Two new species in the *Nematus wahlbergi* group (Hymenoptera: Tenthredinidae) and a key to species from China

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Abstract: The *Nematus wahlbergi* group from China is revised. Two species are described as new: *N. luyaensis* Liu, Li & Wei **sp. nov.** and *N. rubifemoratus* Liu, Li & Wei **sp. nov.** from the Chinese Provinces of Shanxi and Gansu, respectively. A key to all Chinese species of the *Nematus wahlbergi* group is provided.

Key words: Nematinae; sawflies; taxonomy

中国沃氏突瓣叶蜂种团两新种暨分种检索表（膜翅目：叶蜂科）

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摘要：厘定了中国沃氏突瓣叶蜂种团，记述了采自山西和甘肃的 2 新种：芦芽突瓣叶蜂 *Nematus luyaensis* Liu, Li & Wei **sp. nov.** 和红股突瓣叶蜂 *N. rubifemoratus* Liu, Li & Wei **sp. nov.**。文中还编制了中国沃氏突瓣叶蜂种团的分种检索表。

关键词：突瓣叶蜂亚科；叶蜂；分类

Introduction

Nematus Panzer, 1801 is a medium sized genus in the subfamily Nematinae belonging to the family Tenthredinidae. Morphological classification is very complicated. The *Nematus wahlbergi* group was first proposed by Vikberg (1972) and to date there are 7 valid species worldwide belonging to the *N. wahlbergi* group (Vikberg 1972; Zinovjev 1978; Prous *et al*. 2014).

The morphological characters of the three known Chinese *Nematus* species: *N. hei* Wei & Niu, 2008, *N. sheni* Wei, 1999 and *N. yuae* Wei, 2002, conform to the generic characters of the *N. wahlbergi* group proposed by Vikberg: pronotum and tegula more or less yellowish; stigma dark brown; hind tibia at least in basal third pale; frontal basin rather distinct, not notched in the midline; mesepisternum smooth; claws with a large subapical tooth; sawsheath in dorsal view narrowing toward the apex, apically broadly rounded; cerci strong and broad,

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reaching as far back as sawsheath; the radix distinctly shorter than lamnium, and so on. We propose that these three species should belong to the *N. wahlbergi* group, expanding this group to include 10 known species.

In this study, two new species are described and illustrated from the Chinese Provinces Shanxi and Gansu. A key to all species of the *Nematus wahlbergi* group in China is provided.

Material and methods

Specimens were examined with a Motic-SMZ-171 stereomicroscope. Images of the imagines were taken with a Nikon D700 digital camera or a Leica Z16APO. The genitalia were examined with a Motic BA410E microscope. Images of the genitalia were taken with Motic Moticam Pro 285A. The series of images produced were focus-stacked using Helicon Focus (HeliconSoft, Kharkiv, Ukraine) and further processed with Adobe Photoshop CS 11.0.

The terminology of genitalia follows Ross (1945) and that of general morphology follows Viitasaari (2002). For a few terms, including middle fovea, lateral fovea, and lateral walls, we follow Takeuchi (1952).

Specimens examined in this study are deposited in the Asian Sawfly Museum, Nanchang, China (ASMN), including the holotype and all paratypes of the new species.

Abbreviations used in the text and illustrations are as follows: OCL — the distance between a lateral ocellus and the occipital carina, or the hind margin of the head where this carina would be if it were developed (Benson 1954); OOL — the distance between an eye and a lateral ocellus; POL — the distance between the mesal margins of the 2 lateral ocelli.

Taxonomy

Nematus wahlbergi group

Diagnosis refers to Vikberg (1972), Zinovjev (1978) and Prous *et al*. (2014).

