Helminth records for the Madagascan giant day gecko, *Phelsuma grandis* (Gekkonidae) from Hawai'i¹

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The Madagascan giant day gecko, *Phelsuma grandis* Gray is native to Madagascar (Henkel & Schmidt, 2000). This species was first collected in Hawai'i in December 1996 in Mānoa Valley, O'ahu where it was intentionally established (Kraus, 2002, as "*P. mada-gascariensis*").

Between 1996 and 2008, 60 *P. grandis* were collected on O'ahu, (mean snout-vent length, SVL = 87 mm \pm 26.7 SD, range = 34–118 mm), fixed in 10% formalin then transferred to 70% ethanol for storage in the herpetology collection of the Bishop Museum (BPBM), Honolulu, Hawai'i. The following specimens of *P. grandis* were loaned to SRG and examined at Whittier College, Whittier, California: BPBM 13285, 14089, 14092, 14756, 18226, 18227, 20990, 20999, 21000, 21138-21140, 21142, 21143, 21150, 21151, 23521, 23597, 23601-23603, 23917, 23918, 23975, 24106, 24107, 24110, 24112, 24123, 24217, 24710-24712, 24718, 25360, 25589, 27297, 28353-28357, 28361-28364, 28664-28663, 28665-28667, 31551. The gastrointestinal tract and lungs were removed and searched for helminths. Nematodes and pentastomes were placed in glycerol on glass slides, allowed to clear and examined under a light microscope. Voucher helminths were placed in vials of alcohol and deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland and the Bishop Museum, Honolulu (BPBM). The following species were found and are recorded below as new host records.

Cestoda: Linstowiidae

Oochoristica javaensis Kennedy, Killick New host record & Beverlev-Burton

Oochoristica javaensis was originally described from the small intestines of geckos, *Gehyra mutilata, Hemidactylus platyurus,* and *H. frenatus* from Java, Indonesia (Kennedy *et al.,* 1982), and there is one report from Hawai'i (*H. frenatus;* Goldberg & Bursey, 2000a). It is a wide-ranging species currently known only from lizards: a second report in *H. platyurus* from Indonesia (Matsuo & Oku, 2002); additional reports in *Gehyra mutilata* from Guam, Indo-nesia, and the Philippine Islands (Kugi, 1993; Goldberg *et al.,* 1998; Matsuo & Oku, 2002; Goldberg *et al.,* 2005); *Gehyra oceanica* from Guam and Oceania (Goldberg *et al.,* 1998; Goldberg & Bursey, 2002); additional reports in *H. frenatus* from Oceania, Philippines and Thailand (Hanley *et al.,* 1998; Goldberg & Bursey, 2001a, 2002); *Lepidodactylus paurolepis* from the Marshall Islands (Goldberg & Bursey, 2002); *Mabuya carinata* from Bangladesh (Yesmin *et al.,* 2006) and *Sphenomorphus jobiensis* from Papua New Guinea (Bursey *et al.,* 2005). Criscione & Font (2001) reported *O. javaensis* in nonnative *Hemidactylus turcicus* collected in the southern United States and they experimentally infected nonnative *Hemi*

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dactylus garnotii and native Sceloporus undulatus. Prevalence (number infected hosts/ number hosts examined): 1/60 (2%); mean intensity (mean number parasites per infected host): 1.0, infection site, small intestine.

Material examined: O'AHU (BPBM F328).

Nematoda: Seuratidae

Skrjabinelazia machidai Hasegawa New host record

Skrjabinelazia machidai was originally described from the intestine of the gekko, Gekko japonicus from Okinawa Island, Japan by Hasegawa (1984). In Hawai'i, it was first found in Lepidodactylus lugubris by Goldberg & Bursey (1997) and subsequently reported in L. lugubris and Hemidactylus frenatus by Hanley et al. (1998) and Goldberg & Bursey (2000a). It has also been reported from Australia in the gecko Diplodactylus ciliaris (Goldberg & Bursey, 2001b), as well as Gehyra mutilata, Hemidactylus garnotii, Lepidodactylus moestus from Oceania (Goldberg & Bursey, 2002), and Leptodactylus aureolineatus from the Philippines (Goldberg & Bursey, 2001a). There is one additional report for Hemidactylus frenatus from Guam (Goldberg et al., 1998). Prevalence: 2/60 (3%): mean intensity: $2.0 \pm$ 1.4: range 1–3; infection site, small intestine.

