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New Species of *Meteterakis* (Nematoda: Heterakidae) in *Brachymeles* spp. (Squamata: Scincidae) from the Philippines

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ABSTRACT: *Meteterakis hurawensi*s n. sp. (Nematoda, Heterakidae) from the large intestine of *Brachymeles orientalis* and *Brachymeles samad* (Squamata, Scincidae) is described and illustrated. *Meteterakis hurawensi*s n. sp. represents the 20th Oriental species assigned to the genus and is distinguished from other Oriental species by the distribution pattern of the caudal papillae (10 pairs total, 3 pairs of relatively large pedunculate papillae, 2 pairs of short pedunculate papillae immediately anteriolateral to ventral sucker, 2 pairs of short pedunculaltle papillae midway between ventral sucker and cloaca, 1 pair of sessile papillae just posterior to cloaca, 2 pairs of sessile near terminus of tail; 1 unpaired sessile papilla on midline just anterior to cloaca) and length of spicules (0.30–0.33 mm).

KEY WORDS: Nematoda, *Meteterakis hurawensi*s n. sp., *Brachymeles orientalis*, *Brachymeles samad*, Philippine Islands, biogeographical distribution.

The southern burrowing skink, *Brachymeles orientalis* Brown and Rabor, 1967, is known from the Philippine islands of Bohol, Samar, Leyte, Dinagat, Camiguin Sur, and eastern and central Mindanao, where it occurs in agricultural areas as well as disturbed and secondary growth forests (Siler and Brown, 2010). The eastern Visayas slender skink, *Brachymeles samad* Siler, Jones, Diesmos, Diesmos and Brown, 2012, is known from the Philippine islands of Samar and Leyte, where it occurs in primary and secondary growth forests as well as disturbed and agricultural habitats (Siler et al., 2012). There are, to our knowledge, no reports of helminths from either *B. orientalis* or *B. samad.*

Species of *Meteterakis* Karve, 1930 occur in the digestive tracts of amphibians and reptiles (Inglis, 1958). Of the 27 nominal species (Table 1), 20 are known from the Oriental region. The purpose of this paper is to describe a new species of *Meteterakis* from the large intestines of *B. orientalis* and *B. samad*.

MATERIALS AND METHODS

Seven specimens of *B. orientalis* and 10 of *B. samad* collected between June 25 and July 5, 2014 at Mt. Huraw, Western Samar Province, the Philippines, were borrowed from the Sam Noble Museum (OMNH) and examined for helminths (*B. orientalis,* snout-vent length [SVL] 105.4 mm ± 10.6 mm, range 93–120 mm, OMNH 44659–44665; *B. samad*, SVL 68.2 mm ± 5.5, range 57–73 mm, OMNH 44666–44671, 44676–44678, 44685). Skinks had been fixed in neutral buffered 10% formalin and stored in 70% ethanol.

The body cavity was opened by a longitudinal lateral incision, and the gastrointestinal tract was removed by cutting across the esophagus and rectum. The esophagus, stomach, small intestine, and large intestine of each skink were examined separately for helminths. The coelom was also searched. Only nematodes were found, and each nematode, fixed in situ, was removed and placed in lactophenol, allowed to clear, then examined under a light microscope. Drawings were made with the aid of a microprojector. Measurements were made with an optical micrometer and are given in micrometers, unless otherwise stated, with mean ± 1 SD and range in parentheses.

RESULTS

Four (57%) of 7 *B. orientalis* and 2 (20%) of 10 *B. samad* harbored nematodes. One species of Nematoda, i.e., adults of a new species of *Meteterakis* Karve, 1930, were found. Selected nematode specimens were deposited in the Harold W. Manter Laboratory (HWML), University of Nebraska, Lincoln, U.S.A.

Meteterakis hurawensis n. sp. (Figs. 1–10)

Description

General: Heterakidae Railliet and Henry, 1912; Meteterakinae Inglis, 1967; *Meteterakis* Karve, 1930.

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Table 1. Current list and selected characters of species assigned to *Meteterakis* Karve, 1930.