Key to Chinese species of the *Nematus wahlbergi* group

1. Middle femur mostly to entirely reddish yellow or yellow; pronotum mostly and tegula entirely yellowish brown ····· 2
-. Middle femur entirely black; apical margin of pronotum and tegula partly yellowish brown ····· 3
2. Fore and middle femora mostly yellow, hind femur mostly black; basal 2/3 of hind tibia white; valvifer 2 brown; cenchri distance as long as breadth of a cenchrus; vein M in fore wing as long as vein R+M; lancet with 20 serrulae, sutures 8–14 with some setae, without setae bands. China (Shanxi) ····· ····· *N. luyaensis* Liu, Li & Wei **sp. nov.**
-. Fore and middle femora entirely reddish yellow, base mostly of hind femur reddish yellow; basal 2/5 of hind tibia white; valvifer 2 black; cenchri distance 1.3 times as long as breadth of a cenchrus; vein M in fore wing distinctly longer than vein R+M; lancet with 21 serrulae, sutures 3–17 with setae bands, longest setae band about 1/3 length of annulus. China (Gansu)·····*N. rubifemoratus* Liu, Li & Wei **sp. nov.**
3. Inner margins of eyes convergent in frontal view; malar space about as long as diameter of median ocellus; middle fovea sub-circular; postocellar furrow distinct; lateral furrows of postocellar area slightly narrow and straight, slightly divergent backward; suture 2 of lancet without setae band ····· 4
-. Inner margins of eyes parallel in frontal view; malar space shorter than diameter of median ocellus; middle

fovea oval; middle part of postocellar furrow distinct, lateral sides weak; lateral furrows of postocellar area slightly wide and curved, distinctly divergent backward; suture 2 of lancet with setae band. China (Gansu, Henan)……*N. sheni* Wei

4. Apical 5/6 of hind coxa and basal 1/4 of hind femur white; cell 2Rs in fore wing large, 2 times as long as wide, distinctly longer than 1/2 length of cell 1Rs; apex of cercus distinctly protruding beyond apical sheath in dorsal view; setae in ovipositor sheath strongly curved; tangium of lancet short and wide, dorsal margin prominent, suture 1 distinctly more ossified than other sutures, longest setae band narrower than 1/3 length of annulus. China (Henan) ……*N. hei* Wei & Niu

-. Apical 1/4 of hind coxa white, hind femur entirely black; cell 2Rs in fore wing small, slightly longer than wide, distinctly shorter than 1/2 length of cell 1Rs; apex of cercus equal to apical sheath in dorsal view, setae in ovipositor sheath weakly curved; tangium of lancet slightly narrow and long, dorsal margin flat and straight; suture 1 and other sutures ossified at the same extent, longest setae band as long as 1/2 length of annulus. China (Henan, Hunan, Shaanxi)……*N. yuae* Wei

1. ***Nematus luyaensis* Liu, Li & Wei sp. nov.** (Fig. 1)

Female. Body length 7.0 mm.

Coloration. Body black. Labrum, most of pronotum, two spots of median mesoscutal lobes, tegula, apical margins of all coxae, all trochanters, most of fore and middle femora, basal margin of hind femur yellow; fore and middle tibiae and tarsi, basal 2/3 of hind tibia, cenchrus white; basal margin of fore femur, streak of middle femur on ventral side, valvifer 2 brown. Wings hyaline, without infuscate maculae; vein C yellowish brown, stigma and most of veins black brown (Fig. 1A).

Head. Inner margins of eyes convergent in frontal view, and distance between them 1.8 times as long as height of eyes. Base of labrum distinctly elevated, and apex rounded; clypeus short and almost flat, anterior margin of clypeus incised to 1/4 length of clypeus, lateral corners rounded; labrum shiny and smooth, without distinct setigerous punctures and microsculpture; clypeus shiny, with faint and sparse setigerous punctures, without microsculpture. Malar space about as long as diameter of median ocellus (Fig. 1C). Middle fovea sub-circular, slightly shallow. Frons elevated, shiny, punctures minute and slightly dense, with some weak microsculpture; anterior wall elevated and curved, lateral wall very low and blunt. Interocellar and postocellar furrow broad and shallow; POL : OOL : OCL = 6 : 7 : 4. Vertex shiny, setigerous punctures shallow and slightly dense, microsculpture indistinct; ocellar area dull, wrinkles distinct, punctures minute and sparse; postocellar area shiny, punctures minute and slightly sparse, without microsculpture; postocellar area feebly elevated, mesosulcus unclear, 3.1 times as wide as long, lateral furrows narrow and slightly deep, subparallel; in dorsal view, vertex about 0.4 times as long as eyes, subparallel between lateral margins (Fig. 1B). Antenna filamentous, compressed weakly, slightly shorter than thorax and abdomen together, tapered towards apex; antennomere 3 : antennomere 4 : antennomere 5 = 1 : 1 : 1 (Fig. 1E).

