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Research Note

Plagiorchis taiwanensis (Digenea: Plagiorchiidae), *Kurilonema markovi* (Nematoda: Rhabdiasidae) and Other Helminths in *Eumeces latiscutatus* (Scincidae) and *Takydromus tachydromoides* (Lacertidae) from Japan

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ABSTRACT: Helminths from *Eumeces latiscutatus* (*n* 17) and *Takydromus tachydromoides* (*n* 34) from Japan are reported. Two species of Nematoda, *Kurilonema markovi* and *Meteterakis japonica*, and 1 taxon of Acanthocephala, cystacanths of *Centrorhynchus* sp., were found in *E. latiscutatus*; 1 species of Digenea, *Plagiorchis taiwanensis*, and 2 species of Nematoda, *K. markovi* and *Oswaldocruzia filiformis*, were found in *T. tachydromoides*. *Oswaldocruzia yezoensis* is proposed as a synonym of *Oswaldocruzia filiformis*. *Takydromus tachydromoides* represents a new host record for *P. taiwanensis* and Japan is a new locality record.

KEY WORDS: Japan, Trematoda, Nematoda, Lizard, *Plagiorchis taiwanensis*, *Kurilonema markovi*, *Eumeces latiscutatus*, *Takydromus tachydromoides*.

The Far Eastern skink, *Eumeces latiscutatus*, occurs on mainland Japan, a few scattered localities of southwestern Russia, and the Kuril Islands (Szczerbak, 2003). The Japanese grass lizard, *Takydromus tachydromoides*, is restricted to mainland Japan (Welch et al., 1990). *Plagiorchis taiwanensis* Fischthal and Kuntz, 1975, was originally described from specimens taken from the small intestine of a China grass lizard, *Takydromus septentrionalis*, collected in Taipei Prefecture, Taiwan (Fischthal and Kuntz, 1975). *Kurilonema markovi* Szczerbak and Sharpilo, 1969, was described from specimens taken from the lungs of *E. latiscutatus* collected in the Kuril Islands, Russia (Szczerbak and Sharpilo, 1969). To our knowledge, there are no reports of additional hosts or localities for *P. taiwanensis*. The purpose of this note is to report new host and location records for *P. taiwanensis* and to revise the helminth list of *E. latiscutatus* and *T. tachydromoides*.

Seventeen specimens of *E. latiscutatus* collected in 1999 2000 at Hakone (35°30′N; 139°50′E), Kana gawa Prefecture, Honshu Island, Japan, were exam ined for helminths. Lizards were killed with Nembutal, fixed in formalin, and preserved in 70% ethanol. The abdominal cavity of each lizard was opened, and the gastrointestinal tract removed by cutting across the esophagus and rectum. Each tract was slit longitudinally and examined under a dissect ing scope for helminths. The lungs and body cavity were also searched for helminths. When found, helminths were removed to a vial of 70% ethanol for storage. Carcasses of *E. latiscutatus* were de posited in the herpetology collection of the Natural History Museum of Los Angeles County, Los Angeles, California, U.S.A., as LACM 143679 143693, 146587, 146588.

Thirty four specimens of *T. tachydromoides*, a small subsample of the 1,275 individuals collected in 1965 1967 by Telford (1997) at Hanno (35°51′N; 139°00′E), Saitama Prefecture, Honshu Island, Japan, was also examined. These lizards were killed with Nembutal and necropsied within 1 wk of collection. Helminths were counted and fixed in alcohol forma lin acetic acid, then stored in 70% ethanol. Specimens of *T. tachydromoides* were deposited in the herpetol ogy collection of the Florida Museum of Natural History, University of Florida (UF), Gainesville, Florida, U.S.A., with the following accession numbers: UF 130224, 130314, 130367, 130425, 130471, 130606, 130785, 130786, 130797, 130812, 130822, 130901, 131092, 131098, 131798, 131818, 131898, 131913, 132236, 132239, 132266, 132360, 132361, 132365, 132374, 132789, 132801, 132812, 132894, 132897, 132898, 132906, 132908, and 132959.

Helminths from both host taxa were placed indi vidually in a drop of undiluted glycerol on a micro scope slide for study. Voucher specimens were

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deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland.