Biogeographical region*	Species	Spicules	Junker et al. (2015) designation	Caudal papillae	Gubernaculum	Reference
Afrotropical region	*M. saotomensis* Junker, Mariaux, Measey and Mutafchiev, 2015	410–521, equal	Group I	16–17 pairs	Absent	Junker et al., 2015
Australian region	No species reported					
Madagascan region	No species reported					
Nearctic region	No species reported					
Neotropical region	No species reported					
Oceanian region	*M. crombiei* Bursey, Goldberg and Kraus, 2005	427–488, equal	Group I	9 pairs	Present	Bursey et al., 2005
	M. triaculeata (Kreis, 1933)	380, equal	Group IV	17 pairs	Absent	Inglis, 1958
	Syn. *Ganguleterakis triaculeatus* Kreis, 1933					
Oriental region	*M. andamanensis* Soota and Chaturvedi, 1972	400–500, equal	Group I	10 pairs	Absent	Soota and Chaturvedi, 1972
	M. aurangabadensis Deshmukh and Choudhari, 1980	620–720, equal	Group III	16 pairs	Absent	Deshmukh and Choudhari, 1980
	M. baylisi Inglis, 1958	420–450, equal	Group I	19 pairs	Present	Inglis, 1958
	M. bufonis (Biswas and Chakravaraty, 1963)	Right, 310;	Group II	12 pairs	Absent	Biswas and Chakravarty, 1963
	Syn *Heterakis bufonis* Biswas and Chakravarty, 1963	left, 270				
	M. gambhiri Zhang and Zhang, 2011	220–270, equal	Group IV	10 pairs	Absent	Gambhir et al., 2006
	M. govindi Karve, 1930	180–270, equal	Group IV	20 pairs	Present	Inglis, 1958
	Syn. *Heterakis govindi* (Krve, 1930) Baylis, 1936					
	Syn. *Ganguleterakis govindi* Skrjabin, 1949					
	Syn. *Africana varani* Maplestone, 1931					
	Syn. *Spinicauda bufonis* Yamaguti, 1935					
	M. guptai Gupta and Naiyer, 1993	490, equal	Group I	13 pairs	Absent	Gupta and Naiyer, 1993
	M. hurawensis n. sp.	315–391, equal	Group IV	10 pairs	Present	This report
	M. lombokensis Purwaningsih, Dewi and Nugroho, 2016	300–670m equal		13 pairs	Present	Purwaningsih et al. 2016
	M. japonica (Wilkie, 1930)	460–690, equal	Group I	23 pairs	Present	Inglis, 1958
	Syn. *Spinicauda japonica* Wilkie, 1930					
	Syn. *Africana howardi* Li, 1933					
	M. karvei Naidu and Thakare, 1981	660–840, equal,	Group III	17 pairs	Present	Naidu and Thakare, 1981
	M. longispiculata (Baylis, 1929)	630–680, equal,	Group III	20 pairs	Present	Inglis, 1958
	Syn. *Spinicauda longispiculata* Baylis, 1029					
	Syn. *Spinicauda cophotis* Baylis, 1935					
	M. louisi Inglis, 1958	970–1,100, equal	Group III	18–19 pairs	Present	Inglis, 1958
	M. lyriocephali (Crusz and Ching, 1975)	Right, 340–561;	Group II	10–11 pairs	presenst	Crusz and Ching, 1975
	Syn. *Cometeterakis lyriocephali* Crusz and Ching, 1975	left 595–754				

