

## New Geographic Records of Soft Ticks (Ixodida: Argasidae) Parasitic on Bats (Mammalia: Chiroptera) from the Philippines

ACE KEVIN S. AMARGA<sup>1, 2, 3</sup>, RICHARD G. ROBBINS<sup>4, 5, 6</sup>

<sup>1</sup>Biodiversity Program, Taiwan International Graduate Program, Biodiversity Research Center, Academia Sinica, Nangang District, Taipei 11529, Taiwan. Email: ace\_amarga061@yahoo.com

<sup>2</sup>School of Life Science, National Taiwan Normal University- Gongguan Campus, Wenshan District, Taipei 11677, Taiwan

<sup>3</sup>International Union for Conservation of Nature Species Survival Commission (IUCN SSC) Parasite Specialist Group

<sup>4</sup>Walter Reed Biosystematics Unit, Smithsonian Institution, Museum Support Center, Suitland, Maryland 20746, U.S.A.

<sup>5</sup>One Health Branch, Walter Reed Army Institute of Research, Silver Spring, Maryland 20910, U.S.A.

<sup>6</sup>Department of Entomology, Smithsonian Institution, National Museum of Natural History, Washington, DC 20560, U.S.A.

**Abstract:** The Argasidae (soft ticks) is a family of medically important blood-feeding arachnids that parasitize terrestrial vertebrates. In this paper, we present additional geographic records of bat-associated soft ticks belonging to the genera *Argas* Latreille and *Ornithodoros* Koch collected in the Philippines. These records include the first report of *Argas pusillus* Kohls from Balabac Island and the initial findings of *Ornithodoros batuensis* Hirst from Batan, Bohol, and Panay Islands. These discoveries enhance our understanding of the distribution of these tick species in the Philippines, which is relevant for assessing their potential impact on public health.

**Keywords:** Argasidae, ectoparasites, Philippines, Pteropodidae, Vespertilionidae.

### Introduction

The family Argasidae, also known as soft ticks, is one of three extant tick families primarily characterized by the absence of a sclerotized scutum. Instead, they have a leathery and wrinkled cuticle, which is why they are commonly referred to as 'soft ticks.' Unlike hard ticks (family Ixodidae), which exhibit prominent sexual dimorphism, soft ticks lack such a feature, and distinguishing between adult males and females is possible only by examining the genital aperture. In males, the anterior margin of the aperture is more highly chitinized, resembling a human thumbnail, while in females, both margins are equally but lightly chitinized, resembling a pair of human lips (Nadolny et al. 2021). Late-stage nymphs may possess a pregenital pore, and the gnathosoma of argasid ticks is not visible in adults when viewed dorsally. This group currently comprises more than 190 species belonging to an indeterminate number of genera, although this report recognizes the five genera accepted by Guglielmone et al. (2010).

Argasid ticks parasitize reptiles, birds, and mammals, especially those that burrow, roost, or live in colonies (Diehl et al., 1982; Vial, 2009). Many argasid ticks can serve as reservoirs, amplifiers, or vectors of a broad range of pathogenic agents, including viruses, rickettsiae, borreliae, protozoans, and microfilariae (Hoogstraal, 1985; Lopez et al., 2016) or can cause allergic reactions resulting in skin lesions (Buczek et al., 2018). Accordingly, many argasid species are specific parasites of bats, including species belonging to the genera *Antricola* Cooley and Kohls, *Argas* Latreille, *Nothoaspis* Keirans and Clifford (presumably), as well as *Ornithodoros* Koch. As endophilic species, argasid ticks parasitizing bats typically inhabit crevices within the roosting sites of their hosts. Bat-associated argasid ticks exhibit a wide range of host preferences, with some feeding on multiple genera of bats (Sándor et al., 2021). Unlike other bat ectoparasites, such as bat flies (Nycteribiidae and Streblidae), relatively few reports have documented the bat-associated argasid ticks of the Philippines, although significant contributions have been made by Kohls (1950), Wilson (1970), Klompen et al. (1995), and Amarga et al. (2017). In this paper, we present new geographic records for the bat argasids *Argas pusillus* Kohls and *Ornithodoros batuensis* Hirst in the Philippines and provide an overview of the distribution of the two species across their respective ranges.

