

# ***Rhabdias mcguirei* sp. nov. (Nematoda, Rhabdiasidae) from the flying lizard, *Draco spilopterus* (Squamata, Agamidae) of the northern Philippines**

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## **Abstract**

*Rhabdias mcguirei* sp. nov., is described on the basis of specimens found in the lungs of northern Philippine flying lizards, *Draco spilopterus* (Reptilia, Agamidae) collected in Aurora province, Luzon Island, Philippines. It is characterized by a rounded oral opening, a buccal capsule consisting of anterior and posterior parts, and the shape of the cuticular inflation in the anterior part of the body: the cuticle is less inflated in the anterior-most part, with the inflation gradually thickening up to the level of the oesophageal-intestinal junction. The new species is differentiated from the 11 most closely related species of *Rhabdias* previously known from lizards.

## **Keywords**

Rhabdiasidae, *Rhabdias mcguirei* sp. nov., flying lizards, *Draco spilopterus*, Philippines

## **Introduction**

*Rhabdias* Stiles et Hassall, 1905 is a genus distributed worldwide that comprises about 70 nominal species (Kuzmin and Tkach 2002–2011) parasitic primarily in the lungs of their amphibian and reptilian hosts. Eighteen *Rhabdias* species parasitize lizards of the families Agamidae (2 species), Chameleonidae (13 species) and Polychrotidae (3 species) in tropical regions of Africa, Madagascar, South-East Asia and Central America (Kuzmin 2003; Burse et al. 2003, 2007 in press; Lhermitte-Vallarino and Bain 2004; Martínez-Salazar 2006; Lhermitte-Vallarino et al. 2008, 2009, 2010). One species, *Rhabdias lacertae* Moravec, 2010, was described from a lacertid lizard from Europe (Moravec 2010).

To the best of our knowledge, no *Rhabdias* species have been reported so far from lizards in the Philippines. In the course of a biodiversity survey of vertebrates and their parasites in the Philippines, we found *Rhabdias* nematodes in lungs of several Philippine flying lizards, *Draco spilopterus* (Wiegmann, 1834) collected in Aurora province on the island

of Luzon. Morphological examination has demonstrated that these specimens belong to a new species. In this paper, we describe the new species and use its distinctive morphology to differentiate it from related taxa.

## **Materials and methods**

Lizards were collected in coconut plantations in Aurora Memorial National Park, Aurora Province, Luzon Island, Philippines, on May 28, 2009. Lizards were necropsied immediately following euthanasia with 20% aqueous chloratone. Live nematodes recovered from the lungs were rinsed in saline, killed with hot 70% ethanol and preserved in 70% ethanol. Before light microscopical examination, nematodes were cleared in phenol/glycerine solution (ratio 2:1). Drawings were made with the aid of a drawing tube. All measurements are in micrometers unless otherwise stated.

Specimens used for scanning electron microscopy (SEM) were dehydrated in a graded series of ethanol, and dried with

