SPECIES DIVERSITY OF THE LARGE CENTIPEDES (Chilopoda: Scolopendromorpha) IN THE MUONG NHE NATURE RESERVE, DIEN BIEN PROVINCE

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1. INTRODUCTION

Muong Nhe Nature Reserve (NR) is located in the western area of Dien Bien province, northwestern Vietnam. It has an area of 46 730.51 ha. This area has specific forest ecosystems for the Northwest region of Vietnam. However, at present, natural habitats are serious degraded by farming activities of local people. The protected forest areas play an important role in the protection of the region as well as the Da river basin.

The geographical location and specific forest ecosystems created Muong Nhe NR has high biodiversity and that is a place to save and live many rare species of animals and plants. However, like many other regions in Vietnam, this region has not had much research on centipedes. The data so far are very fragmentary, lack of systematic, centipedes have only been recorded in some studies by Vu *et al.* and Schileyko [1, 2]. According to these studies, three species have been recorded in Dien Bien province, namely *Otostigmus voprosus*, *Otostigmus aculeatus* and *Otostigmus multidens*. In this study, *Otostigmus aculeatus* and *Otostigmus multidens* were recorded again, whereas *Otostigmus voprosus* was not recorded.

In order to contribute to the conservation and monitoring of biodiversity in general, a complete study of the centipede area is of great importance both in theory and practice.

2. MATERIALS AND METHODS

The field surveys were carried out during the period of 2018 - 2020. Specimens were collected from different habitats (wood forest, bamboo forest, mixed wood-bamboo forest and agricultural area) using hand, sieving leaf litter, and pitfall trapping. Centipede samples were preserved in ethanol 75-80% and deposited in Joint Vietnam - Russia Tropical Science and Technology Research Centre and Hanoi National University of Education, Vietnam.

Scolopendromorph specimens were morphologically examined by using the Olympus microscope SZ61. Species identification follows Bonato *et al.* [3], Siriwut *et al.* [4, 5], Schileyko [2, 6], Schileyko *et al.* [7].

3. RESULTS AND DISCUSSION

Taxonomic part

Family Scolopendridae Leach, 1814

Subfamily Scolopendrinae Leach, 1814

Genus *Scolopendra* Linnaeus, 1758

***1. Scolopendra dehaani* Brandt, 1840**

Figures 1-3.

Material examined: 03 specimes (spms) (DB.LG.01, DB.LG.02, DB.LG.03) agricultural area, 21°12’46.3N, 103°23’54.3’’E, 610m above sea level (a.s.l), December 2019, collector (col.). Nguyen D. Hung & Le X. Son.

Distribution: Cao Bang province (Phia Oac - Phia Den National Park (NP)); Son La (Xuan Nha NR); Quang Ninh (Hon Gai; Ha Long); Nghe An (Vinh); Dak Lak (Ban Me Thuot); Gia Lai (Kon Chu Rang NR); Kon Tum; Ba Ria - Vung Tau (Con Dao Island) [8 - 11].

Remarks: This can be said to be the largest species in Asia (body length can be up to 28-30 cm). It was previously classified as a subspecies of *Scolopendra subspinipes*, which is a subspecies of *Scolopendra subspinipes dehaani*, however, morphological confirmation by Kronmuller and molecular by Siriwut confirmed it to be an independent species [12, 13].

***2. Scolopendra calcarata* Porat, 1876**

Figures 4-6.

Material examined: 2 spms (DB015, DB016), Agricultural area, 21°12’46.34”N, 103°23’54.2”E, May 2019, 610m a.s.l, col. Nguyen D. Hung.

Distribution: Son La, Hoa Binh, Vinh Phuc, Hai Phong, and Hanoi [8, 14, 15], Kon Tum (Thach Nham forest) [16].

Remarks: Specimens in Muong Nhe NR have almost the same characteristics as described by Schileyko [6]. However, in our specimens, it was observed that antennae with 3 basal articles glabrous, while the Schileyko reported that antennae with 5-6 basal articles glabrous.

***3. Scolopendra subspinipes* Leach, 1815**

Figures 7-9.

