SOME PARASITIC NEMATODES, EXCLUDING HETERAKIDAE AND PHARYNGODONIDAE, FROM AMPHIBIANS AND REPTILES IN EGYPT

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Abstract. The present paper comprises a systematic survey of the nematodes (except for those belonging to the Heterakidae and Pharyngodonidae) collected from 137 specimens of amphibians and reptiles in Egypt. In addition to 6 species of adult nematodes (Rhobelia bufinis, Strongyloides prokopici sp. n., Cosynoceara ornata, Adiactes macintoshi, and Thabasaenius jucundus) this material included also 6 species of larval forms (Spicercida bufi, Agamospirura sp. 1, Agamospirura sp. 2, Apameospirura sp. 3, Acuarainae gen. sp. larv., and Nematoda gen. sp. larv.) the adults of which being apparently the parasites of birds and mammals. Strongyloides prokopici sp. n. from Bufo regulorius is the first representative of the genus in amphibians in Africa; it is characterized mainly by the structure of its mouth, spiral ovaries, the shape of the tail and the size of eggs (0.060—0.069 × 0.033 to 0.038 mm). Rhobelia bufinis is reported for the first time from Africa. B. bufinis in Bufo regulorius and C. ornata in B. regulorius and Boes megarhinos is a new host record. All the nematodes found are briefly described and illustrated and some problems concerning their taxonomy and geographical distribution are discussed.

Despite the fact that some data concerning the nematodes parasitizing amphibians and reptiles in Egypt date back to the end of the last century, there is as yet little knowledge available on the nematode fauna of these cold-blooded animals in Egypt. This ecological group of parasitic nematodes was studied in Egypt mainly by Linstow (1899), Baylis (1923), Balke (1957) and Myers et al. (1962) and some important data in this respect can be found also from the near-by African countries (e.g. Seurat 1914, 1917, Baylis 1930, Chabaud and Goyan 1957, Pike 1979, Baker 1980). From September 1971 until March 1972, during his stay in Egypt, the first author had an opportunity to examine helminthologically a certain number of amphibians and reptiles from Cairo and its vicinity. The trematodes and cestodes of this material have already been dealt with in the paper by Groschaft and Moravec (1983); the systematic evaluation of nematodes of this fundamental material, as also of those collected from several additional host specimens by the two co-authors (V. B. and B. R.), is presented in this study. The nematodes of the families Heterakidae and Pharyngodonidae have not been included and they will be treated in a separate paper.

MATERIALS AND METHODS

From Cairo and its vicinity, a total of 137 amphibians and reptiles were examined, belonging to several species of the families Ranidae (31 specimens), Bufonidae (24), Lacertidae (3), Scincidae (52), Chamaeleontidae (5), Geckonidae (16), and Colubridae (6); of those, only the following species were found to harbour parasitic nematodes: Amphibia: Bufo regulorius Regen.*, B. viridis Laur.,

* For species identification of the majority of host amphibians and reptiles our thanks are due to Dr. J. Chal of the National Museum in Prague.
RESULTS AND DISCUSSION

Review of species

A. Adults:

Fam. Rhabdiasidae Railliet, 1915

1. *Rhabdias bufonis* (Schrank, 1788)  

*Syn.: Frosoria nigrovenosa Zeder, 1800; Rhabdias microceris Semenov, 1929.*

*Host:* Bufo regularis Reuss.

*Localization:* lungs.


*Prevalence:* in 7 out of 12 toads examined (intensity of infection 1—16 specimens).

*Description of parasitic female* (10 specimens): Medium sized nematodes. Body covered by outside strongly folded on its surface. Length of body of gravid females 2.96—13.02 mm. Mouth provided with six small mouth papillae. Small buccal capsule present, measuring 0.015 in length and 0.021 in width. Oesophagus throughout muscular, being somewhat expanded at its posterior end; length of oesophagus 0.288—0.510, its maximum width 0.057—0.072. Nerve ring 0.168—0.240 from anterior extremity. Vulva situated near mid-body or slightly in front of mid-body, i.e. 1.47—1.99 from anterior end. Vagina containing large number of larvated eggs 0.117 to 0.144 x 0.051—0.072 in size; uterus of smallest specimen containing only one egg. Tail conical, 0.144—0.420 long, ending in sharp point.