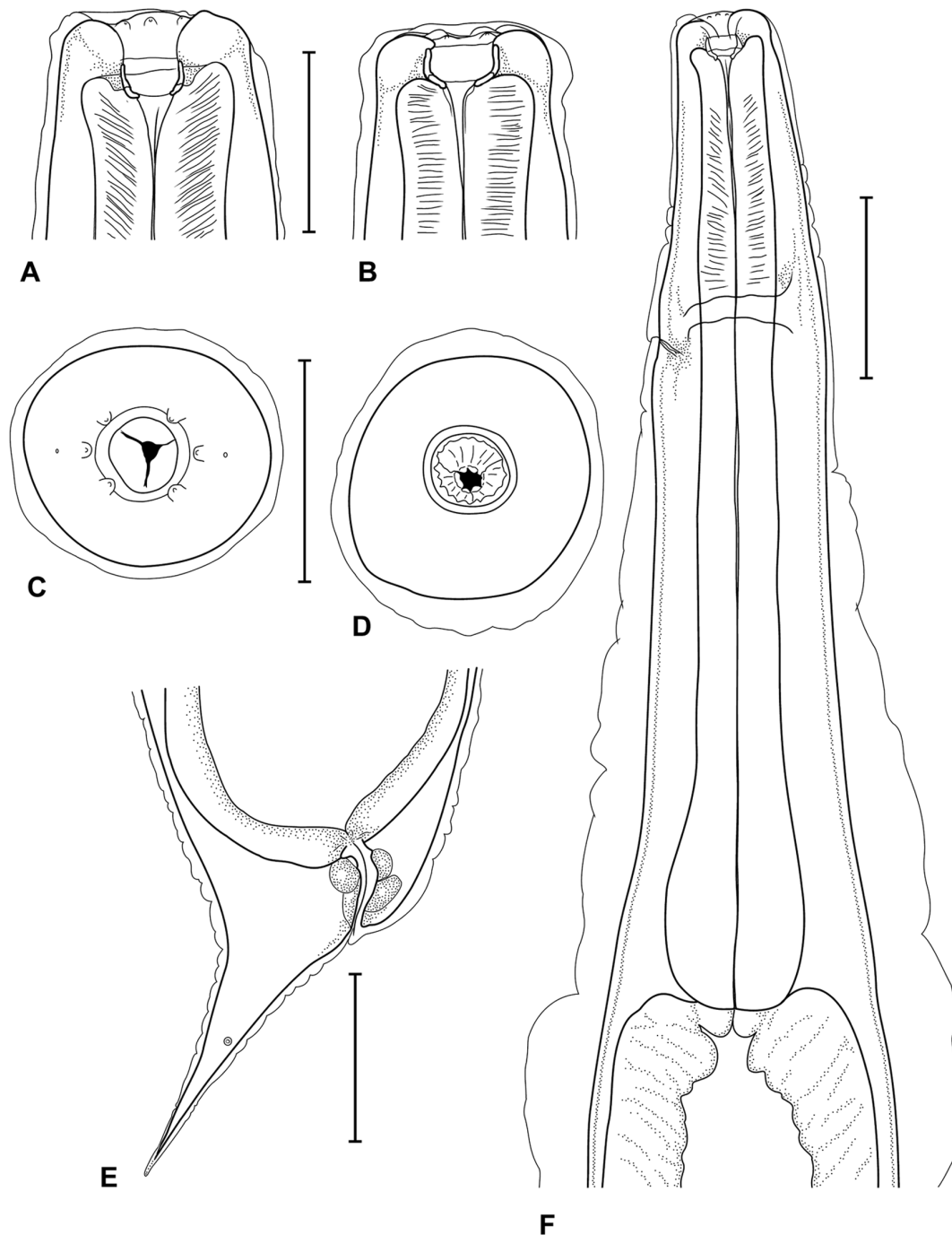
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hexamethyldisilazane (Ted Pella Inc., Redding, California) as transition fluid. The specimens were mounted on aluminium stubs using conductive double-sided tape and silver paste, coated with gold-palladium, and examined with the use of a Hitachi 4700 scanning electron microscope (Hitachi U.S.A., Mountain View, California) at an accelerating voltage of 5–10 kV.

## Results

*Rhabdias mcguirei* sp. nov. (Figs 1 and 2)

Description based on 8 specimens: holotype and 7 paratypes including 1 younger specimen (smaller and with fewer eggs in uteri). Measurements of the holotype are followed by limits



**Fig. 1.** *Rhabdias mcguirei* sp. nov. **A** – head end, lateral view. **B** – head end of young specimen, median view. **C** – head end, apical view. **D** – head end, apical view, optical section at level of buccal capsule posterior segment. **E** – tail end. **F** – anterior part of body. Scale bars = 100  $\mu$ m (A-D), 200  $\mu$ m (E-F)