Material examined: 1 specimen (spm) (MN101) agricultural area, 21°12’46.3”N, 103°23’54.3”E, 610m a.s.l, 01 November 2018, col. Nguyen D. Hung; 2 spms (MN102-103) agricultural area, 22°17’35.1”N, 102°23’3.7”E, November 2019, 837m a.s.l, col. Le X. Son; 2 spms (DB021-DB022**)** agricultural area, 22°17’45.0”N, 102°24’04.9”E, December 2019, 651m a.s.l, col. Le X. Son; 1 spms (DB023) agricultural area, 22°17’54.8”N, 102°24’21.0”E, December 2019, 860m a.s.l, col. Nguyen D. Hung.

Distribution: Lao Cai (Hoang Lien NP); Cao Bang (Phia Oac - Phia Den NP), Son La (Ta Xua NR, Xuan Nha NR), Vinh Phuc (Tam Dao NP); Ha Noi; Hoa Binh (Thuong Tien NR), Hai Phong (Cat Ba NP); Quang Binh (Minh Hoa; Dong Hoi); Thua Thien Hue; Da Nang (Ba Na Mts); Gia Lai (Kon Ka Kinh NP, Kon Chu Rang NR), Kon Tum (Thach Nham forest), Dak Lak; Khanh Hoa (Hon Ba Mountain); Dong Nai (Cat Tien NP) [8, 10, 11, 14-17].

Remarks: The characteristics of the specimens in this study are consistent with the description of Kronmüller and Siriwut [4, 12]. However, the length of the specimens in Dien Bien is up to 22 cm, longer than described by Siriwut, the length is only 16 cm.

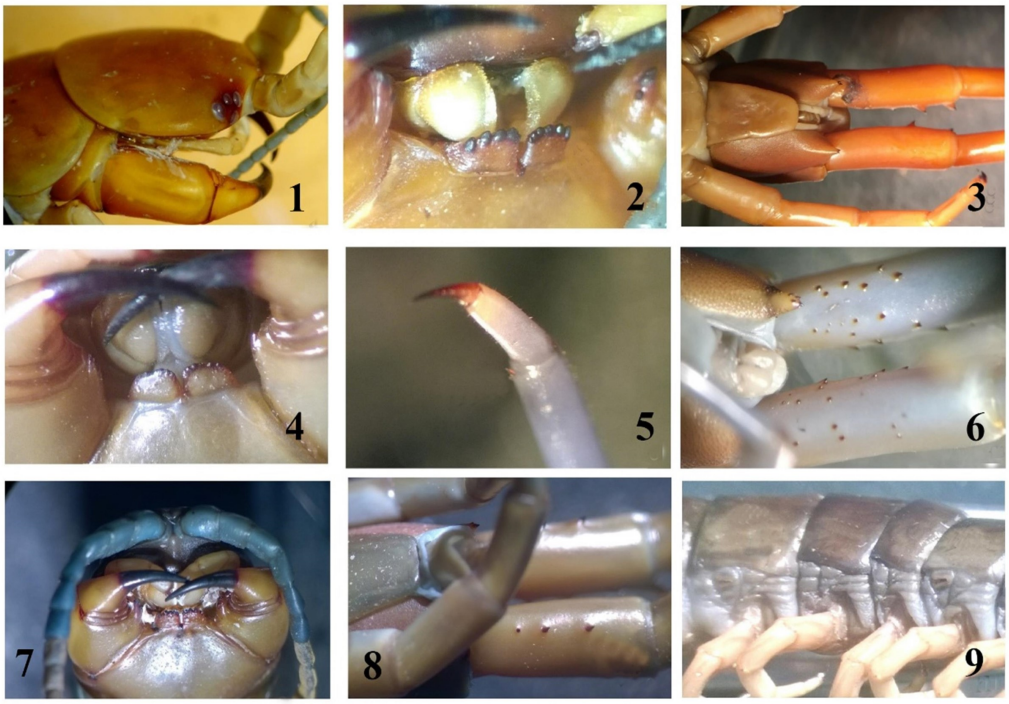


Figure 1-9. Genus *Scolopendra* Linnaeus, 1758

Note: 1-3: *Scolopendra dehaani* Brandt, 1840 (**1**: Head plate ventral-lateral view; **2**: Toothplate and teeth, ventral view; **3**: leg-bearing segment 21 + prefemora of ultimate legs, ventral view); **4-6**: Scolopendra calcarata Porat, 1876 (**4**: forcipular segment, ventral view; **5**: Ultimate leg with a tarsal spur; **6**: Prefemur of left ultimate leg, lateral view); **7-9:** Scolopendra subspinipes Leach, 1815 (**7**: Forcipular segment, ventral view; **8**: leg-bearing segment 21 + prefemur of right ultimate leg, ventral view; **9**: left pleuron of leg-bearing segment 5-8 with strangle spiracles).

