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RESEARCH ARTICLE

Scolopendromorph centipedes on the Karst Plateau: A survey from Bat Dai Son Nature Reserve, northern Vietnam

Le X. Son[1], Do T. Thinh[1], Nguyen H. Thuc[1], Tran T.T. Binh[2], Nguyen D. Anh[3]

1 *Joint Vietnam - Russia Tropical Science and Technology Research Centre, 63 Nguyen Van Huyen Road, Nghia Do, Hanoi, Vietnam*
2 *Hanoi National University of Education, 136 Xuan Thuy Str., Hanoi, Vietnam*
3 *Institute of Biology, Vietnam Academy of Science and Technology, 18 Hoang Quoc Viet Rd., Hanoi, Vietnam*

Corresponding author: Le X. Son (lesonenv86@gmail.com)

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Abstract

The species diversity of scolopendromorph centipedes in the Bat Dai Son Nature Reserve, located on the southwestern edge of the Dong Van Karst Plateau in northern Vietnam, is documented based on freshly collected specimens. A total of 27 specimens were examined resulting in six species belonging to four genera and three families, namely *Cryptops* (*Cryptops*) *tahitianus*, *Otostigmus aculeatus*, *Otostigmus voprosus*, *Scolopendra cataracta*, *Scolopendra dawydoffi*, and *Scolopocryptops spinicaudus*. This study provides information on examined specimens, illustrative photographs, and a discussion of the species' geographic distributions. An identification key is also presented to the scolopendromorph centipedes in Bat Dai Son Nature Reserve. The findings contribute to the understanding of myriapod diversity in northern Vietnam and highlight the faunal distinctiveness of transitional karst highlands within the Dong Van Plateau system.

Keywords

Biodiversity, fauna, distribution, Chilopoda, Scolopendromorpha, Vietnam

Introduction

The Bat Dai Son Nature Reserve is situated within the communes of Bat Dai Son, Can Ty, and Thanh Van in the Quan Ba District of Ha Giang Province, located in the northern Vietnam (Fig. 1). The geographical center of the reserve is marked by a limestone peak situated within a mountain range that extends in a southeast direction from the Chinese border. This mountain range is part of the upper reaches of the Gam River. The majority of the reserve is situated at elevations that exceed 1,000 meters, with the highest peak reaching 1,645 meters (BirdLife 2004). The forest habitats are characteristic of limestone mountain forests; however, a considerable portion of the forested area has been and continues to be severely affected by human farming activities.

As the northernmost nature reserve in Vietnam, Bat Dai Son holds considerable ecological and biogeographical significance. The region's flora is characterized by a significant proportion of species belonging to the China-Himalayan phytogeographic element, indicative of its position at the intersection of major floristic zones (Vu Van Dung & Vu Huy Thang 1999). Despite its uniqueness, the biodiversity of the reserve – particularly its invertebrate fauna – remains undocumented.

Studies on the centipede fauna (Chilopoda) of Ha Giang Province in general, and the Bat Dai Son Nature Reserve in particular, remain limited compared to many other groups of invertebrates. Previous surveys were mostly conducted as part of general biodiversity assessments, with results largely restricted to species checklists and lacking in-depth taxonomic or ecological analyses. In the comprehensive checklist of Vietnamese centipedes compiled by Tran Thi Thanh Binh et al. (2013), only three species of the order Scolopendromorpha were recorded from Ha Giang Province, namely *Scolopendra subspinipes*, *S. dawydoffi*, and *S. morsitans*. For Bat Dai Son specifically, no detailed publications have so far addressed the species composition, distribution patterns, or ecological characteristics of centipedes. This paucity of data highlights the considerable potential of the area for expanding knowledge of centipede diversity and biology, especially given its distinctive karst ecosystems.

This study presents the documentation of scolopendromorph centipedes from the Bat Dai Son Nature Reserve, a remote karstic highland in northern Vietnam. The findings contribute novel data to the taxonomy and distribution of scolopendromorphs in Vietnam and provide a foundation for further research on myriapod diversity within the broader China-Himalayan region.

