



# Revision of Palearctic *Trissolcus* Ashmead (Hymenoptera, Scelionidae)

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## Abstract

Species of *Trissolcus* Ashmead are potent natural enemies of stink bugs (Pentatomidae). Research on biological agents to control the brown marmorated stink bug, *Halyomorpha halys* (Stål) (BMSB), in Western Europe requires reliable taxonomic resources for identification of *Trissolcus* wasps. To aid this research endeavor, we present a species identification key to females of Palearctic *Trissolcus*. Morphological characters and concepts of the genus and species groups are discussed. We discovered a number of nomenclatural and identification issues that we here rectify.

## Keywords

*Halyomorpha halys*, Platygastroidea, biological control, identification key, egg parasitoid

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## Introduction

The introduction of the brown marmorated stink bug (BMSB) (*Halymorpha halys* Stål; Hemiptera: Pentatomidae) into the Eastern United States, followed by invasion on the West Coast, prompted interest in *Trissolcus* as a classical biological control agent with emphasis on two species, *T. cultratus* (Mayr) and *T. japonicus* (Ashmead). Recent work in this genus (Talamas et al. 2015a) provided identification tools to separate these species from the Nearctic fauna. This work followed relatively recent revisions of Nearctic *Trissolcus* (Johnson 1984a, 1985a–b) that made production of these tools a straightforward task. The second taxonomic component of this project is species-level revision of *Trissolcus* to enable identification of *T. japonicus* and *T. cultratus* in their native ranges. The expansive distributions of some species, including

*T. cultratus*, led us to revise the genus for the entire Palearctic region. Some species extend to Southeast Asia and we here include species from this region for which we directly examined primary types.

BMSB has recently become established in Europe (Wermelinger et al. 2008) where its range continues to expand (Haye et al. 2015). In light of this, revision of *Trissolcus* from this region has assumed greater urgency. With this publication we provide Europe, Asia, and the Middle East with the basic tools of species identification that facilitate molecular diagnostics and research on host selection, species evolution, and biological control.

### Criticism of previous taxonomy

Our quest to identify species of the Eastern Palearctic revealed that multiple species range from Western Europe to East Asia, requiring evaluation of material from the entire Palearctic region. In the process we discovered deep-rooted problems in the taxonomy of the group, many of which stem from insufficient or nonexistent examination of primary types. Species descriptions have typically been based on a small number of specimens from a restricted geographic area, and were not part of a thorough revisionary effort. As a result, most of the available names in the Palearctic are synonyms. The detrimental consequences of this are significant and difficult to overemphasize, as they put an incredible strain on taxonomists that are already faced with a formidable array of biodiversity to describe and understand. To be sure, it forces the time consuming loan of type specimens, creates literature with confusing or erroneous name usage, and prevents an accurate understanding of the true diversity within the genus and the distributions of its constituent species. Evaluation of *Trissolcus* for biological control of BMSB in Europe simply cannot progress without the ability to properly identify the species under study.

The above mentioned issues in *Trissolcus* are directly relevant to establishing proper name usage for *T. japonicus*, the primary candidate for biological control in the United States. *Trissolcus halymorphae* was carefully characterized in the description by Yang (2009), but its identity as *T. japonicus* (Ashmead) was not recognized because no primary types were examined. Buhl (1996) apparently examined a single specimen of *Trissolcus*, which he correctly keyed to the couplet of *T. cercus* and *T. pontus* in Kozlov (1978), but nonetheless described the species, *T. dobashii*, as new. We here treat all three (*T. cercus*, *T. pontus* and *T. dobashii*) as junior synonyms of *T. japonicus*. Kononova (2014) and her concept of the *flavipes* group was produced seemingly unaware of Talamas et al. (2013) or Yang (2009) as she redescribed *T. japonicus* as *T. mirus*.

Reliance on erroneous literature alone, without reassessment of type material, has compounded taxonomic problems in Palearctic *Trissolcus*. For example, *Trissolcus cultratus* (Mayr), originally described as *Microphanurus cultratus* Mayr, was erroneously treated by Kozlov (1968) as a junior synonym of *Trissolcus flavipes*. Kozlov subsequently perpetuated the concept of *T. cultratus*, a distinctive and easily recognized

species, under the name *T. flavipes*. The concept of *T. flavipes* that we provide here is a trans-Palearctic species which was redescribed as *T. circus* by Kozlov and Lê (1976) and as *T. crassus* by Kononova (2014).

The key to species by Kozlov (1978) treats most of the Palearctic fauna, but ignores pleural characters entirely and in some cases the couplets do not match specimens from the type series. We suspect that many of the identification keys are simply regurgitations of previous works without contributing new knowledge to an understanding of the group. Specimen size and distribution were frequently used for identification, precluding the possibility of large distributions or size differences caused by emergence from different host species. Based on our experience comparing the identification keys of Kozlov, Petrov (2013), and Kononova to primary types and specimens from a broad geographic distribution, we recommend that these publications be avoided, as they do not accurately enable species identification. We suspect that all of the species described by Kononova (2014) will be treated as junior synonyms once the material is fully assessed.

Our experience with *Trissolcus* leads us to believe that other groups in Platygastroidea (esp. Platygasterinae and *Telenomus*) are likely to harbor large numbers of trans-Palearctic species that have been described multiple times.

The contributions of the authors are as follows: E.J. Talamas: character definition and coding, species concept development, imaging, manuscript preparation; M.L. Buffington: project co-supervisor, manuscript preparation; K. Hoelmer: project co-supervisor, fieldwork coordinator and specimen acquisition.