Subfamily Otostigminae Krapelin, 1903

Genus *Otostigmus* Porat, 1876

***4. Otostigmus multidens* Haase, 1887**

Figures 10-12.

Material examined: 2 spms (MN020, MN040) mixed bamboo-wood forest, 22°17’56.9”N, 102°24’19.5”E, 684m a.s.l, 11 August 2020, col. Le X. Son; 1 spm (MN037) mixed bamboo-wood forest, 22°17’31.3”N, 102°23’14.5”E, 716m a.s.l, 11 August 2020, col. Le X. Son;

Distribution: Son La (Ta Xua NR, Xuan Nha NR), Hoa Binh (Thuong Tien NR, Mai Chau), Da Nang, Hai Phong (Cat Ba NP), Ha Tinh (Vu Quang NP), Khanh Hoa (Nha Trang), Gia Lai (An Khe, Buon Luoi), Lam Dong (Da Lat), Dong Nai (Cat Tien NP), Ta Ninh (Lo Go - Xa Mat NP) and Ba Ria - Vung Tau [8, 9, 14].

Remarks: Our specimens in this study are similar to those described by Schileyko [6]. However, in our specimens, there are 0 to 7 small, haphazardly arranged spines on the femur of ultimate legs, but Schileyko's description shows that on femur of ultimate leg with 10 spines arranged in obvious vertical line.

***5. Otostigmus aculeatus* Haase, 1887**

Figures 13-15.

Material examined: 3 spms (MN104, MN105, MN107) wood forest, 22°18’02.5”N, 102°23’54.4”E, 558m a.s.l, 01 November 2018; 1 spm (Iebr-Chi 074) bamboo forests, 20°42’32.76”N, 104°41’12.84”E, 14 June 2019; 1 spm (Iebr-Chi 076) mixed forests, 20°42’38.88”N, 104°41’12.84”E, 673m a.s.l, 14 May 2019; 1 spm (Iebr-Chi 179) residential area, pitfall trapping, 11 January 2018. All of specimens collected by Le X. Son & Nguyen D. Hung.

Distribution: Lao Cai (Hoang Lien NP), Cao Bang (Phia Oac - Phia Den NP), Son La (Xuan Nha NR, Ta Xua NR), Hoa Binh (Mai Chau, Thuong Tien NR), Vinh Phuc (Tam Dao NP, Me Linh), Quang Ninh (Hon Gai, Ha Long, Dong Kho Island, Bai Tu Long NP), Bac Giang (Tay Yen Tu NR), Ha Noi (Ba Vi NP), Hai Phong (Cat Ba NP), Ninh Binh (Cuc Phuong NP), Nghe An (Pu Mat NP), Quang Binh (Son Trach), Quang Ngai (Ly Son Island), Quang Nam (Cu Lao Cham Island, Song Thanh NR), Gia Lai (Kon Ka Kinh NP), Kon Tum (Buon Luoi, Thach Nham forest), Dak Lak, Gia Lai (An Khe), Dong Nai (Cat Tien NP) [2, 8-10, 11, 14-17].

Remarks: The specimens in our study have similar morphological characteristics compared to those described by Schileyko [18]. However, some speciments with had 2+2 teeth on the tooth plate compared to the 4+4 teeth described by Schileyko.