Thorax. Mesonotum shiny, with fine and dense punctures, without microsculpture; median mesoscutal groove fine and shallow; mesoscutellum shiny and smooth, without punctures and microsculpture, and flat, without middle ridge, about 0.8 times as long as wide; slightly lower than top of mesonotum in lateral view; mesoscutellum appendage shiny, with some shallow and faint punctures, without microsculpture; about 1/3 length of scutellum, middle ridge indistinct. Cenchri distance as long as breadth of a cenchrus. Mesepisternum shiny, setigerous punctures fine and sparse, without microsculpture; mesepimeron shiny and

smooth, without punctures, posterior part of katepimeron with distinct microsculpture; metepisternum shiny and smooth, backside with hair warts, without microsculpture; metepimeron smooth and shiny, backside with distinct microsculpture, punctures indistinct (Fig. 1D). Subbase of vein M in fore wings distinctly curved; vein Sc far away from origin of vein M from R, vein M about as long as vein R + M; fore wings with crossvein cu-a joining cell 1M at basal 3/5, cell 2Rs 1.3 times as long as wide, 1.7 times as long as cell 1R1, 1st section of vein Rs exists; petiole of hind anal cell 1.3 times as long as cu-a, and cu-a curved.

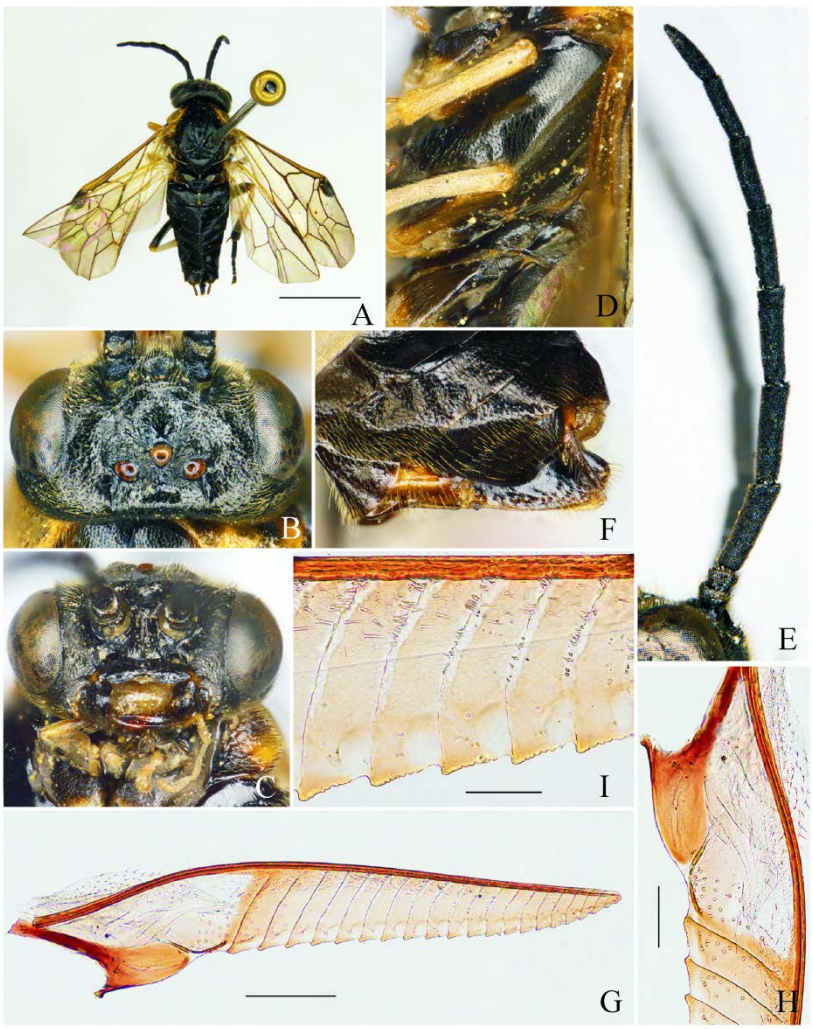

Figure 1. *Nematus luyaensis* Liu, Li & Wei **sp. nov.**, ♀, holotype. A. Female adult, dorsal view; B. Head, dorsal view; C. Head, anterior view; D. Mesopleuron and metapleuron; E. Antenna, lateral view; F. Ovipositor sheath, lateral view; G. Lancet; H. Tangium; I. Middle serrulae. Scale bars = 2 mm (A); 200 μm (G); 100 μm (H); 50 μm (I).