Eumeces latiscutatus

Seventeen Far Eastern skinks (8 male, 9 female; mean snout vent length [SVL] = 69 ± 10 mm SD, range 51 86 mm) were collected (15 in March 1999; 2 in August 2000) at Hakone (35°30′N; 139°50′E), Kanagawa Prefecture, Honshu Island, Japan (Pale arctic biogeographic region).

Kurilonema markovi Szczerbak and Sharpilo, 1969

(Syn. *Rhabdias* sp. indet. of Telford, 1997; *Entomelas* cf. *markovi* of Hasegawa and Asakawa, 2004).

Prevalence, mean intensity, and range: Hosts infected, 2 of 17 (12%, 5.0 ± 1.4; 4 6).

Site of infection: Lung.

Type host and type locality: Eumeces latiscutatus, Kuril Islands, Russia (Szczerbak and Sharpilo, 1969).

Other reported hosts: Takydromus tachydromoides (Hasegawa and Asakawa, 2004).

Geographic range: Kuril Islands (Szczerbak and Sharpilo, 1969; Kuzmin and Sharpilo, 2002), Japan (Hasegawa and Asakawa, 2004).

Specimens deposited: USNPC 93743, 1 vial.

Remarks: Telford (1997) reported the helminth community of *E. latiscutatus* at Hanno, Saitama Prefecture, Japan, as *Meteterakis japonica* (Wilkie, 1930), *Rhabdias* sp. indet. and cystacanths of *Centrorhynchus*. Telford (1997) did not describe his *Rhabdias* sp. indet. but did publish a photograph in which the diagnostic character of *Kurilonema* can be seen: a relatively large subspherical buccal cavity with dense sclerotized walls of uniform thickness. According to Kuzmin and Sharpilo (2002), a large buccal cavity is the major character differentiating *Kurilonema* from *Rhabdias*. Baker (1980) in a re vision of *Entomelas* designated *Kurilonema* as a synonym of *Entomelas*. However, Kuzmin and Sharpilo (2002) in a redescription of *K. markovi*, rejected the synonymy, maintaining that the absence of onchia in *Kurilonema* versus their presence in *Entomelas* was sufficient morphology to justify the validity of *Kurilonema*. Our specimens lack onchia on the posterior wall of the buccal cavity, thus we have assigned them to *Kurilonema*.

Meteterakis japonica (Wilkie, 1930)

(Syn. *Spinicauda japonica* Wilkie, 1930; *Africana howardi* Li, 1933).

Prevalence, mean intensity, and range: Hosts infected, 7 of 17 (41%, 7.4 ± 6.9; 1 20).

Site of infection: Large intestine.

Type host and type locality: "Bull frog" (? *Rana japonica*), Tokyo, Japan (Wilkie, 1930).

Other reported hosts: Java toad, *Bufo asper* (Myers and Kuntz, 1969); Chusan Island toad, *Bufo gargar izans* (Wang et al., 1978; Hasegawa, 1984, 1989); Japanese toad, *Bufo japonicus* (Hsü, 1933; Yamaguti, 1935, 1941; Telford, 1997; Goldberg and Bursey, 2002); Mongolian toad, *Bufo raddei* (Kung and Wu, 1945); montane brown frog, *Rana ornativentris* (Telford, 1997); *E. latiscutatus* (Telford, 1997); *T. tachydromoides* (Telford, 1997); Siberian pit viper, *Gloydius halys (Kagei, 1973); Japanese rat snake, Elaphe climacophora (Kagei, 1973); Japanese four lined rat snake, Elaphe quadrivirgata (Kagei, 1973); Asian tiger keelback, Rhabdophis tigrinus (Kagei, 1973); yellow spotted pit viper, Protobrothrops flavoviridis (Hori and Kaneko, 1969).*

Geographic range: China (Hsü, 1933; Kung and Wu, 1945; Wang et al., 1978); Japan (Yamaguti, 1935, 1941; Telford, 1997; Goldberg and Bursey, 2002); North Borneo (Myers and Kuntz, 1969); Okinawa (Hasegawa, 1984, 1989). (Although Okinawa is a political subdivision of Japan, it lies within the Oriental biogeographical region rather than the Palearctic biogeographical region and is listed separately.)

Specimens deposited: USNPC 93744, 1 vial.

Remarks: Infection occurs through ingestion of infective ova or larvae at sites of fecal deposition; no intermediate host or vector is known (Telford, 1997).