## Materials and methods

The locality data reported for primary types are not literal transcriptions of the labels: some abbreviations are expanded; additional data from the collectors are also included. The numbers prefixed with “USNMENT” or “ZMAS” are unique identifiers for the individual specimens (note the blank space after some acronyms). Details on the data associated with these specimens may be accessed at the following link, [purl.oclc.org/NET/hymenoptera/hol](http://purl.oclc.org/NET/hymenoptera/hol), and entering the identifier in the form. The taxonomic synopsis was generated by the Hymenoptera Online Database ([hol.osu.edu](http://hol.osu.edu)).

Photographs were captured with a Z16 Leica<sup>®TM</sup> lens with a JVC KY-F75U digital camera using Cartograph<sup>®TM</sup> software, or a Leica<sup>®TM</sup> DMRB compound microscope with a GT-Vision<sup>®TM</sup> Lw11057C-SCI digital camera attached. In both systems, lighting was achieved using techniques summarized in Buffington et al. (2005), Kerr et al. (2009) and Buffington and Gates (2009). Single montage images were produced from image stacks with the program CombineZP<sup>®TM</sup>. In some cases, multiple montage images were stitched together in Photoshop<sup>®TM</sup> to produce larger images at high resolution and magnification. Full resolution images are archived at the image database at The Ohio State University (<http://purl.oclc.org/NET/hymenoptera/specimage>) and MorphBank (<http://www.morphbank.net>).

The specimen(s) that formed the bases for concepts of species that we here treat as junior synonyms are provided in Morphbank collections following the act of synonymy for each species. The Morphbank collection for the valid name contains all images of that species, including the types of junior synonyms.

Morphological terms were matched to concepts in the Hymenoptera Anatomy Ontology using the text analyzer function. A table of morphological terms and URI links is provided in Suppl. material 1.

## Abbreviations and characters annotated in the figures

<b>A1–A11</b>	antennomeres 1–11 (Figures 4, 6)
<b>aem</b>	anteroventral extension of metapleuron (Figures 4, 52, 58, 99, 118, 128, 189)
<b>anfo</b>	antennal foramen (Figures 4, 6)
<b>aoc</b>	anterior ocellus (Figure 3)
<b>as</b>	antennal scrobe (Figures 150, 191, 204)
<b>asu</b>	acropleural sulcus (Figures 5, 153)
<b>atc</b>	acetabular carina (Figures 6)
<b>atcs</b>	antecostal sulcus (Figures 3)
<b>ats</b>	postacetabular sulcus (Figures 5–6, 37, 74, 170, 202)
<b>axcr</b>	axillar crescent (Figures 4–5)
<b>bs</b>	basiconic sensilla (Figures 6, 80, 141, 142)
<b>bc</b>	basal costae (Figure 3)
<b>cs</b>	clypeal setae (Figures 6, 26, 39, 221)
<b>cx1–cx3</b>	coxae (Figures 4, 6, 58, 99, 118, 128)
<b>epc</b>	epomial carina (Figures 5, 225)
<b>eps</b>	episternal foveae (Figures 5, 6, 37, 50, 74, 105, 154, 170, 202)
<b>ff</b>	felt field (Figure 6)
<b>fs</b>	facial striae (Figures 37, 75, 76, 193)
<b>gc</b>	genal carina (Figures 5, 25, 37)
<b>gen</b>	gena (Figures 4, 6)
<b>hoc</b>	hyperoccipital carina (Figures 3, 24, 41, 47)
<b>iap</b>	interantennal process (Figures 4, 6)
<b>lbr</b>	labrum (Figures 6, 50)
<b>loc</b>	lateral ocellus (Figures 3–4)
<b>lpT1</b>	lateral patch on T1 (Figures 5, 146, 149)
<b>lt1–lt6</b>	laterotergite 1–6 (Figures 4, 6)
<b>mc</b>	mesopleural carina (Figures 25, 37, 189)
<b>mdb</b>	mandible (Figures 4, 6)
<b>mees</b>	mesepimeral sulcus (Figures 5–6, 25, 185)
<b>meps</b>	metapleural epicoxal sulcus (Figures 5, 52)
<b>mes</b>	mesopleural epicoxal sulcus (Figures 5–6)
<b>mmc</b>	median mesoscutal carina (Figures 47, 50, 215)

<b>mms</b>	median mesoscutal sulcus (Figure 3, 98, 100)
<b>mns</b>	metanotal trough (Figure 3, 5)
<b>mpit</b>	metapleural pit (Figures 64, 94, 133)
<b>mpp</b>	mesopleural pit (Figures 5–6)
<b>ms</b>	malar sulcus (Figures 4–6)
<b>mst</b>	malar striae (Figures 193)
<b>mscm</b>	mesoscutum (Figures 3–4)
<b>mshs</b>	mesoscutal humeral sulcus (Figures 3, 5, 81, 138, 169)
<b>mspl</b>	mesopleuron (Figures 4)
<b>msct</b>	metascutellum (Figures 3–4)
<b>mtnm</b>	metanotum (Figures 3–4)
<b>mtpl</b>	metapleuron (Figure 4)
<b>mtpm</b>	metapostnotum (Figure 3–4)
<b>mtps</b>	metapleural sulcus (Figure 5)
<b>mv</b>	marginal vein (Figures 79, 126)
<b>nes</b>	netrion sulcus (Figures 5–6, 22, 140, 170)
<b>net</b>	netrion (Figures 5–6)
<b>not</b>	notaulus (Figure 3)
<b>of</b>	orbital furrow (Figures 4–6, 37, 61, 110–111)
<b>pcxs</b>	paracoxal sulcus (Figures 5, 52)
<b>pdms</b>	posterodorsal metapleural sulcus (Figures 5, 139, 189)
<b>pmma</b>	posterior mesepimeral area (Figure 6)
<b>ppm</b>	propodeum (Figures 3–4)
<b>prcs</b>	pronotal cervical sulcus (Figure 5)
<b>prnm</b>	pronotum (Figures 3–4)
<b>prpl</b>	propleuron (Figure 4)
<b>pss</b>	pronotal suprahumeral sulcus (Figures 3, 5)
<b>pssu</b>	prespecular sulcus (Figures 5, 153)
<b>psu</b>	posterior scutellar sulcus (Figures 3, 5)
<b>pv</b>	postmarginal vein (Figures 79, 126)
<b>r</b>	radicle (Figures 4, 6, 26, 188)
<b>S1–S6</b>	sternites 1–6 (Figures 6)
<b>sasu</b>	subacropileural sulcus (Figure 5, 153)
<b>scu</b>	mesoscutellum (Figure 3–4)
<b>slt1</b>	setation of laterotergite 1 (Figures 5, 110, 146, 149)
<b>shms</b>	mesoscutal suprahumeral sulcus (Figures 3, 5)
<b>spec</b>	speculum (Figures 5, 154, 185)
<b>ss</b>	sublateral seta (Figure 3)
<b>sss</b>	scutoscutellar sulcus (Figures 5)
<b>sv</b>	stigmal vein (Figure 79, 126)
<b>T1–T7</b>	mediotergites 1–7 (Figure 3–4)
<b>tga</b>	tegula (Figures 3–5)
<b>vplc</b>	ventral mesopleural carina (Figures 6, 25)