Abdomen. All abdominal terga shiny, with weak and sparse punctures, microsculpture fine and weak. Ovipositor sheath shiny, punctures on lateral of valvula 3 small and sparse, microsculpture indistinct; sheath 1.7 times as long as metatarsomere 1 and 1.1 times as long

as front tibia, valvula 3 approximately 1.4 times as long as valvifer 2; in lateral view, sheath straight, and apex rounded (Fig. 1F); in dorsal view, apex of cercus hardly protruding beyond valvula 3; angle between most lateral setae of valvula 3 about 50°. Lancet with 20 serrulae (Fig. 1G); each middle serrula with 7–9 distal teeth; annular suture 1 not curved, sutures 8–14 with some setae, without distinct setae band; cypsella very short, with very shallow or without emargination; tangium short and 3.0 times as long as annulus 1, basal angle sharp, dorsal slightly prominent; radix 0.3 times as long as lamnium (Fig. 1H); middle serrulae from base as in Fig. 1I.

Legs. Protarsomere 1 as long as following three tarsomeres together; inner apical spur of hind tibia 0.5 times as long as metatarsomere 1, hind tibia 1.3 times as long as hind tarsus, metatarsomere 1 not compressed, 0.7 times as long as following four tarsomeres together; tarsal claw with inner tooth distinctly shorter than outer tooth.

Male. Unknown.

Holotype. ♀, **China**, Shanxi, Mt. Luya, Beigoutan, 111°57.193′ E, 38°40.457′ N, alt. 1600 m, 25-V-2008, Xiaohua WANG leg.

Etymology. The specific name "*luyaensis*" refers to the locality of the holotype.

Remarks. The new species is similar to *N. tulunensis* Vikberg, 1972, but can be distinguished from the latter by the following combination of characters: basal margin of hind femur yellow; basal 2/3 of hind tibia white; annular suture 1 of lancet not curved, sutures 8–14 with some setae, without setae band; basal angle of tangium sharp. *N. tulunensis*: hind femur black; basal 1/2 of hind tibia white; annular suture 1 of lancet curved, sutures 2–12 with setae bands; basal angle of tangium rounded.

2. ***Nematus rubifemoratus*** **Liu, Li & Wei sp. nov.** (Fig. 2)

Female. Body length 9.0 mm.

Coloration. Body black. Labrum, most of pronotum, tegula, most of all coxae, all trochanters, fore and middle tibiae and tarsi yellow; basal 2/5 of hind tibia, cenchrus white; fore and middle femora, basal 2/3 of hind femur reddish yellow. Wings hyaline, without infuscate maculae; vein C yellowish brown, stigma and most of veins black brown (Fig. 2A).

Head. Inner margins of eyes slightly convergent in frontal view, and distance between them 2.2 times as long as height of eyes. Base of labrum distinctly elevated, and apex rounded; clypeus very short, base elevated feebly, anterior margin of clypeus incised to 1/4 length of clypeus; labrum shiny, with shallow and faint setigerous punctures, without microsculpture; clypeus shiny, with minute and sparse setigerous punctures, microsculpture weak. Malar space 0.8 times as long as diameter of median ocellus (Fig. 2C). Middle fovea sub-oval, slightly deep. Frons hardly elevated, shiny, punctures minute and slightly sparse, microsculpture weak; anterior wall elevated and curved, lateral wall very low and blunt. Interocellar and postocellar furrow broad and shallow; POL : OOL : OCL = 14 : 16 : 9. Vertex and postocellar area shiny, setigerous punctures weak and sparse, microsculpture indistinct; postocellar area elevated, without mesosulcus, 3.0 times as wide as long, lateral furrows slightly broad and deep, divergent backward; in dorsal view, vertex about 0.4 times as long as eyes, parallel between lateral margins (Fig. 2B). Antenna filamentous, compressed weakly, slightly shorter than thorax and abdomen together, tapered towards apex; antennomere 3 : antennomere 4 : antennomere 5 = 12 : 13 : 12 (Fig. 2D).