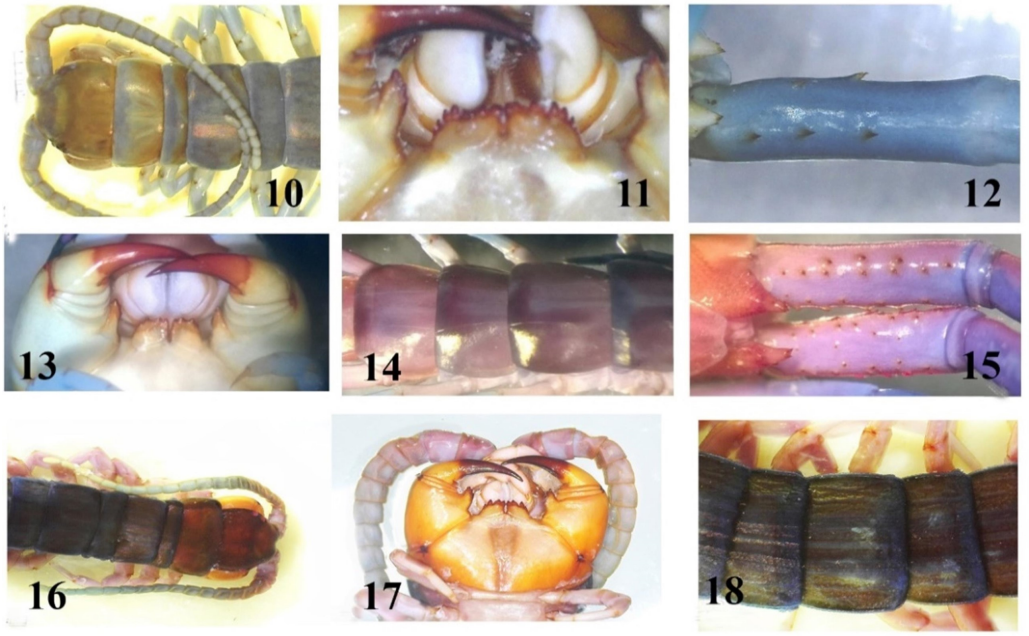
***6. Otostigmus scaber* Porat, 1876**

Figures 16-18.

Material examined: 1 spm (MN002) wood forest, 22°19’57.6”N, 102°21’14.0”E, 692m a.s.l, 12 April 2018, col. Nguyen D. Hung. 1 spm (MN003) wood forest, 22°19’49.8”N, 102°21’17.9”E, 580m a.s.l, 12 April 2018, col. Nguyen D. Hung**,** 1 spm (MN111) wood forest, 22°12’46.3”N, 103°23’54.3”E, 610m a.s.l, 07 May 2019, col. Le X. Son; 2 spms (MN114, MN115) wood forest, 22°17’56.9”N, 102°24’19.5”E, 684m a.s.l, 08 May 2019, col. Le X. Son.

Distribution: Son La (Xuan Nha NR, Ta Xua NR), Hoa Binh (Thuong Tien NR), Ninh Binh (Cuc Phuong NP), Hai Phong (Cat Ba NP); Quang Binh (Minh Hoa District); Quang Nam (Song Thanh NR), Da Nang (Ba Na NP); Gia Lai (Kon Ka Kinh NP, Kon Chu Rang NR, An Khe District, Buon Luoi); Dak Lak (Chu Yang Sin NP), Lam Dong (Da Lat, Langbian Mts.); Dong Nai (Ma Da) [2, 8-11, 14, 15].

Remarks: Our specimens agree with the description of Schileyko [18].



Figures 10-18. Genus *Otostigmus* Porat, 1876

Note: 10-12: *Otostigmus multidens* Haase, 1887 (**10**: cephalic plate and segments 1-5, dorsal view; **11**: forcipular segment ventral view; **12**: prefemur of left ultimate leg, ventral view); **13-15**: Otostigmus aculeatus Haase, 1887 (**13** prefemur of left ultimate leg, ventral view; **14**: leg-bearing segment 15-18, dorsal view); **16-18**: Otostigmus scaber Porat, 1876 (**16**: cephalic plate and segments 1-5, dorsal view; **17**: forcipular segment, ventral view; **18**: leg-bearing segment 9-11, dorsal view with many keels on tergites)**.**