## Collections

This revision is based on material from the following collections:

<b>BMNH</b>	British Museum of Natural History, London, England
<b>BPBM</b>	Bernice P. Bishop Museum, Honolulu, Hawaii, USA
<b>CNCI</b>	Canadian National Collection of Insects, Ottawa, Canada
<b>EIHU</b>	Hokkaido University Museum of Entomology, Sapporo, Japan
<b>EMBT</b>	Department of Agriculture, Bangkok, Thailand
<b>HNHM</b>	Hungarian Natural History Museum, Budapest, Hungary
<b>IEBR</b>	Institute of Ecology and Biological Resources, Hanoi, Vietnam
<b>KUEC</b>	Entomology Laboratory of Kyushu University, Fukuoka, Japan
<b>MCSN</b>	Museo Civico de Storia Naturale “Giacomo Doria”, Genoa, Italy
<b>MNHN</b>	Muséum National d’Histoire Naturelle, Paris, France
<b>MZUF</b>	Museo di Storia Naturale di Firenze, Sezione di Zoologia “La Specola”, Università degli Studi di Firenze, Florence, Italy
<b>NHMW</b>	Naturhistorisches Museum Wien, Vienna, Austria
<b>NHRS</b>	Naturhistoriska Riksmuseet - Entomology, Stockholm, Sweden
<b>SDEI</b>	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany
<b>OSUC</b>	C.A. Triplehorn Collection, The Ohio State University, USA
<b>UCRC</b>	Entomology Research Museum, University of California, Riverside, California, USA
<b>USNM</b>	National Museum of Natural History, Smithsonian Institution, Washington, DC, USA
<b>ZIN</b>	Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia
<b>ZMUC</b>	Zoological Museum, Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark

## Character discussions

### Clypeal setae

The number of setae on the clypeus is at times a challenging character to observe, but it is very useful for delimiting the *flavipes* group and separating similar species within it. Consistent with Talamas et al. (2015a), species in the *flavipes* group have 4 or fewer clypeal setae, and those in the *thyantae* group have 6. We find that the number of clypeal setae in the *basalis* group is almost always 6, but we encountered a small number of specimens of *T. comperei* with 8 clypeal setae. Scanning electron microscopy revealed that in addition to the two prominent clypeal setae, *T. cultratus* has a pair of extremely small setae that are not visible with light microscopy. We here clarify that our treatment of these setae is based on brightfield microscopy, and note that the actual number of setae may vary when analyzed in an SEM.

### Episternal foveae

In our revisionary efforts, we found no explicit mention of episternal foveae, nor are we aware of their use in any identification tools for Palearctic *Trissolcus*. The separation, or lack thereof, of the episternal foveae from the postacetabular sulcus and mesopleural pit, as well as their presence or absence, is relatively easy to interpret and has great diagnostic utility in *Trissolcus*.

### Subacropleural sulcus

We here coin the name subacropleural sulcus for the line of foveae anterior to the prespecular sulcus that extends from the acropleural sulcus toward the mesopleural pit (Figures 5, 153).

### Posterodorsal metapleural sulcus

Directly ventral to the metapleural carina there is often a line of cells in Scelionidae (Figs. 5, 139, 189). We here coin the name posterodorsal metapleural sulcus for this character. In many species this sulcus is a clearly defined line of cells, whereas in others its definition is challenged by coarse sculpture or irregular forms of the cells that comprise the sulcus.

### Generic diagnosis of Holarctic *Trissolcus*

The characters presented in Talamas et al. (2015a) will separate most, but not all, species of Palearctic *Trissolcus* from *Telenomus*. A four-merous clava is found in *T. hyalinipennis* and *T. oobius*, compounded by as many as 6 clavomeres that can be found in *Telenomus*. *Trissolcus perepelovi* and *T. plautiae* have a frons that can be largely smooth, reducing the reliability of a sculptured frons as a diagnostic character for *Trissolcus*. The ratio of width to length of T2: wider than long in *Trissolcus* and longer than wide in *Telenomus*, remains unequivocal in the Palearctic region as far as we know.

In the Nearctic, we encountered a species of *Telenomus* (USNMENT01197254), reared from lepidopteran eggs, with a 5-merous clava and T2 wider than long. This species can easily be separated from *Trissolcus* by an occipital carina that extends to the anterior articulation of the mandible. In all Holarctic *Trissolcus*, the occipital carina extends to the posterior articulation of the mandible.

