



## The exact status and synonyms of three Chinese *Afronurus* Lestage, 1924 established by Navás in 1936 (Ephemeroptera: Heptageniidae)

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### Abstract

Navás named more than 20 mayfly species from China but most of them are not associated with currently known specimens. In 2021, we found three common species of Chinese *Afronurus* Lestage, 1924 (Heptageniidae), which genitalia and color patterns match three species described and illustrated by Navás in 1936. Therefore, three new synonyms are established: *Afronurus pallescens* (Navás, 1936) (= *Cinygmina obliquistriata* You *et al.*, 1981, **syn. nov.**), *Afronurus kiangsuensis* (Puthz, 1971) (renamed from *Ecdyonurus hyalinus* Navás, 1936= *Cinygmina rubromaculata* You *et al.*, 1981, **syn. nov.**), *Afronurus costatus* (Navás, 1936) (= *Cinygmina yixingensis* Wu & You, 1986, **syn. nov.**). As the type specimens for Navás' three species are supposed to be lost, neotypes are designated for them.

**Key words:** taxonomy, old species, association, China, neotype designation

### Introduction

From 1922 to 1936, Navás described 24 mayfly species from China (Zhou *et al.* 2015). Because of lost or damaged types (Alba-Tercedor & Peters 1985), brief original descriptions and inaccurate illustrations, most of them are poorly known, especially those in the families Baetidae, Ephemeridae, Heptageniidae and Leptophlebiidae.

In 2021, after a review of the Chinese *Afronurus* Lestage, 1924 species (Zhang *et al.* 2021), we noticed a paper of Navás published in 1936 with eleven mayflies (seven in the family Heptageniidae). His drawings of the abdominal color pattern and genitalia of three heptageniid species, *Ecdyonurus pallescens* Navás, 1936, *Ecdyonurus hyalinus* Navás, 1936, and *Heptagenia costata* Navás, 1936, appear to match those of more recently named species. As the type specimens of Navás species deposited in the Heude Museum (now the Shanghai Entomological Museum) can no longer be located (Alba-Tercedor & Peters 1985; Prof. Hong Gui, personal communication), we collected specimens from nearby their type localities, allowing us to confirm that they are conspecific with three *Afronurus* species, which are very common in China and have very wide distribution. So all these species names are listed and clarified here, neotypes are redesigned for the three species. The detailed descriptions, photos, diagnoses and real status of them can be found in Zhang *et al.* (2021).

All neotypes and other specimens mentioned in this article were collected from China and are deposited in the Mayfly collection, College of Life Sciences, Nanjing Normal University (NJNU), China.

### *Afronurus pallescens* (Navás, 1936)

*Ecdyonurus pallescens* Navás, 1936: 121, fig. 81 (male, female). Types: male, female, Kuling, Jiangxi province, China.

*Ecdyonurus pallescens*—Gui 1985: 87.

