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A new species of *Cosmocerca* (Nematoda: Cosmocercidae) and other helminths in *Cyrtodactylus gubaot* (Squamata: Gekkonidae) from the Philippines

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Abstract

Cosmocerca leytensis sp. nov. (Ascaridida, Cosmocercidae) from the large intestine of *Cyrtodactylus gubaot* (Squamata: Gekkonidae) collected on Leyte Island, Philippines is described and illustrated. *Cosmocerca leytensis* sp. nov. is the 30th species assigned to the genus, the 4th from the Oriental region, and the first from the Philippine Islands. The new species is most similar to those species possessing 4 pairs of plectanes, i.e., *C. archeyi*, *C. australis*, *C. oroensis*, and *C sardiniae*. *Cosmocerca sardiniae* lacks lateral alae; *C. archeyi*, *C. australis*, *C. leytensis* sp. nov. and *C. oroensis* possess lateral alae. Spicule length of *C. oroensis* is less than 75 µm, while *C. archeyi*, *C. australis*, and *C. leytensis* sp. nov. have spicule lengths greater than 75 µm. Males of *C. australis* possess 2 pairs of rosette caudal papillae, which are lacking in *C. archeyi* and *C. leytensis* sp. nov. Females of *C. archeyi* posses a conical tail, females of *C. leytensis* sp. nov. have a rounded posterior end supporting a flexible filament.

Keywords

Cosmocerca leytensis sp. nov., Nematoda, *Cyrtodactylus guabot*, Philippine Islands

Introduction

Cyrtodactylus gubaot Welton, Silver, Linkem, Diesmos and Brown, 2010, a member of the Philippine bent-toed gecko complex, is currently known only from the type locality, Leyte Island, Leyte Province, Philippine Islands. To our knowledge, there are no reports of helminths from *C. gubaot*. The purpose of this paper is to describe a new species of *Cosmocerca* and establish the initial helminth list for *C. gubaot*.

Materials and Methods

Fifteen specimens of *Cyrtodactylus gubaot* were borrowed from the herpetology collection University of Kansas (KU), Lawrence, Kansas, USA (KU 311186, 311188, 311189, 311192, 311196, 311200–311206, 311209, 311213, 31130; mean snout-vent length, 90.5 ± 5.3 mm, range 81–97 mm; 8 males, 7 females). Geckos had been collected by hand, euthanized within 12 hr of capture, preserved in 10% formalin, and stored in 70% ethanol. The body cavity was opened by a longitudinal incision, and the digestive tract was removed and opened. The oesophagus, stomach, small intestine and large intestine were examined for helminths under a dissecting microscope. Helminths were placed on a glass slide in a drop of lactophenol, a coverslip added and identification was made from these temporary wet mounts. Helminths were deposited in the Harold W. Manter Parasitology Laboratory (HWML), University of Nebraska, Lincoln, Nebraska, USA. Measurements are in micrometers unless otherwise stated.

Results

Gravid individuals representing 3 species of Nematoda, *Meteterakis longispiculata*, *Moaciria komodoensis*, *Parapharyngodon maplestoni*, as well as a male and 3 females assignable to *Cosmocerca* sp., a single female assignable to *Falcaustra*, larvae assignable to *Physalopteroides* and cestode cysticercoids, were found. Site of infection, number of helminths, prevalence, mean intensity and range are given in Table I. Description of the new species follows.

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Table I. Site of infection, number of helminths, prevalence (%), mean intensity and range of infection for 7 endoparasitic species in *Cyrtodactyus gubaot* from the Philippine Islands

Helminth	Site of Infection	Number	Prevalence	Mean Intensity ± SD	Range	HWML Voucher #
Cestoda						
Cysticercoids	Body cavity	81	1/15 (7%)	81	–	64727
Nematoda						
Cosmocerca leytensis sp. nov.	Large intestine	4	2/15 (13%)	2.0 ± 1.4	1–3	64763–65
Falcaustra sp. (female)	Large intestine	1	1/15 (7%)	1	–	64728
Meteterakis longispiculata	Large intestine	1	1/15 (7%)	1	–	64729
Moaciria komodoensis	Large intestine	21	6/15 (40%)	3.5 ± 2.7	1–3	64730
Parapharyngodon maplestoni	Large intestine	12	6/15 (40%)	2.0 ± 0.9	1–8	64731
Physolapteroides sp. (larvae)	Large intestine	3	1/15 (7%)	3	–	64732

***Cosmocerca leytensis* sp. nov.** (Figs 1–11)

General morphology: Cosmocercidae Railliet, 1916. Small, fusiform nematodes. Prominent sexual dimorphism, males two-thirds length of females. Lateral alae beginning at posterior end of pharynx and terminating on base of tail in both males and females. Cuticle transversely striated. Mouth with three small V-shaped lips, dorsal lip with two sessile papillae, each ventrolateral lip with one ventral, sessile papilla and one lateral amphid. Esophagus with indistinct buccal cavity, short pharynx, cylindrical corpus, short isthmus and valved bulb. Excretory pore posterior to esophageal bulb in male, anterior to esophageal bulb in females.

