles and Nolan (1931). Heyneman and Macy (1962) added to their findings of *Spirocerca listowi* from *Tadarida aegyptiaca*, and *Spirocerca* sp. from different host species from Egypt the findings by Sonsino (1895) and Looss (1901) from the same territory.

Spirurata larvae were found also by Myers et al. (1962) in the hosts *Rhinopoma hardwickei*, *Taphozous perforatus*, *Nycteris thebaica*, *Rhinolophus acrotis*, *Plecotus auritus*, *Tadarida teniotis* and *Pipistrellus kuhli*. Our finding of acanthellae in bats is the first record for Egypt. The composition of the food in connection with the season and site of collection is one of the factors determining the occurrence of reservoir parasitism in bats. Insectivorous bat species are, therefore, the most frequent reservoir hosts of infective nematode larvae of the suborder Spirurata, because the life cycle of nematodes of this suborder involves an intermediate host—mainly of the class Insecta. Infective larvae recovered from bats belonged to the genera *Physocephalus* (*P. sexalatus*); *Ascarops* (*A. strongylina*); *Spirocerca* (*S. lupi*); *Physaloptera* and *Rhabdochona* (Ryzhikov and Nazarova 1959; Myers et al. 1962; Skvortsov 1966; Andreyko and Skvortsov 1967; Baruš and del Valle 1967; Baruš and Tenora 1970; etc.). This factor is of similar importance for the occurrence of reservoir parasitism in acanthocephalans, although acanthellae are less frequently found in bats than are nematode larvae.

Reservoir parasitism in bats appears to be mainly of the active, accumulating, type (Ryšavý and Baruš 1965). This is consistent with Chabaud's (1971) conclusion on the high specificity of nematodes of the suborder Spirurata to parasitism (the same applies also to the acanthocephalans). According to the classification suggested by Odening (1968) bats are eureservoir, stationary hosts and, as regards the mode of infection, bioreceptory hosts, because they substitute the external environment of the infective larva in the organism of its intermediate host. The finding of unencysted larvae of the genus *Cyrnea* and of the genus *Rhabdochona* in the gut (Baruš and Tenora 1970) inferred that also Microchiroptera may serve as eureservoir, transitory, bioreceptor hosts (Odening 1968). An evaluation of the importance of bats in the biological cycle of several nematode species made from the epizootological point of view indicates that reservoir hosts are "fictitious" hosts as suggested by Shults and Davtyan (1955). This group of reservoir hosts represents for the infective stages of the afore mentioned helminths a blind alley in the process of circulation.

## НАХОДКА КРУГЛЫХ ЧЕРВЕЙ И СКРЕБНЕЙ У ЕГИПТСКИХ РУКОКРЫЛЫХ

В. Баруш

**Резюме.** Дано описание 4 видов нематод, обнаруженных у египетских рукокрылых, а именно *Spinostongylus spinosus*, *Rictularia macdonaldi*, *Physaloptera* sp. (личинки), *Cyrnea* sp. (личинки) и 2 вида скребней — *Pachisentis* sp. и *Moniliformis* sp. (личинки). Дана морфология и размеры вида *S. spinosus* и *R. macdonaldi*, вместе с оценкой и набором хозяев и их географическим распространением (включая список родов и видов подсемейства *Spinostongylinae*). Кроме того, дана оценка явления резервуарного паразитизма личинок нематод и скребней у рукокрылых.

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