*Comments:* The morphology of the specimens found correspond, on the whole, to the descriptions of *R. bufonis* given e.g. by Travassos (1930) and Hartwich (1972, 1975); some small differences (slightly greater measurements of the buccal capsule and eggs, the preopercular position of the vulva in some females) that were found in Egyptian specimens can be taken for intraspecific variability. The present material included variously developed specimens, the smallest of them containing only 1—2 unlarvated eggs in their uterus. It is remarkable that although gravid females may increase their body length more than four times, the measurements of their buccal capsule remain unchanged.

*Rhabdias bufonis* is a widespread parasite of the various species of frogs and toads in Europe and Central Asia (e.g. Hartwich 1973, Vojtková 1976, Ryzhikov et al. 1980); its finding in Egyptian toads represents the first record of this parasite in Africa. *B. regularis* is a new host record.

*Fig. 1. A—B—* Rhabdias bufonis (Schrank, 1788) (A — anterior end, B — posterior end); C—E—Strongyloides prokopsii sp. n. from Bufo regularis (C — general view, D — anterior end, E — posterior end).
Description of parasitic female (10 specimens) (measurements of holotype in brackets): Body slender, elongate, length 1.95—2.27 (2.09), maximum width 0.041—0.045 (0.045). Stoma simple, elongate, surrounded by six small lobes, each of them bearing one inconspicuous papilla. Oesophagus filiform, 0.585—0.680 (0.625) long, opening into intestine through well developed valves. Nerve ring 0.120—0.150 (0.135) from anterior end of body, excretory pore at 0.177—0.183 (0.177). Vulva provided with well developed vulvar lips situated approximately at border of second and third thirds of body length, 0.695—0.721 (0.721) from posterior extremity. Uterus opposed, containing 1—4 eggs; eggs oval, thin-walled, their content being at early stage of cleavage; length of eggs 0.060—0.069 (0.060—0.066), their width 0.033—0.039 (0.033—0.036). Ovaries elongate, with reflexed coils; anterior ovary reaching almost to junction of oesophagus and intestine, its reflexed part spirally encircling intestine, forming usually three coils around it. Posterior ovary reaching almost to level of anal opening, its reflexed part not spirally encircling intestine. Tail conical, 0.078—0.084 (0.061) long, with obtuse conical tip.

Comments: — Until now, altogether six species of the genus Strongyloides have been described from amphibians: S. perreirai Travassos, 1932 from Elosia rustica in South America, S. carinii Pereira, 1935 from Leptodactylus gracilis in South America, S. amphibiophillus Pérez Vigueras, 1942 from Bufo pellecapheus in Cuba, S. phylisci Little, 1966 from Bufo valiceps in North America, S. bfonisi Rao et Singh, 1968 from Bufo melanostictus in India, and S. spiralis Grabda-Kazubaka, 1978 from Rana esculenta and R. esculenta in Poland. The parasitic females of all these species are rather similar and these species represent the smallest females of the genus with the length of the body ranging within 1.2—2.3 mm.

Taking into account the features for a species separation in Strongyloides used e.g. by Little (1966) and Grabda-Kazubka (1978), S. prokopci sp. n. appears to be closest to S. bfonisi, differing from it distinctly, however, in the presence of a well developed stoma which, as reported by Rao and Singh (1968), is lacking in the latter species and its mouth opens directly into the oesophagus. S. phylisci and S. spiralis differ from S. prokopci sp. n. in having a sharply pointed tail tip, the latter species also by distinctly smaller eggs. Spiralled ovaries distinguish S. prokopci sp. n. from S. carinii and S. amphibiophillus (see Grabda-Kazubka 1978); moreover, the eggs of S. amphibiophillus are distinctly smaller than those in S. prokopci sp. n. (0.042 to 0.048 × 0.022—0.025 mm versus 0.060—0.066 × 0.033—0.039 mm). From S. perreirai the new species differs by more posterior position of the vulva. In view of the common opinion about the high degree of host specificity in Strongyloides members, a host type of the individual species of this genus parasitizing amphibians has also to be considered. S. prokopci sp. n. is the first Strongyloides species parasitizing amphibians that is reported from Africa.