Male: Based on holotype. Length 1.91 mm, width at midbody 146. Pharynx 15 long, corpus 211 long, isthmus 12 long, oesophageal bulb 55 long, 49 wide. Nerve ring 67 and excretory pore 317 from anterior end, respectively. Tail conical 128 in length, terminating in narrow, flexible filament 18 in length. Subventral precloacal caudal musculature prominent, consisting of 15 pairs of muscles. Sclerified gubernaculum 79 in length, V-shaped with heavily sclerotized proximal margins and pointed distal end. Spicules 110 in length, equal, lightly sclerotized. Posterior end with 4 pairs of plectanes and 10 pairs of mammiliform papillae and 1 unpaired papillae on midline just anterior to cloaca. Plectanes precloacal, long axis parallel to long axis of body, each consisting of central papilla with sclerified anterior and posterior rami supporting a single rosette of small punctations. Underlying supports not fused between plectanes. Two pairs of precloacal mammiliform papillae, 1 pair adcloacal and 7 post cloacal pairs, of which 4 pairs are ventrolateral and 3 pairs are dorsolateral in position. Flexible filament of tail lies posterior to the last pair of ventrolateral mammiliform papillae.

Female: Based on holotype and 2 paratypes (measurements of holotype followed by paratypes in parentheses). Length 3.07 mm (2.94 mm, 2.88 mm), width at vulva 383 (350, 344). Pharynx 18 (15, 18) long, corpus 305 (275, 293) long, isthmus 24 (31, 24) long, oesophageal bulb 92 (110, 92) long, 98 (122, 110) wide. Nerve ring 73 (73, 79) and excretory pore 295 (273, 285) from anterior end, respectively. Female reproductive system prodelphic, vulva near midbody, 1.40 mm (1.33 mm, 1.35 mm) from anterior end (46% of body length from anterior end). Uteri are filled with undeveloped eggs, larvated eggs and free larvae not present. Eggs (n = 10) 64 ± 4 (range, 58–70) long by 51± 4 (range, 43–58) in diameter. Anus 332 (357, 344) from posterior end of body. Posterior end of body rounded, terminating in slender filament 104 (98, 110) in length.