Materials and methods

Specimens were collected using standard methods for sampling soil invertebrates, including soil sieving, pitfall trapping, and direct hand collection. Specimens were preserved in 70–80% ethanol and deposited in the Joint Vietnam–Russia Tropical

Science and Technology Research Center and the Faculty of Biology, Hanoi National University of Education.

Preserved specimens were examined, described and measured under Olympus SZ61 binocular microscope; the photos were taken using Olympus SC180 camera. Photographs of habitats were taken using a Canon EOS 7D digital camera. Preserved specimens were examined under an Olympus SZ61 binocular microscope, and images were captured using an Olympus SC180 camera. Image processing was performed using Helicon Focus 7.0 and Adobe Photoshop CC18.

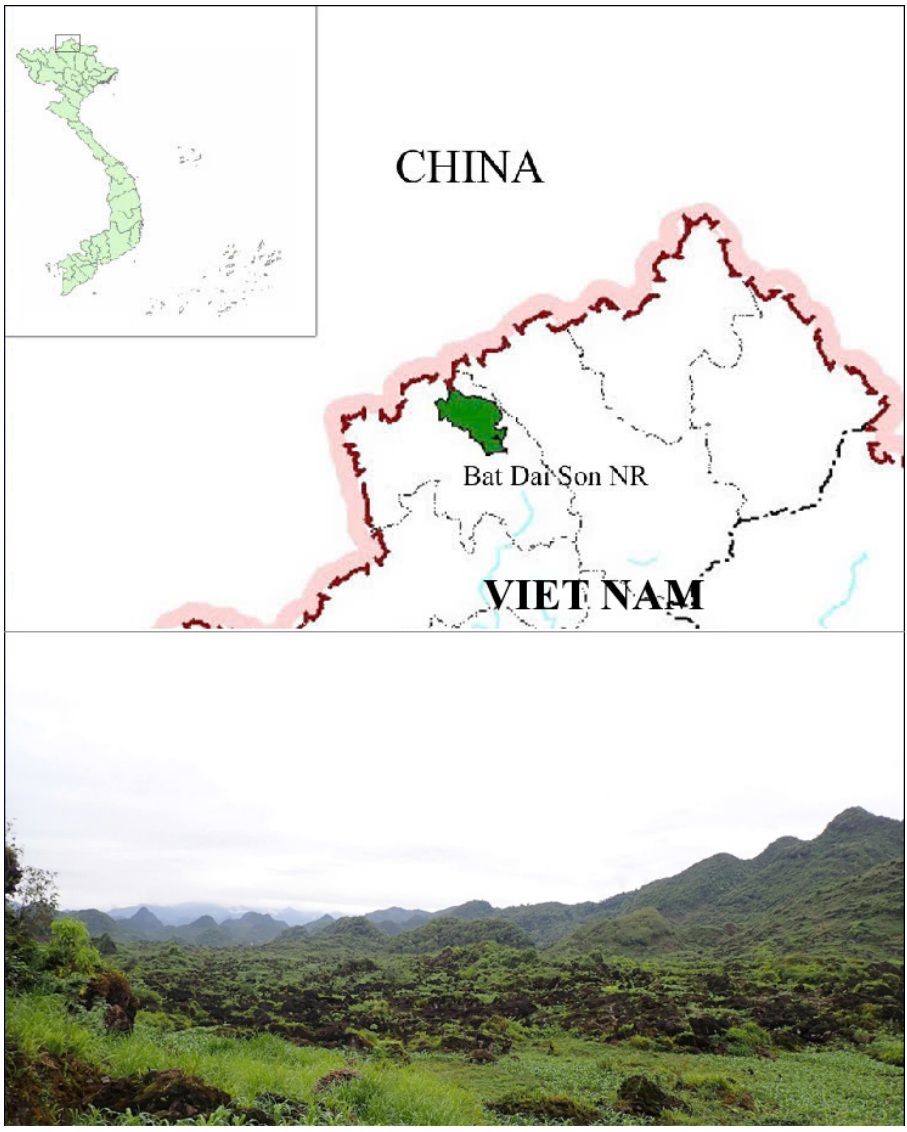

Figure 1. Locations and habitats of Bat Dai Son Nature Reserve, northern Vietnam.

