

Description of a new species of *Foenatopus* Smith (Hymenoptera, Stephanidae), with a key to the species from Vietnam

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Abstract

Foenatopus meridionalis Ge & Tan, **sp. nov.**, as the first species of the genus *Foenatopus* Smith, 1861 discovered from southern Vietnam, is reported and illustrated in detail. The key to the species of *Foenatopus* from Vietnam is compiled. A distribution map of the Vietnamese species is provided.

Keywords

new species, parasitoids, crown wasps, southern Vietnam

Introduction

The cosmopolitan family Stephanidae Leach, 1815, consisting of 365 extant species (van Achterberg 2002; Aguiar 2004, 2006; Aguiar and Jennings 2005; van Achterberg and Quicke 2006; Aguiar et al. 2010; Hong et al. 2010, 2011; Tan et al. 2015a, 2015b, 2018; Chen et al. 2016; Moghaddam et al. 2019; Gupta and Gawas 2020;

Binoy et al. 2020; Ge et al. 2021) are generally parasitoids of xylophagous insect larvae, including species of Coleoptera and Hymenoptera (Chao 1964; Taylor 1967; Kirk 1975; Königsmann 1978; van Achterberg 2002; Aguiar 2004). The genus *Foenatopus* Smith, 1861 (Hymenoptera: Stephanidae) is the largest genus in the family that contains about 50% species of the family (Aguiar et al. 2010; Binoy et al. 2020). *Foenatopus* can be found in the tropical and subtropical areas of the Afrotropical, Neotropical, Palearctic and Oriental regions (Hong et al. 2011; van Achterberg, 2002). Biological information is almost lacking. Up to now, only four species are known from Vietnam, i.e. *Foenatopus annulitarsus* Enderlein, 1913, *Foenatopus chinensis* (Elliott, 1919), *Foenatopus flavidentatus* (Enderlein, 1913), *Foenatopus ruficollis* (Enderlein, 1913), which are also recorded from China. Here we report the fifth Vietnamese species, which is the first species discovered from southern Vietnam. A key to all species from Vietnam is provided.

Materials and methods

The descriptions, measurements, and figures were made using a ZEISS AxioZoom V16 microscope with a ZEISS AxioCam 503 color camera. Photographs were combined using the ZEN 2.3 (blue edition). Morphological nomenclature follows van Achterberg (2002) including the abbreviations for the wing venation. The types are deposited in the College of Forest Protection, Beijing Forestry University (BFU), China.

Taxonomy

Genus *Foenatopus* Smith, 1861

Foenatopus Smith, 1861: 58. Type species (by monotypy): *Stephanus indicus* Westwood, 1841.

Diastephanus Enderlein, 1905: 473. Type species: *Stephanus flavomaculatus* Enderlein, 1901. Synonymized by Benoit, 1956.

Neostephanus Kieffer, 1904: 1–4. Type species (by monotypy): *Neostephanus alluaudi* Kieffer, 1904. Synonymized by Narendran et al. (2001).

Diagnosis. Small to medium size. Temple always with pale yellowish streak behind eye. Neck emarginate anteriorly, finely striate, pronotal fold absent; reduced venation with vein 2-CU1 of fore wing always less developed, but sometimes complete; veins 2-SR and 2-SR+M of fore wing absent; vein 1-SR absent or faintly developed; hind tibia distinctly narrowed and compressed basally, outer side usually without fine oblique striae; hind tarsus with three tarsomeres in the female, while five in the male.

Distribution. Afrotropical, Neotropical, Palearctic and Oriental.