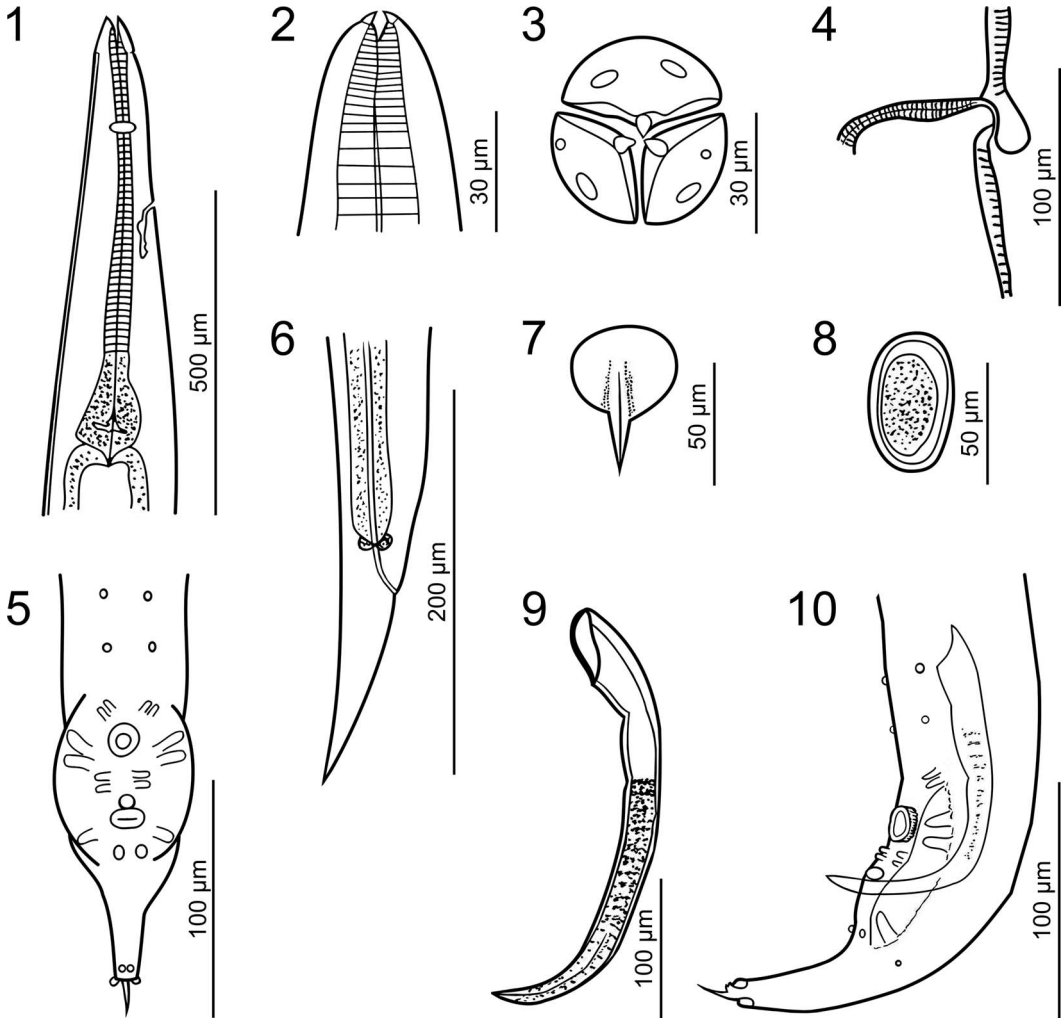
Table 1. Continued

Biogeographical region*	Species	Spicules	Junker et al. (2015) designation	Caudal papillae	Gubernaculum	Reference
	M. nabuyi (Chakravarty, 1944)	300, equal	Group IV	20 pairs	Absent	Chakravarty, 1944
	Syn. *Africana mabuyae* Chakraarty, 1944					
	M. singaporensis (Sandosham, 1954)	740–960, equal,	Group III	22 pairs		Sandosham, 1954
	Syn. *Africana singaporensis* Sandosham,1954					
	M. sinharajensis Crusz and Ching, 1975	344–451, equal	Group I	7 pairs	Present	Crusz and Ching, 1975
	M. striatura Oshmarin and Demshin, 1972	680, equal	Group I	9 pairs	Present	Oshmarin and Demshin, 1972
	M. vaucheri Adamson, 1986	1,057–1,242, equal	Group III	11 pairs	Absent	Adamson, 1986
	M. wonosoboensis Purwaningsih, Dewi and Hasegawa, 2015	630–890, equal	Group III	16 pairs	Present	Purwaningsih et al., 2015
Palaearctic region	No species reported					
Panamanian region	No species reported					
Saharoarabian region	No species reported					
Sino-Japanese region	*M. amamiensis* Hasegawa, 1990	227–640, equal	Group I	13 pairs	Absent	Hasegawa, 1990
	M. ishikawanae Hasegawa, 1987	520–650, equal	Group I	14 pairs	Absent	Hasegawa, 1987
	M. paucipapillosa Wang, 1980	400–416, equal	Group I	6 pairs	Absent	Wang, 1980
	M. wangi Zhang and Zhang, 2011	740–930, equal	Group III	20 pairs	Present	Zhang and Zhang, 2011

* Holt et al., 2013.

