

## THE MYRIAPOD FAUNA (Chilopoda, Diplopoda) OF THE TRUONG SA (SPRATLY) ARCHIPELAGO, VIETNAM

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### ABSTRACT

This paper provides the first data on myriapods in the Truong Sa archipelago (Vietnam). A total of 292 myriapod specimens identified 9 species in 7 genera, 6 families, 5 orders of two classes Chilopoda and Diplopoda were collected from 10 islands in the Spratly archipelago of Khanh Hoa province in Vietnam including Southwest Cay (Song Tu Tay), Sand Cay (Son Ca), Namyit island (Nam Yet), Grierson Reef (Sinh Ton Dong), Sin Cowe island (Sinh Ton), Pearson Reef (Phan Vinh), Central Reef (Truong Sa Dong), Spratly island (Truong Sa), West Reef (Da Tay), and Amboyna Cay (An Bang), , , during two surveys in October–November 2020 and May–June 2021. The class Chilopoda has 276 specimens of seven species, 6 genera, 5 families in three orders (Scolopendromorpha, Geophilomorpha, and Lithobiomorpha); The class Diplopoda has 16 specimens of 2 species, 2 genera, and 2 families in two orders (Polydesmida and Spirobolida). Among the recorded species, *Rhysida longipes* (Newport, 1845) were commonly recorded on all islands.

**Keywords:** Chilopoda, Diplopoda, biodiversity, bio-investigation, island fauna.

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## INTRODUCTION

The islands are considered hot areas in terms of culture, biology, and natural geography. These places can serve as laboratories for global environmental maintenance, sustainability, and socio-cultural progress (Kueffer & Kinney, 2017). Although islands cover about 5% of the global land area, their biological endemism accounts for about 20% of the world's vascular plant species and 15% of the world's animals (Epple & Soye, 2010).

The Truong Sa archipelago (internationally known as the Spratly archipelago) belongs administratively to Khanh Hoa province, Vietnam, with geographical coordinates from 6.5003°N to 12.0000°N and 111.3333°E to 117.3333°E. The archipelago contains about 130 islands, shoals, and reefs, which scatter in an area of about 180,000 km<sup>2</sup>, with a length of about 800 km from east to west and 600 km from north to south. Of these, there are 23 islands, and most of the islands has an area of fewer than 20 hectares, even only a few dozen square meters wide (Le Ba Thao, 1998).

The Truong Sa archipelago is geographically located far from the mainland, and the natural conditions and climate in this area are very harsh: sunny and windy, frequent thunderstorms, lack of fresh water, and some islands without trees. Therefore, this area may have unique features in terms of biodiversity (Do Huy Cuong, 2018).

The myriapod fauna of Vietnam has been known for 141 centipede species (Chilopoda) and 136 millipede species (Diplopoda) (Tran et al., 2013; Enghoff et al., 2004). However, almost all myriapod species were recorded in the mainland of Vietnam. Little was known about the myriapod fauna in islands, except a few new species were described from Cat Ba (Stoev & Enghoff, 2011; Golovatch et al., 2006, 2013), and Con Dao (Huynh & Veenstra, 2020; Vu et al., 2022).

So far, only some research on terrestrial flora and fauna in the Truong Sa archipelago

were published, such as Dang Ngoc Thanh (2003), but not about myriapods. To facilitate future studies, this paper provides the first data on myriapod species in the Truong Sa archipelago.

## MATERIALS AND METHODS

The field surveys were carried out two times (18 days in October–November 2020 and 24 days in May–June 2021). Study sites were carried out on different islands in the Truong Sa archipelago, including Spratly island, Sin Cowe island, Namyit island, Amboyna Cay, Sand Cay, Southwest Cay, Central Reef, West Reef, Grierson Reef and Pearson Reef (Fig. 1). Specimens were manually searched from 8 am–3 pm and 8 pm–10 pm daily.

Myriapod specimens were collected directly by hand sorting and preserved in ethanol 75–80% with the code KCB.TS (= Khoa hoc Co Ban - Truong Sa). All specimens were housed in Vietnam-Russia Tropical Center (VRTC), Vietnam.

Myriapod specimens were morphologically examined using the Olympus microscope SZ61. Species identification follows Bonato et al. (2011), Siriwt et al. (2016, 2018), Schileyko (2007, 2014), Schileyko et al. (2020), Likhitrakarn et al. (2011), Attems (1937) and Shelley & Lehtinen (1999). Images were taken using the camera attached to the microscope, and stacked using the software Helicon Focus ver. 7.0, then enhanced and grouped with Adobe Photoshop CS6.

## RESULTS

### Taxonomic checklist

#### Class CHILOPODA

#### Order Scolopendromorpha Leach, 1814

#### Family Scolopendridae Leach, 1814

#### Subfamily Scolopendrinae Kraepelin, 1903

#### Genus *Scolopendra* Linnaeus, 1758

**Type species.** *Scolopendra morsitans* Linnaeus, 1758, by original designation.

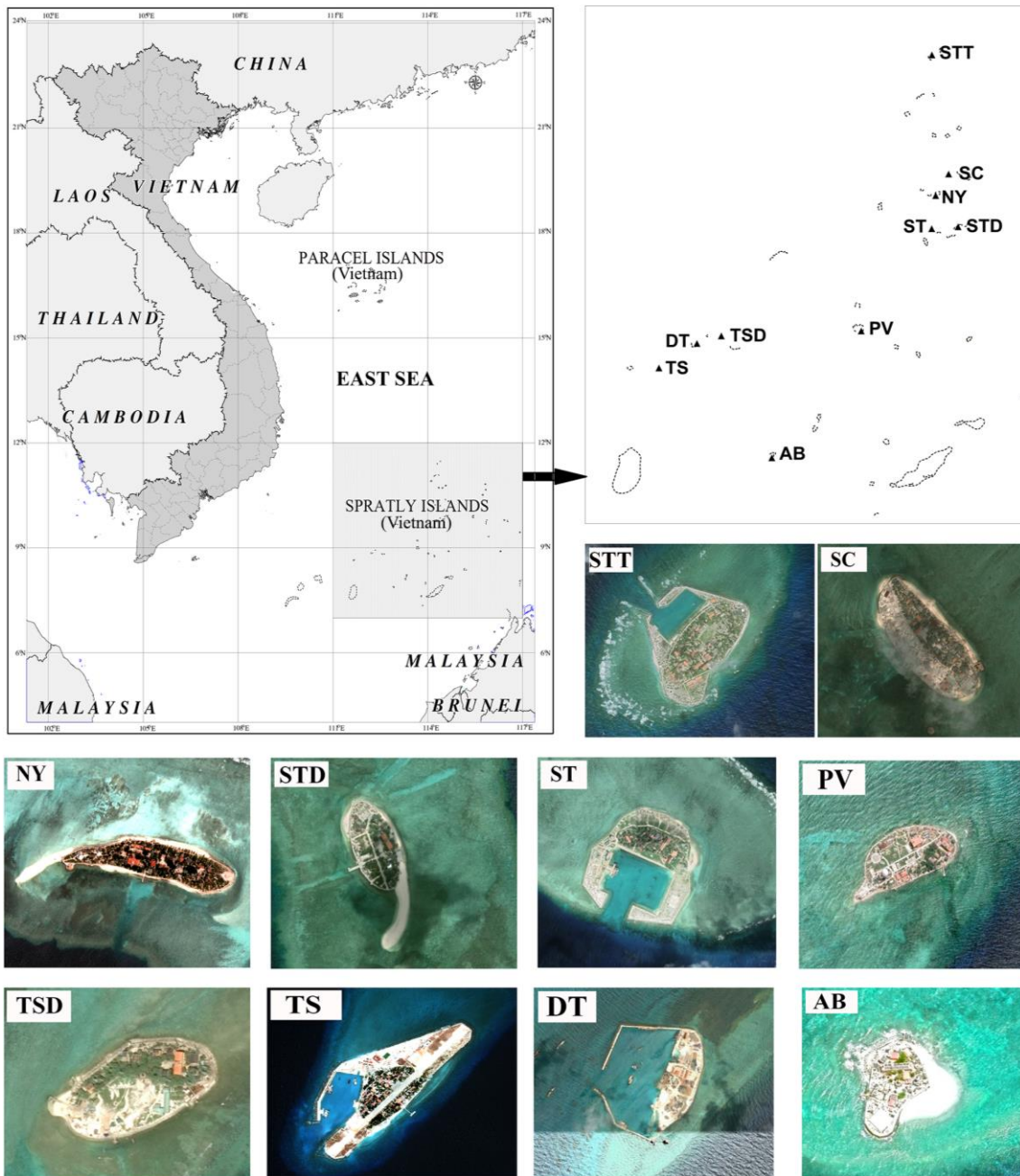


Figure 1. Sampling locations in the Spratly archipelago. STT: Southwest Cay; SC: Sand Cay; NY: Namyit island; STD: Grierson Reef; ST: Sin Cowe island; PV: Pearson Reef; TSD: Central Reef; TS: Spratly island; DT: West Reef; AB: Amboyna Cay.  
Satellite image source: <https://amti.csis.org/>

**Remarks.** The genus *Scolopendra* has the largest size in the order Scolopendromorpha and is widely distributed. This genus currently

contains about 101 valid species (Bonato et al., 2016), but only seven species have been known in Vietnam (Tran et al., 2013).

***Scolopendra morsitans* Linnaeus, 1758**  
(Fig. 2)

*Scolopendra morsitans* Linnaeus, 1758: 638. Schileyko, 2007: 75. Tran et al., 2013: 228; Siriwut et al., 2016: 14–28, figs: 1–7.

*Scolopendra morsitans fasciata* Attems, 1930: 372.