The subacropleural sulcus is present in all species of Holarctic *Trissolcus* with the sole exception of *T. exerrandus*. We have yet to thoroughly examine *Telenomus* from the Palearctic region, and thus cannot give a complete analysis of this character's diagnostic power, but nonetheless we consider it to be a useful generic character for *Trissolcus*.

## Species groups

The creation of species-groups can be very useful for identifying subgeneric lineages that represent monophyletic groups or morphologically similar clusters of species. However, as more species are examined, many species cannot be placed in species-groups without drastically altering their limits. *Trissolcus stoicus* presents a challenge to our concepts of species-groups because it exhibits characters suggesting relation to both the *flavipes* and *thyantae* groups. The complete hyperoccipital carina aligns it with the *flavipes* group, but it has 6 clypeal setae. The posteroventral metapleuron has 2 large setae, perhaps an intermediate form between the glabrous metapleuron of the *flavipes* group and the dense setation typical of the *thyantae* group. This species also lacks notaui and well-defined episternal foveae of the *thyantae* group and we here do not treat it as part of any species group. As the taxonomic treatment of *Trissolcus* expands geographically, the concepts of species groups will likely require modification, as has occurred following our revision of the Palearctic species.

### *basalis* species group

The *basalis* species-group in the context of the Nearctic fauna was defined by a glabrous metapleuron and the absence of a hyperoccipital carina. We here continue to approach this cluster of species as the *basalis* group, although where the *basalis* group ends become increasingly blurry as more species are examined, particularly in Southeast Asia.

### *flavipes* species group

Multiple species in the *flavipes* group from the Palearctic region do not comply with the characters in the key to species of Nearctic *Trissolcus* by Talamas et al. (2015a). The notaulus may be very weakly indicated and present only at the posterior margin of the mesoscutum, as in *T. gonopsidis*, and the hyperoccipital carina in *T. eriventus* may be unrecognizable. Use of these characters is further complicated by species with a hyperoccipital carina that are well outside of the *flavipes* group (*T. carinifrons* and *T. stoicus*). Regarding the Holarctic fauna and what we have seen from Southeast Asia, the number of clypeal setae (4 or fewer) is the most reliable character for identifying the *flavipes* group and is the primary character that we use for its delimitation.

Kononova (2014) presented a new concept of the *flavipes* species group, one based on a postmarginal vein longer than the stigmal vein. The vast majority of species in *Trissolcus* have this form of wing venation, and thus this concept offers very little for subgeneric classification or identification. We prefer more restrictive species group

concepts because they enable us to produce more efficient identification tools. However, there is presently no objective basis for selection of one species-group concept over another because there is no phylogeny to demonstrate which, if any, of the concepts correspond to monophyletic groups.

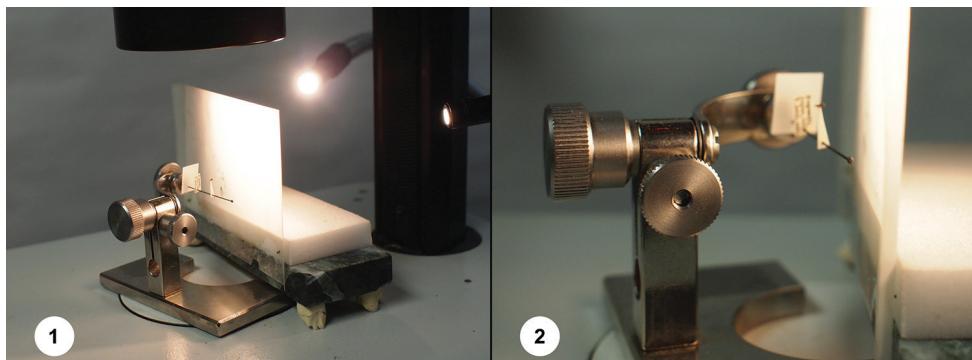
### ***thyantae* species group**

The *thyantae* species-group in the Nearctic is characterized by setae in the poster-oventral portion of the metapleuron, presence of notauli, episternal foveae present as large, distinct cells that are often elongate horizontally and form a continuous line from the dorsal limit of the postacetabular sulcus (or acetabular carina) to the mesopleural pit, a transversely strigose speculum, and six clypeal setae. These characters are valid for the Palearctic species, but there are some notable species (*T. larides*, *T. levicaudus*, *T. tersus*) with a densely setose metapleuron that lack the other defining characters of the *thyantae* group. Some of these species are also morphologically close to species that lack setation of the metapleuron. We here choose not to expand the concept of the *thyantae* group to include all species with a setose metapleuron until additional phylogenetic analysis determines whether or not this character delimits a monophyletic lineage.

The relationships between species of the *thyantae* group across the Northern Hemisphere warrant further investigation. We here present a concept of *T. scutellaris* that contains a great deal of variation in the sculpture of the frons, mesoscutum and mesoscutellum, and in the degree of development of the mesopleural carina. Among the specimens at hand there is a continuous gradient of sculptural development, and clear lines cannot be drawn between *T. scutellaris* and the species that we treat as junior synonyms. In the Nearctic, these characters appear to be fixed and are thus used in species diagnosis. We were unable to find morphological characters to separate the more rugose specimens of *T. scutellaris* (Palearctic) from *T. ruidis* Johnson (Nearctic), and the smoother specimens from *T. valkyria* Johnson & Talamas (Nearctic). We refrain from treating the Nearctic species as junior synonyms at this time because of their disjunct distributions and the possibility that these are cryptic species. Molecular data will undoubtedly be useful in determining how well our morphological species concepts match concepts generated from DNA data; the combination of these data will help determine with greater confidence if *T. scutellaris* is a Holarctic species.