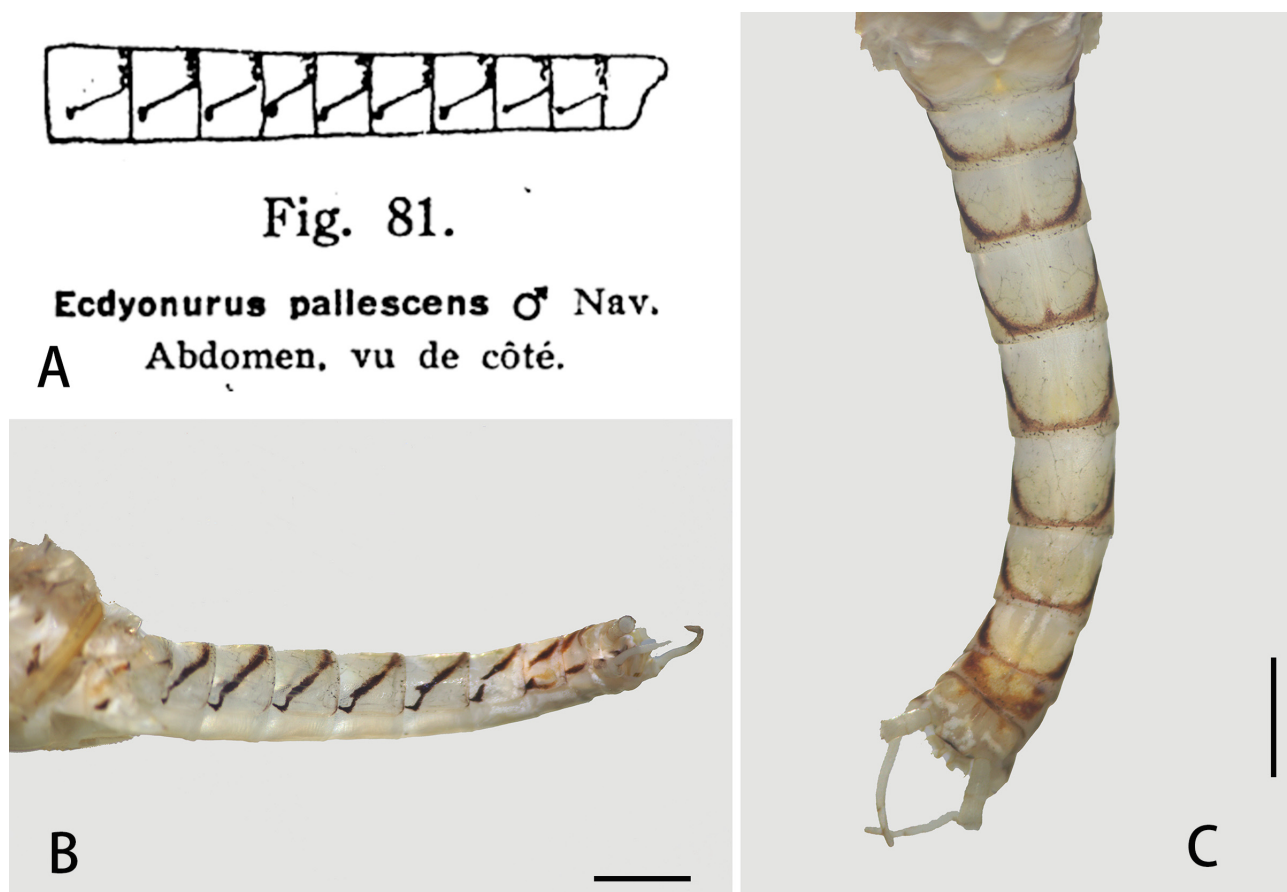
*Cinygmina obliquistriata* You *et al.*, 1981: 26, pl. 1, figs 1–13 (male, female). Types: male, female, Yixing, Jiangsu Prov. **New**

#### **Synonym.**

*Cinygmina obliquistriata*—Wu *et al.* 1986: 65, figs 12–22 (nymph).

*Cinygmina obliquistriata*—Gui 1985: 86; Zhang & Cai 1991: 237; You & Gui 1995: 51, fig. 50 (male); Su *et al.* 1995: 41; Gui *et al.* 1999: 330, figs 11-10 (male); Zhou & Zheng 2003: 756, figs 9, 12, 16 (male and nymph).  
*Afronurus obliquistriatus*—Braasch & Jacobus 2011: 65; Zhang *et al.* 2021: 109.

**Remarks:** Both imagoes (Figs. 1B, 1C) and nymphs of *C. obliquistriata* have remarkable oblique abdominal stripes that clearly match the original descriptions and drawings (Fig. 1A) of *E. pallescens* by Navás (1936). Therefore, we propose the following synonymy: *Ecdyonurus pallescens* Navás, 1936 (= *Cinygmina obliquistriata* You *et al.*, 1981). In addition, since the types of this species are lost (Alba-Tercedor & Peters 1985), we redesign a neotype for it.



**FIGURE 1.** Abdomen of *Afronurus pallescens* (Navás, 1936) male imago. A: Original drawing from Navás (1936). B: Lateral view. C: Dorsal view. Scale bars = 1.0 mm.

**Neotype designation for *Afronurus pallescens* (Navás, 1936):** male imago, China, Jiangxi Province, Wu-Yuan County, Qing-Hua Town (29°41'55.49" N, 117°78'11.82"E), 2-VIII-2015, collected by Juanyan Luo, Junzhi Sun, Yike Han. The neotype designed here was collected from the same province and in a very nearby locality of the original types, and has typical characters mentioned in the original description.