**Material examined.** 13 specimens. **Sand Cay:** 1 specimen (KCB.TS.04.401), 10.3749°N, 114.4784°E, November 2020, leg. Dinh The Dung; 1 specimen

(KCB.TS.04.409), 6 November 2020, leg. Le Xuan Son. **West Reef:** 4 specimens (KCB.TS.04.304, KCB.TS.04.308–309, KCB.TS.04.311), 8.8657°N, 112.2544°E, 21 May 2021, leg. Le Xuan Son; **Southwest Cay:** 1 specimen (KCB.TS.04.038), 11.4295°N, 114.3305°E, October 2020, leg. Le Xuan Dac; 6 specimens (KCB.TS.04.017, KCB.TS.04.020, KCB.TS.04.024, KCB.TS.04.026, KCB.TS.04.047–048), 14–17 June 2021, leg. Le Xuan Son.

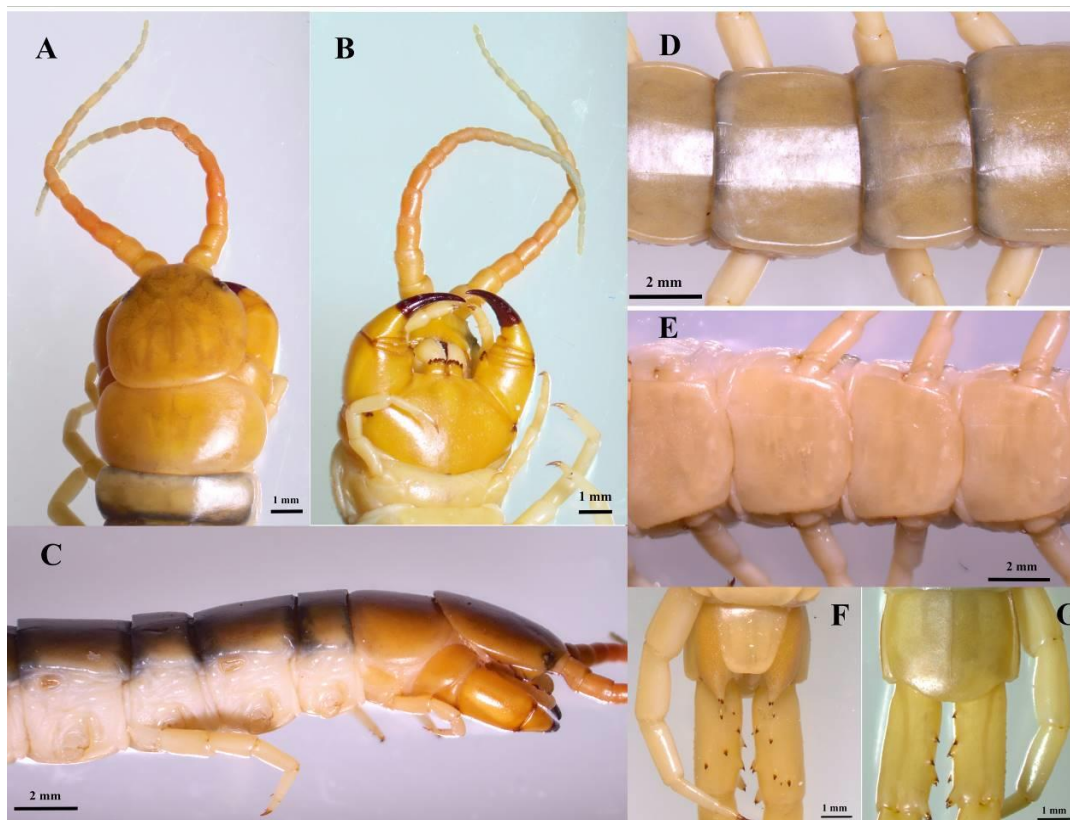


Figure 2. *Scolopendra morsitans* Linnaeus, 1758 (KCB.TS04.401). A: Head and tergites 1–2; B: head and forcipular segment; C: head and leg-bearing segments 1–5, lateral view; D: tergites 16–19; E: sternites 15–18; F: leg-bearing segment 21 and prefemur of ultimate leg, ventral view; G: leg-bearing segment 21 and prefemur of ultimate leg, dorsal view

**Diagnosis.** 21 body segments. Antennae with 18–19 articles; five basal ones virtually lacking setae (Figs. 2A, 2B). Tooth plates with 5+5 teeth (Fig. 2B). Tergites not setose; tergites 4–19 with complete paramedian sutures (Figs. 2C, D); lateral marginations

incomplete on tergites 10–20, but complete on tergite 21 (Figs. 2D, 2G); tergite 21 with a median suture (Fig. 2G). Sternites 2–20 with complete median sutures (Fig. 2E). Spiracles triangular (Fig. 2C), and absent in segment 7th. Coxopleural process with three apical

spines, one subapical spine and no lateral spine (Fig. 2F). Ultimate legs with 1 apical, 1–2 subapical, 1 ventrolateral, 2–3 ventromedial, 2 medial, 2 dorsomedial spines on prefemur (Figs. 2F, 2G).

**Distribution.** The species occurs in Thailand, Cambodia, Laos, Myanmar, Brunei, Philippines, Indonesia, China, Japan, India and Middle Asian Territory, Africa, Australia, South Pacific (Siriwut et al., 2016). In Vietnam, it is nationwide species (Attems, 1938, 1953; Schileyko, 1992, 1995, 2007; Tran et al., 2013).

**Remarks.** Our specimens have minor differences from the description of Siriwut et al. (2016) in lateral marginations (from tergite 10 vs. from tergite 14), the number of apical spines on coxopleural process (3 vs. 4–5), and the number of ventro-lateral spines on ultimate prefemur (1 vs. 2–4).

#### Subfamily Otostigminae Krapelin, 1903

#### Genus *Rhysida* Wood 1862

**Type species.** *Branchiostoma lithobioides* Newport, 1845, by subsequent designation.

**Remarks.** *Rhysida* and *Alloropus* are two representative genera of centipedes with spiracles on the 7<sup>th</sup> body segment. These are also two groups that easily cause confusion when classifying because of their similar morphological features. However, Siriwut et al. (2018) pointed out some obvious features to distinguish between them including differences in paramedian suture on sternites, the presence of dorsal spine on coxopleural process and prefemoral spurs on leg 1. Schileyko et al. (2020) re-examined the specimens in Indochina that are kept in the Russian museum, he also agreed with Siriwut.

To date, there are 36 species of the genus *Rhysida* recorded in the world (Schileyko et al., 2020), and only three species were known in Vietnam (Tran et al., 2013).

#### *Rhysida longipes* (Newport, 1845) (Figs. 3–4)

*Rhysida longipes* Newport, 1845: 411; Pocock 1891a: 418; Attems, 1938: 337; Schileyko, 2007: 82; Tran et al., 2013: 227; Schileyko & Stoev, 2016: 257, 22–24.

*Otostigmus* (*O.*) *simplex* Chamberlin, 1913: 75; Attems, 1930: 153; Schileyko, 1998: 269; Schileyko, 2001: 432.

**Material examined.** 202 specimens. **Southwest Cay:** 1 specimen (KCB.TS.04.040), 11.4295°N, 114.3305°E, October 2020, leg. Le Xuan Duc; 11 specimens (KCB.TS.04.001-003, KCB.TS.04.011, KCB.TS.04.016, KCB.TS.04.019, KCB.TS.04.021-023, KCB.TS.04.033, KCB.TS.04.046), 14–17 June 2021, leg. Le Xuan Son. **Sin Cowe island:** 21 specimens (KCB.TS.04.201, KCB.TS.04.203-204, KCB.TS.04.206-209, KCB.TS.04.214-215, KCB.TS.04.217, 219–230), 9.8858°N, 114.3289°E, 3 June 2021, leg. Le Xuan Son. **West Reef:** 7 specimens (KCB.TS.04.301-303, KCB.TS.04.305-307, KCB.TS.04.310), 8.8657°N, 112.2544°E, 21 May 2021, leg. Le Xuan Son. **Sand Cay:** 7 specimens (KCB.TS.04.402-408), 10.3749°N, 114.4784°E, November 2020, leg. Dinh The Dung and Nguyen Ngoc Tan; 16 specimens (KCB.TS.04.410-411, KCB.TS.04.414-421, KCB.TS.04.423-425, KCB.TS.04.427, KCB.TS.04.428-431), 6 June 2021, leg. Le Xuan Son. **Spratly island:** 1 specimen (KCB.TS.04.501), 8.6468°N, 111.9174°E, November 2020, leg. Dinh The Dung; 23 specimens (KCB.TS.04.506, KCB.TS.04.511-512, KCB.TS.04.515-518, KCB.TS.04.520, KCB.TS.04.526-527, KCB.TS.04.529, KCB.TS.04.531-534, KCB.TS.04.536-537, KCB.TS.04.539-544), 25–27 May 2021. **Grierson Reef:** 2 specimens (KCB.TS.04.102-103), 9.9033°N, 114.5622°E, 2 June 2021, leg. Le Xuan Son. **Pearson Reef:** 8 specimens (KCB.TS.04.601-608), 8.9769°N, 113.7065°E, November 2020, leg. Dinh The Dung and Nguyen Ngoc Tan; 22 specimens (KCB.TS.04.609-618, KCB.TS.04.620-621, KCB.TS.04.623-632), 1 June 2021, leg. Le Xuan Son. **Central Reef:** 10 specimens (KCB.TS.04.701-710), 8.9324°N, 112.4686°E, November 2020, leg. Dinh The Dung and Nguyen Ngoc Tan; 30 specimens (KCB.TS.04.711-721, KCB.TS.04.723-726, KCB.TS.04.728-740, KCB.TS.04.745-746), 21 May 2021, leg. Le



Xuan Son and Truong Ba Hai. **Namyit island:** 31 specimens (KCB.TS.04.801-804, KCB.TS.04.807-819, KCB.TS.04.821-830, KCB.TS.04.832, KCB.TS.04.837, KCB.TS.04.840-842), 10.1810°N, 114.3634°E, 7–14 June 2021, leg. Le Xuan

Son; 04 specimens (KCB.TS.04. 844-864, November 2020, leg. Dinh The Dung and Nguyen Ngoc Tan. **Amboyna Cay:** 6 specimens (KCB.TS.04.901-904, KCB.TS.04.906, KCB.TS.04.908), 7.8968°N, 11.9174°E, 28 May 2021, leg. Le Xuan Son.