Key to species of the genus *Foenatopus* Smith from Vietnam

- 1 Ovipositor sheath with ivory sub-apical band..... 2
 – Ovipositor sheath completely blackish or with brownish sub-apical band 3
 2 Large ventral tooth of hind femur ivory *F. flavidentatus* (Enderlein, 1913)
 – Large ventral tooth of hind femur blackish [The male with frons entirely bright yellow; hind femur with the third basal tooth acutely developed].....
 *F. chinensis* (Elliott, 1919)
 3 Pterostigma relatively short and wide, obtuse apically; hind femur tridentate, ventral tooth blackish to partly ivory; propodeum completely covered with rather large and dense reticulate-foveolae 4
 – Pterostigma comparatively long and narrow, somewhat subparallel-sided, acute apically; hind femur bidentate, large ventral tooth ivory; propodeum covered with sparse, shallow and circular foveolae, and with a relatively smooth area anteriorly [The male with a large reddish-brown spot developed in the middle part of the hind femur, the third tooth of the hind femur moderately developed].....
 *F. meridionalis* Ge & Tan, sp. nov.
 4 Vertex with 4 carinae between ocelli; vein 2-CU1 of fore wing distinct, 0.7–1.1 × as long as vein cu-a [male with frons completely yellowish; vein 2-CU1 of the fore wing 0.3 × as long as vein cu-a] *F. annulitarsus* Enderlein, 1913
 – Vertex with 3 carinae between ocelli; vein 2-CU1 of fore wing short or absent [male unknown]..... *F. ruficollis* (Enderlein, 1913)

Foenatopus meridionalis Ge & Tan, sp. nov.

<http://zoobank.org/FDB28C76-5980-4253-A039-43D556C3F480>

Figs 1–31

Material examined. **Holotype**, ♀ (BFU), Vietnam: Binh Thuan, Huyen Thuan Bac, Dong Tien, 108°2.382'E, 11°12.912'N, VI.2020, leg. Local collector; **Paratypes**, 3♂ (BFU), Vietnam: Binh Thuan, Huyen Thuan Bac, Dong Tien, 108°2.382'E, 11°12.912'N, VI.2020, leg. Local collector.

Diagnosis. Head transverse in dorsal view and slightly elliptical in lateral view; frons completely yellowish-brown without streaks; vertex coarsely transversely carinate rugose with three distinct carinae between ocelli; propodeum shallowly circularo-foveolate with a relatively smooth coriaceous area anteriorly (the anterior coriaceous area concave more deeply in the male than in the female); pterostigma translucent with dark brown margins, long and narrow, subparallel-sided; vein 2-CU1 extremely short; hind femur with 2 ivory large teeth ventrally and with a blackish tooth obtusely developed basally; ovipositor sheath without sub-apical band.

Description. *Holotype. Female.* The length of body (except ovipositor sheath) 10.5 mm; forewing 6.4 mm long, 1.4 mm wide; the length of ovipositor sheath 9.6 mm.

Head. Antenna with 28 flagellomeres; frons finely and transversely rugose (Fig. 1); three anterior coronal teeth large and lobe-shaped, while the posterior two relatively small and wide; the ocular triangular area with three coarse transverse rugae; vertex finely transversely rugose anteriorly, with coarse and slightly curved rugae reaching occipital carina; temple smooth and shiny, roundly contracts behind eyes (Fig. 2).

Mesosoma. Pronotum moderately robust and largely coriaceous; neck anteriorly deeply emarginated, with several transverse ridges (Fig. 4), neck at about the same level of the middle part of pronotum postero-dorsally; pronotal fold absent; middle part of pronotum finely coarsely striate; posterior pronotum distinctly elevated and transversely rugose; mesoscutum with finely reticulate striate anteriorly and posterior half coarsely; scutellum smooth and with foveolae laterally (Fig. 5); propodeum completely with shallow, circular foveolae, with a relatively smooth coriaceous area anteriorly (Fig. 6).

Wings. Fore wing: hyaline (Fig. 7); vein 2-CU1 weakly developed, $0.25 \times$ as long as vein cu-a; pterostigma subparallel-sided, elongate and acute apically, $2.5 \times$ as long as vein r and $11.0 \times$ as wide as its maximum width; vein SR1 $2.1 \times$ as long as vein r; vein SR1 and vein r obtusely angled; vein r ends $0.13 \times$ length of pterostigma behind level of apex of pterostigma.