for the whole series in parentheses. A relatively large *Rhabdias* species. Body length 14.5 (6.1–14.6) mm, width at mid-length 560 (250–600). Body slender, anterior end truncated, posterior end tapering. Body cuticle less inflated on anterior part, gradually thickening posteriorly starting from about level of oesophagus mid-length (Fig. 1F). Cuticle thickest near oesophageal-intestinal junction. Lateral pores visible in anterior part of body where the cuticle is thinnest. Pores shaped as narrow funnels connecting outer surface of cuticle with hypoderm, arranged into 2 longitudinal rows running along lateral cords. Oral opening rounded (Figs 1C, 2). Six lips present as small, elongated elevations of body wall, similar in shape and size (Figs 1C, 2). Submedian lips situated closer to oral opening than lateral ones. Each lip with small interiolabial papilla on inner edge. Papillae of outer circle not observed. Amphid openings minute, situated near posterior edges of lateral lips. Oral opening surrounded with narrow flat velum. Vestibulum short and wide (Figs 1A, B). Buccal capsule cup-shaped in lateral view, round in apical view, with prominently sclerotized walls consisting of longer anterior segment and shorter, shallow posterior segment (Figs 1A, B). Inner surface of buccal capsule walls smooth in anterior segment, rough in posterior segment (Fig. 1D). Buccal capsule outer diameter 37 (37–40), total length of both segments 22 (17–22). Oesophagus wide, about half as wide as anterior part of body, club-shaped, 1080 (870–1090) long, constituting 7.4 (7.4–14.1)% of body length, lacking distinct dilation in muscular portion; posterior bulb egg-shaped (Fig. 1F). Width of oesophagus 82 (75–82) at anterior end, 87 (75–97) at mid-length of muscular

part, 87 (72–95) at mid-distance between nerve ring and posterior edge; oesophageal bulb 157 (117–167) wide. Nerve ring situated at 270 (230–270) from anterior edge of oesophagus or 25.0 (21.1–26.8)% of oesophagus length. Excretory pore situated immediately posterior to nerve ring; excretory duct short and straight (Fig. 1F). Excretory glands inconspicuous. Anterior-most portion of intestine wider than oesophageal bulb. Posterior part of intestine wide, thin-walled, filled with dark contents.

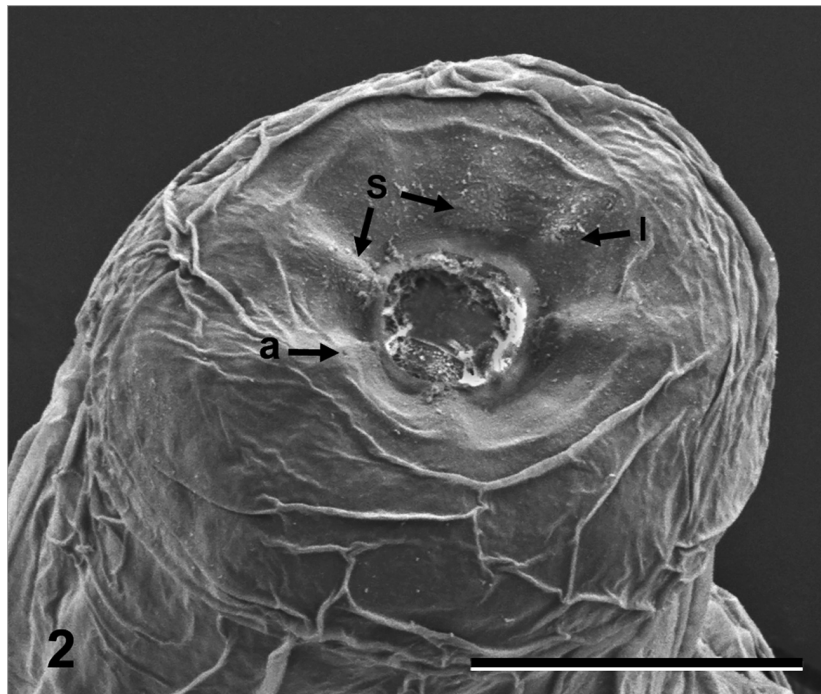
Reproductive system typical of the genus. Vulva slightly post-equatorial, situated at 8.2 (3.1–8.2) mm from anterior end or 56.4 (51.2–56.4)% of body length. Vulva lips not salient. Vagina short, transverse. Uteri thin-walled, filled with numerous eggs, most containing first stage larvae. Egg size 120–130 × 52–65 (N = 10, measured in uteri of holotype). Proximal parts of ovaries extending well beyond level of vulva.

Tail straight, relatively short, tail length 290 (290–360) or 2.0 (2.0–5.0)% of body length. Rectum tubular, thick-walled. Tail sharply tapering from level of anus to mid-length of tail, then gradually tapering to posterior extremity (Fig. 1E). Tail tip sharpened, with thin cuticle. Phasmids situated somewhat posterior to mid-length of tail.

#### Taxonomic summary

Type host: *Draco spilopterus* (Wiegmann, 1834) (Reptilia, Squamata, Agamidae).

Prevalence: Found in 2 out of 5 *D. spilopterus*.