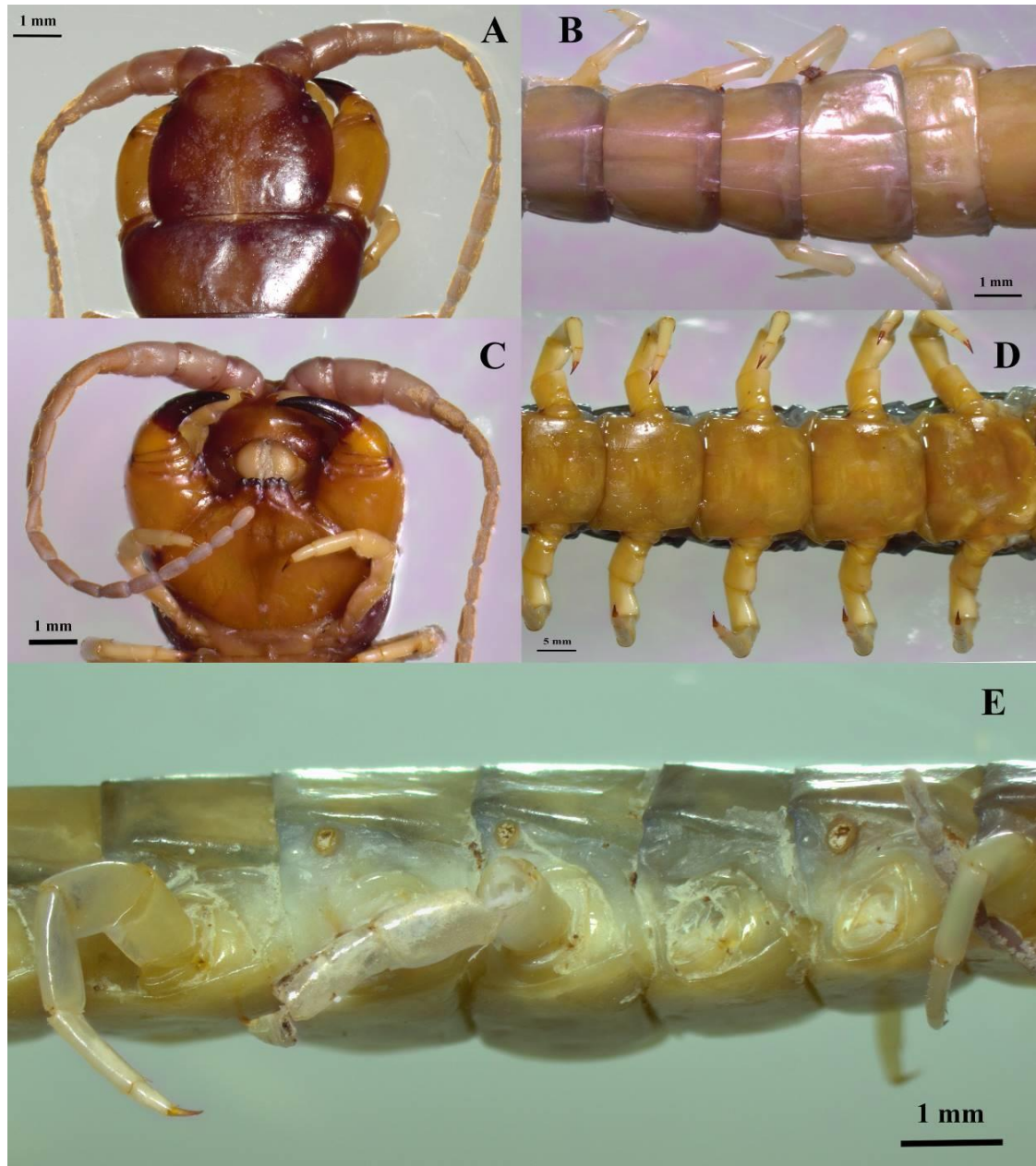


Figure 3. *Rhytida longipes* (Newport, 1845) (KCB.TS04.418). A: Head and tergite 1; B: head and forcipular segment, ventral view; C: Tergites 9–14; D: Sternites 6–10; E: Spiracles 5<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> (right to left)

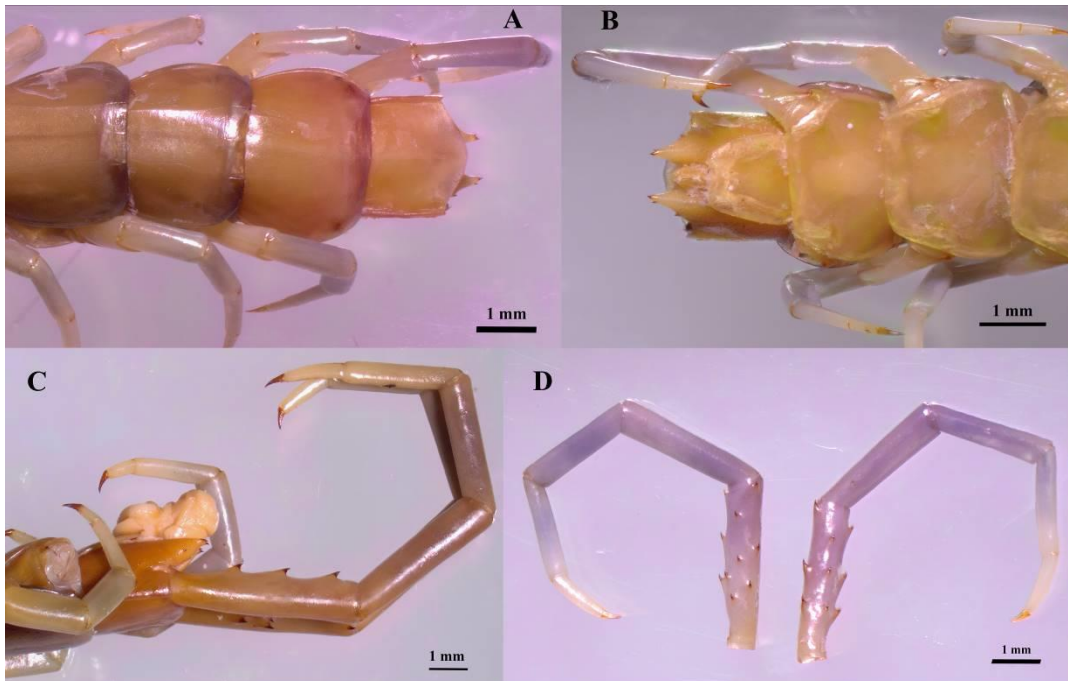


Figure 4. *Rhysida longipes* (Newport, 1845) (KCB.TS04.418). A: Tergites 18–21; B: Sternites 18–21; C: leg-bearing segment 21 and ultimate leg, lateral view; D: Ultimate leg, mesal view

**Diagnosis.** 21 body segments. Antennae with 18 articles including three dorsally glabrous basal ones (Figs. 3A, 3C). Tooth plates with 4+4 teeth (Fig. 3C). Tergites not setose; tergites 4–20 with complete paramedian sutures (Figs. 3B, 4A); tergites 9–20 with incomplete lateral marginations (Figs. 3B, 3E). Sternites 5–19 with incomplete paramedian sutures (Figs. 3D, 4B). Segment 7<sup>th</sup> with oval-shaped spiracles (Fig. 3E). Coxopleural process with two apical spines, one subapical spine and one lateral spine (Figs. 4A, 4C). Ultimate prefemur with 3 ventro-lateral, 2–3 ventro-medial, 1 medial, 1 dorso-medial and 1 corner spines (Figs. 4C, 4D).

**Distribution.** This species occurs in Japan, China, Taiwan, Thailand, Malaysia, Myanmar, Papua New Guinea, Indonesia, Sri Lanka, Cambodia, Philippines, India, Pakistan, USA, and Venezuela (Attems 1938; Schileyko, 2007; Shelley, 2002, Siriwut et al., 2018). In Vietnam, it has been recorded in Thua Thien Hue (Hai Van Pass); Dong Nai (Ma Da); Kien Giang (Phu Quoc

island) (Attems, 1938; Schileyko, 2007; Tran et al., 2013).

**Remarks.** Our specimens have a minor difference from the description of Siriwut et al. (2018), specifically, the paramedian suture is present from tergite 4 in our specimens, while it is from tergite 5 as in the description of Siriwut.

#### Family Cryptopidae Kohlrausch, 1881

##### Genus *Cryptops* Leach, 1815

**Type species.** *Scolopendra hortensis* Donovan, 1810, by monotypy.

**Remarks.** The genus *Cryptops* has a small size, about 30 mm in maximum length (Schileyko, 2007). It is widely distributed in tropical, subtropical, and warm temperature areas (Schileyko et al., 2020). There are more than 180 species recorded in the world (Bonato et al., 2016). In Vietnam, only four species have been reported (Tran et al., 2013).