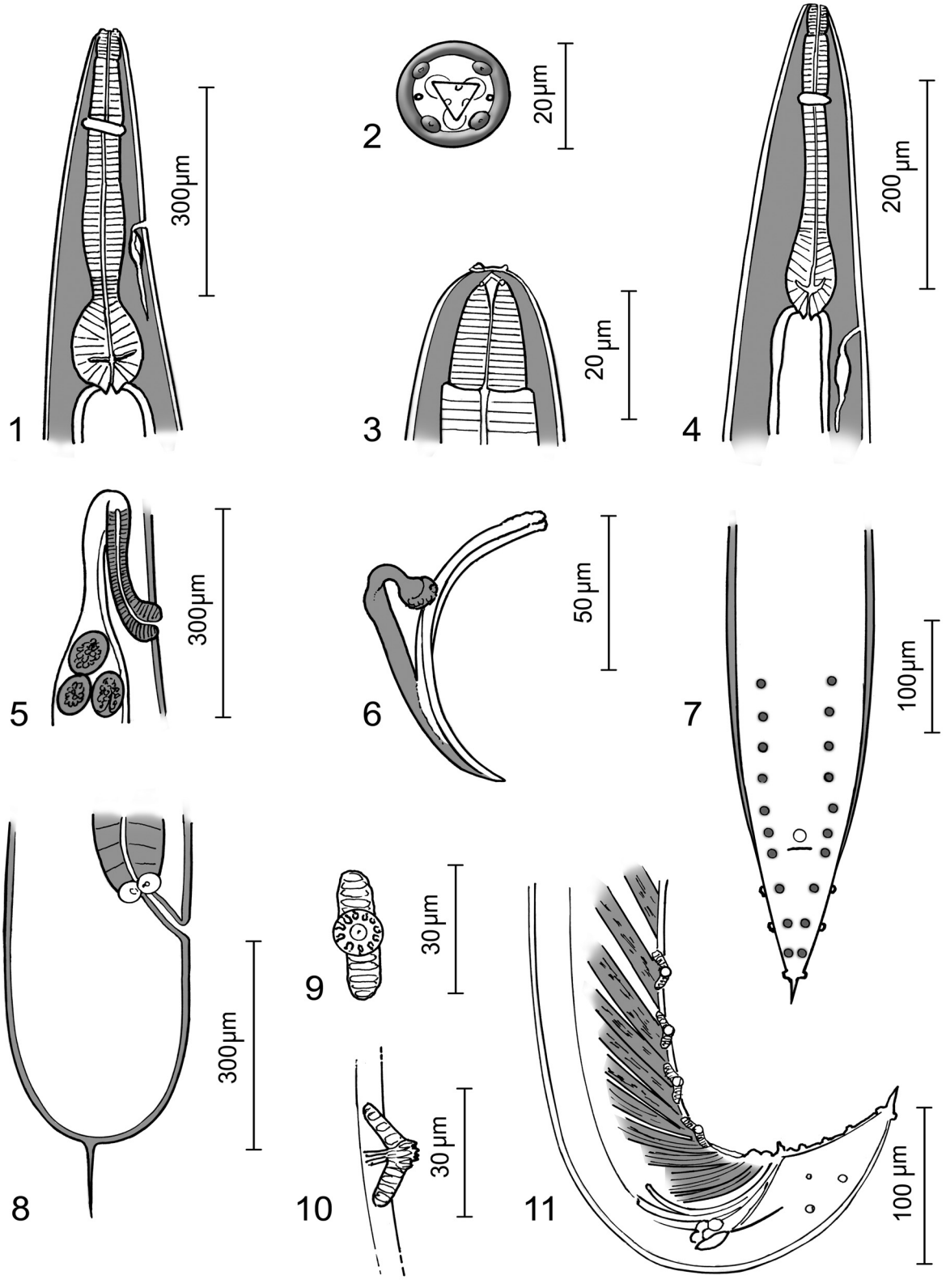
Taxonomic summary

Type host: C*yrtodactylus gubaot* Welton, Silver, Linkem, Diesmos and Brown, 2010 (no common name); Symbiotype, KU311202, November 2007.
Type locality: Baybay Municipality (10°40′N, 124°55′E), Leyte Province, Leyte Island, Philippines.
Site of infection: Large intestine.
Type Material: Holotype male, HWML-64763; Allotype female, HWML-64764; Paratype females, HWML-64765.
Etymology: The new species is named after the locality of collection, Leyte Island, Philippines.

Remarks

It is of interest to note that the position of the excretory pore is different in males (postbulbar) and females (prebulbar) assigned to *C leytensis* sp. nov. However, this arrangement is similar to that seen in *Cosmocerca longispicula*, a Panamanian Region species and *Cosmocerca longicauda*, a Palaearctic Region species. The anterior ends of male and female members of a species of *Cosmocerca* are rarely illustrated in a species description, thus it is difficult to determine how many species might show such a condition.

Species of *Cosmocerca* by biogeographical region are listed in Table II. *C. leytensis* sp. nov. represents the 30th species assigned to the genus, the first to be described from the Philippine Islands and the 4th described from the Oriental region.



Figs 1–11. *Cosmocerca leytensis* sp. nov. 1. Female, anterior end, lateral view. 2. Female, en face view. 3. Female, anterior end, dorsal view. 4. Male, anterior end, lateral view. 5. Female, vulvar region. 6. Male, gubernaculum and spicules. 7. Male, posterior end. 8. Female, posterior end, lateral view. 9. Plectane, ventral view. 10. Plectane, lateral view. 11. Male, posterior end, ventral view

Table II. Selected characters of male individuals of *Cosmocerca* spp.
(Revised from Rizvi *et al.*, 2011)