**Other material examined:** 19 male imagoes, 2 female imagoes, same data as the neotype; male imago (holotype of *Cinygmina obliquistriata* You *et al.*, 1981), Jiangsu Province, Yi-Xing County, Ming-Ling Town (31°10'50.20" N, 119°40'17.52" E), 21-31-VII-1980, collected by Tian Wu; 12 male imagoes (paratypes), same data as the holotype; 15 male imagoes, 18 female imagoes, 20 nymphs, Zhejiang Province, Lin-An city, Yu-Qian Town, Tianmu Mountain (30°32'11.91" N, 119°44'73.71" E), 3-IV-2019, collected by Wei Zhang, Zhenxing Ma; 2 male imagoes, 2 female subimagoes, Hubei Province, Yi-Chang City, Yang-Lin-Qiao Town (30°74'79.01" N, 110°76'60.72" E), 13-VIII-2019, collected by Ran Li, Wei Zhang; 20 male imagoes, 10 male subimagoes, 14 female imagoes, 10 female subimagoes, 12 nymphs, Hunan Province, Yi-Yang City, An-Hua County, Liu-Bu-Xi Nature Reserve (28°31'16.95" N, 110°82'65.41" E), 17-VIII-2019, collected by Ran Li, Wei Zhang.

**Distribution:** almost all Chinese mainland except the Qinghai-Tibet Plateau.

## *Afronurus kiangsuensis* (Puthz, 1971)

*Ecdyonurus hyalinus* Navás, 1936: 123, fig. 83 (male, female). Types: male, female, Jiangsu (*nec Ecdyurus [sic] hyalinus* Ulmer, 1912: 369, 372; *nec* Esben-Petersen 1916: 6). Renamed as *Ecdyonurus kiangsuensis* by Puthz 1971: 44.

*Cinygmina rubromaculata* You *et al.*, 1981: 28, pl. 2, figs 14–24 (male, female). Types: male, female, Yixing, Jiangsu province, China. **New Synonym.**

*Cinygmina rubromaculata*—Wu *et al.* 1986: 65, figs 1–11 (nymph).

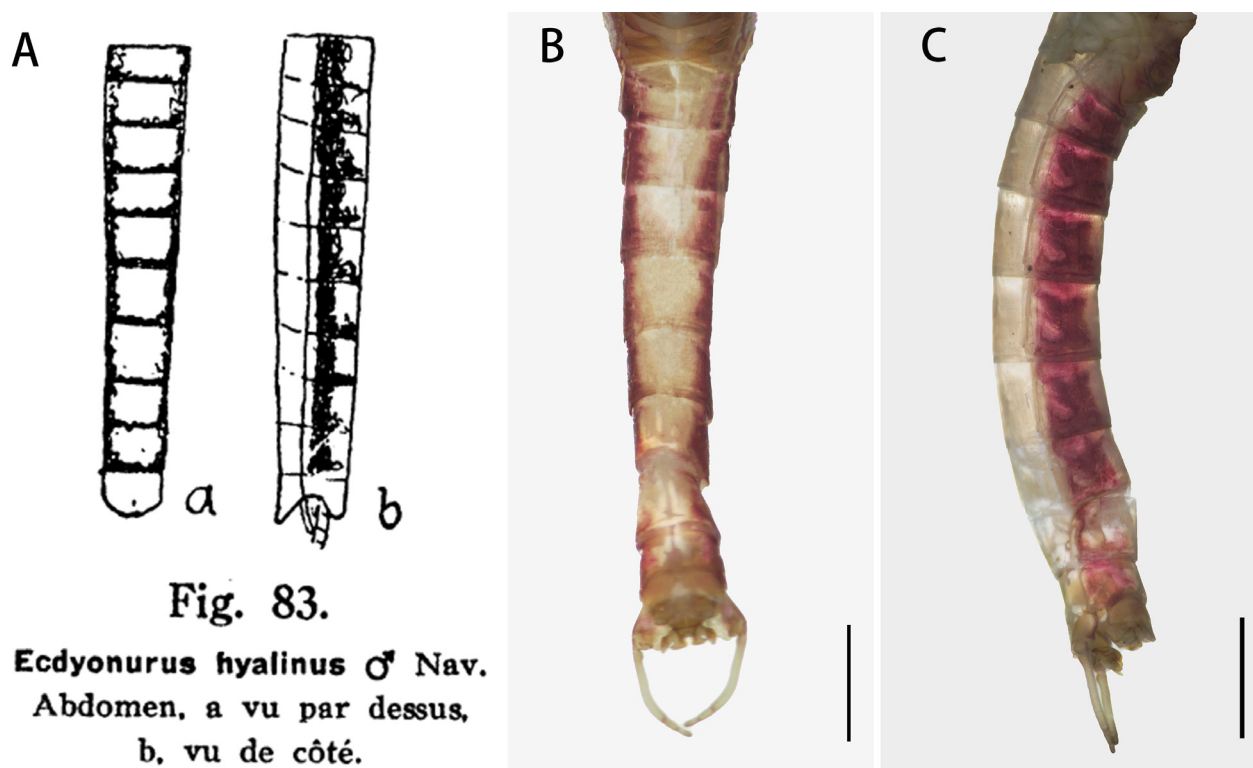
*Cinygmina rubromaculata*—Gui 1985: 86; Zhang & Cai 1991: 237; You & Gui 1995: 52, fig. 51 (male); Zhou & Zheng 2003: 758, figs 7, 13, 17 (male and nymph).