**Fig. 2.** Scanning electron photograph of the anterior end of *Rhabdias mcguirei* sp. nov. **Abbreviations:** a – amphids, l – lateral lip, s – submedian lips. Scale bar = 0.05 mm

Intensity: 1–7 specimens (mean 4.0).

Type locality: Aurora Memorial National Park, Sitio Dimani, Barangay Villa Aurora, Municipality of Maria Aurora, Aurora Province, Luzon Island, Philippines, 500 m a.s.l., 15.680°N, 121.336°E.

Specimens deposited: The type series consists of 6 fully mature and 1 young specimens. Holotype: HWML-67079 (labeled: ex *Draco spilopterus*, Aurora Memorial National Park, Sitio Dimani, Barangay Villa Aurora, Municipality of Maria Aurora, Aurora Province, Luzon Island, Philippines, 28 May 2009, coll. V. Tkach). Paratypes: HWML-67080 (labeled: ex *Draco spilopterus*, Aurora Memorial National Park, Sitio Dimani, Barangay Villa Aurora, Municipality of Maria Aurora, Aurora Province, Luzon Island, Philippines, 28 May 2009, coll. V. Tkach).

Etymology: We are pleased to name this new species for Dr. Jimmy A. McGuire, in recognition of his many contributions to systematic herpetology in Southeast Asia, in particular to our knowledge of the systematics and evolution of the genus *Draco*.

#### Remarks

While most *Rhabdias* species from lizards and amphibians share main morphological characters such as presence of cuticular inflations, rather long oesophagi and numerous eggs in uteri, *Rhabdias mcguirei* sp. nov. is morphologically and biologically similar to other species of *Rhabdias* parasitizing lizards. Therefore, the differential diagnosis below is restricted to the parasites of lizards. Of 18 known species from this group, 11 possess round or almost round oral openings and 6 mostly uniform lips similar to the situation in the new species. These species are: *R. anolis* Bursey, Goldberg et Telford, 2003; *R. casiraghii* Lhermitte-Vallarino, Barbuto et Bain, 2010; *R. chamaeleonis* (Skrjabin, 1916); *R. cristati* Lhermitte-Vallarino et Bain, 2008; *R. gemellipara* Chabaud, Brygoo et Petter, 1961; *R. japalurae* Kuzmin, 2003; *R. jarki* Lhermitte-Vallarino et Bain, 2004; *R. nicaraguensis* Bursey, Goldberg et Vitt, 2007; *R. okuensis* Lhermitte-Vallarino et Bain, 2008; *R. rabetafikae* Lhermitte-Vallarino, Junker et Bain, 2009 and *R. rhampholeonis* Lhermitte-Vallarino et Bain, 2009. In the differentiating diagnosis we used the original descriptions of these 11 species as well as redescriptions of *R. chamaeleonis* by Lhermitte-Vallarino and Bain (2004) and of *R. gemellipara* by Lhermitte-Vallarino, Junker and Bain (2009).

*Rhabdias japalurae*, parasitizing agamid lizards on Okinawa Island and Taiwan (Kuzmin 2003), is close to *R. mcguirei* sp. nov. morphologically, geographically and by its occurrence in another agamid genus, *Japalura*. The two species have a similar pattern of cuticular inflation, narrow in the anterior part and widening posteriorly from the level of the mid-length of the oesophagus (Kuzmin 2003). The widening, however, is much more prominent in *R. japalurae* than in *R. mcguirei* sp. nov. *Rhabdias japalurae* has a narrower buccal capsule (Kuzmin 2003): 26–30 vs 37–40 in *R. mcguirei* sp. nov. The buccal capsule in *R. japalurae* is not divided into anterior and

posterior parts as found in the buccal capsule of *R. mcguirei* sp. nov. The tail in *R. japalurae* is more gradually tapering than that in *R. mcguirei* sp. nov. The cuticle covering the tail tip is inflated in *R. japalurae* (Kuzmin 2003), but not in *R. mcguirei* sp. nov.