### **Illumination**

High quality optics and bright, diffuse lighting are necessary for observing the characters in this key. The authors recommend fluorescent desk lamps, or fiber optic lamps

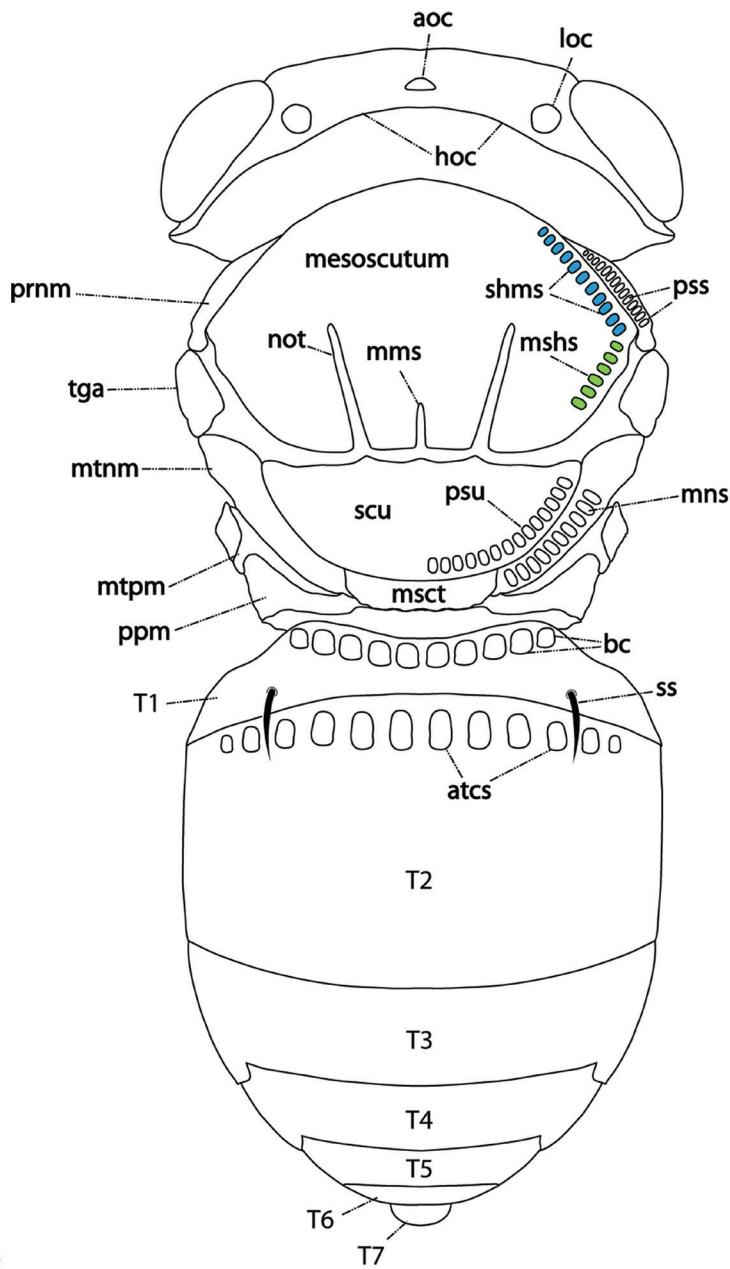


**Figures 1–2.** Configuration of mylar shield for reducing glare.

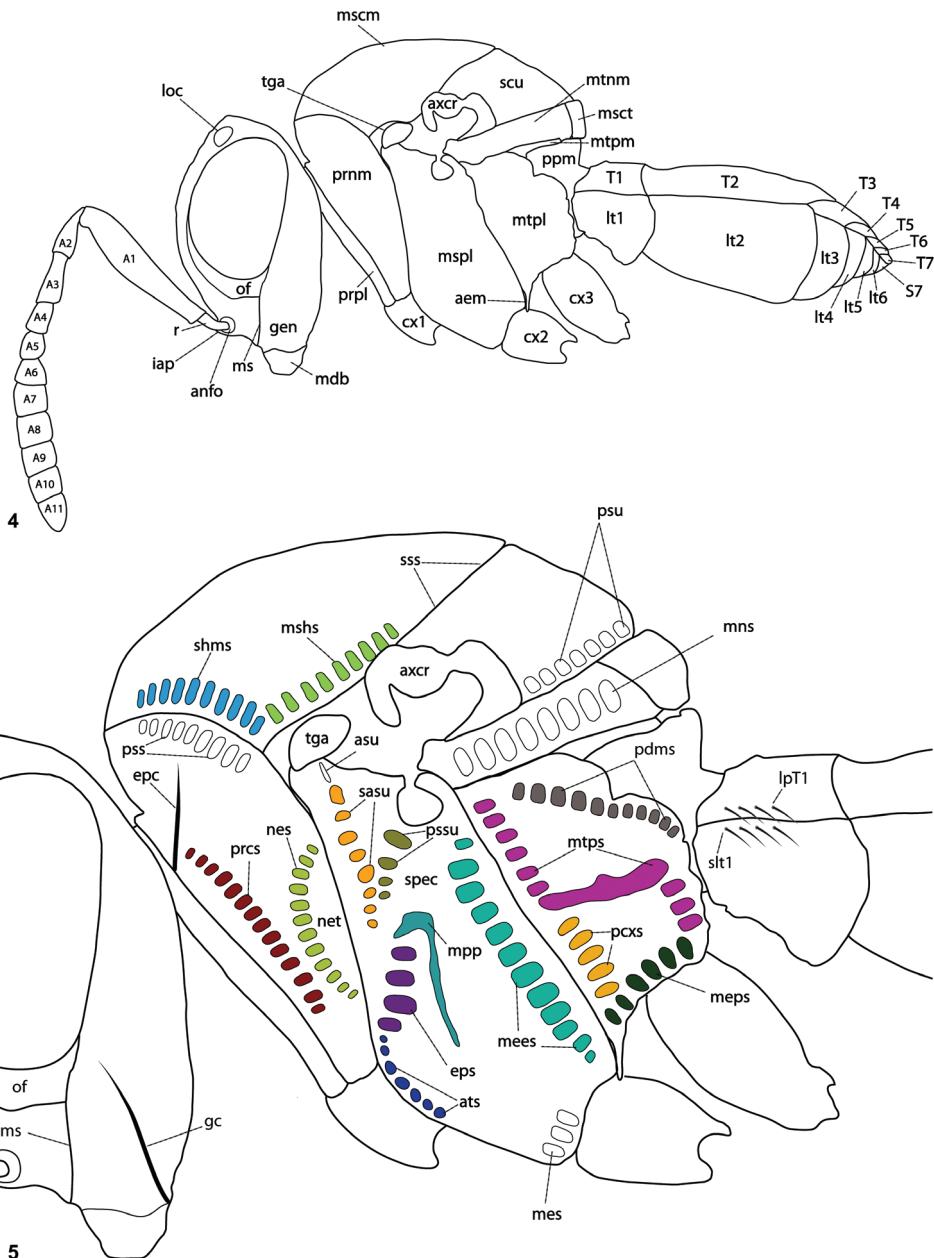
with a mylar shield between the tip of the light pipes and the specimen. The mylar should be placed close to the specimen, with the light source approximately 10 cm from the mylar (Figures 1–2) for the optimal light-scattering effect. The characters used in this key are evaluated with brightfield microscopy.