*Ecdyonurus rubromaculatus*—Tshernova *et al.* 1986: 114.

*Cinygmina hainanensis* She *et al.*, 1995: 72, fig. 1 (male, female, male subimago). Types: male, female, subimago, Hainan (Synonymized by Zhou & Zheng 2003: 758).

*Afronurus rubromaculatus*—Braasch & Jacobus 2011: 65; Zhang *et al.* 2021: 110.

**Remarks:** The abdominal color pattern of this species is very unique (Fig. 2). Comparison of the drawings of Navás (Fig. 2A) with specimens of *C. rubromaculata* (Figs. 2B, 2C) shows they are equivalent. The types of them were collected from the same county, Jiangsu province, China. Therefore, we propose the following synonymy: *Ecdyonurus kiangsuensis* Puthz, 1971 (= *Cinygmina rubromaculata* You *et al.*, 1981).



**FIGURE 2.** Abdomen of *Afronurus kiangsuensis* (Puthz, 1971) male imago. A: Original drawing from Navás (1936). B: Lateral view. C: Dorsal view. Scale bars = 1.0 mm.

Ulmer (1912) named a species *Ecdyurus hyalinus* from the Chinese Taiwan island which was later transferred to the genus *Afronurus* by Kang & Yang (1994). *Ecdyonurus hyalinus* Navás, 1936 is therefore a junior homonym and was renamed by Puthz (1971) as *Ecdyonurus kiangsuensis*. We also redesigned a neotype for this species.

**Neotype designation for *Afronurus kiangsuensis* (Puthz, 1971):** male imago, China, Jiangsu Province, Yi-Xing County, Hu-Fu Town (31°22'89.41" N, 119°79'67.42" E), 18-V-1995, collected by Chaodong Zhu. The neotype designed here was collected from the same province and in a very nearby locality of the original types, and has typical characters mentioned in the original description.

**Other material examined:** 6 male imagoes, 6 nymphs, same as the neotype; male imago (holotype of *Cinygmina rubromaculata* You *et al.*, 1981), Jiangsu Province, Yi-Xing County, Ming-Lin Town (31°10'5.02" N, 119°40'17.52" E), 21-VII-1980, collected by Tian Wu; 12 male imagoes, 10 female imagoes (paratypes), same data as holotype; 6 male imagoes, 7 male subimagoes, 10 female imagoes, 8 female subimagoes, 40 nymphs, Hunan

Province, Zhang-Jia-Jie City, Jin-Bian creek (29°32'18.93" N, 110°44'15.57" E), 12-VIII-2019, collected by Ran Li, Wei Zhang; 20 male imagoes, 5 male subimagoes, 8 female imagoes, 6 female subimagoes, Hubei Province, Yi-Chang City, Chang-Yang County, Gao-Jia-Yan Town, Qing-Yan Village (30°59'41.08" N, 111°11'37.93" E), 20-VII-2013, collected by Yanxia Wang, Dan Zhou; 100 nymphs, Hainan Province, Chang-Jiang County, Ba-Wang-Ling (19°06'37.61" N, 109°17'05.81" E), 15-I-2015, collected by Junzhi Sun, Yike Han.