*Rhabdias casiraghii*, parasitizing *Trioceros ellioti* (Günther, 1895) (Chamaeleonidae) in East Africa (Lhermitte-Vallarino et al. 2010), is close to *R. mcguirei* sp. nov. by metrical characters (size of the body, the buccal capsule and the oesophagus) but differs from the new species by the presence of a thick cuticular inflation on the anterior end and on the tail tip. In addition, the anterior part of the intestine is narrow in *R. casiraghii* (Lhermitte-Vallarino et al. 2010) and wide in *R. mcguirei* sp. nov. The 2 species differ in the position of the lips: the lateral lips are situated at approximately the same distance from the edge of the oral opening as the submedian ones in *R. casiraghii* (Lhermitte-Vallarino et al. 2010), whereas in *R. mcguirei* sp. nov. the submedian lips are closer to the oral opening than the lateral ones.

*Rhabdias chamaeleonis* from African chamaeleonids differs from *R. mcguirei* sp. nov. by the absence of segments in the buccal capsule and the presence of a cuticular inflation at both the anterior part of the body and the on the tip of the tail (Skrjabin 1916; Lhermitte-Vallarino and Bain 2004).

*Rhabdias cristati*, parasitic in *Chamaeleo cristatus* (Stutchbury, 1837) from Africa, differs from *R. mcguirei* sp. nov. by a larger buccal capsule (50–63 wide), presence of cuticular inflations at both the anterior part of the body and on the tip of the tail, absence of the velum around the oral opening and absence of segments in the buccal capsule (Lhermitte-Vallarino et al. 2008).

*Rhabdias jarki*, parasitic in *Chamaeleo johnstoni* (Boulenger, 1901) from Africa (Lhermitte-Vallarino and Bain 2004), differs from *R. mcguirei* sp. nov. by the absence of segments in the buccal capsule, triangular shape of the buccal capsule in lateral view, a comparatively narrow oesophagus occupying less than half of the body width in the anterior part, and a narrower oesophageal bulb, 100–110 wide in *R. jarki* vs 117–167 in *R. mcguirei* sp. nov.

*Rhabdias okuensis*, parasitic in *Chamaeleo quadricornis* (Tornier, 1899) from Africa (Lhermitte-Vallarino et al. 2008), differs from *R. mcguirei* sp. nov. by having a shallow buccal capsule (10–15 deep and 30–50 wide) without segments, and by the presence of an arrowhead shaped cuticular inflation on the anterior end (Lhermitte-Vallarino et al. 2008).

*Rhabdias rabetafikae*, described from *Calumma cucullatum* (Gray, 1831) (Chamaeleonidae) in Madagascar (Lhermitte-Vallarino et al. 2009), differs from *R. mcguirei* sp. nov. by the presence of cuticular inflations on the anterior part of the body and the tail tip. In addition, *R. rabetafikae* has a wider oesophagus (140–150 at midlength vs 72–95 wide in *R. mcguirei* sp. nov.) and oesophageal bulb (210–240 wide vs 117–167 in *R. mcguirei* sp. nov.).

*Rhabdias rhampholeonis*, parasitizing the chameleon *Rhampholeon spectrum* (Buccholtz, 1874) in Africa (Lher-

mitte-Vallarino *et al.* 2009), differs from *R. mcguirei* sp. nov. by the presence of a distinct head vesicle and a larger buccal capsule (50–55 wide vs 37–40 in *R. mcguirei* sp. nov.).

*Rhabdias gemellipara* from Malagasy chameleons is much smaller than *R. mcguirei* sp. nov. Body length in the former species is 3.5–7.7 mm vs 6.1–14.6 mm in *R. mcguirei* sp. nov. Other metric characters (buccal capsule 7–10 × 12–16, oesophagus 530–610 long and oesophageal bulb 33–40 wide) are also smaller in *R. gemellipara* (Lhermitte-Vallarino *et al.* 2009) than in *R. mcguirei* sp. nov. The body cuticle is evenly inflated on the anterior part of the body in *R. gemellipara* (Chabaud *et al.* 1961), whereas it is less inflated on the anterior part of the body in *R. mcguirei* sp. nov.

Both *Rhabdias anolis* and *R. nicaraguensis*, parasitizing Polychrotidae in Neotropics, are smaller than *R. mcguirei* sp. nov. Body length in *R. anolis* is 4.6–7.4 mm (Burseley *et al.* 2003) and body length in *R. nicaraguensis* is 6.6–7.2 mm (Burseley *et al.* 2007). These species also have much smaller buccal capsules: 9–13 wide in *R. anolis* and 11–15 wide in *R. nicaraguensis* (Burseley *et al.* 2003, 2007) vs 37–40 in *R. mcguirei* sp. nov.; even the smallest studied specimen of the new species that was only 6.1 mm long, still had the buccal capsule 40 wide. *Rhabdias anolis* and *R. nicaraguensis* are separated from *R. mcguirei* sp. nov. geographically (both are from the Neotropical region) and by their specificity to the Polychrotidae.