This species has been named in honour of Dr. Jan Prokopčík, a helminthologist and the director of the Institute of Parasitology, Czechoslovak Academy of Sciences, in České Budějovice.
4. *Aplectana macintoshii* (Stewart, 1914)  

**Syn.:** *Oxyuris praepatutus* Skrjabin, 1916; *Aplectana schneideri* Travassos, 1931; *Oxyurias punctata* Walton, 1933; *O. breviplicatum* Yuen, 1935; *O. minutum* Bobek, 1935.

**Hosts:** *Bufo regularis* Reuss, *B. viridis* Laur., and *Bunom rufibunda* Pallas.

**Location:** Large intestine and rectum.

**Distribution:** Cairo—Ilmab (13, 6, 14, and 30.9, and 12.10, 1971, 10.3, 1972), Warrak El Arab (9, 11, 1971), Ousein—Establish (30, 9, 1971), Hamadwa ward (8, 11, 1971) and Shadawar (30, 11, 1971).

**Prevalence:** In 21 of 24 *B. regularis* examined (intensity 1–114 specimens), in 1 of 24 *B. rufibunda* (intensity 5) and in the only *B. viridis* examined (intensity 77).

**Description:** Small, whitish nematodes of fusiform body. Lateral alae extending from anterior end of body to tail. Oesophagus anteriorly with short pharynx, posteriorly with bulb provided with valvular apparatus. Excretory pore situated at level of anterior border of bulb.

**Male** (4 specimens): Length of body 1.48–2.04, maximum width 0.204–0.272. Numerous minute somatic papillae present. Length of entire oesophagus 0.286–0.330, of bulb 0.067–0.066; width of bulb 0.063–0.069, width of narrow anterior part of oesophagus 0.027–0.030. Nerve ring and excretory pore 0.009–0.014 and 0.020–0.021, respectively, from anterior extremity. Two well sclerotized spicules with sharply pointed distal ends present; length of spicules 0.213–0.249, width 0.009–0.012. Urogenital moderately sclerotized, length 0.054–0.060, and width 0.015 in lateral view. Genital papillae indistinguishable from somatic papillae. Anterior lip of cloaca bearing one unpaired papilla. Postanal papillae, approximately 18–22 number, these being localized subventrally, laterally and subdorsally. Tail conical, 0.231–0.270 long, ending in sharp cuticular point. Lateral cuticular alae (width 0.006) reaching posteriorly slightly below level of cloacal opening.

**Female** (10 specimens): Body length of gravid females 2.96–3.71, maximum width 0.231–0.272. Length of entire oesophagus 0.408–0.462, that of bulb 0.033–0.096; width of bulb 0.090–1.05, width of narrow anterior part of oesophagus 0.039–0.045. Nerve ring and excretory pore 0.150–0.190 and 0.225–0.297, respectively, from anterior extremity. Uterus prospirlic. Valve postequatorial, 1.24–1.52 from anterior end of body. Eggs oval, thin-walled, containing larvae; size of eggs 0.123–0.133 x 0.063 to 0.069. Tail conical, 0.475–0.490 long, ending in long, slender cuticular spike. One pair of small papillae (outlets of phasmids) present in about mid-length of tail. Lateral cuticular alae ending near these papillae.

**Comments:** By their morphology the specimens found correspond to the description of this species given by Baker (1980) who has recently carried out a revision of species of the genus *Aplectana* Railliet et Henry, 1916. According to him, *A. macintoshii* was previously often mistaken for other species, in Europe especially for *A. acuminata* (Schrank, 1788).

Later Grabda-Kazubeka (1985), who was not acquainted with Baker’s (1980) paper, has recognized the validity of the genera *Neourailittiina* Balesteroes Márquez, 1946 and *Neuaryctiletona* Balesteroes Márquez, 1946 and she has also considered the European *N. schneideri* (Travassos, 1931) to be an independent species, different from the African species *N. praepatutae* (Skrjabin, 1916). But we follow Baker’s conclusions that both the above mentioned genera are only the synonyms of *Aplectana* with *N. schneideri* and probably also *N. praepatutae* being the synonyms of *A. macintoshii* (Stewart, 1914).