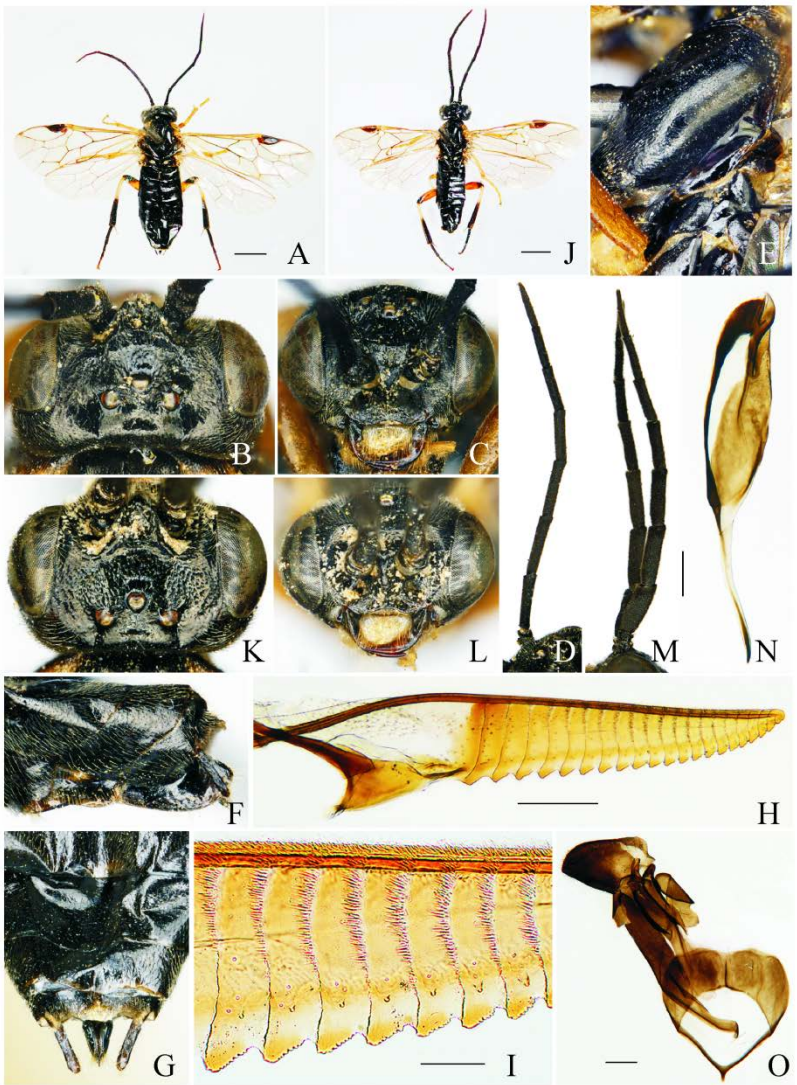

Figure 2. *Nematus rubifemoratus* Liu, Li & Wei **sp. nov.**, ♀, holotype, ♂, paratype. A. Female adult, dorsal view; B. Female head, dorsal view; C. Female head, anterior view; D. Female antenna, lateral view; E. Female mesopleuron and metapleuron; F. Ovipositor sheath, lateral view; G. Ovipositor sheath and cercus, dorsal view; H. Lancet; I. Middle serrulae; J. Male adult, dorsal view; K. Male head, dorsal view; L. Male head, anterior view; M. Male antenna, lateral view; N. Penis valve; O. Gonoforceps. Scale bars = 2 mm (A, J); 200 μm (H, N, O); 50 μm (I).

Thorax. Mesonotum shiny, with shallow and dense punctures, without microsculpture; median mesoscutal groove fine and shallow; mesoscutellum shiny and smooth, without punctures and microsculpture, and flat, without middle ridge, about 0.9 times as long as wide; lower than top of mesonotum in lateral view; mesoscutellum appendage shiny, with shallow and faint punctures, microsculpture indistinct; about 2/5 length of scutellum, middle ridge indistinct. Cenchri distance 1.3 times as long as breadth of a cenchrus. Mesepisternum shiny,

setigerous punctures fine and sparse, without microsculpture; mesepimeron shiny and smooth, without punctures and microsculpture; metepisternum shiny and smooth, backside with setigerous punctures, without microsculpture; metepimeron smooth and shiny, without microsculpture and punctures (Fig. 2E). Subbase of vein M in fore wings distinctly curved; vein Sc far away from origin of vein M from R, vein M distinctly longer than vein R + M; fore wings with crossvein cu-a joining cell 1M at basal 1/2, cell 2Rs 1.3 times as long as wide, 1.9 times as long as cell 1R1, vein Rs vestigial; petiole of hind anal cell 1.6 times as long as cu-a, and cu-a curved.