*Cryptops (Cryptops) doriae* Pocock, 1891 (Fig. 5)

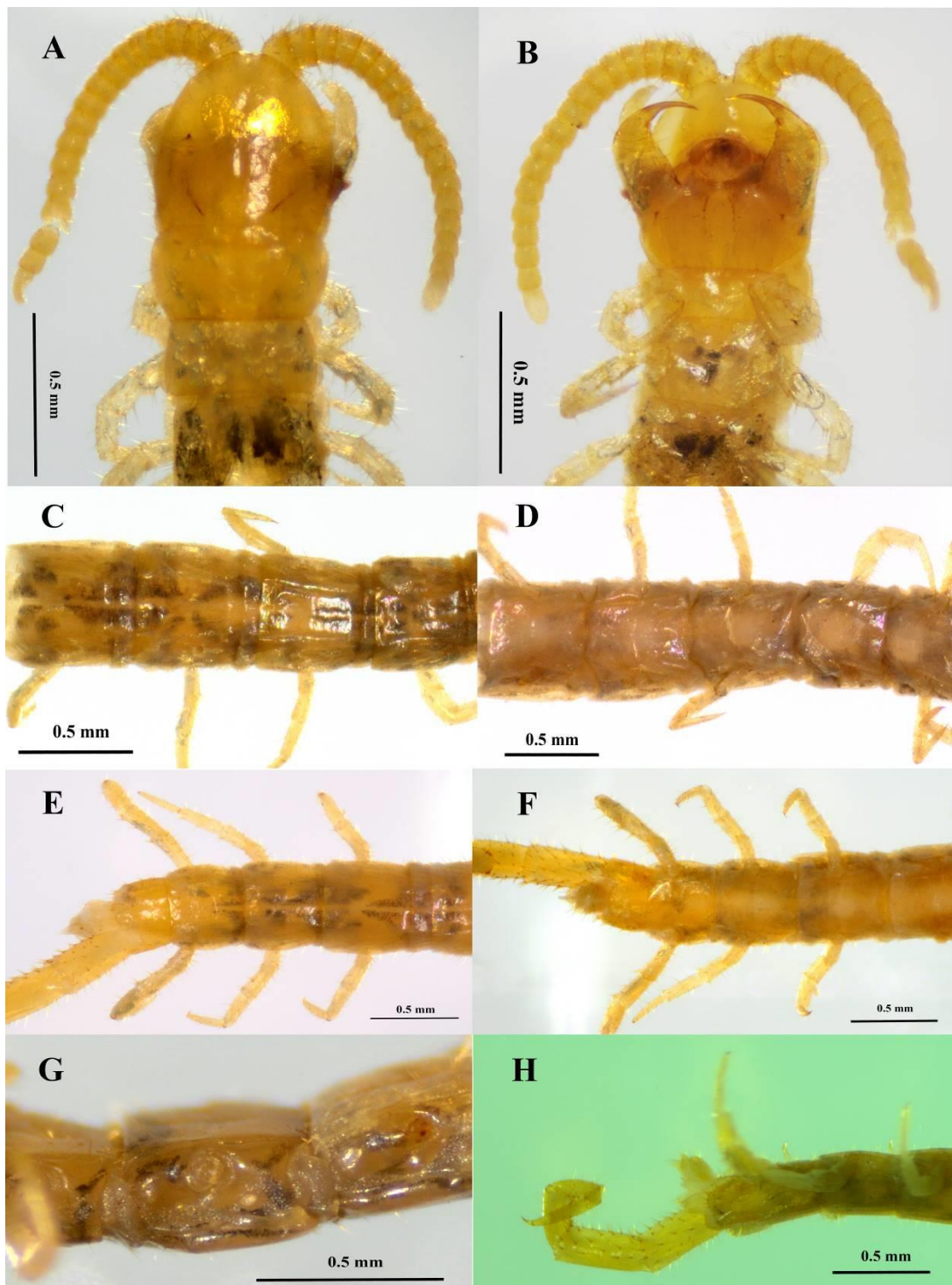


Figure 5. *Cryptops (Cryptops) doriae* Pocock, 1891 (KCB.TS04.820). A: Head and tergites 1-3; B: head, forcipular segment and sternites 1-3; C: tergites 6-9; D: sternites 5-9; E: tergites 17-21; F: sternites 17-21; G: leg-bearing segments 7-8 with spiracles on leg-bearing segment 8; H: leg-bearing segments 19-21 and ultimate leg, laterally



*Cryptops doriae* Pocock, 1891b: 421; Attems, 1938: 338; Attems, 1953: 138; Schileyko, 2007: 86; 2016: 262, figs. 40–44; Lewis, 2013: 12; Tran et al., 2013: 220.

*Cryptops (C.) japonicus* - Schileyko, 1998: 268; Schileyko, 2001: 439.

*Cryptops (C.) niuensis* - Schileyko, 1998: 268; 2001: 438

**Material examined.** 16 specimens. **Southwest Cay:** 7 specimens (KCB.TS.04.006, KCB.TS.04.010, KCB.TS.04.012, KCB.TS.04.028-030, KCB.TS.04.044), 11.4295°N, 114.3305°E, 14–17 June 2021, leg. Le Xuan Son. **Sin Cowe island:** 1 specimen (KCB.TS.04.202), 9.8858°N, 114.3289°E, 3 June 2021, leg. Le Xuan Son. **Spratly island:** 03 specimens (KCB.TS.04.502, KCB.TS.04.521, KCB.TS.04.530), 8.6468°N, 111.9174°E, 25–27 May 2021, leg. Le Xuan Son. **Central Reef:** 01 specimens (KCB.TS.04.744), 8.9324°N, 112.4686°E, 1 June 2021, leg. Le Xuan Son. **Namyit island:** 03 specimens (KCB.TS.04.820, KCB.TS.04.833, KCB.TS.04.843), 10.1810°N, 114.3634°E, 5 June 2021, leg. Le Xuan Son; **Amboyna Cay:** 01 specimens (KCB.TS.04.905), 7.8968°N, 11.9174°E, 28 May 2021, leg. Le Xuan Son.

**Diagnosis.** 21 body segments. Eyes absent (Fig. 5A). Antennae with 17 articles including three sparsely setose basal ones (Figs. 5A, 5B). Tooth plate without teeth, only with obscure margination; forcipular tarsungulae long (Fig. 5B). Tergite not setose, without lateral marginations; tergites 5–17 with complete paramedian sutures (Figs. 5C, 5E). Sternites not setose; sternites 8–20, each with a transverse suture, or sometimes a depression (Figs. 5D, 5F). Spiracles oval-shaped and absent on segment 7<sup>th</sup> (Fig. 5G). Coxopleuron process without apical spines (Figs. 5F, 5H). Ultimate legs with saw-teeth on tibia and tarsus 1 (Fig. 5H).

**Distribution.** The species occurs in Myanmar, Jawa, Nepal, India, Myanmar, Cambodia, Laos, Indonesia, Papua New Guinea, and Seychells (Attems, 1930; Schileyko, 2007; Tran et al., 2013; Bonato et

al., 2016). In Vietnam, it is nationwide species (Attems, 1938; Schileyko 1992, 2007; Tran et al., 2013; Le et al., 2021; Nguyen et al., 2019b).

**Remarks.** Our specimens fit well with the description of Schileyko (2007).

***Cryptops (Paracryptops) indicus* (Silvestri, 1924)** (Fig. 6)

*Paracryptops indicus* Silvestri, 1924: 74; Attems, 1930: 245, figs. 321–322; Schileyko, 1992: 7; Schileyko, 1995: 74; 1998: 268; Schileyko, 2001: 439; Schileyko, 2007: 91, fig. 1.

*Cryptops (Paracryptops) indicus* - Schileyko et al., 2020: 22, figs. 17, 31.

**Material examined. Sin Cowe island:** 2 specimens (KCB.TS.04.218, KCB.TS.04.231), 9.8858°N, 114.3289°E, 3 June 2021, leg. Le Xuan Son.

**Diagnosis.** 21 body segments. Eyes absent (Fig. 6A). Antennae with 17 articles including four sparsely setose basal ones (Figs. 6A, 6B). Tooth plate without teeth; forcipular tarsungulae very short (apical of tarsungulae not touch each other when closed) (Fig. 6B). Tergite not setose; tergites 4–20 with complete paramedian sutures; tergites 5–20 with lateral marginations; tergites 21 with a large median depression (Figs. 6C, 6E); Sternites without median suture and depression; sternites 8–19, each with a transverse suture (Figs. 6B, 6D, 6F). Spiracles oval-shaped and absent on 7<sup>th</sup> (Fig. 6H). Coxopleuron process short, without apical spine (Fig. 6F). Ultimate legs with saw-teeth on tibia and tarsus 1 (Fig. 6H).

**Distribution.** The species has been recorded in India (Attems, 1930; Schileyko, 2007; Tran et al., 2013; Bonato et al., 2016). In Vietnam, it has been known in several localities (Son La, Kon Tum, Gia Lai, Dong Nai, Lam Dong, and Kien Giang) (Attems, 1938; Schileyko, 1992, 2007; Tran et al., 2018; Nguyen et al., 2019a).

**Remark.** Schileyko (2007) mentioned “a shallow, incomplete, unclear, longitudinal depression on sternites 2(3) and 20, well-developed on sternites 4–19”. However, our specimens lack such sternal depressions.