According to Baker (1980), *A. macintoshii* is widely distributed over Europe, Asia and Africa; from North Africa it is reported from Saharan (Baylis 1930), Morocco and the Sudan (Baker 1980). In Egypt (Cairo, Alexandria) this species was probably found.
already by Baylis (1923) who reported the nematodes designated as *Aplectana acuminata* from *Bufo regularis* and *Rana moschata*: he noted that owing to insufficient data concerning the European nematodes of this species the identification of his Egyptian material was uncertain. It is shown by the results of this study that *A. macintoshii* is the most abundant parasite of *B. regularis* in Cairo and its vicinity, occurring there also in members of *Rana*: therefore it can be supposed that the nematodes studied by Baylis (1923) belonged in fact to *A. macintoshii*. Also the nematodes reported by Myers et al. (1962) from *Bufo sp.* from Egypt belonged probably to the same species.

*B. regularis* and *R. moschata* are the most frequently recorded host species of *A. macintoshii* in Africa; in *R. rubida* of this continent it was previously recorded only from Morocco (Baker 1980).

Fam. Physalopteridae (Railliet, 1889, subfam.)

**5. Thabunanae pudica** Seurat, 1914

**Host:** *Scinax stramineus* L.

**Localisation:** stomach.

**Locality:** Abu Rawash (18. 9. 1971).

**Prevalence:** 1 of 5 *S. stramineus* examined (intensity 1 and 21 nematodes).

**Description:** Medium sized nematodes with very fine transverse striation of cuticle. Mouth surrounded by two symmetrical lips, each of them bearing three rounded, forwardly directed teeth at its inner side. Four submedian mouth papillae and two lateral amphids present. Short vestibule present. Division of oesophagus into muscular and glandular portions not easily discernable. Small, simple deirids situated slightly below nerve ring level. Excretory pore approximately at level of junction of both portions of oesophagus.

**Male (5 specimens):** Length of body 8.43--9.09, maximum width 0.231--0.299. Length of vestibule 0.036--0.039. Entire oesophagus measuring 1.15--1.30, of which length of muscular oesophagus 0.201--0.210. Nerve ring 0.150--0.159, excretory pore 0.228 to 0.235, and deirids 0.180--0.198 from anterior end. Two moderately sclerotized, badly distinguishable spicules present, being some 0.063--0.075 long and 0.006 wide. Tail conical, 0.174--0.228 B. Caudal alae well developed, 0.080 wide. In larger specimen, altogether 35 papillae present of which 11 pairs of preanal; postanal papillae: 7 papillae on one side and 6 papillae on other side. Ventral surface of posterior end of body covered with numerous small cuticular protruberances.

**Female (5 specimens):** Body length of gravid females 15.64--19.17, maximum width 0.301--0.344. Length of vestibule 0.045--0.051. Length of entire oesophagus 1.23 to 2.00 of which muscular oesophagus measuring 0.201--0.246. Nerve ring 0.168--0.240, excretory pore 0.320--0.324, and deirids 0.301--0.246 from anterior end. Vulva without elevated lips, being situated 2.34--3.20 from anterior end of body: vagina pointing backwards. Uterus with numerous eggs containing larvae: eggs oval, thick-walled (thickness of wall 0.005), size 0.055--0.063 x 0.039--0.042. Tail conical, relatively short, with small caudal spike at tip; length of tail 0.067--0.183.

**Comments:** This species was described by Seurat (1914) from several species of reptiles, including *Scinax stramineus*, from North Africa. Our specimens correspond, more or less, by their morphology and measurements to the original description of *T. pudica*. Differences are only in the numbers of caudal papillae in the male: while Seurat (1914) reports only 32 caudal papillae in the male of *T. pudica*, there were 35 papillae present in one larger specimen of the present material (see Fig. 3c); it is possible that Seurat (1914) overlooked the most anterior pairs of preanal papillae that are usually more observable than others. In addition, it is probable that there is a considerable intraspecific variability in the number and arrangement of caudal papillae in the male of *Thabunanae* members (see Sharpilo 1976). Since in all other features the nematodes of the present material correspond to *T. pudica*, they are considered to belong to this species.