Results and discussion

A total of 27 centipede specimens were collected from the Bat Dai Son Nature Reserve and identified to be six species in four genera and three families of the order Scolopendromorpha (Table 1, Fig. 2).

Table 1. Species composition of centipedes in Bat Dai Son Nature Reserve

No	Taxon	Number of individuals
	Family Cryptopidae Kohlrausch, 1881	
	Genus *Cryptops* Leach, 1815	
1	*Cryptops* (*Cryptops*) *tahitianus* Chamberlin, 1920	4
	Family Scolopendridae Pocock, 1891	
	Genus *Otostigmus* Porat, 1876	
2	*Otostigmus aculeatus* Haase, 1887	2
3	*Otostigmus voprosus* Schileyko, 1992	4
	Genus *Scolopendra* Linnaeus, 1758	
4	*Scolopendra cataracta* Siriwut và cs. 2016	3
5	*Scolopendra dawydoffi* (Kronmüller, 2012)	2
	Family Scolopocryptopidae Pocock, 1896	
	Genus *Scolopocryptops* Newport, 1844	
6	*Scolopocryptops spinicaudus* Wood, 1862	12

This study presents the inaugural species checklist of scolopendromorph centipedes from the Bat Dai Son fauna. The results of this study contribute three new records to the extant centipede fauna of Ha Giang Province. Among the identified taxa, the family Scolopocryptopidae was the most abundant, accounting for 12 individuals, all belonging to a single species, *Scolopocryptops spinicaudus*. The family Scolopendridae was represented by 11 individuals, comprising four species from two genera: *Otostigmus* (2 species) and *Scolopendra* (2 species). The family Cryptopidae exhibited the least representation, with a mere four individuals of a single species, *Cryptops* (*Cryptops*) *tahitianus*.

As reported in the studies of Tran et al. (2013) and Schileyko (2007), several species of Scolopendra have been identified in the Ha Giang Province, including *Scolopendra morsitans*, *S. subspinipes*, and *S. dawydoffi*. However, these records exclusively referenced the provincial level and lacked specificity regarding precise collection localities. In the present study, we confirmed the occurrence of *S. dawydoffi* in Bat Dai Son Nature Reserve, while *S. morsitans* and *S. subspinipes* were not recorded. The absence of *S. morsitans* in our samples can be explained by its ecological preference for lowland areas, which is consistent with previous distribution data (Tran et al. 2013; Le et al. 2022, 2024). Conversely, *S. subspinipes* is a species that is

widely distributed throughout Vietnam. Therefore, it is plausible that this species occurs in the study area but was not detected during the present survey.