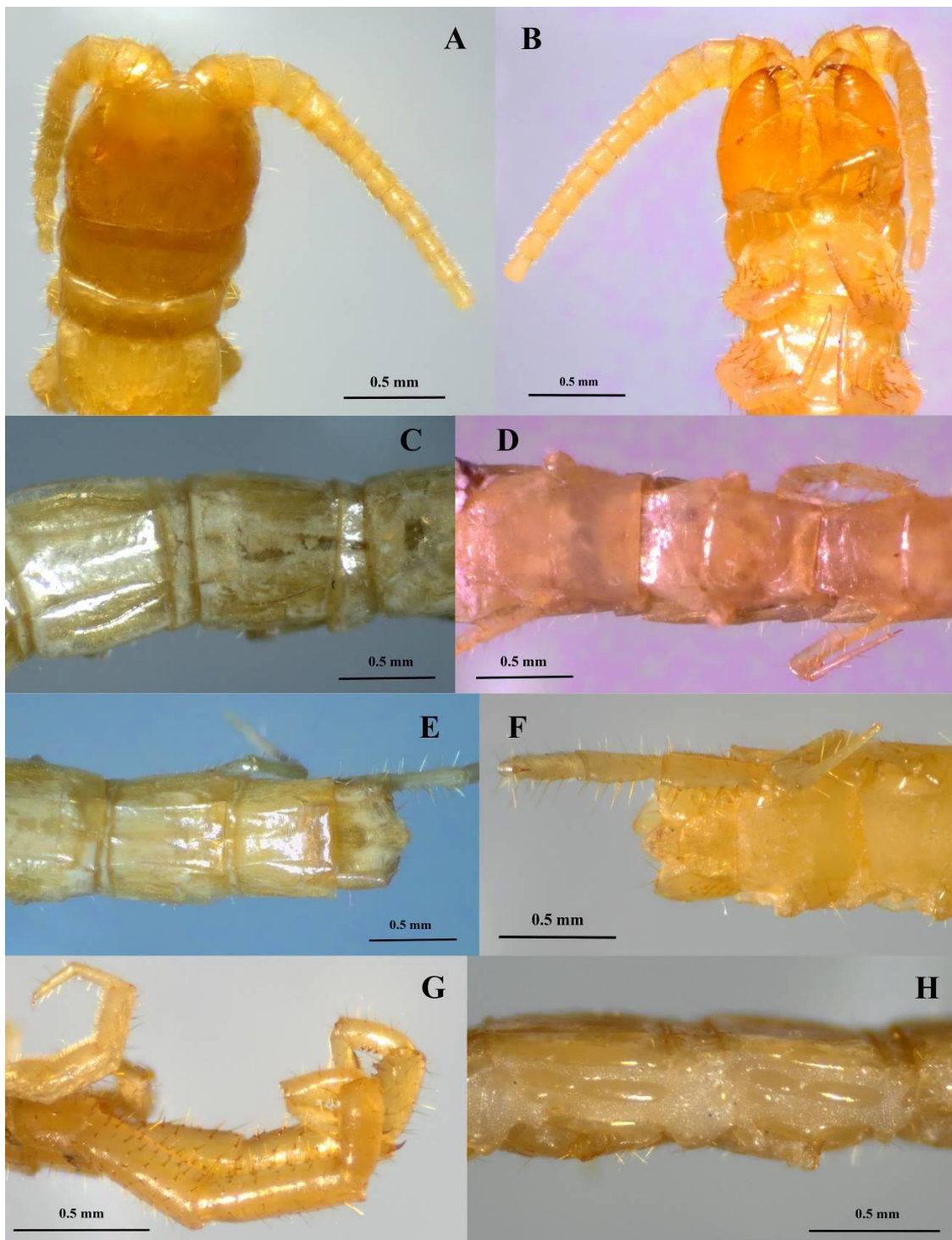


Figure 6. *Cryptops (Paracryptops) indicus* (Silvestri, 1924) (KCB.TS04.231). A: Head and tergites 1-3; B: head, forcipular segment and sternites 1-3; C: tergites 8-10; D: sternites 8-10; E: tergites 18-21; F: sternites 19-21; G: leg-bearing segment 21 and ultimate leg, laterally; H: leg-bearing segments 6-7 without spiracles on leg-bearing segment 7

**Order Geophilomorpha Pocock, 1895**

**Family Mecistocephalidae Bollman, 1893**

**Genus *Mecistocephalus* Newport, 1843**

**Type species.** *Mecistocephalus punctifrons* Newport, 1843.

**Remark.** The genus *Mecistocephalus* is the most diverse and widespread

geophilomorphs. More than one hundred species have been recognized, and they are mainly inhabiting the Oriental region (Bonato & Minelli, 2004). In Vietnam, only five species have been reported (Attems, 1938, 1953; Tran et al., 2013).

***Mecistocephalus mikado* Attems, 1928** (Fig. 7)

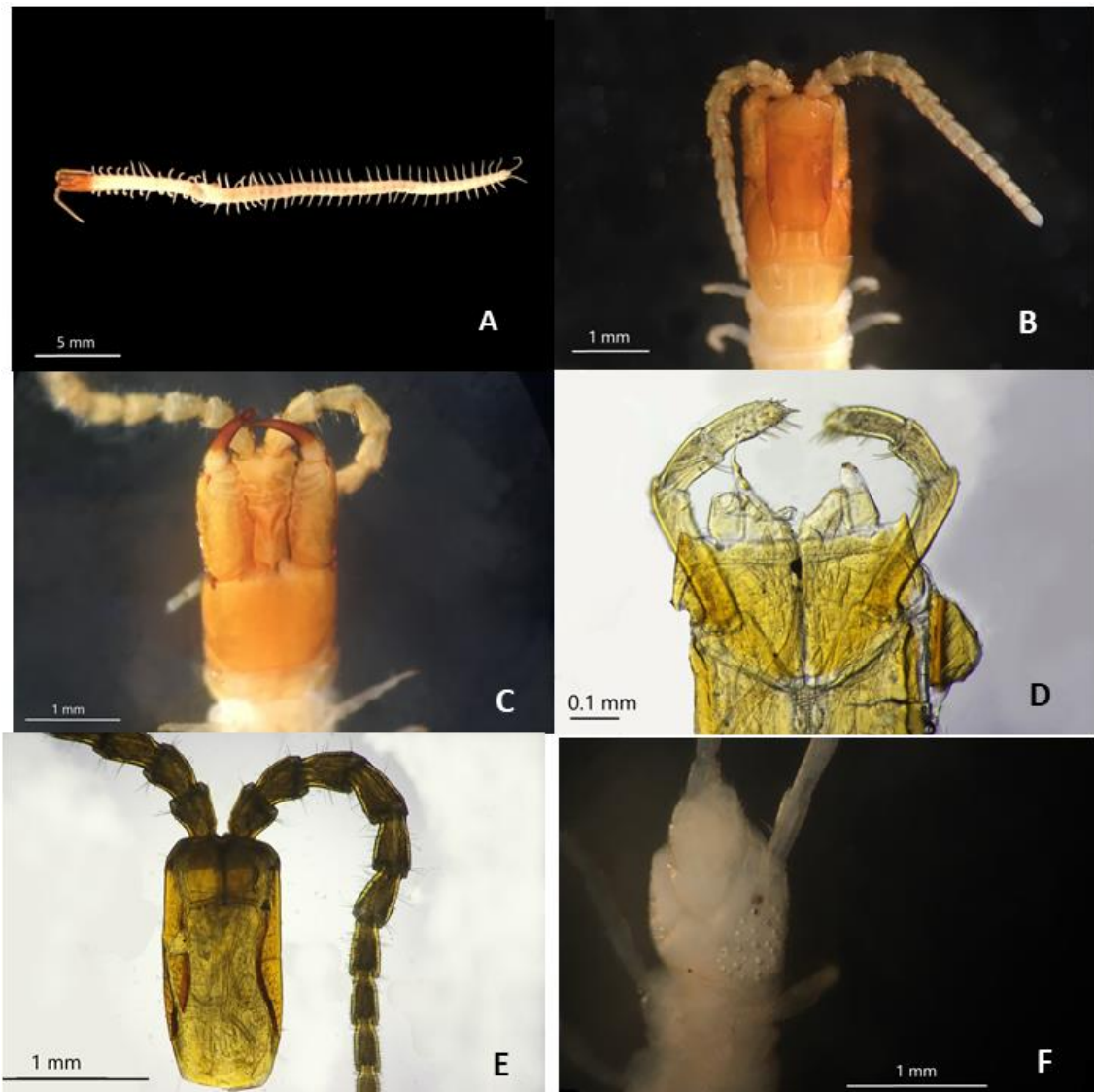


Figure 7. *Mecistocephalus mikado* Attems, 1928. A: Dorsal body; B: Head and tergites 1–2; C: Head, forcipular segment and sternite 1; D: Maxillary complex, ventral view; E: Anterior part of head, ventral view (maxillary complex removed); F: Sternites 47–49

*Mecistocephalus mikado* Attems, 1938: 329; Takakuwa, 1940: 63, fig. 57; Chamberlin & Wang, 1952: 178; Ilie et al., 2009: 45.

**Material examined.** 34 specimens.  
**Southwest Cay:** 13 specimens (KCB.TS.04.004-005, KCB.TS.04.007-008, KCB.TS.04.013-015, KCB.TS.04.018, KCB.TS.04.025, KCB.TS.04.031-032, KCB.TS.04.035, KCB.TS.04.041), 11.4295°N, 114.3305°E, 14–17 June 2021, leg. Le Xuan Son. **Sin Cowe island:** 5 specimens (KCB.TS.04.205, KCB.TS.04.210-211, KCB.TS.04.213, KCB.TS.04.216), 9.8858°N, 114.3289°E, 3 June 2021, leg. Le Xuan Son. **Sand Cay:** 3 specimens (KCB.TS.04.412-413, KCB.TS.04.422), 10.3749°N, 114.4784°E, 6 June 2021, leg. Le Xuan Son. **Spratly island:** 2 specimens (KCB.TS.04.505, KCB.TS.04.535), 8.6468°N, 111.9174°E, 25–27 May 2021, leg. Le Xuan Son. **Grierson Reef:** 1 specimen (KCB.TS.04.101), 9.9033°N, 114.5622°E, 2 June 2021, leg. Le Xuan Son. **Pearson Reef:** 1 specimen (KCB.TS.04.622), 8.9764°N, 113.7065°E, 1 June 2021, leg. Le Xuan Son. **Central Reef:** 3 specimens (KCB.TS.04.722, KCB.TS.04.742-743), 8.9324°N, 112.4686°E, 21 May 2021, leg. Le Xuan Son and Truong Ba Hai. **Namyit island:** 4 specimens (KCB.TS.04.806, KCB.TS.04.834-836), 10.1810°N, 114.3634°E, 7–14 June 2021, leg. Le Xuan Son.