#### Key to *Trissolcus* of Europe (females)

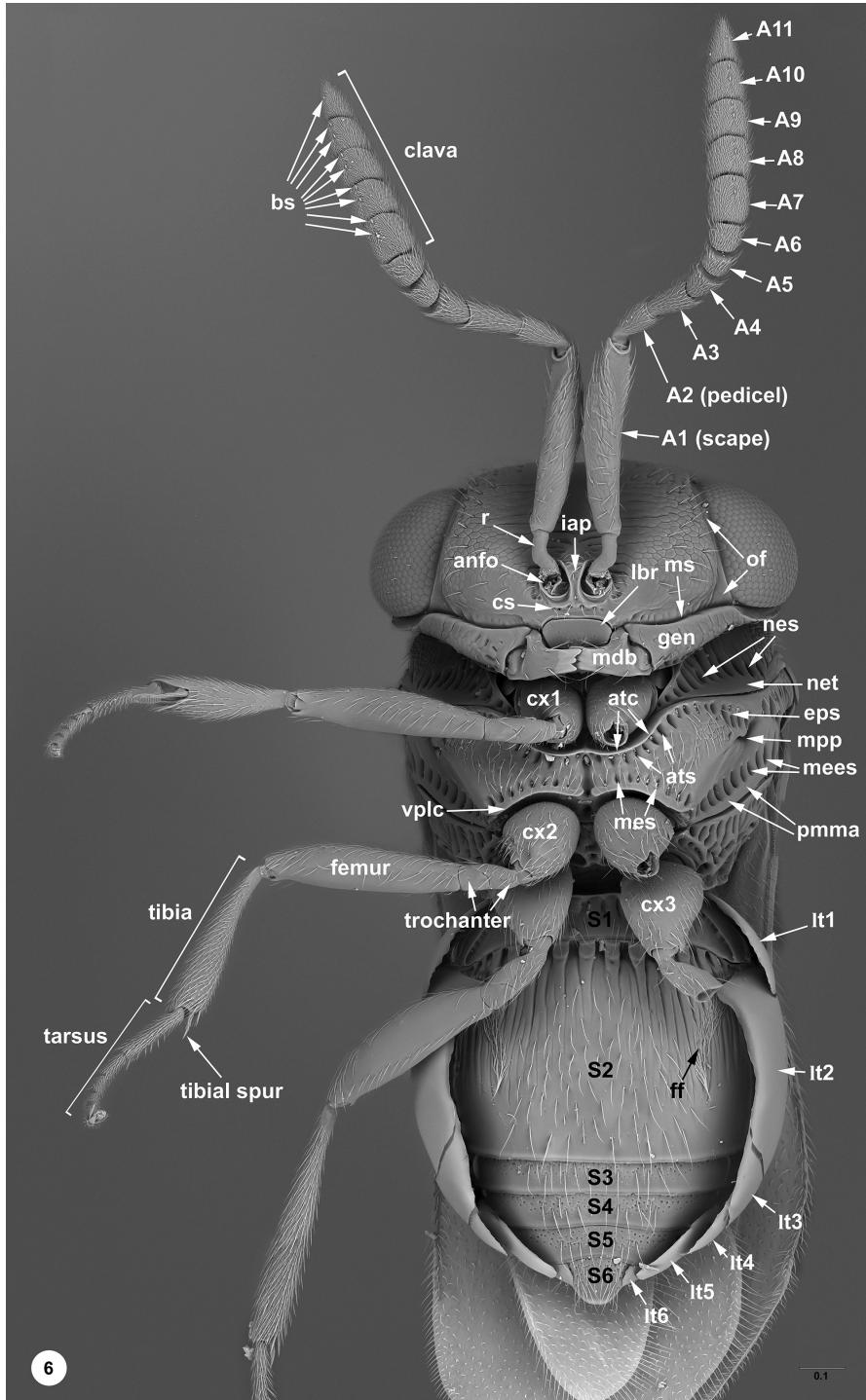
- 1 Vertex between lateral ocelli with hyperoccipital carina (Figures 43, 72); carina sometimes weakened medially (Figures 47, 200, 206–207); clypeus with 4 or fewer setae (Figures 69–70, 85, 92, 221) ..... **2** (*flavipes* group)
- Vertex between lateral ocelli without hyperoccipital carina (Figures 29, 104, 108); clypeus with 6 or 8 setae (Figures 97, 123, 172–177) ..... **8**
- 2 Laterotergite 1 with line of setae dorsally (Figures 5, 146, 149).....  
..... *Trissolcus saakowi* (Mayr), p. 115
- Laterotergite 1 without setae (Figures 28, 35) ..... **3**
- 3 At intersection with malar sulcus, orbital furrow expanded with medial margin well-defined (Figures 37–38, 48, 84, 86–87, 93)..... **4**
- At intersection with malar sulcus, orbital furrow absent or without a defined medial margin (Figures 42, 44, 65, 69–70, 73–76) ..... **7**
- 4 Mesoscutum with median mesoscutal carina (Figure 51) .....  
..... *Trissolcus edessae* Fouts, p. 49
- Mesoscutum without median mesoscutal carina (Figures 200, 206–208).... **5**
- 5 Mesopleuron with episternal foveae distant from postacetabular sulcus and mesopleural pit, often weakly indicated (Figure 202); vertex with hyperoccipital carina weakened medially (Figure 200) .... *Trissolcus tumidus* (Mayr), p. 148
- Mesopleuron with episternal foveae forming a continuous line of cells from postacetabular sulcus to mesopleural pit (Figures 37, 88, 133, 197, 219); vertex with hyperoccipital carina uniform and robust (Figures 72, 89)..... **6**