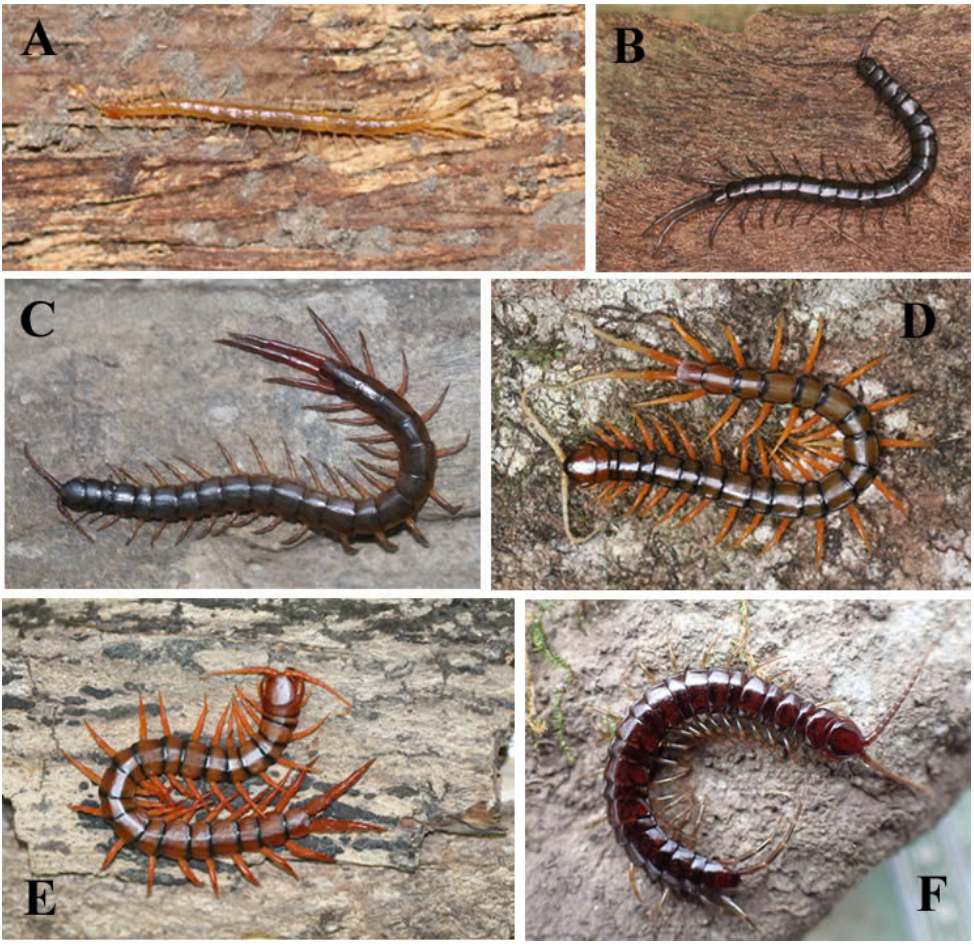

Figure 2. Habitus of scolopendromorph centipedes recorded in Bat Dai Son Nature Reserve: **A.** *Cryptops* (*Cryptops*) *tahitianus* Chamberlin, 1920; **B.** *Otostigmus aculeatus* Haase, 1887; **C.** *Otostigmus voprosus* Schileyko, 1992; **D.** *Scolopendra cataracta* Siriwut, Edgecombe, Sutcharit, Tongkerd & Panha, 2016; **E.** *Scolopendra dawydoffi* (Kronmüller, 2012); **F.** *Scolopocryptops spinicaudus* Wood, 1862

Cryptops (*Cryptops*) *tahitianus* Chamberlin, 1920

Figures 2A, 3A

Material examined: 3 specimens (VRTC.BDS.054-056), 23.08341°N, 104.94950°E, 890 m, broadleaf forest, 21 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.065), 23.08416°N, 104.94915°E, 900 m, broadleaf forest, 21 April 2022, col. Le X.S.

Remark: The presence of *Cryptops* (*Cryptops*) *tahitianus*, a species widely distributed across tropical Asia–Pacific regions (Bonato et al. 2016), supports the biogeographical transitional character of the study area. *C. tahitianus* is a common tropical species, recorded from numerous islands and regions in Southeast Asia, indicating that the surveyed area lies within an ecological zone suitable for its biology. Its relatively high occurrence suggests a good level of adaptation to local environmental conditions.

***Otostigmus aculeatus* Haase, 1887**
Figures 2B, 3B,E, 4A

Material examined: 1 specimen (VRTC.BDS.020), 23.10771°N, 104.97812°E, 980 m, agricultural area, 19 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.022), 23.11105°N, 104.97612°E, 990 m, agricultural area, 19 April 2022, col. Abramov A.B.