Centrorhynchus sp. (cystacanths)

Prevalence, mean intensity, and range: Hosts infected, 3 of 17 (18%, 1.3 ± 0.6; 1 2).

Site of infection: Body cavity.

Typical host: Adults are parasites of birds and mammals; amphibians and reptiles may serve as paratenic hosts (Yamaguti, 1963).

Other reported hosts: Centrorhynchid cystacanths have been reported from 20 species of amphibians

and lizards worldwide (see Yamaguti, 1963). In Japan, centrorhynchid cystacanths have been found in the lizard *T. tachydromoides*, and cystacanths of *Centrorhynchus elongatum* have been reported from mammals (Telford, 1997).

Geographic range: Cosmopolitan genus (Yamaguti, 1963).

Specimens deposited: USNPC 93745, 1 vial.

Remarks: The life cycle of acanthocephalans generally requires 2 hosts (Schmidt, 1985). The cycle begins with egg ingestion by an arthropod, which hosts cystacanth development. Ingestion of an infected arthropod by a suitable definitive host leads to cystacanth excystation and maturation in the digestive tract. In an unsuitable host, the cystacanth may excyst, migrate into the body cavity, and reencyst. This is the first report of acanthocephalan cystacanths in *E. latiscutatus*.

Takydromus tachydromoides

Thirty four Japanese grass lizards (21 male, 13 female; SVL = 52 ± 9 mm SD, range 26 63 mm) from Hanno (35°51′N; 139°00′E), Saitama Prefecture, Honshu Island, Japan, were used (4 collected in 1965, 10 in 1966, and 20 in 1967).

Plagiorchis taiwanensis Fischthal and Kuntz, 1975

(Syn. *Glypthelmins rugocaudata* sensu Telford, 1997, nec Yoshida, 1916).

Prevalence, mean intensity, and range: Hosts infected, 26 of 34 (76%, 3.8 ± 5.9; 1 26).

Site of infection: Small intestine.

Type host and type locality: Takydromus septentrionalis, Taipei Prefecture, Taiwan (Fischthal and Kuntz, 1975).

Other reported hosts: None.

Geographic range: Taiwan (Fischthal and Kuntz, 1975); Japan.

Specimens deposited: USNPC 93745, 1 vial.

Remarks: Telford (1997) published a photograph of the digenean in *T. tachydromoides* identified as *G. rugocaudata*. In that photograph, the diagnostic character of *Plagiorchis* can be seen: ascending and descending loops of a posteriorly positioned uterus passing between diagonal testes. *Takydromus tachydromoides* represents the second host species of *P. taiwanensis*. Japan is a new locality record.

Kurilonema markovi Szczerbak and Sharpilo, 1969

Prevalence, mean intensity, and range: Hosts infected, 20 of 34 (59%, 3.4 ± 5.3; 1 25).

Site of infection: Lung.

Specimens deposited: USNPC 93745, 1 vial.

Remarks: Taxonomic summary, distributional summary, and other remarks are presented under *E. latiscutatus*.

Oswaldocruzia filiformis (Goeze, 1782) Travassos, 1917

(Syn. *Ascaris filiformis* Goeze, 1782; *Cucullanus ranae* Goeze, 1782; *Ascaris bufonis* Gmelin, 1790; *Ascaris intestinalis* Gmelin, 1790; *Ascaris tenuissima* Froelich, 1791; *Strongylus auricularis* Zeder, 1800; *Strongylus bialata* Molin, 1861; *Oswaldocruzia socialis* Morishita, 1926; *Oswaldocruzia yezoensis* Morishita, 1926; *Oswaldocruzia molgeta* Lewis, 1928; *Oswaldocruzia skrjabini* Travassos, 1937; *Oswaldocruzia problematica* Ivanitzky, 1940; *Oswaldocruzia goezi* Skrjabin and Schulz, 1952).

Prevalence, mean intensity, and range: Hosts infected, 26 of 34 (76%, 4.1 ± 3.1; 1 11).

Site of infection: Intestine.

Type host and type locality: European frog, *Rana temporaria*, Europe (Goeze, 1782).