### Material and Methods

Bats were collected using mist netting, and ticks were carefully removed with fine-tipped forceps and preserved in 95% ethanol prior to identification. Specimens were examined and photographed under a Leica S9D dissecting microscope and identified to species based on the morphological descriptions of Kohls (1950) and Dumbleton (1958). Host species names were determined according to Burgin et al. (2020), and argasid species names were obtained from the list provided by Guglielmone et al. (2010).

### Results and Discussion

稿件收到 Received: 29 April 2023

稿件接受 Accepted: 24 July 2023

稿件出版 Published: 25 September 2023

Superorder Parasitiformes Reuter, 1909  
Order Ixodida Leach, 1815  
Family Argasidae Koch, 1844  
Subfamily Argasinae Koch, 1844  
Genus *Argas* Latreille, 1795

***Argas pusillus* Kohls, 1950**  
**(Fig. 1A–B)**

*Argas pusillus* Kohls, 1950: 1. Repository: ♂ holotype in Field Museum of Natural History, Chicago, Illinois. Type locality: Philippines (Palawan). Type host: unspecified bat.

**Material examined: PHILIPPINES:** Balabac Island: on *Scotophilus kuhlii* Leach (Fig. 2): 6 larvae, X.2019, coll. J. Cantil.

**Philippine records:** Balabac (new island record), Cuyo, Luzon, Mindanao and Palawan (Kohls 1950, Parrish 1971; **this study**).

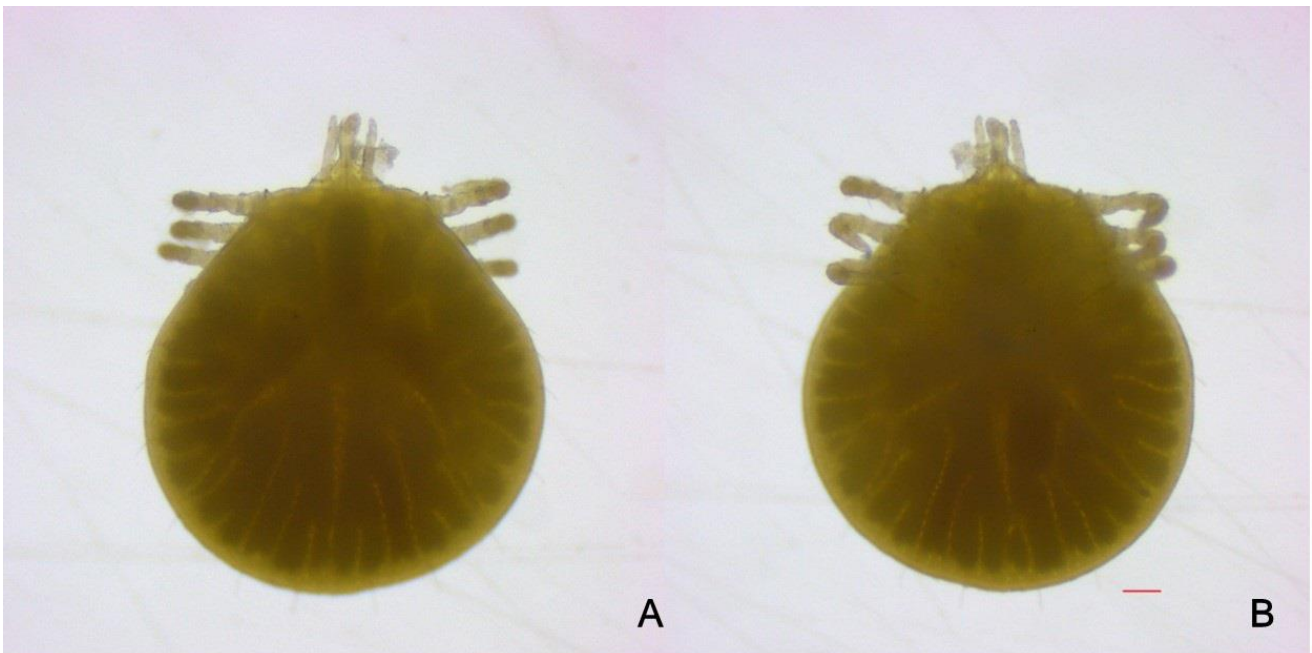


Figure 1. Dorsal (A) and ventral (B) views of an *Argas pusillus* larva collected from Balabac Island, Philippines. Scale bar = 100  $\mu\text{m}$ .