Remark: Previously, *Otostigmus aculeatus* was mainly recorded in tropical and subtropical regions of Southeast Asia and is widely distributed in Vietnam (Tran et al. 2013; Vu et al. 2020). Its occurrence in Bat Dai Son – a mid-elevation limestone area – indicates a high degree of ecological adaptability. This finding helps clarify the biogeographical transition between the northern fauna and southern regions, and also suggests a zoogeographical connection between northeastern Vietnam and nearby tropical areas.

***Otostigmus voprosus* Schileyko, 1992**
Figure 2C

Material examined: 1 specimen (VRTC.BDS.013), 23.08343°N, 104.94949°E, 900 m, broadleaf forest, 16 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.014), 23.08439°N, 104.94871°E, 910 m, broadleaf forest, 16 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.015), 23.08183°N, 104.94888°E, 820 m, broadleaf forest, 16 April 2022, col. Le X.S.

Remark: *Otostigmus voprosus* is a species currently known only from Vietnam (Schileyko 2007), with confirmed records restricted to the northern region (Vu et al. 2020). The occurrence of this species in Bat Dai Son suggests a narrow distribution range and raises the possibility of local endemism. This new locality record not only expands the known distribution of *O. voprosus* but also underscores the biological significance of Bat Dai Son as a habitat for lesser-known and potentially range-restricted centipede taxa.

***Scolopendra cataracta* Siriwut, Edgecombe, Sutcharit, Tongkerd & Panha, 2016**
Figuress 2D, 3C,D

Material examined: 3 specimens (VRTC.BDS.068.1-068.3), 23.10052°N, 104.97338°E, 930 m, Residential area, 22 April 2022, col. Le X.S.

Remark: The discovery of *Scolopendra cataracta*, a species with rare semi-aquatic behavior (Siriwut et al. 2016), is of particular ecological interest and underscores the behavioral and adaptive diversity of centipedes in the region. Known for its ability to swim, *S. cataracta* exhibits an unusual lifestyle rarely observed in centipedes. This marks the first record of the species in the area and opens up new questions regarding its ecology and natural behavior in Vietnam.

***Scolopendra dawydoffi* (Kronmüller, 2012)**
Figures 2E, 4C

Material examined: 1 specimen (VRTC.BDS.067), 23.10052°N, 104.97338°E, 930 m, Residential area, 22 April 2022, col. Le X.S.

Remark: *Scolopendra dawydoffi* – previously recorded primarily in Laos and southern Vietnam (Siriwut et al. 2016), the first time it is reported here for from northern Vietnam. This is a noteworthy record, as the locality lies beyond the species' previously known range, which was thought to be restricted to tropical and subtropical regions of the south. The occurrence of this specimen in the karst mountain habitats of Ha Giang Province not only provides further evidence of the species' presence in the north but also suggests that the distribution of *S. dawydoffi* may be considerably wider than previously recognized.

***Scolopocryptops spinicaudus* Wood, 1862**
Figures 2F, 4B

Material examined: 1 specimen (VRTC.BDS.001), 23.09678°N, 104.97258°E, 1030 m, broadleaf forest, 14 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.002), 23.09680°N, 104.97227°E, 1020 m, broadleaf forest, 14 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.003), 23.09669°N, 104.97531°E, 1020 m, broadleaf forest, 14 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.006), 23.09743°N, 104.97150°E, 1010 m, broadleaf forest, 14 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.012), 23.10052°N, 104.97338°E, 930 m, broadleaf forest, 15 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.0027; 028), 23.10657°N, 104.98164°E, 1040 m, broadleaf forest, 19 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.040), 23.13286°N, 104.93171°E, 1240 m, broadleaf forest, 20 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.048), 23.13318°N, 104.93134°E, 1261 m, broadleaf forest, 20 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.053), 23.08341°N, 104.94950°E, 890 m, broadleaf forest, 21 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.064), 23.08416°N, 104.94915°E, 900 m, bamboo forest, 21 April 2022, col. Le X.S.; 1 specimen (VRTC.BDS.070), 23.13263°N, 104.93206°E, 1230 m, broadleaf forest, 20 April 2022, col. Le X.S.