*T. pudica* is a type species of the genus *Thabunanae* Seurat, 1914 as also a representative of the morphological group of species noted for the presence of symmetrical lips. From Egypt, it has been reported from the snake *Pseudechis schokari* by Myers et al. (1962), whereas two other congeneric species (*T. leucophyllas* and *T. impolus*) have been recorded there by these authors from *Scinax stramineus*.

**B. Larval forms:**

Fam. Spiroceraceae (Chitwood et Wehr, 1932, subfam.)

**6. Spirocerca lupi** (Rudolph, 1819) larvae

**Host:** *Scinax stramineus* L.

**Localisation:** stomach wall, less frequently intestinal wall, lungs and body cavity.

**Locality:** Abu Rawash (18. 9. 1971).

**Prevalence:** 2 of 5 *S. stramineus* examined (intensity of infection 95--128 nematodes).

**Description:** Larvae encysted in firm, whitish ovoid cysts, size 0.993--1.047 x 1.034 to 1.266. Cuticle of larvae with very fine transverse striation. Length of body of more advanced larvae 2.08--3.26, maximum width 0.136--0.150. In lateral view, head end provided on each side with one conical cuticular process 0.066 long; four head papillae present. Size of vestibule, 0.033--0.039 long, somewhat oval. Length of muscular oesophagus 0.135--0.144, width 0.024, length of glandular oesophagus 0.925--0.953, its maximum width 0.090--0.078. Nerve ring situated at base of muscular oesophagus, excretory pore at level of anterior end of glandular oesophagus, deirids approximately at level of nerve
ring. Nerve ring 0.129—0.150, excretory pore 0.165—0.307, and deirids 0.141—0.153 from anterior extremity. Tail conical, 0.072—0.075 long, its tip provided with small protuberance 0.060 long with numerous minute papilla-like projections.

Comments: — The morphology of these nematodes corresponds to the description of the third-stage larvae of *S. lupi*, given e.g. by Sharpilo (1976). The definitive hosts of this species are various Carnivora (e.g. dog, jackal, fox, wolf), whereas insects, mainly dung beetles, are serving as its intermediate hosts; various lizards serve, besides some other animals, only as paratenic hosts (see e.g. Baylis 1929, Sharpilo 1976). These larvae have already been recorded from *Scincus scincus* (see Skryabin et al. 1967). Adult nematodes were reported from Egypt e.g. by Myers et al. (1982) from *Ptenopus zarda*.

Fam. Habronematidae (Chitwood et Wehr, 1932)

7. *Agamospirura* sp. 1

*Host:* *Mabuya quinquenotata* Licht.

*Localization:* large intestine.

*Locality:* Hararwa drain II (8. 11. 1971).

*Prevalence:* in 1 of 18 *M. quinquenotata* examined (intensity 3 larvae).

Description: — Whitish nematodes with transverse striated cuticle; this striation indistinct on both ends of body. Length of body 3.32—3.33, maximum width 0.095. Two well developed lateral cuticular alae (maximum width 0.009) extending along body, starting anteriorly somewhat below level of vestibule end. Mouth provided with two tripartite pseudolabia, each of them bearing at its posterior border two leaf-like structures (altogether 2 subdorsal and 2 subventral), appearing as hooks in lateral view. Poorly big cephalic papillae present. Length of vestibule 0.036—0.039, of muscular oesophagus 0.171—0.180, width 0.018; length of glandular oesophagus 1.14—1.24, its width 0.039. Nerve ring encircling muscular oesophagus somewhat below its mid-length, at 0.168 to 0.174 from anterior end of body; distance of excretory pore and simple deirids from anterior extremity 0.129—0.295 and 0.090—0.105, respectively. Tail conical, 0.087—0.096 long; its tip bluntly rounded, bearing some 7—8 conical cuticular processes 0.009 long.

Comments: — A species and generic determination of these larvae, belonging apparently to the family Habronematidae, was not possible and, therefore, we are assigning these larvae provisionally to the composite genus *Agamospirura* Henry et Sisoff, 1913. The host lizard serves, undoubtedly, as a paratenic host for this nematode species.

8. *Agamospirura* sp. 2

*Host:* snake “gerrian”.

*Localization:* unknown.

*Locality:* Abu Rawash (7. 6. 1971).