Genus *Rhysida* H. C. Wood, 1862

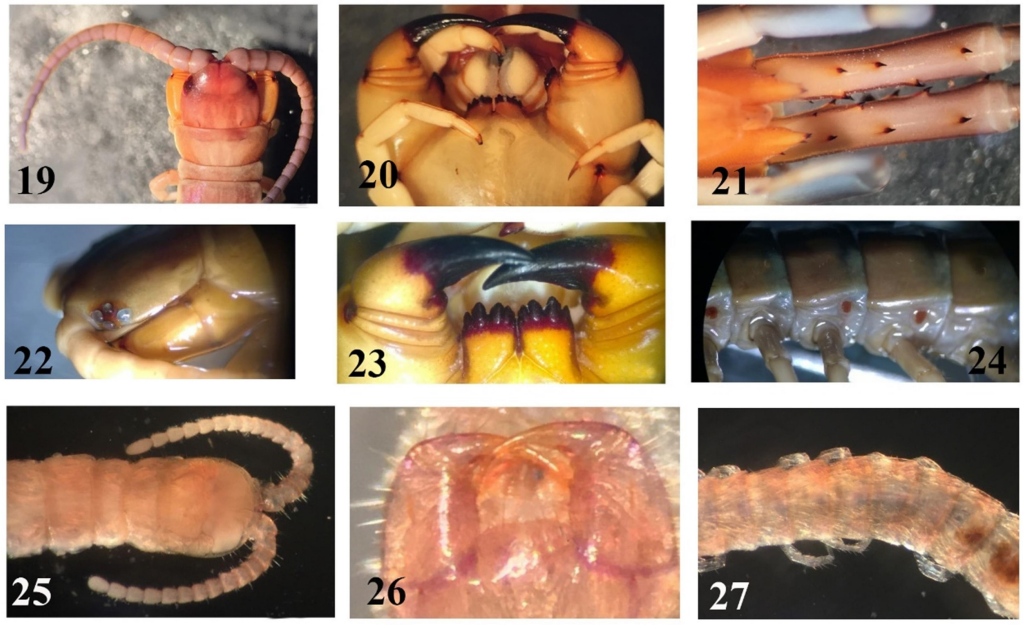
***7. Rhysida longipes* (Newport, 1845)**

Figures 19-21.

Material examined: 4 spms (DB013; DB018, DB019, DB020) agricultural area, 21°12’46.3”N, 103°23’54.3”E, 610m a.s.l, 12 May 2019, col. Le X Son & Nguyen D. Hung. 1 spm (MN018.1) agricultural area, 22°18’02.5”N, 102°23’54.4”E, 558 m a.s.l, November 2018, col. Le X. Son, 1 spm (TD143) wood forest, 22°17’38.5”N, 102°22’56.6”E, 555 m a.s.l, 10 August 2020, col. Nguyen D. Hung; 1 spm (TD145) wood forest, 22°17’09.9”N, 102°22’41.9”E, 576 m a.s.l, 08 May 2019, col. Le X. Son.

Distribution: Dien Bien (Dien Bien Dong), Thai Binh (Tien Hai NR), Thua Thien Hue (Hai Van Pass), Dong Nai (Ma Da), Kien Giang (Phu Quoc Island) [8].

Remarks: The specimens fit to Koch's description. However, the maximum length of specimens in our study is 90 mm, while Koch's description is only 73 mm [19].



Figures 19-27. Genus *Rhysida* H. C. Wood, 1862

Note: 19-21: *Rhysida longipes* (Newport, 1845) (**19**: head and leg-bearing segments 1-3, dorsal view; **20**: head and forcipular segment, ventral view; **21**: leg-bearing segment 21 + prefemora of ultimate legs, ventral view); **22-24:** Ethmostigmus rubripes spinosus (Newport, 1845). **22**: head and ocelli, ventro-lateral view; **23**: head and forcipular segment without forcipular trochanteroprefemur, ventral view; **24**: left pleuron of leg-bearing segment 5 - 9 with spiracles on the 7th body segment); **25-27**: Cryptops (Trigonocryptops) spinipes Pocock, 1891 (**25**: head without ocelli and leg-bearing segments 1-4, dorsal view; **26**: head and forcipular segment without toothplate, ventral view; **27**: segments of mid body, dorsal view).

***8. Rhysida immarginata* (Porat, 1876)**

Material examined: 2 spms (DB018, DB019) Residential area, 21^{o}12’46.3”N, 103^{o}23’54.3”E, 610m a.s.l, 12 May 2019, col. Le X. Son & Nguyen D. Hung.

Distribution: Quang Ninh (Ha Long Archipelage), Nghe An (Vinh), Son La (Ta Xua NR), Thai Binh (Tien Hai NR) [8, 14].