Other reported hosts: Firebelly toad, *Bombina bombina* (Kozák, 1969; Moravec and Vojtková, 1975; Rozman, 1976; Vojtková, 1976); yellow belly toad, *Bombina variegata* (Kozák, 1969; Rozman, 1976; Vojtková, 1976); European toad, *Bufo bufo* (Baylis, 1928; Travassos, 1937; Kozlowska, 1960; Vojtková et al., 1963; Kozák, 1969; Hristovski and Riggio, 1971; Schmidt and Enigk, 1972; Frandsen, 1974; Moravec and Vojtková, 1975; Rozman, 1976; Vojtková, 1976; Ryzhikov et al., 1980; Hendrikx, 1983; Galli et al., 2001; V.V. Shimalov and V. T. Shimalov, 2001); natterjack toad, *Bufo calamita* (Frandsen, 1974); *B. japonicus* (Morishita, 1926; Goldberg and Bursey, 2002); square marked toad, *Bufo regularis* (Schad et al., 1960); European green toad, *Bufo viridis* (Kozlowska, 1960; Schad et al., 1960; Kozák, 1969; Hristovski and Riggio, 1971; Frandsen, 1974; Rozman, 1976; Vojtková, 1976;

Ryzhikov et al., 1980; Al Barwari and Nassir, 1983; Yildirimhan, 1999; V. V. Shimalov and V. T. Shimalov, 2001); European treefrog, *Hyla arborea* (Kozlowska, 1960; Kozák, 1969; Frandsen, 1974; Rozman, 1976; Vojtková, 1976; Ryzhikov et al., 1980); Japanese treefrog, *Hyla japonica* (Goldberg et al., 1994); Mediterranean treefrog, *Hyla meridionalis* (Baker, 1981); Eurasian spadefoot toad, *Pelobates fuscus* (Kozlowska, 1960; Kozák, 1969; Antsyshkina et al., 1976; Vojtková, 1976; Ryzhikov et al., 1980); Khabarovsk frog, *Rana amurensis* (Ryzhikov et al., 1980); Moor frog, *Rana arvalis* (Kozlowska, 1960; Vojtková et al., 1963; Kozák, 1969; Plasota, 1969; Frandsen, 1974; Antsyshkina et al., 1976; Vojtková, 1976; Ryzhikov et al., 1980; Borisova, 1988; Cedhagen, 1988); spring frog, *Rana dalmatina* (Kozák, 1969; Frandsen, 1974; Rozman, 1976; Vojtková, 1976); edible frog, *Rana esculenta* (Kozlowska, 1960; Vojtková et al., 1963; Tscherner, 1966; Kozák, 1968, 1969; Plastoa, 1969; Frandsen, 1974; Rozman, 1971, 1976; Vojtková, 1976; Ryzhikov et al., 1980); Japanese brown frog, *R. japonica* (Morishita, 1926); pool frog, *Rana lessonae* (Borisova, 1988); Brusa frog, *Rana macrocnemis* (Schad et al., 1960; Ryzhikov et al., 1980; Yildirimhan et al., 1997); black spotted pond frog, *Rana nigromaculata* (Morishita, 1926); marsh frog, *Rana ridibunda* (Tscherner, 1966; Kozák, 1969; Frandsen, 1974; Rozman, 1976; Ryzhikov et al., 1980); wrinkled frog, *Rana rugosa* (Morishita, 1926); *Rana temporaria* (Morishita, 1926; Baylis, 1928; Travassos, 1937; Kozlowska, 1960; Vojtková et al., 1963; Kozák, 1969; Frandsen, 1974; Moravec and Vojtková, 1975; Rozman, 1976; Vojtková, 1976; Ryzhikov et al., 1980; Sattmann, 1986; Cedhagen, 1988; Griffin, 1989); European fire salamander, *Salamandra salamandra* (Barus et al., 1963; Moravec and Vojtková, 1975); Laurenti's alpine newt, *Triturus alpestris* (Barus and Groschaft, 1962); northern crested newt, *Triturus cristatus* (Kozlowska, 1960; Frandsen, 1974; Vojtková, 1976; Bertman, 1994); palmate newt, *Triturus helveticus* (Lewis, 1928; Avery, 1971); smooth newt, *Triturus vulgaris* (Baylis, 1928; Lewis, 1928; Hsü and Chow, 1938; Taranko Tulecka, 1959; Kozlowska, 1960; Barus and Groschaft, 1962; Vojtková, 1963, 1976; Avery, 1971; Daiya, 1973; Frandsen, 1974; Moravec and Vojtková, 1975; Ryzhikov et al., 1980); slow worm, *Anguis fragilis* (Schad et al., 1960; Sharpilo, 1962, 1976; Moravec, 1963; Bertman and Okulewicz, 1987; Lewin, 1990; Shimalov et al., 2000); sand lizard, *Lacerta agilis* (Moravec, 1963; Moravec and Vojtková, 1975; Okulewicz, 1976; Lewin, 1992; Shimalov et al., 2000); emerald lizard, *Lacerta viridis* (Schad et al., 1960; Moravec, 1963; Moravec and Vojtková, 1975; Biserkov and Kostadinova, 1998; Kirin, 2002a); viviparous lizard, *Lacerta vivipara* (Travassos, 1937; Moravec, 1963; Moravec and Vojtková, 1975; Sanchis et al., 2000; Shimalov et al., 2000); armored glass lizard, *Ophisaurus apodus* (Sharpilo, 1976); Crimean wall lizard, *Podarcis taurica* (Schad et al., 1960); Amur grass lizard, *Takydromus amurensis* (Sharpilo, 1976); smooth snake, *Coronella austriaca* (Sharpilo, 1976); grass snake, *Natrix natrix* (Moravec, 1963; Moravec and Vojtková, 1975; Bertman and Okulewicz, 1987; Biserkov, 1995; Kirin, 2002b); dice snake, *Natrix tessellata* (Sharpilo, 1976); European tiger snake, *Telescopus fallax* (Sharpilo, 1976); sand viper, *Vipera ammodytes* (Sharpilo, 1976); common viper, *Vipera berus* (Moravec, 1963; Markov and Mozgovoi, 1969; Moravec and Vojtková, 1975).