Biogeographical Region* **_Cosmocerca_ spp.**	**Type host**	**Length (um)**	**Spicule (um)**	**Guberna-culum (um)**	**Plectane pairs**	**Lateral alae**	**Reference**
Afrotropical Region							
No species reported	–	–	–	–	–	–	–
Australian Region							
C. archeyi Baker and Green, 1988	Frog	1.77	95	87	4	Present	Baker and Green 1988
C. australis Baker and Green, 1988	Frog	1.28–1.78	99–123	82–88	4	Present	Baker and Green 1988
C. lymnodynastes Johnson and Simpson, 1942	Frog	1.6	50–75	110	5	Absent	Johnston and Simpson 1942
Madagascan Region							
No species reported	–	–	–		–	–	–
Nearctic Region							
C. acanthurum Falcon-Ordaz, Perez, Garfias, Olea And Ponce de Leon	Salamander	2.18–2.38	51–66	75–90	5	Present	Falcon-Ordaz *et al.* 2007
Neotropical Region							
C. brasiliensie Travassos, 1925	Toad	2.24–3.99	158–185	140–156	8	Absent	Dyer and Altig 1976
C. chilensis Lent and Freitas, 1948	Toad	1.4	80	84	6	Absent	Lent and Freitas 1948
C. cruzi rodrigues and Fabio, 1970	Frog	2.99	74	85	5	Absent	Rodrigues and Fabio 1970a
C. paraguayensis Moravec and Kaiser, 1994	Frog	1.33–1.79	83–108	106–122	5	Present	Baker and Vaucher 1984
Syn. *Cosmocerca ornata* sensu Baker and Vaucher, 1984							
Syn.*Cosmocerca uruguayensis* Moravec and Barus, 1990 nec Lent and Freitas, 1948							
C. parva Travassos, 1925	Frog	1.43–2.01	90–110	85–108	5–7	Present	Mordeglia and Digiani, 1998
Syn. *C. freitasi* Silva, 1954							
Syn. *C. panamaensis* Martinez and Maggenti, 1989							
C. podicipinus Baker and Vaucher, 1984	Frog	2.97	94	134	5	Present	Baker and Vaucher, 1984
C. rara Freitas and Vicente, 1966	Toad	2.8	200	206	6	Absent	Freitas and Vicente, 1966
C. travasssosi Rodrigues and Fabio, 1970	Frog	3.66	167	130	5	Absent	Rodrigues and Fabio, 1970b
C. uruguayensis Lent and Freitas, 1948	Toad	2.42	155	133	7	Absent	Lent and Freitas, 1948
C. vrcibradici Bursey and Goldberg, 2004	Lizard	1.62–1.86	171–183	92–98	7	Present	Bursey and Goldberg, 2004
Oceanian Region							
C. novaeguineae Moravec and Sey, 1990	Frog	1.90	69	111	5	Present	Moravec and Sey, 1990
C. oroensis Bursey, Goldberg and Kraus, 2013	Frog	0.77–0.99	37–52	24–29	4	Present	Bursey *et al.*, 2013
C. tyleri Bursey, Goldberg and Kraus, 2006	Frog	1.02–1.43	37–43	58–61	9	Present	Bursey *et al.*, 2006
C. zugi Bursey, Goldberg and Kraus, 2005	Lizard	1.63–1.84	79–116	92–122	4	Present	Bursey *et al.*, 2005
Oriental Region							
C. ishaqi (Islam, Farooq and Khanum, 1981)	Toad	2.92	100	Absent	11	Absent	Islam *et al.*, 1981
Syn. *Paraomatium ishaqi* Islam, Farooq and Khanum, 1981							