Slender cylindrical nematodes tapering at both ends. Cuticle with fine, regular, transverse striations. Lateral alae extending from base of lips to anterior to caudal alae in males and to posterior half of tail in females. Mouth bounded by 3 rounded lips, not set off from body, interlabia absent (Figs. 1, 2). Dorsal lip with 2 sessile papillae near anterior margin; each ventrolateral lip with 1 sessile papilla and 1 flat amphid. Inner edge of each lip with anterior membranous cuticular flange (Fig. 3). Anterior end of esophagus divided into 3 lobes; cuticle lining each lobe forming an anteriorly projecting toothlike process. Esophagus divided into short anterior pharynx, long corpus and pear-shaped valved bulb (Fig. 1). Excretory pore near midpoint of corpus; nerve ring approximately half-way between anterior end and excretory pore. Male posterior end with cuticular sucker, narrow caudal alae supported by pedunculate papillae (Figs. 5, 6).

Male (based on holotype and 9 paratypes from type host): Length 3.83 ± 0.41 mm (3.20–4.48 mm); width at level of esophageal-intestinal junction 142 ± 9 (128–153). Mouth bounded by 3 lips each 24 ± 6 (18–37) long, dorsal lip 32 ± 3 (31–37) wide. Esophagus 699 ± 55 (612–765) in length consisting of short anterior muscular pharynx 58 ± 6 (50–68) in length and long posterior glandular corpus 523 ± 59 (437–597) in length by 29 ± 3 (24–33) wide throughout; with valved bulb 118 ± 10 (93–130) in length by 81 ± 7 (68–93) wide. Esophagus length/body length = 0.18. Nerve ring 192 ± 6 (180–198) and excretory pore 253 ± 21 (223–279) from anterior end, respectively. Caudal extremity curved ventrally, prominent precloacal sucker, 29 ± 3 (25–31) external diameter at base. Conical tail 152 ± 13 (135–172) in length, posterior portion of tail developed as a filament 54 ± 8 (43–68) in length (Fig. 5). Tail length/body length = 0.05. Caudal alae narrow, each supported by 3 pedunculate papillae, 2 pedunculate papillae at level of ventral sucker, more anterior papilla slightly lateral of posterior papilla, 1 pedunculate papilla at level of anus (Fig. 10). Genital papillae, distinguished from somatic papillae by larger size: 2 pairs immediately anterolateral to ventral sucker, 2 pairs midway between ventral sucker and cloaca, 1 pair just posterior to cloaca; 1 papilla on midline just anterior to cloaca. Two pairs of ventrolateral somatic papillae on body proper anterior to caudal alae, 2 pairs of somatic papillae at base of tail filament, (1 pair ventral, 1 pair dorsal). Phasmids lateral of genital papillae posterior to cloaca. Spicules equal 339 ± 26 (315–391) in length, slightly curved, alate, distal end pointed, proximal end ex-



Figures 1–10. Line drawings of *Meteterakis hurawensis* n. sp. **1**. Female, anterior end, lateral view. **2**. Female, detail of anterior end, lateral view. **3**. Female, anterior end, en face view. **4**. Female, vulvar area, lateral view. **5**. Male, papillae arrangement, ventral view. **6.** Female, posterior end, lateral view. **7**. Gubernaculum. **8**. Egg. **9**. Spicule. **10**. Male, posterior end, lateral view.

panded into a well-developed manubrium, tessellated throughout length and with a slight expansion about 75 from proximal end (Fig. 9). Spicule length/body length = 0.09. Gubernaculum 77 ± 7 (68–93) in length, distal tip pointed, proximal end flattened, expanded (Fig. 7).

Female (based on allotype and 9 paratypes from type host): Length 4.91 ± 0.44 mm (3.89–5.44 mm), width at level of vulva 134 ± 14 (115–153). Mouth bounded by 3 lips, each 28 ± 4 (24–31) long, dorsal lip 39 ± 2 (37–42) wide. Esophagus 773 ± 55 (689–842) in length, consisting of pharynx 57 ± 5 (49–67) in length, corpus 578 ± 62 (488–665) in length by 32 ± 3 (27–37) wide throughout; with valved bulb 133 ± 8 (122–145) in length by 85 ± 7 (73–92) wide. Esophagus length/body length = 0.16. Nerve ring 194 ± 11 (179–214) and excretory pore 301 ± 36 (255–357) from anterior end, respectively. Vulva transverse slit covered by posteriorly directed flap, 2,438 ± 143 (2,240–2,624) from anterior end (Fig. 4); ratio of distance of vulva from anterior end and body length = 0.5. Vagina directed anterodorsally, giving rise to 2 divergent uteri. Eggs oval ($N = 20$), 59 ± 3 (55–64) in length by 37 ± 2 (34–40) wide, thick shell, smooth

surface, unembryonated (Fig. 8). Rectum separated from intestine by well-developed valve; thick cuticular lining present (Fig. 6). Conical tail, 88 ± 10 (79–110) in length. Tail length/body length = 0.02.