*Argas pusillus* is one of two bat-associated soft ticks belonging to the genus *Argas* that have been recorded in the Philippines, with the other being *A. vespertilionis* (Latreille). Kohls (1950) described *A. pusillus* as a new species based on a male holotype specimen collected from an unknown bat host in the municipality of Brooke's Point on Palawan Island. This species is widespread in the Oriental faunal region, extending northward to the Palearctic region and southward to the Australasian region (Camicas et al., 1998; Petney et al., 2019). It has been documented in several Asian countries, including Malaysia (Audy et al., 1960), Singapore (Leong et al., 2010; Kwak, 2018), Taiwan (Robbins, 2005), Thailand (Uchikawa & Kobayashi, 1978), and the Philippines (Kohls, 1950). In the Philippines, *A. pusillus* was previously recorded from the following islands: Cuyo, Luzon, Mindanao, and Palawan (Kohls, 1950; Parrish, 1971). In this paper, we present the first record of *A. pusillus* from Balabac Island, which is the southernmost island of Palawan Province. The specimens were collected from an adult Lesser Asiatic Yellow Bat (*Scotophilus kuhlii* Leach), an insectivorous species that is widespread in South and Southeast Asia, including southern parts of China and Taiwan (Srinivasulu & Srinivasulu, 2019). The primary hosts of *A. pusillus* are insectivorous bats in the family Vespertilionidae, especially members of the genera *Scotophilus* Leach and *Pipistrellus* Kaup. Thus, collections of this species from other bat groups, such as flying foxes (family Pteropodidae) and birds (see the account of Parrish, 1971), can be considered instances of facultative or accidental parasitism.



Figure 2. *Scotophilus kuhlii* (Vespertilionidae), one of the hosts of *Argas pusillus* across its geographic range.

Subfamily Ornithodorinae Pospelova-Shtrom, 1946

Genus *Ornithodoros* Koch, 1844

***Ornithodoros batuensis* Hirst, 1929**

(Figs 3–4)

*Ornithodoros batuensis* Hirst, 1929: 365. Repository: unspecified. Type locality: Malaysia (Selangor). Type host: unspecified.

**Material examined:** **PHILIPPINES: Batan Island:** on *Eonycteris spelaea* (Dobson) (Fig. 5): 3 larvae, Baranggay Lagundi (13.223052N, 124.004372E), Rapu-Rapu municipality, Albay Province, XII.2015, coll. A.K. Amarga & R. Ante. **Bohol Island:** on *Rousettus amplexicaudatus* (E. Geoffroy): 1 larva, Baranggay Tawid (9.822839N, 124.531224E), Candijay municipality, 14.I.2012, coll. K.L. Phelps; on *E. spelaea*: 1 larva, Baranggay Santo Tomas (10.054870N, 124.314673E), Trinidad municipality, 26.II.2012, coll. K.L. Phelps; on *E. spelaea*: 6 larvae Baranggay Tawid (9.822839N, 124.531224E), Candijay municipality, 14.I.2012, coll. K.L. Phelps. **Panay Island:** on *R. amplexicaudatus*: 10 larvae, Baranggay Jayobo (11.102763N, 122.408952E), Lambunao municipality, Iloilo Province, 6-12.III.2017, coll. A.K. Amarga.

**Philippine records:** Batan (new island record), Bohol (new island record), Luzon, Marinduque, Mindanao, Negros, Panay (new island record) and Samal (Kohls 1950, Parrish 1971, Klompen et al. 1995, Amarga et al. 2017; **this study**).