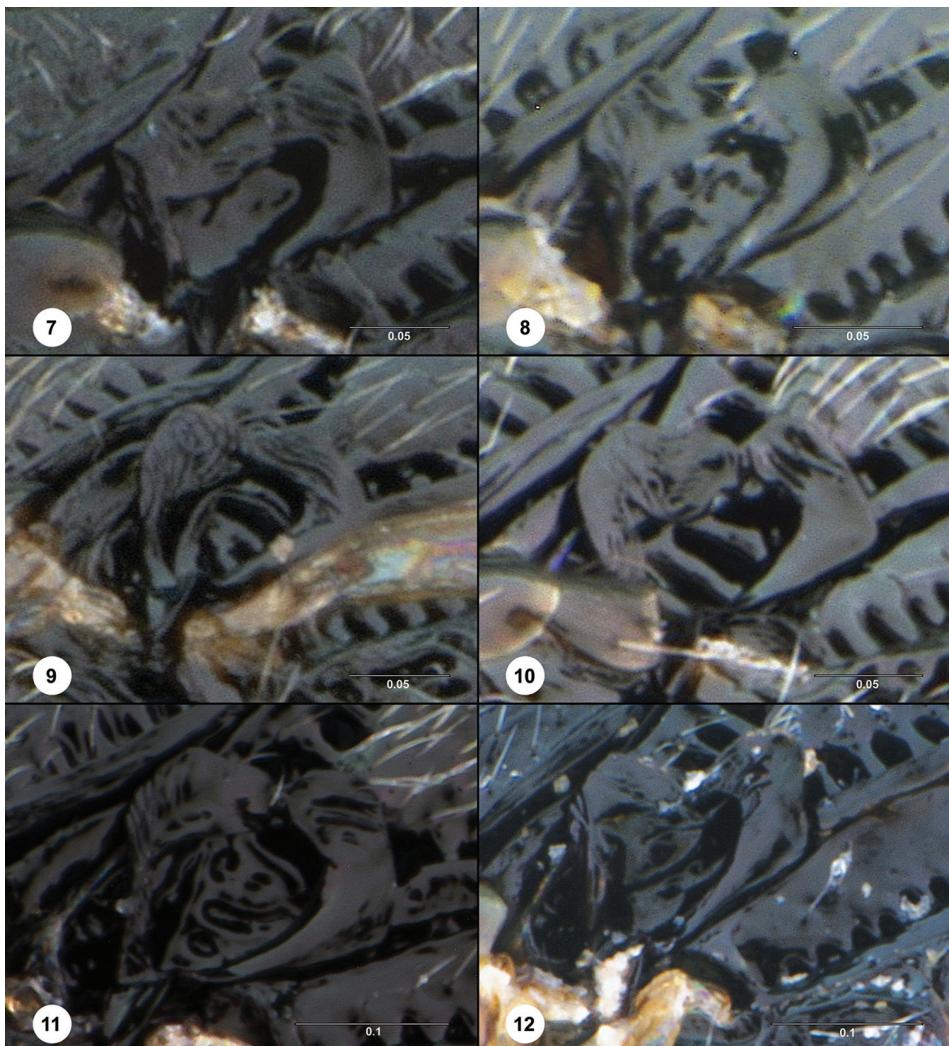
**Figure 3.** Line drawing of dorsal *Trissolcus*.



**Figures 4–5.** 4 Line drawing of lateral *Trissolcus* 5 Line drawing of lateral *Trissolcus*.



**Figure 6.** *Trissolcus japonicus*, female (USNM ENT00896000), head, mesosoma, metasoma, ventral view. Scale bar in millimeters.



**Figure 7–12.** **7** *T. mitsukurii*, female (USNMENT00675722), axillar crescent, lateral view **8** *T. tumidus*, female (USNMENT00979425), axillar crescent, lateral view **9** *T. flavipes*, holotype of *T. circus*, female (ZMAS 0143), axillar crescent, lateral view **10** *T. japonicus*, female (USNMENT00675989), axillar crescent, lateral view. **11** *T. saakowi*, female (USNMENT00977544) axillar crescent, lateral view **12** *T. nyceteridaner*, female (USNMENT00896178), axillar crescent, lateral view. Scale bars in millimeters.