C. kalesari Rizvi, Bursey and Bhutia, 2011	Frog	1.11–1.92	82–90	85–95	5	Present	Rizvi *et al.*, 2011
C. leytensis sp. nov.	Lizard	1.91	110	79	4	Present	Present study
C. microhylae Sou and Nandi, 2015	Frog	0.74–0.79	100–112	65–68	5	Present	Sou and Nandi, 2015
Palaearctic							
C. banyulensis Chabaud and Campana-Rouget, 1955	Frog	0.97	10	80	5–6	Present	Chabaud and Campana-Rouget, 1955
C. commutata (Diesing, 1851)	Toad	4.03–4.39	180	186–213	7	Present	Moravec and Vojtkova, 1974
Syn. *Ascaris commutata* Diesing, 1851							
Syn. *Nematoxys commutatus* Linstow, 1889							
Syn. *Cosmocerca pulcherrima* Iwanitzky, 1940							
Syn. Cosmocerca skrjabini Ivaitsky, 1940							
Syn. *Cosmocerca timofejevor* skarbilovitch, 1950							
Syn. *Cosmocerca kashmirensis* Fotedar, 1959							
C. longicauda (Linstow, 1885)	Salamander	2.90	92	190	6	Present	Skrjabin *et al.*,1961
Syn. *Nematoxys longicauda* Linstow, 1885							
Syn. *Cosmocerca trispinosa* Railliet and Henry, 1916							
C. ornata (Dujardin, 1845)	Frog	1.1–2.8	rudimentary	100–120	5	Present	Skrjabin *et al.*,1961
Syn. *Oxyuris ornata* Dujardin, 1845							
Syn. *Nematoxys ornatus* Schneider, 1866							
Syn. *Ananconus commutatus* Railliet and Henry, 1916							
Syn. *Cosmocerca minuscula* Travassos, 1931							
Syn. *Paracosmocerca mucronata* Kung and Wu, 1945							
Syn. *Cosmocercella polissensis* Maguza, 1972							
Syn. *Cosmocerca indica* Nama & Khichi, 1973							
Syn. *Cosmocerca macrogubernaculum* Rao, 1979							
Syn. *Paracosmocerca spinocerca* Rao, 1979							
C. sardiniae Ricci, 1987	Salamander	3.41–4.18	375	260–303	4	Absent	Ricci, 1987
Panamanian Region							
C. longispicula Moravec and Kaiser, 1994	Frog	1.52–2.38	294–300	138	7	Present	Moravec and Kaiser, 1994
Sarahoarabian Region							
No species reported	–	–	–	–	–	–	–
Sino–Japanese Region							
C. japonica Yamaguti, 1939	Frog	1.8	104	84	5	Present	Yamaguti, 1938

*Holt *et al.*, 2013

Three oriental species are currently known, *C. ishaqi*, *C. kalesari* and *C. microhylae* (Table II). *Cosmocerca leytensis* sp. nov. differs from these three species by possessing 4 pairs of plectanes compared to 11 pairs of plectanes in *C. ishaqi* and 5 pairs of plectanes in *C. kalesari* and *C. microhylae.* The new species is most similar to those species possessing 4 pairs of plectanes, i.e., *C. archeyi*, *C. australis*, *C. oroensis*, and *C sardiniae* (Table II). *Cosmocerca sardiniae* lacks lateral alae; *C. archeyi*, *C. australis*, *C. leytensis* sp. nov. and *C. oroensis* possess lateral alae. Spicule length of *C. oroensis* is less than 75 µm, while *C. archeyi*, *C. australis*, and *C. leytensis* sp. nov have spicule lengths greater than 75 µm. Males of *C. australis* possess 2 pairs of rosette caudal papillae (Baker and Green, 1988), which are lacking in *C. archeyi* and *C. leytensis* sp. nov. Females of *C. archeyi* posses a conical tail (Baker and Green, 1988), females of *C. leytensis* sp. nov. have a rounded posterior end supporting a flexible filament.

Discussion

To our knowledge, there is no previous report of helminths from *C. gubaot*; thus, the parasite list currently is *Cosmocerca leytensis* sp. nov., *Meteterakis longispiculata* (Baylis, 1929), *Moaciria komodoensis* (Pinnell and Schmidt, 1977), *Parapharyngodon maplestoni* Chatterji, 1933, *Falcaustra* sp., *Physalopteroides* sp. and an unknown species of Cestoda.

Meteterakis longispiculata was originally described as *Spinicauda longispiculata* by Baylis (1929) from *Gekko gecko* collected in Java, but was reassigned to its current position by Inglis (1958). It is currently known from *G. gecko*, *Lyriocephalus scutatus* collected in Sri Lanka (Crusz and Sanmugasunderam, 1974) and 4 reptilian species from the Philippines, *Mabuya multifasciata*, *Sphenomorphus* sp. *Liopeltis philippinus* and *Xenopeltis unicolor* (Schmidt and Kuntz, 1972). *Moaciria komodoensis* was described from *Psammodynastes pulverulentus* by Pinnell and Schmidt (1977) but reassigned to *Moaciria* by Baker and Bain (1981). It is currently only known from *P. pulverulentus*, a viper common throughout much of the Oriental region. *Parapharyngodon maplestoni* was originally described from *Calotes versicolor* by Chatterji (1933). It has been reported from a number of lizards from the Oriental region; a host list was published by Goldberg *et al*. (2011).

To our knowledge, only one species of *Falcaustra*, (*F. duyagi* a parasite of turtles) has been reported from the Philippine Islands (Tubangui and Villaamil, 1933). Also, we know of no species of *Physalopteroides* reported from the Philippine Islands. Cysticercoids are metacestodes of species in the Cyclophyllidea, Further work will be necessary before these 3 species can be ascertained.

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