Material examined: O'AHU (BPBM H408; USNPC 101876).

Nematoda: Pharyngodonidae

Spauligodon hemidactylus Bursey & Goldberg New host record

Spauligodon hemidactylus was originally described from the large intestine of the gecko Hemidactylus frenatus from American Samoa by Bursey & Goldberg (1996), who also reported it from *H. frenatus* collected in Hawai'i, Fiji, Guam, Marshall Islands, Palau, Philippines, Samoa, Solomon Islands, Society Islands, Vanuatu, and Thailand. It was also reported in H. frenatus from Hawai'i by Hanley et al. (1998) and Goldberg & Bursey (2000a). It is currently known only from lizards. Other hosts include Hemidactylus platyurus, Gehyra mutilata, H. garnotii, Hemiphyllodactylus typus and Lepidodactyus lugubris (Goldberg et al, 1998, 2005; Goldberg & Bursey, 2001a, 2002; Matsuo & Oku, 2002) Prevalence: 2/60 (3%); mean intensity: 1.0, infection site large intestine.

Material examined: O'AHU (USNPC 101877).

Nematoda: Spirocercidae

Physocephalus sp. (larvae)

Adults of *Physocephalus* have been found in the stomachs of swine, horses, cattle, and rabbits: infective larvae have been recovered from dung beetles and are found in terrestrial vertebrates which have ingested infected beetles (Anderson, 2000). Larvae of Physocephalus sp. were first reported from Hawai'i in Hemidactylus frenatus, H garnotii, and Lepidodactyus lugubris by Brown et al. (1995). Hanley et al. (1998) provided a second report for H. frenatus and there is a third report for this host (Goldberg & Bursey 2000a). Other lizards from Hawaii harboring this species include Anolis carolinensis, Gehyra mutilata, and Lampropholis delicata (Goldberg et al., 2004). Prevalence: 21/60 (35%); mean intensity: 12.6 ± 10.8 SD: range 1–32, infection site, stomach wall.

New host record

Material examined: O'AHU (BPBM H409; USNPC 101878).

Pentastomida: Cephalobaenidae

Raillietiella frenatus Ali, Riley & Self

New host record

Raillietiella frenatus was originally described from the lungs of *Hemidactylus frenatus* collected in Malaysia by Ali *et al.* (1981), who reported it from the same host from the Philippine Islands, South Vietnam, Taiwan, and Thailand. *Raillietiella frenatus* was first reported in *H. frenatus* and *Lepidodactylus lugubris* from Hawai'i by Brown *et al.* (1995). Goldberg & Bursey (1997) provided a second report for *L. lugubris*. It was subsequently reported in both hosts by Hanley *et al.* (1998). Goldberg & Bursey (2000a) provided a third report for *H. frenatus* and a first report for *Anolis sagrei* (Goldberg & Bursey, 2000b). It is known only from lizard hosts, which include *Hemidactylus platyurus, Gehyra mutilata, Gekko monarchus, Japalura swinhonis,* and *Mabuya longicaudata* from Indonesia and Taiwan (Ali *et al.*, 1981; Matsuo & Oku, 2002). Prevalence: 19/60 (32%); mean intensity: 3.7 ± 3.5 SD: range 1–14, infection site: lung.

Material examined: O'AHU (BPBM H410; USNPC 101879).

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Literature Cited

- Ali, J.H., Riley, J. & Self, J.T. 1981. A revision of the taxonomy of the blunt-hooked *Raillietiella*, pentastomid parasites of African, South-East Asian and Indonesian lizards, with a description of a new species. *Systematic Parasitology* 3: 193–207.
- Anderson, R.C. 2000. Nematode parasites of vertebrates: their development and transmission. Second edition. CABI Publishing, Wallingford, UK. 650 p.
- Brown, S.G., Kwan, S. & Shero, S. 1995. The parasitic theory of sexual reproduction: parasitism in unisexual and bisexual geckos. *Proceedings of the Royal Society of London* 260: 317–320.
- Bursey, C.R. & Goldberg, S.R. 1996. Spauligodon hemidactylus n. sp. (Nematoda: Pharyngodonidae) from *Hemidactylus fernatus* (Reptilia: Gekkonidae) from Oceania. *Journal of Parasitology* 82: 299–301.
 - —., S.R. Goldberg & Kraus, F. 2005. Endoparasites in *Sphenomorphus jobiensis* (Sauria: Scincidae) from Papua New Guinea with description of three new species. *Journal of Parasitology* **91**: 1385-1394.
- Criscione, C.D. & Font, W.F. 2001. The guest playing host: colonization of the introduced Mediterranean gecko, *Hemidactylus turcicus*, by helminth parasites in southeastern Louisiana. *Journal of Parasitology* 87: 1273–1278.
- Goldberg, S.R., & Bursey, C.R. 1997. New helminth records for the mourning gecko, Lepidodactylus lugubris (Gekkonidae) from Hawaii. Bishop Museum Occasional Papers 49: 54–56.