Shape of the oral opening and lips was not mentioned in the descriptions of the 2 other species from lizards: *R. brevicorne* Lhermitte-Vallarino, Junker et Bain, 2009 and *R. nasutum* Lhermitte-Vallarino, Junker et Bain, 2009, both parasitizing chameleons on Madagascar.

Unlike *R. mcguirei* sp. nov., both *R. nasutum* and *R. brevicorne* possess cuticular inflations on the anterior part of body and the tail tip. The anterior part of intestine in these 2 species is narrower than the oesophageal bulb (Lhermitte-Vallarino *et al.* 2009), whereas in *R. mcguirei* sp. nov. the anterior part of the intestine is wider than the oesophageal bulb. Both species also differ from *R. mcguirei* sp. nov. by having somewhat wider buccal capsules: 42–48 in *R. nasutum* and 42–55 in *R. brevicorne* (Lhermitte-Vallarino *et al.* 2009) vs 37–40 in *R. mcguirei* sp. nov.

## Discussion

The only previous records of *Rhabdias* from *Draco* spp. were unidentified specimens of *Rhabdias* from *Draco volans* (Linnaeus, 1758) and *D. quinquefasciatus* Hardwicke et Gray, 1827 from Malaysia reported by Kuzmin (2003), who studied material deposited in the collection of the Muséum National d'Histoire Naturelle, Paris. Unfortunately, those specimens were of too poor quality to be properly identified or compared with the new species described in the present work. Although the genus *Draco* includes at least 42 species found in many countries of the South and Southeast Asia (McGuire and Al-

cala 2000, McGuire and Kiew 2001, McGuire *et al.* 2007) we are unaware of other publications on helminths of these lizards. Due to rather limited sampling, the limits of geographical distribution and host range of *R. mcguirei* sp. nov. is unknown. It can be hypothesized that, on one hand, our new species may have a broader distribution (perhaps throughout the range of *D. spilopterus* from both northern and central islands of the Philippines; McGuire and Alcala 2010) and, on the other hand, examination of other species of *Draco* from various regions (mainland Asia; Mantey and Grossman 1997, Grismer 2011) may potentially reveal additional undescribed species of *Rhabdias*.

The majority of *Rhabdias* spp. parasitizing lizards (except for *R. lacertae*) are characterized by similar morphology. The similarities include the presence of prominent cuticular inflations on at least some parts of the body, relatively long oesophagi and numerous eggs in uteri, among other characters. Interestingly, the majority of morphological characters observed in species of this group are also found in some *Rhabdias* spp. parasitizing amphibians. Hence, *Rhabdias* spp. parasitizing lizards do not seem to form a morphologically distinct group within *Rhabdias* or the Rhabdiasidae. Molecular data may shed light on the phylogenetic relationships and evolution of host associations among members of *Rhabdias* spp. parasitic in different host groups.

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## References

- Burseley C.R., Goldberg S.R., Telford S.R. 2003. *Rhabdias anolis* n. sp. (Nematoda: Rhabdiasidae) from the lizard, *Anolis frenatus* (Sauria: Polychrotidae), from Panama. *Journal of Parasitology*, 89, 113–117. DOI: 10.1645/0022-3395(2003)089[0113:RANSNR]2.0.CO;2.
- Burseley C.R., Goldberg S.R., Vitt L.J. 2007. New species of *Rhabdias* (Nematoda: Rhabdiasidae) and other helminths from *Norops capito* (Sauria: Polychrotidae) from Nicaragua. *Journal of Parasitology*, 93, 129–131. DOI: 10.1645/GE-887R.1.
- Burseley C.R., Hoong D.C., Goldberg S.R. (In press). A new species of *Rhabdias* (Nematoda: Rhabdiasidae) in *Calotes versicolor* (Squamata: Agamidae) from Singapore. *Journal of Parasitology*. DOI: 10.1645/GE-2820.1.
- Chabaud A.G., Brygoo E.R., Pettey A. 1961. Description et caractères biologiques de deux nouveaux *Rhabdias malgaches*. *Annales de Parasitologie Humaine et Comparée*, 36, 752–763.
- Grismer L.L. 2011. Lizards of Peninsular Malaysia, Singapore and their Adjacent Archipelagos. Edition Chimaira, Amsterdam, the Netherlands, 728 pp.
- Kuzmin Y. 2003. *Rhabdias japalurae* sp. nov. (Nematoda, Rhabdiasidae) from the japalures (Reptilia, Agamidae) and some notes