**Diagnosis.** 49 body segments. Eyes absent. Body evidently tapering backwards; body length reaching about 5.5 cm; trunk without dark patches (Fig. 7A). Antennae with 14 articles (Fig. 7B). Cephalic plate about 1.9–2.1 times as long as wide, frontal line present; two clypeal plagulae, divided by a mid-longitudinal areolate stripe and extending to the lateral margins of the clypeus; spiculum present (Figs. 7B, 7C, 7E). Telopodites of second maxillae well

developed, overreaching those of the first maxillae, and bearing a simple claw (Fig. 7D). Forcipules: trochanteropraefemur length to width ratio 1.6–1.8, proximal tooth developed, slightly smaller than the distal tooth; teeth on femur and tibia developed, smaller than the distal tooth of trochanteropraefemur; tarsungulum with two small basal teeth, one dorsal to the other, similar in size; tarsungulum uniformly tapering towards the tip (Fig. 7C). Last leg-bearing segment: Coxopleura usually without a macropore distinct from other pores, with about 40 pores on each side (Fig. 7F).

**Distribution.** The species occurs in Cambodia, Taiwan, and Japan (Attems, 1928, 1938; Takakuwa, 1940; Wang & Mauriès, 1996; Uliana et al., 2007). In Vietnam, it was recorded from Da Nang, Phu Yen, Khanh Hoa, Kon Tum, and Lam Dong (Attems, 1938; Tran et al., 2013) and Spratly Archipelago in this study.

**Remark.** Our specimens are consistent with the original description (Attems, 1928).

## Order Lithobiomorpha Pocock, 1895

### Family Lithobiidae Pocock, 1895

#### Genus *Lithobius* Leach, 1814

**Type species.** *Scolopendra forficatus* Linnaeus, 1758, by subsequent designation.

**Remark.** The genus *Lithobius* occurs mostly in Palearctic, several species were also in North America. More than 500 species/subspecies have been recorded in the world. In Vietnam, only 9 species/subspecies were reported (Attems, 1938, 1953; Tran et al., 2013).

#### *Lithobius* (*Monotarsobius*) *tricalcaratus* (Attems, 1909) (Fig. 8)

*Lithobius* (*Monotarsobius*) *tricalcaratus* Attems, 1909: 20; Attems, 1953: 151; Kevan, 1983: 2949



*Monotarsobius tricalcaratus* Attems, 1909: 20, taf. 1, fig. 5; Stagl & Zapparoli, 2006: 38

**Material examined.** 5 specimens. **Spratly island:** 1 specimen (KCB.TS.04.504), 8.6468°N, 111.9174°E,

25–27 May 2021, leg. Le Xuan Son; **Namyit island:** 4 specimens (KCB.TS.04.805, KCB.TS.04.831, KCB.TS.04.838–839), 10.1810°N, 114.3634°E, 7–14 June 2021, leg. Le Xuan Son.

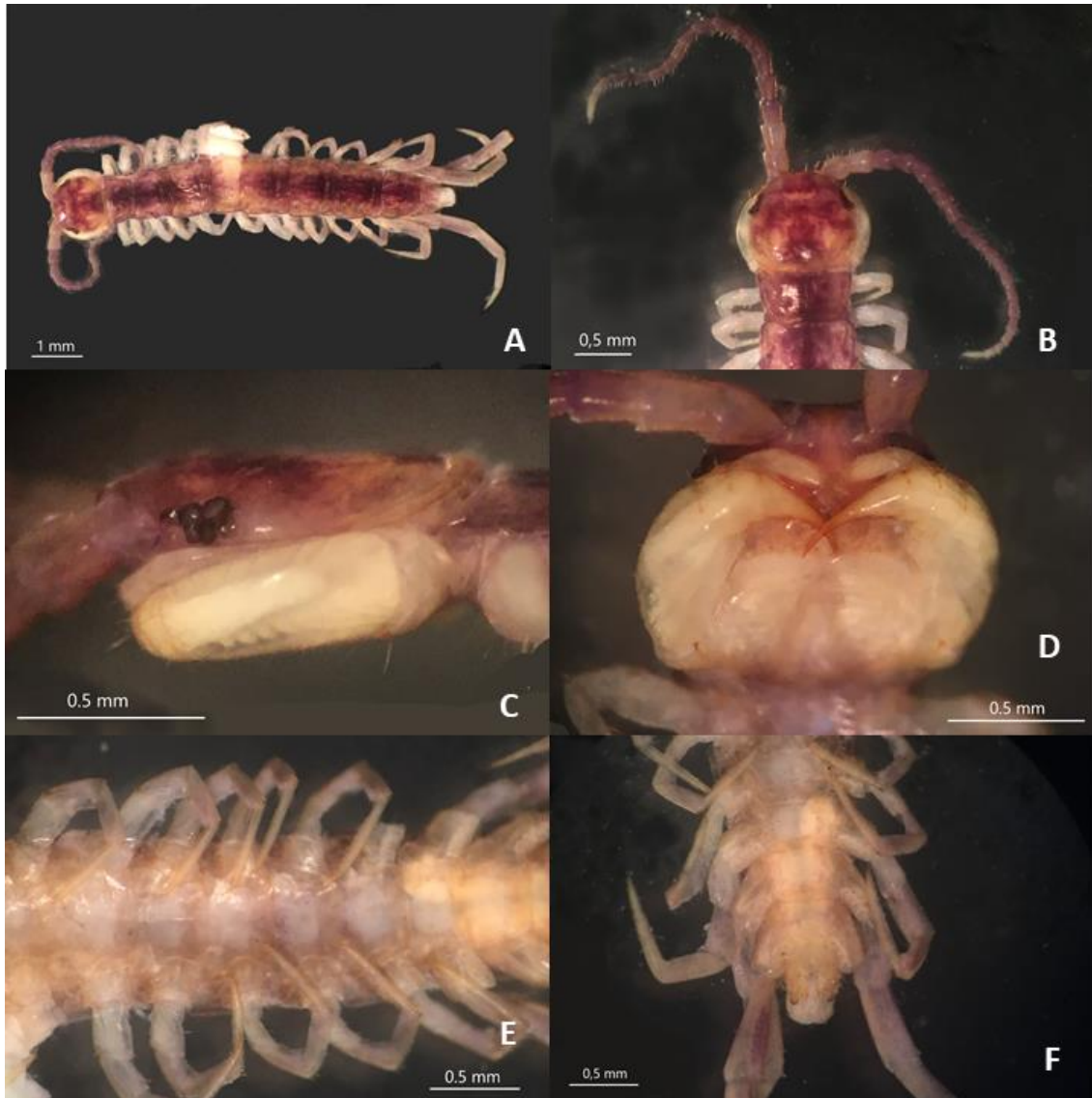


Figure 8. *Lithobius (Monotarsobius) tricalcaratus* (Attems, 1909). A: Dorsal body; B: Head and tergites 1–2; C: Head (side view); D: Head, forcipular segment and sternite 1; E: Sternites 8–15; F: Sternites 12–15

**Diagnosis.** 15 body segments. Body length 8.5 mm. Colour: cephalic plate, tergites purple-brown; antennae, sternites, legs lavender; forcipular coxosternite

yellow- brown (Fig. 8A). Antennae with 20 articles; basal article almost as long as wide, second one markedly longer than wide, succeeding articles gradually shortening; terminal article typically longer than wide, up to 2.3–2.9 times longer than wide (Fig. 8B). Cephalic plate smooth, nearly round, width approximately equal to length (Fig. 8B). Six ocelli on each side, arranged in two irregular rows, the once posterior ocelli comparatively large; Tömösváry's organ moderately small, nearly rounded, slightly smaller than adjoining ocelli (Fig. 8C). Forcipular coxosternite: subtrapezoidal anterior margin with 2+2 teeth (Fig. 8D). Tergites smooth, posterior angles of all tergites without triangular projections (Fig. 8A). Legs strong, tarsal articulation not defined on legs 1–13, tarsal articulation well defined on legs 14–15; all legs with fairly long curved claws (Fig. 8E). Coxal pores arranged in a row; ovate to round; 3444. Female gonopods with 3+3 moderately small, coniform spurs; terminal claw tridentate (Fig. 8F).

**Distribution.** The species was known from Alaska (US) (Attems, 1909). In Vietnam, it was reported from Lam Dong (Attems, 1953) and the Spratly archipelago in this study.

**Remark.** Our specimens fit well with the original description (Attems, 1909) except for the coxal pore formula. Our specimens have coxal pores 3–4–4–4 while it was coxal pores 2–3–3–3(4) as in Attems (1909).

#### Family Henicopidae Pocock, 1901

##### Genus *Anopsobiella* Attems, 1938

**Type species.** *Anopsobius dawydoffi* Attems, 1938, by monotypy.

**Remark.** The genus contains only one species, *A. dawydoffi* Attems, 1938 from Vietnam. Its taxonomic status has never been revised since its original description.

##### *Anopsobiella dawydoffi* Attems, 1938 (Figure 9)

*Anopsobius (Anopsobiella) dawydoffi* Attems, 1938: 351, figs 316–320; Zaleskaja, 1975: 1316; Hollington & Edgecombe, 2004: 25; Stagl & Zapparoli, 2006: 11; Bonato et al., 2011: 377.

**Material examined.** 4 specimens. **Southwest Cay:** 3 specimens (KCB.TS.04.034, KCB.TS.04.036-037), 11.4298°N, 114.3305°E, 14–17 June 2021, leg. Le Xuan Son. **Amboyna Cay:** 1 specimen (KCB.TS.04.905), 7.8966°N, 11.9174°E, 28 May 2021, leg. Le Xuan Son.