*Ornithodoros batuensis* was first described based on a male and a nymph collected in the Batu Caves of Selangor, a state situated on the west coast of Peninsular Malaysia (Hirst, 1929). This species is widespread across Southeast Asia, extending into the Australasian region (Petney et al., 2019; Kazim et al., 2021). It has been recorded in the following countries: Indonesia (Durden et al., 2008), Malaysia (Hirst, 1929; Dumbleton, 1958; Klompen et al., 1995), Papua New Guinea (Klompen et al., 1995), Philippines (Kohls, 1950; Parrish, 1971; Amarga et al., 2017), and Thailand (Uchikawa & Kobayashi, 1978; Klompen et al., 1995). In the Philippines, *O. batuensis* has been recorded on the following islands: Luzon (Parrish, 1971), Marinduque (Amarga et al., 2017), Mindanao (Kohls, 1950), Negros (Klompen et al., 1995), Samal (Kohls, 1950), and Sibuyan (Klompen et al., 1995). Additionally, our records of *O. batuensis* on Batan (Albay Province), Bohol, and Panay are the first for these islands. These findings imply that *O. batuensis* is widespread across the Philippine archipelago, and we expect that this species will be found on other islands, including Cebu, Leyte, Mindoro, Palawan, Samar, and Siquijor. *Ornithodoros batuensis* primarily parasitizes Pteropodidae (Amarga et al., 2017), especially species belonging to the genera *Eonycteris* Dobson (dawn bats) and *Rousettus* Gray (rousette bats) (Klompen et al., 1995). In caves containing mixed colonies of *Eonycteris* and *Rousettus*, *O. batuensis* has been collected together with the streblid bat fly *Megastrebla parvior* (Maa) and the fruit bat ischnopsyllid flea *Thaumapsylla breviceps* Rothschild (Amarga et al., 2017).