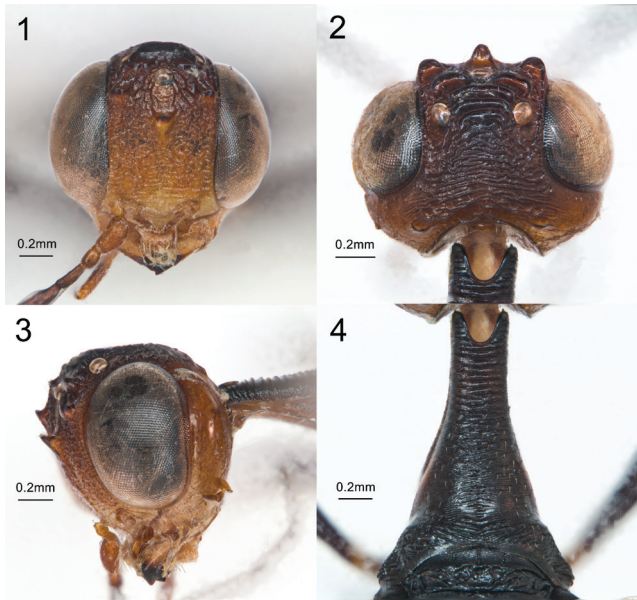
Legs. Hind coxa transversely striate, dilated sub-apically (Fig. 8); hind femur densely reticulate, with two ivory large ventral teeth and with a blackish tooth rather obtuse developed basally (Fig. 9); hind tibia coriaceous, $1.25 \times$ as long as hind femur; basal narrow part of hind tibia $1.1 \times$ as long as widened part, inner side of widened part basally distinctly V-shaped depressed, apically setose (Fig. 10); basitarsus $4.7 \times$ as long as wide, with dense and bristle setae ventrally (Fig. 11).

Metasoma. Tergite I (TI) finely transversely striate (Fig. 12), ca $7.4 \times$ as long as its maximum width, $2.25 \times$ as long as TII; basal one fifth of TII striate, and the remaining tergites largely shiny, smooth or weakly aciculate (Fig. 13); pygidial area indistinctly differentiated in color, and truncate apically (Fig. 14); ovipositor sheath completely black, and ca $0.9 \times$ as long as body length (Fig. 15).

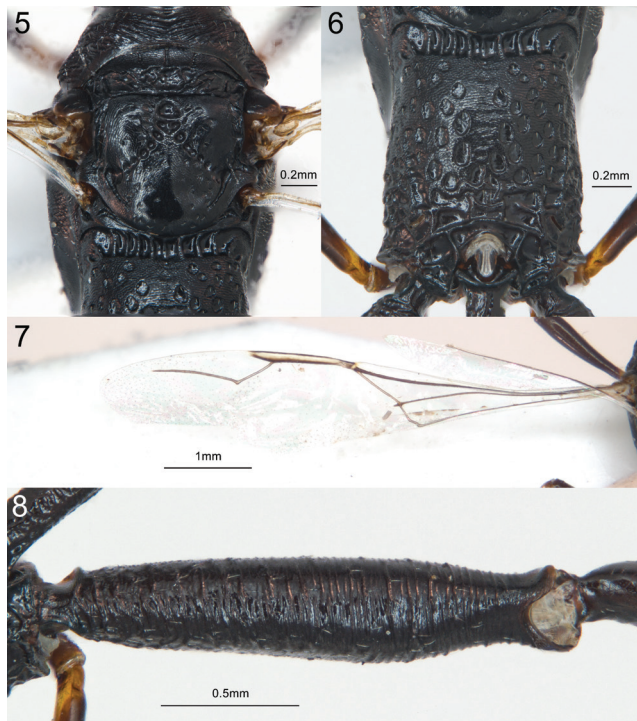
Colour. Brownish to blackish; frons completely yellowish-brown without streaks (Fig. 1), temple ventrally yellowish-brown along compound eye; wing membrane hyaline (Fig. 7), wing veins brownish; pterostigma translucent with dark brown margins; pronotum, mesoscutum and propodeum blackish; prosternum brownish; hind femur, hind tibia and metasoma largely blackish to blackish-brown; large ventral tooth of hind femur ivory (Fig. 9); ovipositor sheath completely blackish without whitish sub-apical band (Fig. 15).