**Distribution:** Most areas of Chinese mainland except the Qinghai-Tibet Plateau.

*Afronurus costatus* (Navás, 1936)

*Heptagenia costata* Navás, 1936: 120, fig. 80 (male, female). Types: male, Kuling, Jiangxi province, China.

*Heptagenia costata*—Gui 1985: 84; You & Gui 1995: 43, fig. 38 (male).

*Cinygmina yixingensis* Wu & You, 1986: 280, figs 1–13 (male, female). Types: male, female, Yixing, Jiangsu Prov. **New Synonym.**

*Cinygmina yixingensis*—Wu *et al.* 1986: 66, figs 23–33 (nymph).

*Cinygmina yixingensis*—Gui 1985: 86; Zhang & Cai 1991: 237; You & Gui 1995: 53, fig. 52 (male); She *et al.* 1995: 79; Zhou & Zheng 2003: 758, figs 10, 14, 18 (adults and nymph).

*Afronurus yixingensis*—Braasch & Jacobus 2011: 65; Zhang *et al.* 2021:111.

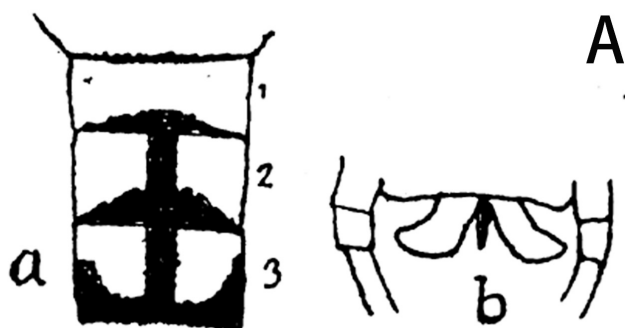


Fig. 80.

· *Heptagenia costata* ♂ Nav.  
Abdomen : a Partie antérieure.  
b Partie postérieure.



**FIGURE 3.** Abdomen of *Afronurus costatus* (Navás, 1936) male imago. A: Original drawing from Navás (1936). B: Dorsal view. C: Genitalia (ventral view). Scale bars: B = 1.0 mm; C = 0.5 mm.



**Remarks:** The males of this species have a remarkable projection between the penes (Fig. 3C), which is clearly showed in the original picture of Navás (1936) (Fig. 3A). The color patterns between the original drawing and our fresh materials are also consistent (Figs. 3A, 3B), so we state that the two species established by Navás in 1936 and Wu & You in 1986 are conspecific. Therefore, we propose the following synonymy: *Heptagenia costata* Navás, 1936 (= *Cinygmina yixingensis* Wu & You, 1986).

**Neotype designation for *Afronurus costatus* (Navás, 1936):** male imago, China, Jiangxi Province, Wu-Yuan County, Qing-Hua Town (29°41'55.49" N, 117°78'11.82" E), 2-VIII-2015, collected by Juanyan Luo, Junzhi Sun, Yike Han. The neotype designed here was collected from the same province and in a very nearby locality of the original types, and has typical characters mentioned in the original description.

**Other material examined:** 8 male imagoes, 2 female imagoes, same as the neotype; male imago (holotype of *Cinygmina yixingensis* Wu & You, 1986), Jiangsu Province, Yi-Xing City, Ming-Lin Town (31°10'5.02" N, 119°40'17.52" E), 25-VII-1980, collected by Tian Wu; 10 male imagoes, 2 male subimagoes, 6 female imagoes (paratypes), same as the holotype; 12 male imagoes (some reared from mature nymphs), 15 female subimagoes, 40 nymphs, Hainan Province, Ba-Wang-Ling National Forest Park (19°06'37.61" N, 109°17'05.81" E), 12-IX-2014, collected by Qin Si, Junzhi Sun, Juanyan Luo; 100 nymphs, Anhui Province, Huang-Shan City, Tang-Kou Town, Zhai-Xi Village (30°05'44.39" N, 118°16'78.03" E), 29-V-2014, collected by Dan Zhou, Junhi Sun, Yike Han; 6 male imagoes, 7 female imagoes, Zhejiang Province, Long-Quan City, Long-Nan Town, Shuang-Xi Village (27°88'69.49" N, 119°21'56.56" E), 5-VIII-2020, collected by Zhenxing Ma, Xuhongyi Zheng.

**Distribution:** Most areas of Chinese mainland except the Qinghai-Tibet Plateau.

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