Remarks: The morphological features of this species are similar to *Rhysida longipes*. However, *Rhysida longipes* has lateral margins on the tergites and it is more obvious in end tergites, while the *Rhysida immarginata* only present this margination on ultimate tergite.

Genus *Ethmostigmus* Pocock, 1898

***9. Ethmostigmus rubripes spinosus* (Newport, 1845)**

Figures 22-24.

Material examined: 1 spm (DB017) agricultural area, 21°12'46.3"N, 103°23'54.2"E, 610m a.s.l, May 2019, col. Nguyen D. Hung; 2 spms (MN043, MN044) Bamboo forest, 22°17'45.0"N, 102°24'04.9"E, 651m a.s.l, 12 August 2020, col. Le X. Son.

Distribution: Lai Chau (Hoang Lien NP), Hoa Binh (Thuong Tien NR), Hai Phong (Cat Ba) and Dong Nai (Ma Da) [8, 15].

Remarks: The morphological features were consistent with Schileyko's description [2]. However, there are some other features such as 21 antennae (Chileyko describes 17-20 antennae) and tooth plate with 4+4 teeth (different from Schileyko with 3+3 teeth).

Family Cryptopidae Kohrausch, 1881

Genus *Cryptops* Verhoeff, 1906

***10. Cryptops (Trigonocryptops) spinipes* Pocock, 1891**

Figures 25-27.

Material examined: 1 spm (MN023) wood forest, 21°17'31.3"N, 102°23'14.5"E, 716m a.s.l, 7 May 2018; 1 spm (TD144) Mixed Bamboo-wood forest, 22°17'45.0"N, 102°24'04.9"E, 651m a.s.l, 12 August 2020; 1 spm (TD147) Wood forest, 22°17'45.0"N, 102°24'04.9"E, 651m a.s.l, 12 August 2020; 1 spm (TD149) Wood forest, 22°17'45.0"N, 102°24'04.9"E, 651m a.s.l, 12 August 2020; 1 spm (TD152.1) Bamboo forest, 22°17'45.0"N, 102°24'04.9"E, 651m a.s.l, 12 August 2020; 1 spm (TD155) Wood forest, 22°17'45.0"N, 102°24'04.9"E, 651m a.s.l, 12 August 2020. All of specimens collected by Le X. Son.

Distribution: Hai Phong (Cat Ba NP) and Dong Nai (Cat Tien NP). In 2019 and 2021, Nguyen and Le further recorded the distribution of this species in Lao Cai (Hoang Lien NP) and Cao Bang (Phia Oac - Phia Oac NP) [11, 17].

Remarks: The specimens in our study showed an average size of 6.2 - 8mm, while the described specimens of Schileyko with a maximum length of 25mm [2]. However, our specimens are completely similar to those described by Chao and Wang in Taiwan [20].

4. CONCLUSION

- This study has added 8 species to Muong Nhe Nature Reserve, bringing the total number of species recorded in Dien Bien province to 11 species belong to 5 genera and 2 families of the order large centipede Scolopendromorpha.

- Of the five genera recorded in the study area, the genus *Otostigmus* has the most diverse species with four species, this is similar to the studies in other centipede fauna in Vietnam; followed by the genus *Scolopendra* with three species, the genera *Cryptops* and *Ethmostigmus* recorded only one species. The family Scolopendridae predominates with 10 species recorded, while the family Cryptopidae has only one species.

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SUMMARY

This paper introduces the results that study on the diversity of the large centipede Scolopendromorpha in Muong Nhe Nature Reserve (Dien Bien province). The results recorded 10 species belonging to five genera and two families. This result has added eight species to the centipede fauna in this area, bringing the total number of species recorded here to 11 species. Of which two species have been recorded by Vu *et al*. (2020) are *Otostigmus multidens* and *Otostigmus aculeatus*; The species *Otostigmus voprosus* recorded by Schileyko (2007) was not recorded in this study. For the species recorded, the study also provided basic information about the collected specimens such as coordinates, altitude... their distribution in Vietnam and some remark on species, specimens compared to other studies.

Keywords: *Centipede, taxonomy, biodiversity, Scolopendromorpha, Dien Bien, rết, phân loại, đa dạng sinh học, bộ Rết nhiệt đới, Điện Biên.*

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