Paratypes. Male. The length of body 9.5–11.4 mm; the length of forewing 4.9–5.7 mm.

Resemble to female but differs as follows: fore legs and mid legs brown; a large reddish-brown spot developed in the middle part of hind femur; the blackish tooth on the basal part of hind femur comparatively more developed; tergite I ca 3.2 – $3.37 \times$ as tergite II and 0.92 – $1.05 \times$ as remainder of metasoma; tergite III reddish-brown in dorsal view, and tergite II to tergite IV brownish to reddish-brown in ventral view;



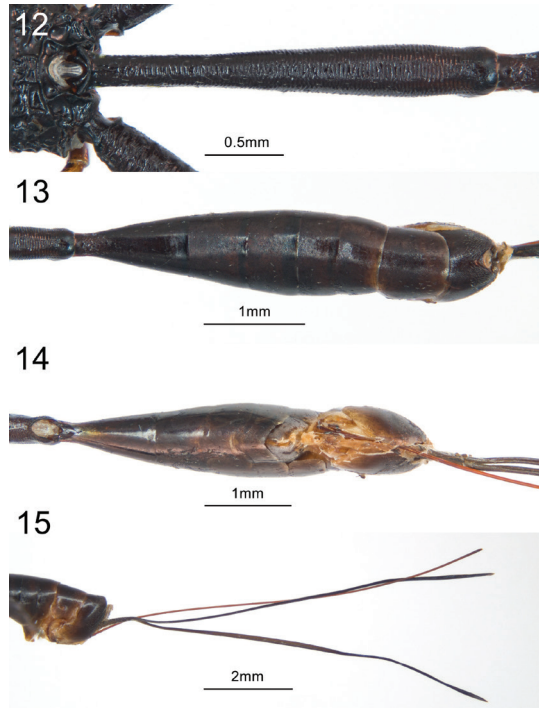
Figures 1–4. *Foenatopus meridionalis* Ge & Tan, sp. nov. Holotype ♀. **1** Head, frontal view; **2** Head, dorsal view; **3** Head, lateral view; **4** Pronotum, dorsal view.



Figures 5–8. *Foenatopus meridionalis* Ge & Tan, sp. nov. Holotype ♀. **5** Mesoscutum and scutellum, dorsal view; **6** Propodeum, dorsal view; **7** Fore Wing; **8** Hind coxa, lateral view.