**Diagnosis.** 15 body segments. Body length 5.0 mm. Cephalic plate smooth, nearly round; length of head shield 0.7 mm (Fig. 9B). Ocellus absent (Fig. 9C). Antennae slender, of 32 articles, the basal articles being rather large and several distal ones submoniliform (Fig. 9B). Forcipular coxosternite: subtrapezoidal anterior margin with 2+2 teeth (Fig. 9D). Stigmata present on 3, 5, 8, 10, 12 and 14<sup>th</sup> leg-bearing somites. Tarsus 1–2 articulation fused on legs 1–13, well-defined on legs 14 and 15; All the tergites smooth on the surface; posterior angles of all tergites without triangular projections. Coxal pores arranged in a row; ovate to round Coxal pores present on the last four pairs (12–15<sup>th</sup>) of legs, 3–3–3–1 (Fig. 9E). Female gonopods with 2+2 moderately small, coniform spurs; terminal claw unfurcated (Fig. 9F).

**Distribution.** The species has been known only from Khanh Hoa province, Vietnam (Attems, 1938) and the Spratly archipelago in this study.

**Remark.** In 1938, Attems described *Anopsobiella dawydoffi* from South Annam as a member of a new subgenus of *Anopsobius*. In 1975, Zaleskaja raised *Anopsobiella* to a full generic rank in the subfamily Anopsobiinae. Our specimen is consistent with the original description.

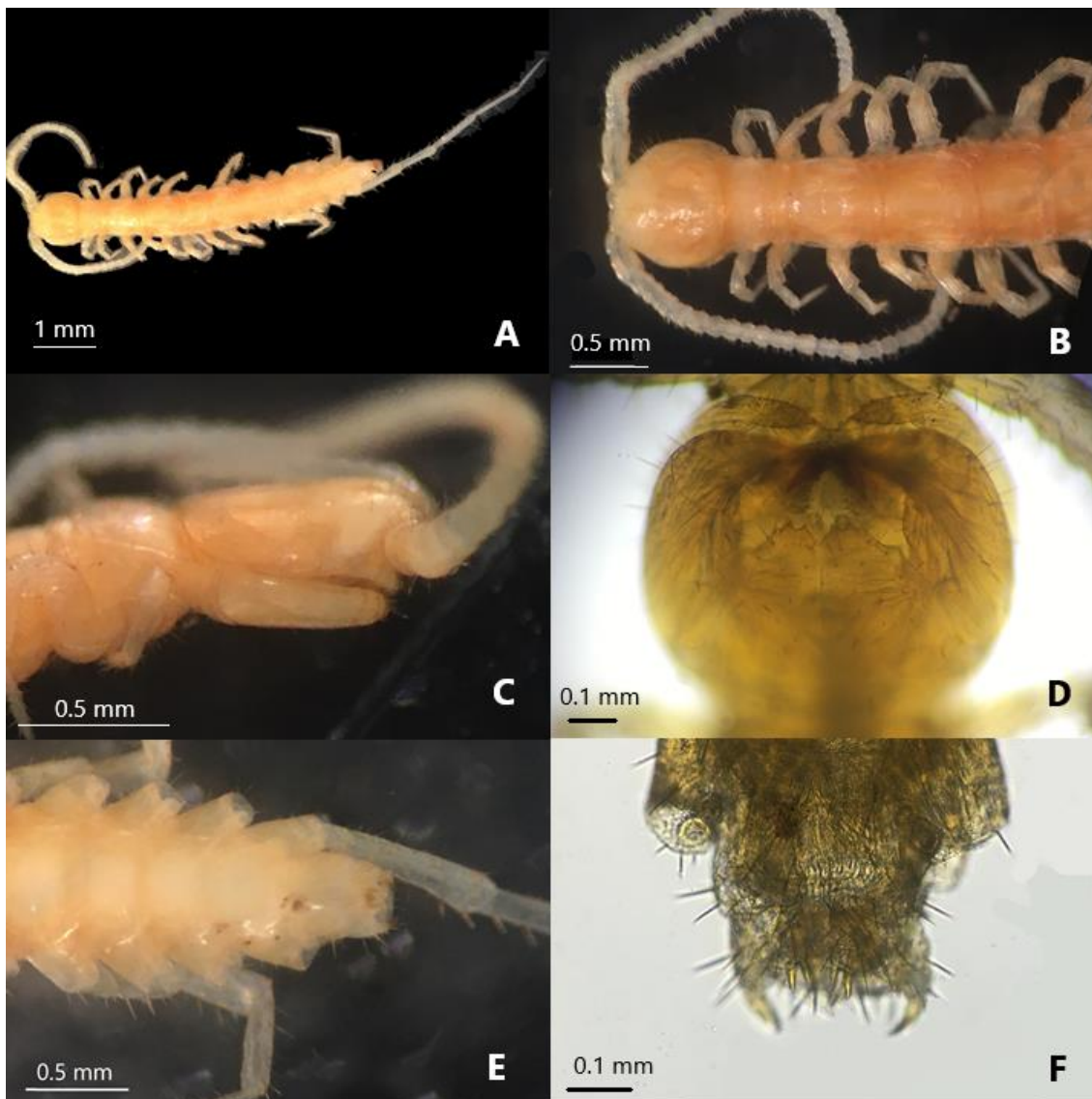


Figure 9. *Anopsobiella dawydoffi* Attems, 1938. A: Dorsal body; B: Head and tergites 1–7; C: Head, segments 1–2 (side view); D: Head, forcipular segment and sternite 1; E: Sternites 12–15; F: Sternite 15

**Class DIPLOPODA**

**Order Polydesmida Leach, 1815**

**Family Paradoxosomatidae Daday, 1889**

**Genus *Orthomorpha* Bollman, 1893**

**Type species.** *Polydesmus beaumontii* Le Guillou, 1841, by subsequent designation.

**Remark.** The genus *Orthomorpha* is one of the species-richest genera with 51

valid species distributed in Indonesia, Malaysia up to Thailand, Cambodia, Vietnam, and Laos. The taxonomy of the genus was recently revised by Likhitrakarn et al. (2011).

***Orthomorpha coarctata* (De Saussure, 1860)** (Fig. 10)

*Polydesmus coarctata* Saussure, 1860: 297.

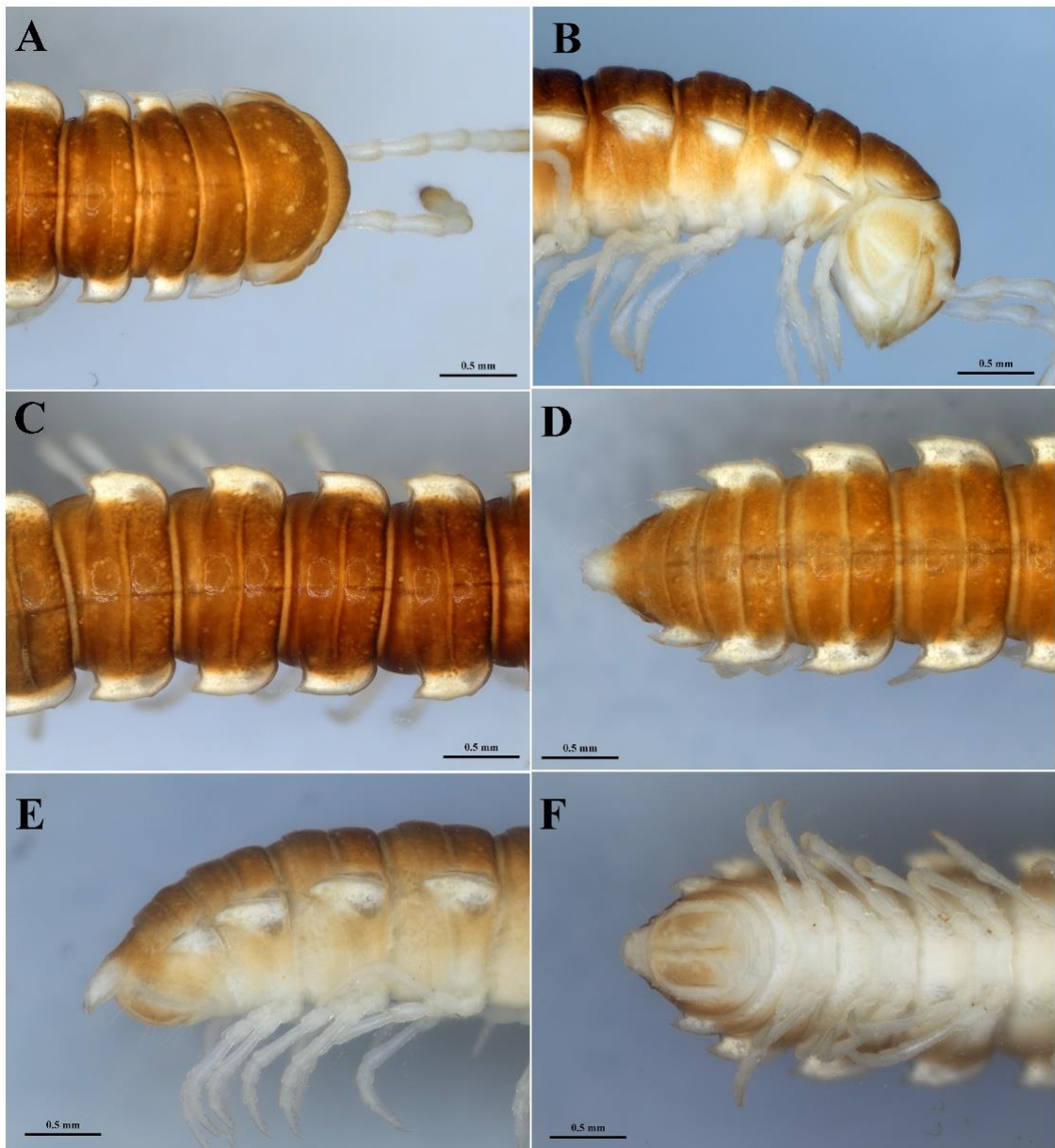


Figure 10. *Orthomorpha coarctata* (De Saussure, 1860). A-B, anterior part of body, dorsal view (A), lateral view (B); C: midbody segments, dorsal view; D-F: posterior part of body, dorsal view (D), lateral view (E), ventral view (F)

*Asiomorpha coarctata* - Shelley & Lehtinen, 1998: 85–86, figs 4–6; Enghoff et al., 2004: 37;

*Orthomorpha coarctata* - Attems 1936: 197; Attems, 1937: 62–63, fig. 75; Jeekel, 1963: 272; Likhitrakarn et al., 2011: 12–17, figs. 4–8.