Abdomen. All abdominal terga shiny, with weak and minute punctures, microsculpture fine. Ovipositor sheath shiny, punctures on lateral of valvula 3 shallow and sparse, without microsculpture; sheath 1.4 times as long as metatarsomere 1 and 1.2 times as long as front tibia, valvula 3 approximately 1.3 times as long as valvifer 2; in lateral view, sheath straight, and apex slightly rounded (Fig. 2F); in dorsal view (Fig. 2G), apex of cercus protruding beyond valvula 3; angle between most lateral setae of valvula 3 about 60°. Lancet with 21 serrulae (Fig. 2H); each middle serrula with 6–8 distal teeth; annular suture 1 curved, sutures 3–17 with setae bands, longest setae band about 1/3 length of annulus; cypsella very short, with very shallow or without emargination; tangium short and 3.4 times as long as annulus 1, basal angle sharp, dorsal slightly prominent; radix 0.4 times as long as lamnium; middle serrulae from base as in Fig. 2I.

Legs. Protarsomere 1 0.9 times as long as following three tarsomeres together; inner apical spur of hind tibia 0.6 times as long as metatarsomere 1, hind tibia 1.2 times as long as hind tarsus, metatarsomere 1 not compressed, 0.8 times as long as following four tarsomeres together; tarsal claw with inner tooth slightly shorter than outer tooth.

Male. Body length 7.0 mm (Fig. 2J); body color and structure similar to female, but following parts: hind femur expect apical margin reddish yellow; wrinkles of dorsal side of head more distinct (Fig. 2K); head in anterior view as shown in Fig. 2L; antennomeres 3–5 compressed distinctly (Fig. 2M); fore wings with crossvein cu-a joining cell 1M at basal 3/5; procidentia of tergum 8 1.1 times as long as wide; penis valve as shown in Fig. 2N; gonoforceps as shown in Fig. 2O.

Holotype. ♀, **China**, Gansu, Qingyang City, Zhengning County, Zhongwan Forest Farm, 108°34′18.2″ E, 35°26′35.4″ N, alt. 1590 m, 01-V-2009, Heng XIN leg. **Paratypes**. 1♀1♂, **China**, Gansu, Pingliang City, Lingtai County, Wanbaochuan State Farm, 107°13′49.8″ E, 34°58′00.1″ N, alt. 1130 m, 30-IV-2009, Yonggang LI leg.; 1♀3♂, **China**, Gansu, Qingyang City, Zhengning County, Zhongwan Forest Farm, 108°34′18.2″ E, 35°26′35.4″ N, alt. 1590 m, 01-V-2009, Xingyu WU leg.; 1♂, **China**, Gansu, Qingyang City, Zhengning County, Zhongwan Forest Farm, 108°34′18.2″ E, 35°26′35.4″ N, alt. 1590 m, 01-V-2009, Weiming DU leg.; 1♀, **China**, Gansu, Qingyang City, Zhengning County, Liujiadian Forest Farm, 108°34′18.2″ E, 35°19′48.3″ N, alt. 1620 m, 02-V-2009, Heng XIN leg.; 1♀, **China**, Gansu, Qingyang City, Zhengning County, Liujiadian Forest Farm, 108°34′18.2″ E, 35°19′48.3″ N, alt. 1620 m, 02-V-2009, Yonggang LI leg.; 1♀, **China**, Gansu, Mt. Xiaolong, Maiji Forest Farm, Mt. Taiyang, 105°46′30.1″ E, 34°25′11.0″ N, alt. 1620 m, 31-V-2009, Heng XIN leg.

Variation. Body length of female 8.5–9.5 mm; body length of male 6.5–7.0 mm. Basal 2/5–1/2 white; petiole of hind anal cell 1.6–1.8 times as long as cu-a.

Etymology. The specific epithet "*rubifemoratus*" refers to the reddish yellow macula of hind femur.

Remarks. The new species is similar to *N. yokohamensis* Konow, 1895, but can be distinguished from the latter by the following combination of characters: most of pronotum, fore and middle tarsi yellow; basal 2/3 of hind femur reddish yellow; vein C yellowish brown; longest setae band of sutures about 1/3 length of annulus. In *N. yokohamensis*, most of pronotum black; fore and middle tarsi strongly infuscate, especially apically; hind femur black; vein C dark brown; longest setae band of sutures about 1/4 length of annulus.

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