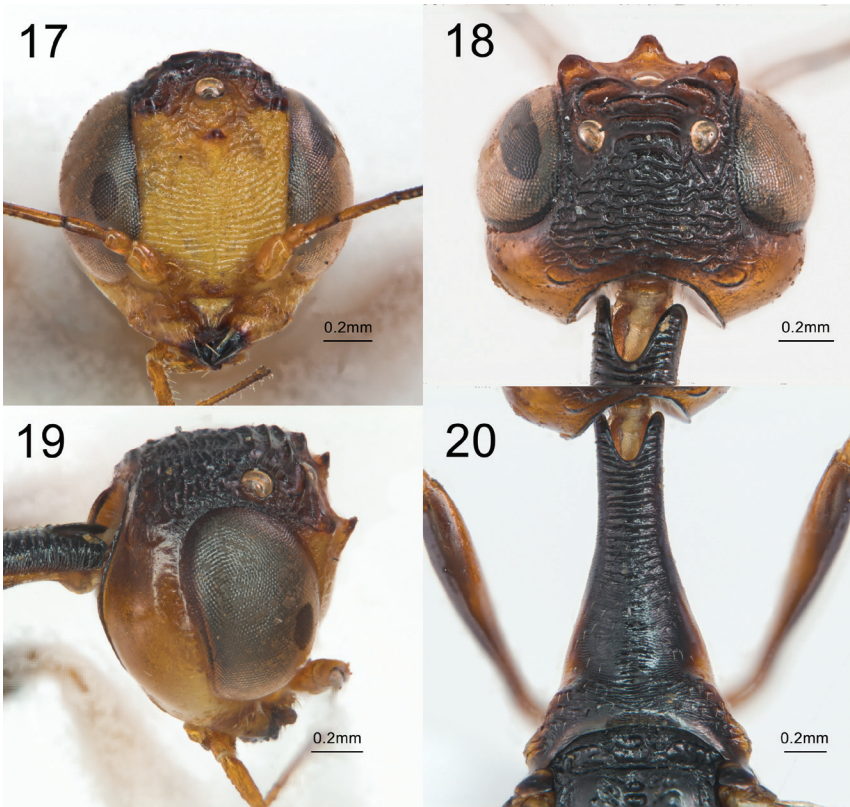
Figures 9–11. *Foenatopus meridionalis* Ge & Tan, sp. nov. Holotype ♀. **9** Hind femur, lateral view; **10** Hind tibia, lateral view; **11** Hind tarsi, lateral view.



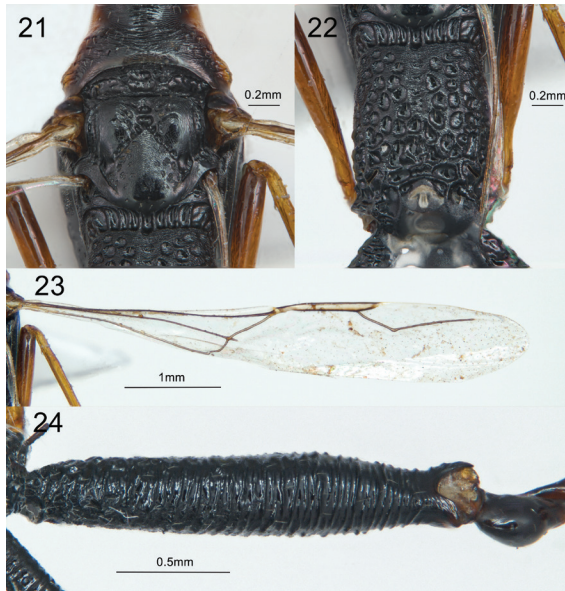
Figures 12–15. *Foenatopus meridionalis* Ge & Tan, sp. nov. Holotype ♀. **12** Tergite I, dorsal view; **13** Metasoma (except tergite I), dorsal view; **14** Metasoma (except tergite I), ventral view; **15** ovipositor and sheath, lateral view.



Figure 16. *Foenatopus meridionalis* Ge & Tan, sp. nov. Holotype ♀, dorsal habitus.



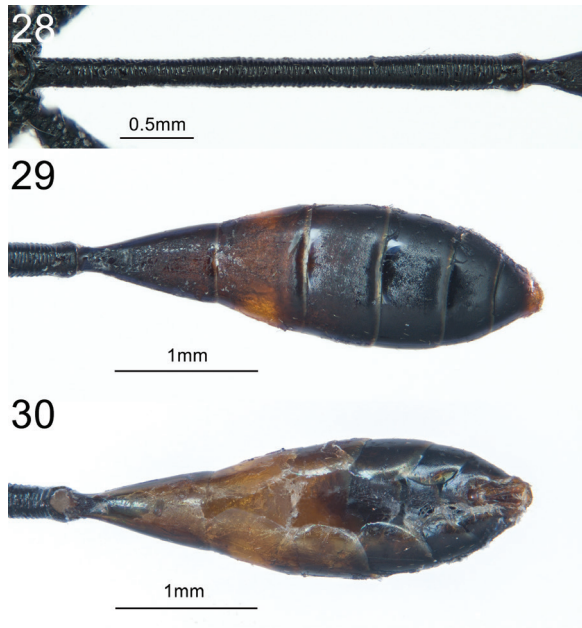
Figures 17–20. *Foenatopus meridionalis* Ge & Tan, sp. nov. Paratype ♂. **17** Head, frontal view; **18** Head, dorsal view; **19** Head, lateral view; **20** Pronotum, dorsal view.