Taxonomic summary

Type host: Brachymeles orientalis Brown and Rabor, 1967, southern burrowing skink, symbiotype OMNH 44662: collection date July 3, 2014.

Type locality: The Philippines, Western Samar Province, San Jose de Baun, Uno Barangay, Mt. Huraw, 12.05613°N, 125.04754°E.

Additional host: Brachymeles samad Siler, Jones, Diesmos, Diesmos and Brown, 2012, eastern Visayas slender skink (OMNH 44665; collection dates: June 25, 2014).

Site of infection: Large intestine.

Prevalence, number, mean intensity (range): B. orientalis, 57%, 77, 17.5 (2–36); *B. samad*: 20%, 12, 6 (5–7).

Type specimens: Holotype male, HWML 99897; allotype female, HWML 99898; paratype HWML 99899; voucher specimens.

Voucher specimens: *B. orientalis* HWML 99900; *B. samad*: HWML 99901

Etymology: The new species is named in reference to the locality of collection.

Remarks

The structure of the lips, rounded with interlabia absent and not set off from the body, the absence of cordons, and in males the presence of a precloacal sucker with cuticularized rim and caudal alae supported by fleshy papillae (Inglis, 1958) allow assignment of the new species to the Meteterakinae, *Meteterakis*. These characters are evident in *M. hurawensis* (Figs. 2, 3, 5, 10).

Two species of *Meteterakis* have previously been reported from the Philippines, namely, *Meteterakis longispiculata* (Baylis, 1929) (Syn. *Spinicauda longispiculalta* Baylis, 1929; *Meteterakis cophotis* [Baylis, 1935] Inglis, 1958) and *Meteterakis vaucheri* Adamson, 1986. *M. longispiculata* has been reported from *Mabuya multifasciata* Fitzinger, 1826 (currently, *Eutropis multifasciata* [Kuhl, 1820]), *Liopeltis philippinus* (Boettger, 1879), *Xenopeltis unicolor* Reinwardt, 1827, and *Sphenomorphus* sp. by Schmidt and Kuntz (1972). *Meteterakis vaucheri* is currently known only from *Varanus grayi* Boulenger, 1885 (currently, *Varanus olivaceus* Hallowell, 1857) (Adamson, 1986). *Meteterakis hurawensis* n. sp. is easily separated from these 2 species by spicule length: *M. hurawensis*, 315–391; *M. longispiculata*, 630–680, *M. vaucheri*, 1,057–1,242.

Species of *Meteterakis* are distinguished on the basis of male characteristics: number and arrangement of caudal papillae and length and morphology of spicules. Junker et al. (2015) divided the species into 4 groups based on the length of spicules and whether they were equal or unequal, i.e., Group I: spicules equal and of intermediate length; Group II: unequal spicules; Group III: spicules equal and comparatively long; Group IV: short, equal spicules (Table 1).

Meteterakis hurawensis n. sp. belongs to Group IV of Junker et al. (2015), i.e., it possesses short, equal spicules, ranging from 180 to 380 μm. Group IV includes *Meteterakis gambhiri, Meteterakis govindi, Meteterakis mabuyi*, *Meteterakis triaculeata*, and *Meteterakis hurawensis* n. sp. The proximal end of the spicules of *M. mabuyi* and *M. triaculeata* are equal to the width of the shaft (Inglis, 1958); the proximal end of the spicules of *M. gambhiri, M. govindi,* and *M. hurawensis* n. sp. are expanded (Inglis, 1958; Gambhir et al., 2006) and are thus much wider than the shaft. *Meteterakis mabuyi* and *M. govindi* possess 20 pairs of caudal papillae, *M. gambhiri* 10 pairs, and *M. hurawensis* n. sp. 10 pairs. In addition, *M. gambhiri*, *M. mabuyi,* and *M. triaculeata* lack a gubernaculum, which is present in *M. govindi* (Zhang and Zhang, 2011) as well as *M. hurawensis* n. sp.

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