*Prevalence:* 3 nematode larvae found in the only snake examined.

Description: — Whitish nematodes with almost smooth cuticle; two narrow lateral alae appearing to extend along body. Head end rounded in lateral view, with small median process; two moon-shaped sclerotized formations, directed to either side, arising from base of latter; two mouth papillae present on each side. Vestibule wide, 0.015—0.018 long. Length of muscular oesophagus 0.114—0.135, of glandular oesophagus 0.330 to 0.408; length of entire oesophagus 0.486—0.540; division of both portions of oesophagus ill-visible. Nerve ring situated at posterior half of muscular oesophagus, 0.165—0.120 from anterior end. Excretory pore at level of anterior end of glandular oesophagus, 0.156—0.165 from anterior extremity. Deirids not observed. Tail conical, 0.045 to 0.065 long, with rounded tip.

9. *Agamospirura* sp. 3

*Host:* *Tortoreola mauritianica* L.

*Localization:* in cyst under skin.


*Prevalence:* in 1 of 4 T. mauritianica examined 1 larva was found.

Description: — Fairly big, whitish nematode with very fine transverse striation of cuticle; width of strie 0.012. Length of body 12.97, maximum width 0.381. Mouth provided with two small rounded lips, each of them appearing to possess at its base two small sublateral tooth-like formations. Four cephalic papillae present. Vestibule rather wide, length 0.036. Oesophagus distinctly divided into anterior muscular and posterior glandular portions. Anterior end of muscular oesophagus bulbously expanded, length of this expanded portion 0.066, its width 0.072; length of whole muscular oesophagus 0.334; length of glandular oesophagus 4.28, its maximum width 0.150. Nerve ring encircling muscular oesophagus 0.218 from anterior end, distance of deirids 0.065. Excretory pore not located. Tail conical, 0.186 long, with knob-like formation on its tip.

Fam. Acuariniidae (Railliet, Henry et Sisoff, 1912, subfam.)

10. *Acuarina* gen. sp. larvae

*Host:* *Mabuya quinquenotata* Licht.

*Localization:* stomach (free) and body cavity (encysted).


*Prevalence:* in 2 of 18 *M. quinquenotata* examined (intensity of infection 1 larva).

Description: — Whitish nematodes with fine transverse striation of cuticle. Length of body 2.60—3.10, maximum width 0.095—0.109. Mouth with two rounded pseudolabia, their terminal ends somewhat protruding to form anterior procerbance. Four cephalic papillae present. Head end provided with narrow cordon, not mutually connected, reaching posteriorly approximately to level of vestibule end. Length of vestibule 0.068—0.072, of muscular oesophagus 0.285, width 0.024; length of glandular oesophagus 0.843—0.979. Nerve ring situated 0.144—0.165 from anterior end, excretory pore at 0.192—0.210, deirids 0.222—0.237. Primordium of vulva 1.58 from anterior extremity. Tail conical, 0.141—0.147 long, with typical round process 0.009 long at its tip.

Comments: — These larvae belong to the subfamily Acuariniidae, but a species or generic identification was not possible. Morphologically they are similar to the larvae described as *Agamospirura magna* Sharpilo, 1963 from a variety of reptile species in the USSR (see Sharpilo 1976).

11. *Nematoda* gen. sp. larvae

*Host:* *Chalcides ocellatus* Forsk.

*Localization:* small intestine.


*Prevalence:* in 1 of 19 *Ch. ocellatus* examined (intensity 2 larvae).
A—E—Spirocerca lupi (Rudolphi, 1819) larva (A, B—head end, lateral and dorsal views, C—tail, D—general view of larva, E—tip of tail); F—I—Aegyospirura sp. 1 (F, G—head end, lateral and dorsal views, H—anterior extremity, lateral view, I—tail); J—K—Aegyospirura sp. 2 (J—head end, lateral view, K—tail).

A—C—Aegyospirura sp. 3 (A, B—head end, lateral and dorsal views, C—tail); D—G—Aemariina gen. sp. larva (D, E—head end, lateral and dorsal views, F—tail, G—general view of larva); H—I—Nematodes gen. sp. larva from Ch. scolopas (H—head end, I—tail).