Figures 21–24. *Foenatopus meridionalis* Ge & Tan, sp. nov. Paratype ♂. **21** Mesoscutum and scutellum, dorsal view; **22** Propodeum, dorsal view; **23** Fore Wing; **24** Hind coxa, lateral view.



Figures 25–27. *Foenatopus meridionalis* Ge & Tan, sp. nov. Paratype ♂. **25** Hind femur, lateral view; **26** Hind tibia, lateral view; **27** Hind tarsi, lateral view.



Figures 28–30. *Foenatopus meridionalis* Ge & Tan, sp. nov. Paratype ♂. **28** Tergite I, dorsal view; **29** Metasoma (except tergite I), dorsal view; **30** Metasoma (except tergite I), ventral view.

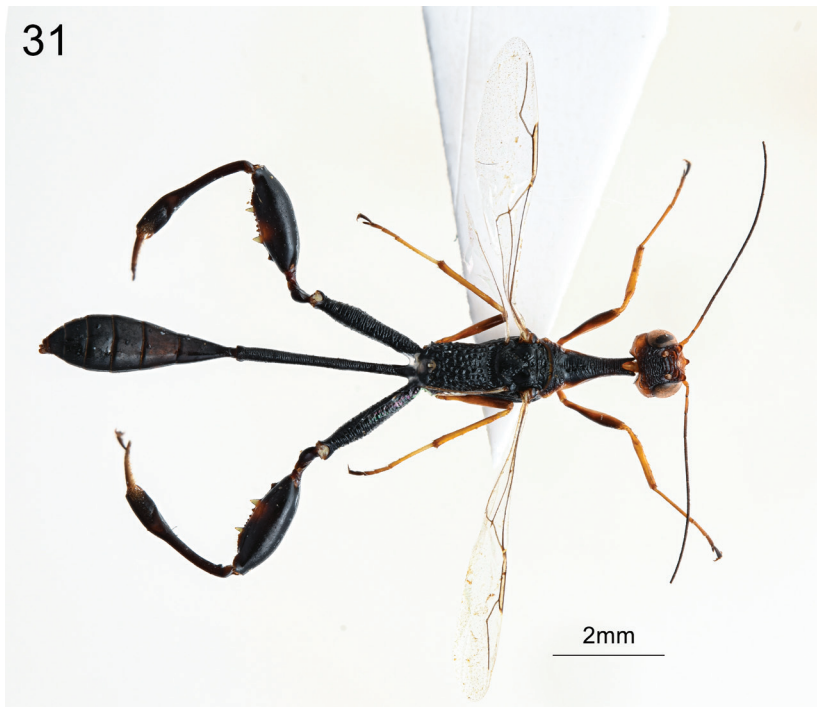


Figure 31. *Foenatopus meridionalis* Ge & Tan, sp. nov. Paratype ♂, dorsal habitus.

forewing 4.9–5.7 mm; vein 2-CU1 weakly developed, $0.21–0.3 \times$ as long as vein cu-a; pterostigma subparallel-sided, elongate and acute apically, $1.74–2.35 \times$ as long as vein r and $8.6–9.6 \times$ as wide as its maximum width; vein SR1 $1.74–2.06 \times$ as long as vein r; vein SR1 and vein r obtusely angled; vein r ends $0.24–0.26 \times$ length of pterostigma behind level of apex of pterostigma.