Remark: *Scolopocryptops spinicaudus* may occupy an important ecological position within the soil invertebrate community, playing a role in regulating populations of small organisms through its predatory activity. In the present sample set, this species was recorded with 12 individuals, indicating its clear dominance and potential

central role in the soil food web. Previous studies have shown that *S. spinicaudus* is an active predator, feeding on earthworms, small insects, and other similarly sized invertebrates (Edgecombe & Giribet 2007).

An identification key to Scolopendromorpha species of Bat Dai Son NR

1 Body with 21 leg-bearing segments; three or more basal antennal articles nearly glabrous dorsally; ultimate leg prefemur with multiple spine rows **2**

– Body with 23 leg-bearing segments (Fig. 2F); two basal antennal articles nearly glabrous dorsally; ultimate leg prefemur with two spinous processes of typical structure and disposition (Fig. 4B) .... ***Scolopocryptops spinicaudus***

2 Ocelli present (Fig. 3B); all legs glabrous; coxopleural process with apical spines (Fig. 4A) ***3***

– Ocelli absent, setae present on all legs (Fig. 3A); coxopleural process without apical spines..... ***Cryptops* (*Cryptops*) *tahitianus***

3 Spiracles triangular (Fig. 3C); 5-6 basal antennal articles glabrous dorsally; ultimate leg prefemur with a few enlarged spines in rows (Fig. 4C)..... genus *Scolopendra*..... 4

– Spiracles oval (Fig. 3B); three basal antennal articles nearly glabrous dorsally; ultimate leg prefemur with numerous small, scattered spines (Fig. 4A).....genus *Otostigmus* ***5***

4 Short paramedian sutures present on the posterior margin of the tergites (Fig. 3D)..... ..... ***S. cataracta***

– Short paramedian sutures absent on the posterior margin of the tergites... ..... ***S. dawydoffi***

5 Sterna with paramedian sutures (Fig. 3E); coxopleural process with 5-6 apical spines, 2–3 lateral spines; ultimate leg with numerous small rows of spines (Fig. 4A) ..... ***O. aculeatus***

– Sterna without paramedian sutures; coxopleural process with one apical spine, 1-2 lateral spine; ultimate leg with rows of bigger spines..... ..... ***O. voprosus***