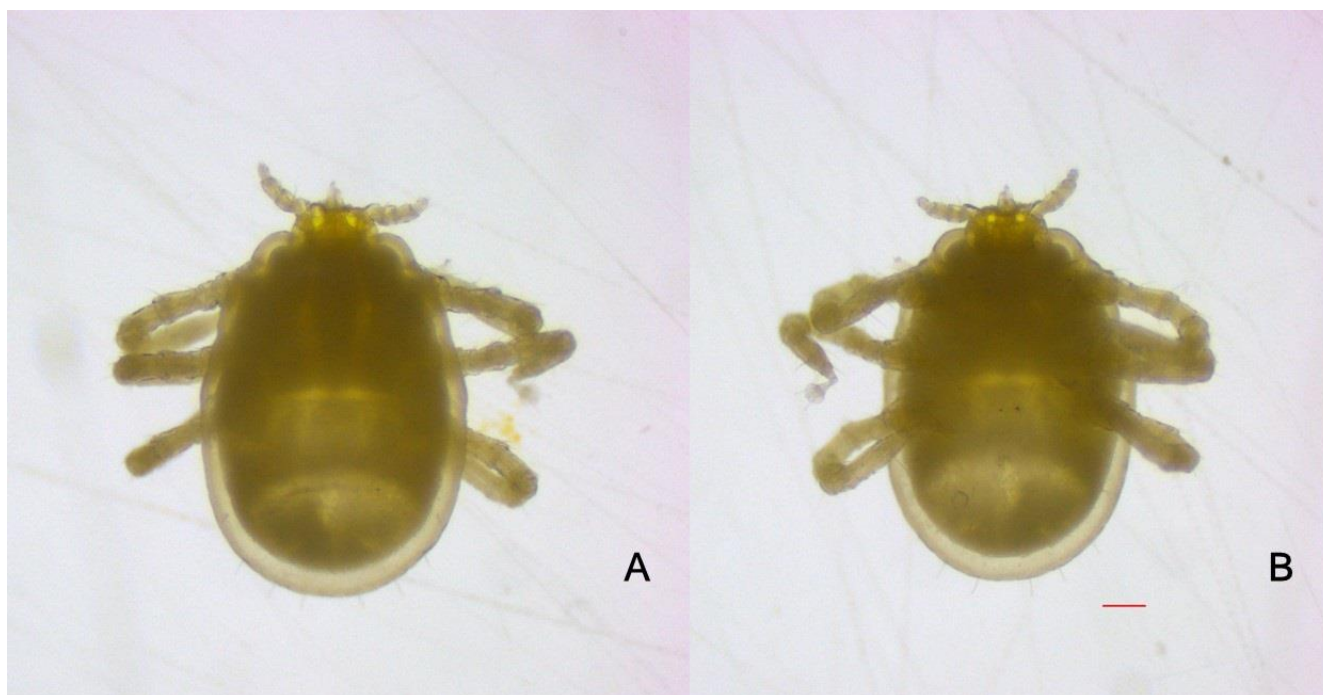


Figure 3. Dorsal (A) and ventral (B) views of an *Ornithodoros batuensis* unfed larva collected on Bohol Island, Philippines. Scale bar = 100  $\mu$ m.



Figure 4. *Ornithodoros batuensis* larvae on the lower back of *Rousettus amplexicaudatus* from Iloilo, Panay Island.



Figure 5. *Eonycteris spelaea* (The Lesser Dawn Bat), the primary host species of *Ornithodoros batuensis* in the Philippines.

#### Acknowledgments

The authors would like to thank the following: the Department of Environment & Natural Resources (DENR) and the Palawan Center for Sustainable Development (PCSD) for providing a collection permit and field assistance; Dr. K.L. Phelps (Texas Tech University, USA) and J. Cantil for donating specimens from Bohol and Balabac to the first author; Dr. J. Araquil (Western Visayas State University) for accommodations while working in Iloilo; and the following colleagues who assisted in the field: R.A. Ruzol, D.A.P. Fernandez, C.E. Supsup, A.A. Asis, J. Cantil, and U. Carestia.

All material in this paper has been reviewed by the Walter Reed Army Institute of Research. There is no objection to its presentation and/or publication. The opinions or assertions contained herein are the private views of the authors and do not necessarily reflect the official views of the U.S. Department of the Army or the Department of Defense.

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## 寄生於蝙蝠（哺乳綱：翼手目）的軟蜱（真蜱目：軟蜱科）之菲律賓新地理紀錄

艾斯<sup>1,2,3</sup>、理查德·G·羅賓斯<sup>4,5,6</sup>

<sup>1</sup>中央研究院生物多樣性中心 生物多樣性臺灣國際研究生博士學位學程 11529 臺北市南港區

E-mail: ace\_amarga061@yahoo.com

<sup>2</sup>國立臺灣師範大學生命科學專業學院 11677 臺北市文山區

<sup>3</sup>國際自然保護聯盟物種存續委員 (IUCN SSC) 寄生蟲專家組

<sup>4</sup>Walter Reed Biosystematics Unit, Smithsonian Institution, Museum Support Center, Suitland, 馬里蘭州 20910 美國

<sup>5</sup>One Health Branch, Walter Reed Army Institute of Research, Silver Spring, 馬里蘭州 20910 美國

<sup>6</sup>史密森尼學會國家自然歷史博物館昆蟲學 華盛頓特區 20560 美國

**摘要：**軟蜱科 (Argasidae) 是一個在陸地脊椎動物身上吸血的節肢動物科別，它具有醫學重要性。本文報導了在菲律賓採集到的 *Argas* 屬和 *Ornithodoros* 屬軟蜱寄生於蝙蝠的新地理紀錄。這些紀錄包括首次報導來自 Balabac 島的 *Argas pusillus* Kohls，以及首次記錄在 Batan 島、Bohol 島和 Panay 島的 *Ornithodoros batuensis* Hirst。這些發現有助於我們了解這些蜱蟲在菲律賓的分布情況，進而研究它們對公共衛生的潛在影響。

**關鍵詞：**軟蜱科、體外寄生蟲、菲律賓、狐蝠科、蝙蝠科