Geographic range: Palearctic (Baker, 1981).

Specimens deposited: USNPC 93745, 1 vial.

Remarks: Three species of *Oswaldocruzia* have been described from Japanese (Palearctic Realm) hosts: *Oswaldocruzia insulae* Morishita, 1926, *O. socialis*, and *O. yezoensis*. Both *O. socialis* and *O. yezoensis* have lateral alae; *O. insulae* lacks lateral alae. Given possible variation within species of *Oswaldocruzia* as illustrated by Moravec and Vojtková (1975), especially variation in spicule morphology, and given the measurements provided by Morishita (1926), we propose *O. yezoensis* as a synonym of *O. socialis*.

Travassos (1937) considered both *O. insulae* and *O. socialis* as synonyms of *O. filiformis*. However, Yamaguti (1961) considered *O. socialis* a synonym of *Oswaldocruzia bialata* (Molin) 1860, and *O. insulae* a synonym of *O. filiformis*. Moravec and Vojtková (1975) synonymized *O. bialata* with *O. filiformis*. We accept the *O. socialis* and *O. bialata* synonymies with *O. filiformis* because of the presence of lateral alae, but we retain *O. insulae* as a valid species because of its lack of lateral alae. Thus, we consider 2 species of *Oswaldocruzia* to occur in Japan, namely *O. filiformis* and *O. insulae*.

DISCUSSION

Telford (1997) reported the helminth community of *T. tachydromoides* at Hanno, Saitama Prefecture, Japan, to include the trematode, *G. rugocaudata*, the nematodes, *Hexametra quadricornis*, *M. japonica*, *O. filiformis*, *O. socialis*, *Rhabdias* sp. indet., and the acanthocephalans, *Acanthocephalus lucidus* Van

Cleave, 1925, and cystacanths of *Centrorhynchus* sp.; sympatric *E. latiscutatus* harbored *M. japonica*, *Rhabdias* sp. indet., and cystacanths of *Centrorhynchus*. In addition, Goldberg et al. (1993) reported *E. latiscutatus* from Hyogo Prefecture, Honshu Island, to harbor *Aplectana macintoshii* (Stewart, 1914).

Given the redeterminations of *G. rugocaudata* as *P. taiwanensis* and *Rhabdias* sp. indet. as *K. markovi*, the helminth list for *E. latiscutatus* is *A. macintoshii*, *K. markovi*, *M. japonica*, centrorhynchid cystacanths; and the helminth list for *T. tachydromoides* is *P. taiwanensis*, *H. quadricornis*, *K. markovi*, *M. japonica*, *O. filiformis*, *A. lucidus*, and centrorhynchid cystacanths. *Takydromus tachydromoides* is a new host record and Japan is a new locality record for *P. taiwanensis*.

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