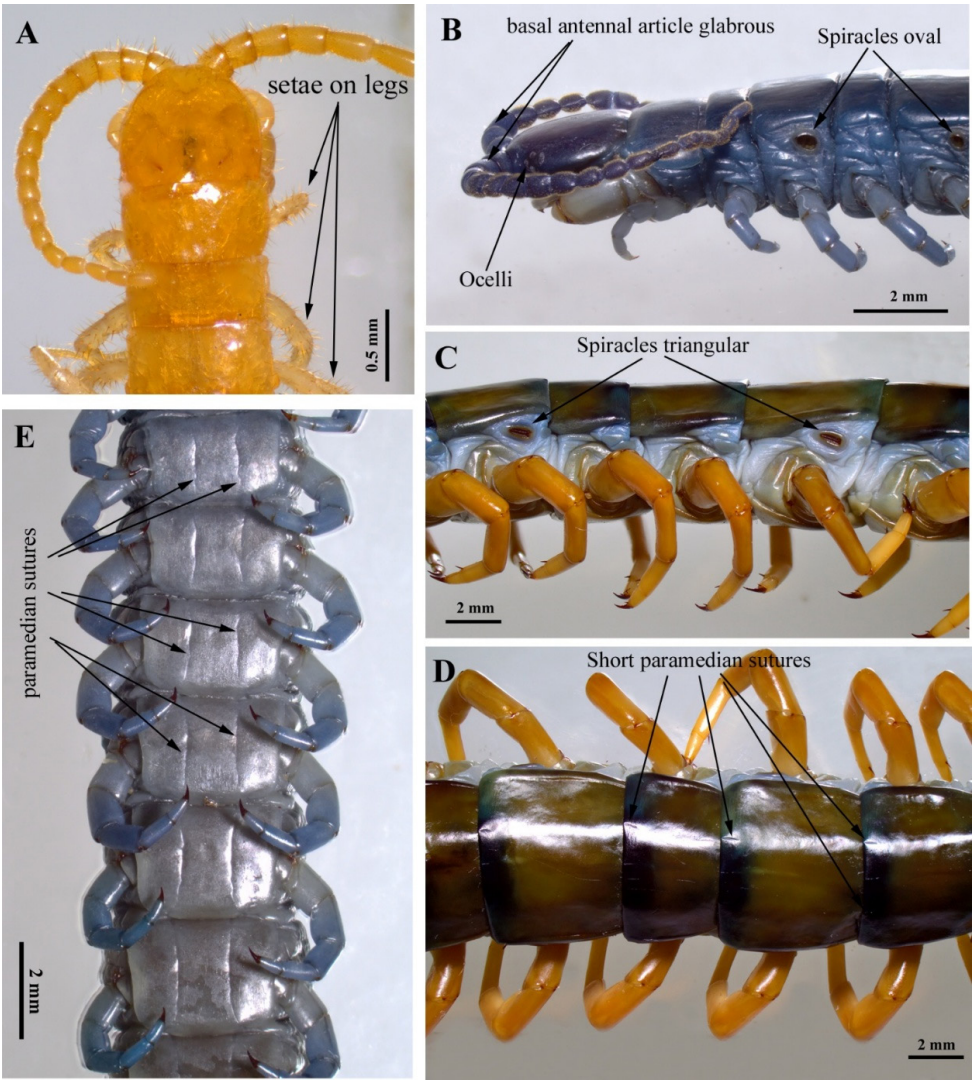

Figure 3. Morphological characters used in the key: **A.** *Cryptops* (*Cryptops*) *tahitianus*; **B, E.** *Otostigmus aculeatus*; **C, D.** *Scolopendra cataracta*.