- on other *Rhabdias* spp. from lizards. *Acta Parasitologica*, 48, 6–11.
- Kuzmin Y., Tkach V.V. 2002–2011. *Rhabdias*. World Wide Web electronic publication. <http://www.izan.kiev.ua/ppages/rhabdias/>.
- Lhermitte-Vallarino N., Bain O. 2004. Morphological and biological study of *Rhabdias* spp. (Nematoda) from African chameleons with description of a new species. *Parasite*, 11, 15–31.
- Lhermitte-Vallarino N., Barbuto M., Ineich I., Wanji S., Lebreton M., Chirio L., Bain O. 2008. First report of *Rhabdias* (Nematoda: Rhabdiasoidea) from lungs of montane chameleons in Cameroon: description of two new species and notes on biology. *Parasite*, 15, 553–564.
- Lhermitte-Vallarino N., Barbuto M., Junker K., Boistel R., Ineich I., Wanji S., Bain O. 2009. *Rhabdias rhampholeonis* n. sp. and *Rhabdias mariauxi* n. sp. (Nematoda, Rhabdiasoidea), first lung worms from leaf chameleons: Description, molecular evidence and notes on biology. *Parasitology International*, 58, 375–383. DOI:10.1016/j.parint.2009.07.009.
- Lhermitte-Vallarino N., Barbuto M., Junker K., Boistel R., Bain O. 2010. *Rhabdias* (Nematoda: Rhabdiasidae) from Chamaeleonidae (Sauria): two new species from *Trioceros ellioti* in east Africa and one from *Brookesia superciliaris* in Madagascar. *Parasite*, 17, 91–105.
- Lhermitte-Vallarino N., Junker K., Bain O. 2009. Reappraisal of the specific status of *Rhabdias* (Nematoda: Rhabdiasoidea) from Malagasy chameleons in the Paris Museum collection. *Parasite*, 16, 111–123.
- Manthey U., Grossman W. 1997. Amphibien und Reptilien Südostasiens. Natur und Tier, Verlag, Germany, 512 pp.
- Martínez-Salazar E.A. 2006. A new rhabdiasid species from *Norops megapholidotus* (Sauria: Polychrotidae) from Mexico. *Journal of Parasitology*, 92, 1325–1329. DOI: 10.1645/GE-872R1.1.
- McGuire J.A., Alcalá A.C. 2000. A taxonomic revision of the flying lizards of the Philippine Islands (Iguania: Agamidae: *Draco*), with a description of a new species. *Herpetological Monographs*, 14, 92–145.
- McGuire J.A., Kiew B.-H. 2001. Phylogenetic systematics of Southeast Asian flying lizards (Iguania: Agamidae: *Draco*) as inferred from mitochondrial DNA sequence data. *Biological Journal of the Linnean Society*, 72, 203–229. DOI: 10.1111/j.1095-8312.2001.tb01312.x.
- McGuire J.A., Brown R.M., Riyanto A., Andayani N. 2007. The flying lizards of the *Draco lineatus* group (Squamata: Iguania: Agamidae): A taxonomic revision with descriptions of two new species. *Herpetological Monographs*, 21, 180–213. DOI: 10.1655/07-012.1.
- Moravec F. 2010. *Rhabdias lacertae* n. sp. (Nematoda: Rhabdiasidae), the first rhabdiasid species parasitising lizards in Europe. *Systematic Parasitology*, 77, 23–27. DOI: 10.1007/s11230-010-9254-y.
- Skrjabin K.I. 1916. Parasitic Trematodes and Nematodes collected by the expedition of Prof. V. Dogiel and I. Sokolov in British East Africa. In: *Scientific Results of the Zoological Expedition to British East Africa and Uganda Made by Prof. V. Dogiel and I. Sokolov in the Year 1914*, Volume I.

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