— & Bursey, C.R. 2000a. Helminth records for the house gecko, *Hemidactylus fre-natus* (Gekkonidae) from Hawai'i. *Bishop Museum Occasional Papers* 64: 56–59.

—. & Bursey, C.R. 2000b. Transport of helminths to Hawaii via the brown anole, *Anolis sagrei* (Polychrotidae). *Journal of Parasitology* **86**: 750–755.

—. & Bursey, C.R. 2001a. Gastrointestinal helminths of gekkonid lizards (Sauria Gekkonidae) from the Philippine Islands and Thailand. *Comparative Parasitology* **68**: 138–142.

—. & Bursey, C.R. 2001b. Intestinal helminths of seven species of gekkonid lizards (Sauria: Gekkonidae) from Western Australia. *Journal of the Royal Society of Western Australia* 84: 23–27.

—. & Bursey, C.R. 2002. Gastrointestinal helminths of seven gekkonid lizard species (Sauria: Gekkonidae) from Oceania. *Journal of Natural History* **36**: 2249–2264.

—, Bursey, C.R., & Cheam, H. 1998. Gastrointestinal helminths of four gekkonid lizards, *Gehyra mutiliata, Gehyra oceanica, Hemidactylus frenatus* and *Lepidodactylus lugubris* from the Mariana Islands, Micronesia. *Journal of Parasitology* **84**: 1295–1298.

—, Bursey, C.R. & Kraus, F. 2004. New helminth records for the green anole, *Anolis carolinensis* (Polychrotidae), stump-toed gecko, *Gehyra mutilata* (Gekkonidae), and the metallic skink, *Lampropholis delicata* (Scincidae) from Hawai'i. *Bishop Museum Occasional Papers* **79**: 58–62.

—, Bursey, C.R. & Telford Jr., S.R. 2005. Metazoan endoparasites of four species of lizards, *Gehyra mutilata, Hemidactylus frenatus* (Gekkonidae), *Mabuya cumingi, Mabuya multifasciata* (Scincidae), and one species of snake, *Ramphotyphlops braminus* (Typhlopidae), from the Philippine Islands. *Comparative Parasitology* **72**: 88–101.

- Hanley, K.A., Petren, K. & Case, T.J. 1998. An experimental investigation of the competitive displacement of a native gecko: no role for parasites. *Oecologia* 115: 196–205.
- Hasegawa, H. 1984. Skrjabinelazia machidai sp. n. (Nematoda: Seuratidae) from Gekko japonicus on Okinawa Island, Japan., Zoological Science 1: 483–486.
- Henkel, F-W. & Schmidt, W. 2000. Amphibians and reptiles of Madagascar and the Mascarene, Seychelles, and Comoro Islands. Kreiger Publishing Company, Malabar, Florida. 316 p.
- Kennedy, M.J., Killick, L.M. & Beverly-Burton, M. 1982. Oochoristica javaensis n. sp. (Eucestoda: Linstowiidae) from Gehyra mutilata and other gekkonid lizards (Lacertilia: Gekkonidae) from Java, Indonesia. Canadian Journal of Zoology 60: 2459–2463.
- Kraus, F. 2002. New records of alien reptiles in Hawai'i. Bishop Museum Occasional Papers 69: 48–52.
- Kugi, G. 1993. Three new cestodes from reptiles collected on Amami-oshima Island, Japan. Japanese Journal of Parasitology 42: 415–421.
- Matsuo, K. & Oka, Y. 2002. Endoparasites of three species of house geckos in Lampung, Indonesia. *Journal of Helminthology* 76: 53–57.
- Yesmin, S., d'Slova, J. & Begum, A. 2006. Infestation of helminth parasites in the skink (Mabuya carinata). Dhaka University Journal of Biological Science 15: 113–119.