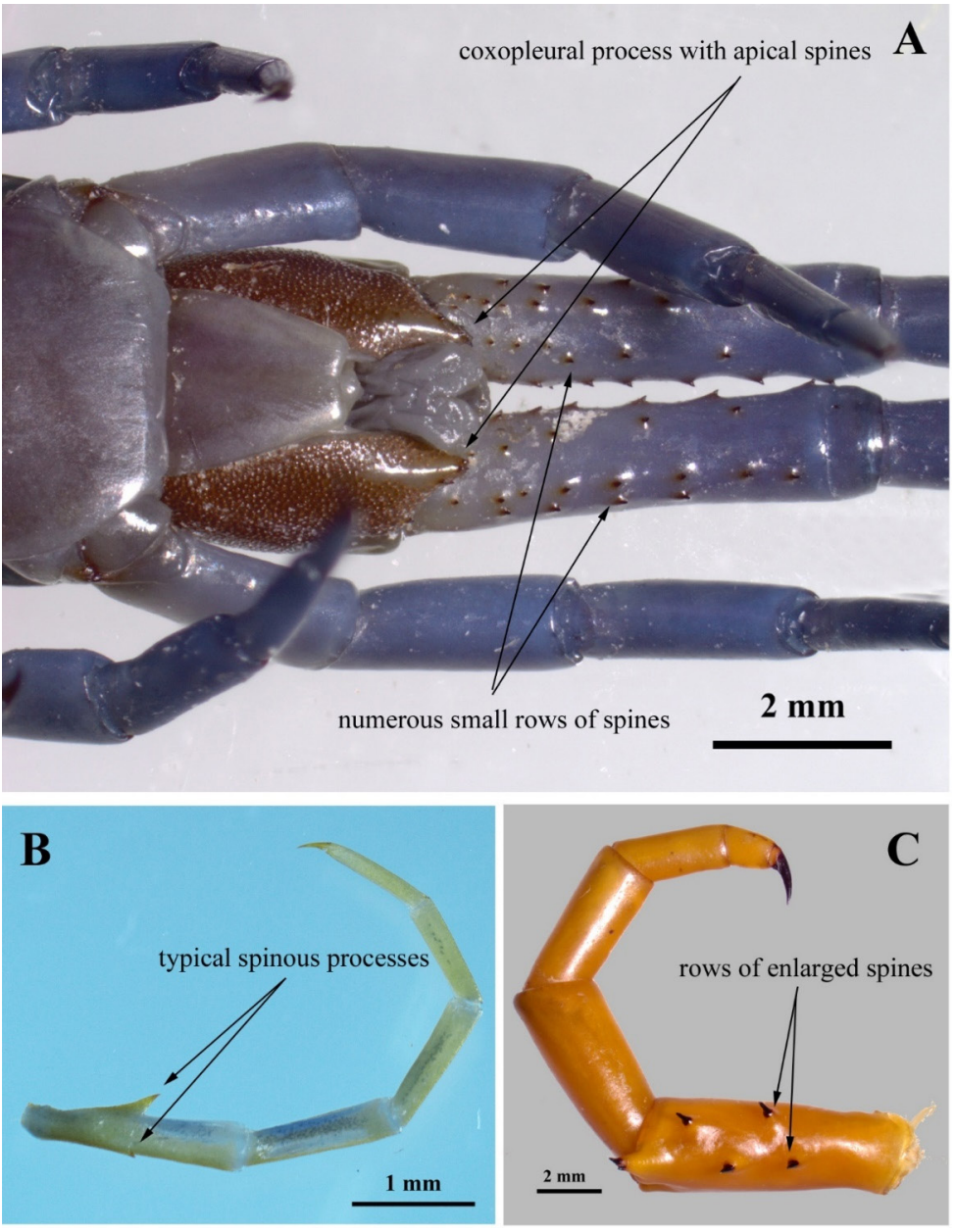

Figure 4. Morphological characters used in the key: **A.** *Otostigmus aculeatus*; **B.** *Scolopocryptops spinicaudus*; **C.** *Scolopendra dawydoffi*.

Conclusions

Preliminary data from the species table not only reflect the taxonomic diversity of scolopendromorph centipedes in Bat Dai Son but also provide an initial basis for assessing ecological conditions, species dominance, and potential roles in the structure of the soil invertebrate community. However, it is important to emphasize that the current results are provisional, limited by sampling scale, seasonality, and collection methods. A more comprehensive understanding of the community structure requires extended seasonal surveys, the use of diverse sampling techniques, and an integrative approach combining morphological and molecular taxonomy.

Within the recorded assemblage, the family Scolopocryptopidae, though represented by only a single species (*Scolopocryptops spinicaudus*), accounted for nearly half of all collected specimens. In contrast, the family Scolopendridae included four species from two genera, but with relatively lower and more evenly distributed abundances. This disparity suggests an uneven taxonomic structure, which may be related to ecological traits, trophic positions, or microhabitat conditions within the surveyed area.

Compared to previous surveys in northern Vietnam and neighboring regions such as Laos and Cambodia (Tran et al. 2013; Siriwut et al. 2016; Le et al. 2021), the number of species recorded in Bat Dai Son is relatively high. The discovery of recently reported species such as *Scolopendra cataracta* and *S. dawydoffi* suggests that this area may harbor additional, yet undescribed or previously unrecorded species in Vietnam.

Given the limited existing knowledge of centipede communities in Vietnam – particularly within northern limestone ecosystems – expanded surveys in similar habitats are essential. These initial findings reinforce the role of Bat Dai Son as a conservation priority area for soil invertebrate biodiversity in northern Vietnam.

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