



Sandflies (Diptera: Psychodidae: Phlebotominae) Feeding on a Red-banded Wolfsnake (*Lycodon rufozonatus*) and Its Prey, a Collared Reedsnake (*Calamaria pavementata*)

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Female sandflies (Psychodidae, Phlebotominae) are hematophagous dipterans that feed on a variety of vertebrates, with many species feeding on amphibians and reptiles (Harwood and James 1979; Akhoundi et al. 2016). These sandflies can be vectors of trypanosomes that are pathogens of zoonotic concern (Mendoza-Roldan et al. 2021). Few records document sandflies feeding on snakes (e.g., Snyman 2020; Mendoza-Roldan et al. 2021), although sandflies have been suggested as vectors of trypanosomes that infect snakes (Viola et al. 2008; Sato et al. 2009; Chen et al. 2019). Whereas sandflies are known to feed on snakes in captivity (Quate 1964; Chaniotis 1967), confirmed instances of sandflies feeding on snakes in nature are rare.

At 2235 h on 21 September 2021, while searching for herpetofauna along the Northern-Cross Island Highway in Baling, Fuxing District, Taoyuan, Taiwan (24.64714 N; 121.41505 E), I encountered a Red-Banded Wolfsnake (*Lycodon rufozonatus*) feeding on a Collared Reedsnake (*Calamaria pavementata*) in a hole in a rock wall. Closer inspection revealed a number of sandflies on both snakes (Fig.

1), at least 7–8 on the *L. rufozonatus* and at least 1–2 on the *C. pavementata*, most of which had already been ingested by the *L. rufozonatus*. Some of the sandflies flew around when the snakes moved or brushed against the rock wall, but most were feeding (Fig 2). After completely ingesting the *C. pavementata*, the *L. rufozonatus* was last seen lying on the side of the road.

The absence of records of sandflies feeding on snakes in Taiwan is unknown, but likely reflects the small size and brief feeding duration of sandflies, making them easy to overlook. Snake behavior might also play a role; *Lycodon rufozonatus*, although common, is an active terrestrial hunter that seldom remains stationary for any length of time and the fossorial *Calamaria pavementata* is rarely encountered (Tu 2004). The present observation undoubtedly was facilitated by the *L. rufozonatus* remaining relatively still while ingesting its prey, but whether that attracted the sandflies or they were already feeding when predation occurred is unknown.

Although some past surveys in Taiwan have collected hundreds of sandflies (e.g., Teng et al. 2008), they are gen-



Figure 1. A Red-Banded Wolfsnake (*Lycodon rufozonatus*) feeding on a Collared Reedsnake (*Calamaria pavementata*). At least four sandflies (Psychodidae) (red arrows) are evident on the *L. rufozonatus* (left) and one on the *C. pavementata* (right). Photographs by Janus Olajuan Boediman.



Figure 2. Sandflies (Psychodidae) feeding on a Red-Banded Wolfsnake (*Lycodon rufozonatus*) with penetrating mouthparts indicative of active feeding. Photograph by Janus Olajuan Boediman.

erally not considered common on the island. Two genera, *Phlebotomus* and *Sergentomyia*, have been recorded in Taiwan: (Gates and Lien 1970; Teng et al. 2008); the latter feeds primarily on ectotherms, whereas the former generally feeds on mammals (Akhoundi et al. 2016), suggesting that the sandflies observed on the two snakes are most likely species of *Sergentomyia*, although identification from images is difficult. To the best of my knowledge, this is the first report of sandflies feeding on a Red-Banded Wolfsnake (*L. rufozonatus*) or a Collared Reedsnake (*C. pavimentata*).

Literature Cited

- Akhoundi, M., K. Kuhls, A. Cannet, J. Votypka, P. Marty, P. Delaunay, and D. Sereno. 2016. A historical overview of the classification, evolution, and dispersion of *Leishmania* parasites and sandflies. *PLoS Neglected Tropical Diseases* 10: e0004349. <https://doi.org/10.1371/journal.pntd.0004349>.
- Chaniotis, B.N. 1967. The biology of California *Phlebotomus* (Diptera: Psychodidae) under laboratory conditions. *Journal of Medical Entomology* 4: 221–233. <https://doi.org/10.1093/jmedent/4.2.221>.
- Chen, H., J. Li, J. Zhang, X. Guo, J. Liu, J. He, Q. Song, J. Zhang, M. Chen, Z. Zheng, D. Chen, and J. Chen. 2019. Multi-locus characterization and phylogenetic inference of *Leishmania* spp. in snakes from Northwest China. *PLoS One* 14: e0210681. <https://doi.org/10.1371/journal.pone.0210681>.
- Gates, M.D. and J.C. Lien. 1970. The *Phlebotomus* of Taiwan. *Journal of Medical Entomology* 7: 529–543. <https://doi.org/10.1093/jmedent/7.5.529>.
- Harwood, R.F. and M.T. James. 1979. *Entomology in Human and Animal Health*. Macmillan Publishing Co., Inc., New York, New York, USA.
- Mendoza-Roldan, J.A., M.A. Mendoza-Roldan, and D. Otranto. 2021. Reptile vector-borne diseases of zoonotic concern. *International Journal for Parasitology: Parasites and Wildlife* 15: 132–142. <https://doi.org/10.1016/j.ijppaw.2021.04.007>.
- Quate, L.W. 1964. *Phlebotomus* sandflies of the Paloich area in the Sudan (Diptera, Psychodidae). *Journal of Medical Entomology* 1: 213–268. <https://doi.org/10.1093/jmedent/1.3.213>.
- Sato, H., A. Takano, H. Kawabata, Y. Une, H. Watanabe, and M.M. Mukhtar. 2009. *Trypanosoma* cf. *varani* in an imported ball python (*Python reginus*) from Ghana. *Journal of Parasitology* 95: 1029–1033. <https://doi.org/10.1645/JE-1816.1>.
- Snyman, L.P. 2020. Review of mosquitoes (Diptera: Culicidae) from the Afrotropical region using herpetofauna as hosts: conservation and epidemiological consequences of knowing little about many species. *Austral Entomology* 60: 163–171. <https://doi.org/10.1111/aen.12501>.
- Teng, H.-J., L.-C. Lu, S.-W. Jian, D.-D. Ji, and C. Lin. 2008. A survey of sandflies in Fushin Township, Taoyuan County, Taiwan and a PCR diagnostic method of sandfly infection. *Taiwan Epidemiology Bulletin* 24: 541–555.
- Tu, M.-C. 2004. *Amazing Snakes [蛇類大驚奇]*. Yuan-Liou Publishing Co., Taipei, Taiwan.
- Viola, L.B., M. Campaner, C.S. Takata, R.C. Ferreira, A.C. Rodrigues, R.A. Freitas, M.R. Duarte, K.F. Grego, T.V. Barrett, E.P. Camargo, and M.M. Teixeira. 2008. Phylogeny of snake trypanosomes inferred by SSU rDNA sequences, their possible transmission by phlebotomines, and taxonomic appraisal by molecular, cross-infection and morphological analysis. *Parasitology* 135: 595–605. <https://doi.org/10.1017/S0031182008004253>.