See Jeekel (1963: 272); Shelley and Lehtinen (1998: 85) for more synonyms.

**Material examined.** 13 specimens. **Southwest Cay:** 12 specimens (KCB.TS.04.043, KCB.TS.04.051-061), 11.4295°N, 114.3305°E, 14–17 June 2021, leg. Le Xuan Son. **Sand Cay:** 1 specimen



(KCB.TS.04.432), 6 June 2021, leg. Le Xuan Son.

**Diagnosis.** The species can be distinguished by the combination of characters: paraterga well developed, yellow whereas metaterga and pronota black; the fifth sternum without processes between coxae 4; gonopod femorite slender, sometimes slightly expanded distad, and demarcated from postfemoral region by distinct cingulum or sulcus laterally; solenophore consisting of both simple, but well developed lamina medialis and lamina lateralis; tip of gonopod rounded, not splitted into any lobes.

**Distribution.** This is a pantropical species, widely distributed in the world. It is commonly found in disturbed areas for regenerating forests. It is rarely found in primary or good forests. In Vietnam, it is nationwide species.

## Order Spirobolida Cook, 1895

### Family Pachybolidae Cook, 1897

#### Genus *Trigoniulus* Pocock, 1894

**Type species.** *Spirobolus goesi* Porat, 1876, by the original designation.

**Remarks.** The genus consists of 54 valid species (Sierwald & Spelda 2021), widely distributed in tropical regions.

#### *Trigoniulus corallinus* (Gervais, 1842) (Fig. 11)

*Julus corallinus* Gervais, 1842 (in Eydoux & Souleyet, 1842): 275, plate 1, figs. 1–4; Gervais, 1847: 171.

*Trigoniulus corallines* - Hoffman, 1994: 20; Shelley, 1998: 56; Shelley & Lehtinen, 1999: 1389, figs. 8–14.

See Shelley & Lehtinen (1999) more synonyms.



Figure 11. *Trigoniulus corallinus* (Gervais, 1842). A: whole body, not to scale; B: head, lateral view; C: caudal part, lateral view; D: midbody, lateral view

**Material examined.** 3 specimens. **Southwest Cay:** 2 specimens (KCB.TS.04.049-050), 11.4295°N, 114.3305°E, 14–17 June 2021, leg. Le Xuan Son. **Amboyna Cay:** 1 specimen (KCB.TS.04.909), 7.8968°N, 11.9174°E, 28 May 2021, leg. Le Xuan Son.

**Diagnosis.** Body brick-red, with pale black bands on the sides. 49–55 body rings; lengths 40–55 mm; width ca. 3.5–4.5 mm; collum broad, slightly overhanging epicranium; ocelli present; epiproct broad, extending only to caudal extremities of paraprocts; dorsal surfaces of mesozona smooth, without impressions.

**Distribution.** This is a pantropical species, widely distributed in the world. They commonly inhabit moist areas, especially in tropical gardens, plantations, or disturbed forests. In Vietnam, it is nationwide species.

## DISCUSSION

A total of 9 species belonging to 7 genera, 6 families, and 5 orders of two classes Chilopoda and Diplopoda were recorded from 10 small islands (Table 1, and the checklist below). These islands have small areas covered sparsely with poor vegetation; soils are very shallow and with a thin leaf-litter layer; therefore, it may also be a reason that the species diversity of myriapods is poor, especially Diplopoda. Myriapods were found mainly under bricks, stones, concrete, and in vegetable gardens on the island.

Spratly islands were formed from reefs and sedimentary rocks. The stability of coral rock makes the soil formation process slow and long, the organic matter that provides the soil formation process on the islands is mainly bird droppings (Nguyen Van Bach, 1997). And recently, there was been a large number of soil and rocks that people brought from the mainland to supplement soils for planting trees on these islands. That work may have brought soil animals, including possible myriapods, to the islands. However, the origin of myriapod species as well as other animals on the islands has so far been unknown.

Clarify this issue, it requires more intensive and comprehensive studies.

Of ten islands, the number of myriapod species was the highest in Southwest Cay (7), reduced to Sandy Cay, Namyit Island, Sin Cowe Island, Spratly Island, and Amboyna Cay (4 species each), Central Reef (3) and lowest in Grierson Reef, Pearson Reef, and West Reef (2 species each) (Table 1).

Of nine species, *R. longipes* is recorded with a much larger number of individuals than other species (202 specimens). This species was collected commonly in all ten islands (Table 1). Besides, in some other studies, *R. longipes* has also been recorded in some island countries in Southeast Asia such as Malaysia, the Philippines, and Singapore (Tran, 2013; Decker, 2013; Siriwt, 2018). Therefore, the appearance of this species in the Spratly archipelago will raise questions about its phylogenetic origin. They can be native species, or they can be species from the mainland or an island nation that migrated to this area. Along with that, the high frequency of encountering *R. longipes* also raises questions about the adaptability of this species in harsh sea and island conditions in the Spratly archipelago (as mentioned above). It is these things show that it is necessary to have further studies on biological and ecological characteristics combined with molecular analysis to understand the origin of *R. longipes* as well as the abnormal development of them on the islands of the Spratly (this may be related to food sources, environmental conditions, natural enemies). In Vietnam, Schileyko (2007) recorded the distribution of this species in only several localities of the Central and North regions of Vietnam, such as Hue, Dong Nai, and Kien Giang (Phu Quoc island). Tran et al. (2020) and Le et al. (2021) recorded a new distribution for *R. longipes* in Tien Hai Wetland Reserve (Thai Binh province) and at elevations above 1,600m a.s.l. in Phia Oac-Phia Den National Park (Cao Bang province). Thus, it can be seen that *R. longipes* has a wide distribution range in Vietnam.

Table 1. Myriapod species recorded in the Spratly Archipelago (Vietnam)

No.	Species	Island	Southwest Cay	Sand Cay	Namyit island	Grierson Reef	Sin Cowe island	Pearson Reef	Central Reef	Spratly island	West Reef	Amboyna Cay
1	<i>Scolopendra morsitans</i> Linnaeus, 1758		7	2							4	
2	<i>Rhysida longipes</i> (Newport, 1845)		12	23	35	2	21	30	40	24	7	6
3	<i>Cryptops (Cryptops) doriae</i> Pocock, 1891		7		3		1		1	3		1
4	<i>Cryptops (Paracryptops) indicus</i> (Silvestri, 1924)						2					
5	<i>Mecistocephalus mikado</i> Attems, 1928		13	3	4	1	5	1	3	2		
6	<i>Lithobius tricalcaratus</i> (Attems, 1909)				4					5		
7	<i>Anopsobiella dawydoffi</i> Attems, 1938		3									1
8	<i>Orthomorpha coarcata</i> (de Saussure, 1860)		12	1								
9	<i>Trigoniulus corallines</i> (Gervais, 1842)		2									1
	<b>Total of specimens</b>		<b>56</b>	<b>29</b>	<b>46</b>	<b>3</b>	<b>29</b>	<b>31</b>	<b>44</b>	<b>34</b>	<b>11</b>	<b>9</b>
	<b>Total species</b>		<b>7</b>	<b>4</b>	<b>4</b>	<b>2</b>	<b>4</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>4</b>

Notes: The number of each cell refers to the examined number of specimens.

Two other species, *Cryptops (Cryptops) doriae* Pocock, 1891 and *Mecistocephalus mikado* Attems, 1928, were also found commonly in the Spratly Archipelago (in 8 and 6 islands, respectively) while the other species were recorded in 1–4 localities (Table 1).

**An identification key to myriapod species occurring in the Spratly archipelago**

- 1. Each body segment with two pairs of legs.....the class Diplopoda, 2
- Each body segment with one pair of legs.....the class Chilopoda, 3
- 2. 20 body segments; eyes absent.....Polydesmida, *Orthomorpha coarcata*
- 49–55 body segments; eyes present.....Spirobolida, *Trigoniullus corallinus*
- 3. 21 body segments.....Scolopendromorpha, 4
- 15 body segments or more than 25 body segments.....7
- 4. Eyes present.....5
- Eyes absent.....6
- 5. 7<sup>th</sup> leg-bearing segment with spiracles, sternite with incomplete paramedian sutures, coxopleural process with 1 subapical and 1 lateral spine.....*Rhysida longipes*
- 7<sup>th</sup> leg-bearing segment without spiracles; ultimate tergites with median suture, coxopleural process with 1 subapical and 1 lateral spine.....*Scolopendra morsitans*
- 6. Trochanteroprefemur of forcipules stout and forcipular tarsungulae short (apical of tasungulae not touching each other when closed).....*Cryptops (Paracryptops) indicus*
- Forcipular tarsungulae long (tasungulae crossed when closed)..*Cryptops (Cryptops) doriae*
- 7. 15 body segments.....Lithobiomorpha, 8
- 49 body segments.....Geophilomorpha, *Mecistocephalus mikado*
- 8. Eyes absent; female gonopods with 2+2 spurs; terminal claw unfurcate.....
- .....*Anopsobiella dawydoffi*
- Eyes present; female gonopods with 3+3 spurs; terminal claw tridentate.....
- .....*Lithobius (Monotarsobius) tricalcaratus*

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