Etymology. We name the new species as “*meridionalis*” (Latin for south) for the type locality is in the southern part of Vietnam.

Distribution. Vietnam.

Biology. Collected in June. Host is unknown.

Note. The new species runs to *F. flavidentatus* in the key to Chinese species by Hong et al. (2011) in having the base of anterior tooth of corona yellowish brown; teeth of hind femur ivory and a less developed vein r on fore wing. However, the new species differs from *F. flavidentatus* in lacking the ivory sub-apical band of ovipositor sheath; propodeum with a relatively smooth coriaceous area anteriorly and an indistinctly differentiated pygidial area (pygidial impression in *F. flavidentatus* deep and reverse V-shaped). This new species runs to *F. sudhae* (Narendran & Sureshan, 2003) in the key to Indian species by Binoy et al. (2020) but it differs from *F. sudhae* in having 3 carinae between ocelli of the vertex and a distinct median longitudinal groove on

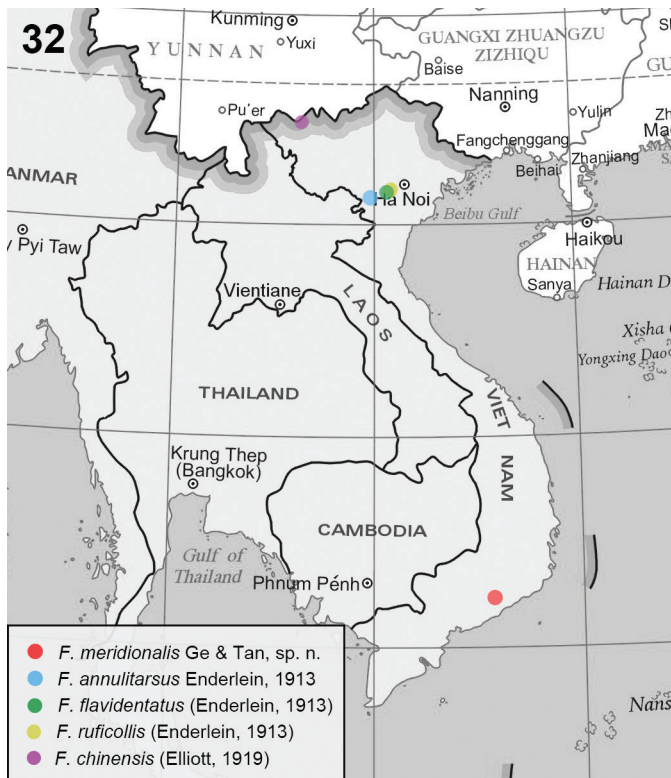


Figure 32. Distribution map of *Foenatopus* species from Vietnam (map of Vietnam from: <http://bzdt.ch.mnr.gov.cn/>)

posterior half of mesoscutum. The new species is also similar to *F. quadridens*, a species from Luang Prabang, Laos, in having posterior half of the pronotum distinctly striate, the ovipositor sheath completely blackish and a coarsely sculptured frons, but it can be easily distinguished by the two robust and ivory teeth on the hind femur (*F. quadridens* has 4 medium to large blackish teeth) and a slightly curved vein SR1 on the fore wing (more straight in *F. quadridens*).

Discussion

Except the new species described in this paper, all of the former recorded species in *Foenatopus* from Vietnam were collected in northern Vietnam (Fig. 32) and China (Hong et al. 2010, 2011). As the fusion area between Gondwana and Malaya, Vietnam is a country with mega-biodiversity and the Indochina Peninsula also serves as a bridge area between the East Asian continent and the Malay Archipelago, thus reflects an integrated fauna composition and characteristics. However, only a few species of Stephanidae have been described from Vietnam and its adjacent areas, and more undescribed species can be expected.

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