- 6 Frons above antennal scrobe with irregular raised lines (Figures 92–93); mesoscutum with microsculpture effaced posteriorly (Figure 91); median lobe of mesoscutum with oblique rugulae (Figure 91); mesoscutellum entirely smooth (Figure 91) ..... *Trissolcus kozlovi* Rjachovskij, p. 79
- Frons above antennal scrobe with transverse rugae or microsculpture alone, but not irregular lines (Figures 84–87); mesoscutum usually with microsculpture present throughout (Figure 89), sometimes with sculpture effaced pos-

- teriorly; rugulae on mesoscutum, if present, oriented longitudinally between notauli; mesoscutellum smooth or with microsculpture .....  
..... *Trissolcus japonicus* (Ashmead), p. 74
- 7 Frons above antennal scrobe with coarse arcuate rugae (Figures 44, 45) .....  
..... *Trissolcus cultratus* (Mayr), p. 45
- Frons above antennal scrobe with shallow rugulae forming a circle (Figures 69–70) ..... *Trissolcus flavipes* (Thomson), p. 63
- 8 Metapleuron with posteroventral portion densely setose (Figures 154, 213) ..  
..... 9 (*thyantae* group)
- Metapleuron without setae below metapleural sulcus (Figures 20, 56–58, 78) ..... 10 (*basalis* group)
- 9 Gena distinctly broad and bulging in lateral view (Figure 213); compound eye with posterior and dorsal margins separated from hyperoccipital carina by a broad furrow (Figure 213) ..... *Trissolcus viktorovi* Kozlov, p. 157
- Gena narrow to moderately broad in lateral view (Figures 154, 209); compound eye with posterior and dorsal margins narrowly separated from hyperoccipital carina (Figures 156–157, 212) ..  
..... *Trissolcus scutellaris* (Thomson), p. 120
- 10 Antenna with 4 clavomeres (A8–A11 with basiconic sensilla) (Figures 80, 82) ..... *Trissolcus hyalinipennis* Rajmohana & Narendran, p. 70
- Antenna with 5 clavomeres (A7–A11 with basiconic sensilla) (Figures 6, 141–142) ..... 11
- 11 Mesopleuron without episternal foveae (Figures 16, 132, 140); metapleuron with anteroventral extension short, not reaching base of mesocoxa (Figures 118, 128) ..... *Trissolcus rufiventris* (Mayr), p. 111
- Mesopleuron with at least one episternal fovea (Figures 74, 105, 171) indicated **or** metapleuron with anteroventral extension extending to base of mesocoxa (Figures 52, 57–58, 171) ..... 12
- 12 Metapleuron with paracoxal sulcus **and** metapleural epicoxal sulcus indicated by distinct foveae (Figures 52, 56–58) ... *Trissolcus elasmuchae* (Watanabe), p. 53
- Metapleuron with paracoxal sulcus **or** metapleural epicoxal sulcus poorly defined or not indicated externally (Figures 20, 171) ..... 13
- 13 Lateral pronotum with netrion sulcus complete dorsally, netrion distinct (Figures 170–171); lateral mesoscutum with mesoscutal humeral sulcus usually comprised of cells (Figure 169), occasionally present as a smooth furrow .....  
..... *Trissolcus semistriatus* (Mayr), p. 128
- Lateral pronotum with netrion sulcus incomplete dorsally, netrion often poorly defined (Figure 22); lateral mesoscutum with mesoscutal humeral sulcus present as a smooth furrow (Figures 20–21) ..  
..... *Trissolcus basalis* (Wollaston), p. 30

### Key to *Trissolcus* of the Palearctic region (females)

- 1 Inner margin of eye with orbital furrow broad and transversely rugulose at midpoint of eye (Figure 61); clypeus with 2 setae (Figures 69–70) .....  
 ..... *Trissolcus eriventris* Lê (*flavipes* group in part), p. 57
- Inner margin of eye with orbital furrow smooth (Figure 48), narrow (Figures 54, 97), or poorly defined at midpoint of eye; clypeus with 2–8 setae ..... 2
- 2 Vertex between lateral ocelli with hyperoccipital carina (Figures 24, 43, 72), carina sometimes weakened medially (Figures 47, 200, 206–207) ..... 3
- Vertex between lateral ocelli without hyperoccipital carina (Figures 29, 104, 108) ..... 18
- 3 Clypeus with 6 setae (Figure 26); mesopleural carina complete, extending to ventral mesopleural carina (Figure 25); mesoscutum with notauli weakly developed or absent (Figures 24, 184) ..... 4
- Clypeus with 4 or fewer setae (Figures 39, 66); mesopleural carina variable; mesoscutum often with distinct notauli (Figures 63, 68, 89) ..... 5 (*flavipes* group)
- 4 Gena smooth and shining posterior to genal carina (Figure 185); mesopleuron with mesepimeral sulcus comprised of transversely elongate cells (Figure 185); mesopleuron with speculum divided by dorsoventral furrow (Figure 185); radicle shorter than width across clypeus (Figure 188) .....  
 ..... *Trissolcus stoicus* (Nixon), p. 139
- Gena with microsculpture and rugae posterior to genal carina (Figure 25); mesopleuron with mesepimeral sulcus comprised of more or less circular foveae (Figure 25); mesopleuron with speculum undivided (Figure 27); radicle as long as width across clypeus (Figure 26) .....  
 ..... *Trissolcus carinifrons* (Cameron), p. 35
- 5 Laterotergite 1 with line of setae dorsally (Figures 5, 146, 149) .....  
 ..... *Trissolcus saakowi* (Mayr), p. 115
- Laterotergite 1 without setae (Figures 28, 35) ..... 6
- 6 At intersection with malar sulcus, orbital furrow expanded with medial margin well-defined (Figures 37–38, 48, 84, 86–87, 93) ..... 7
- At intersection with malar sulcus, orbital furrow absent or without a defined medial margin (Figures 42, 44, 65, 69–70, 73–76) ..... 14
- 7 Mesoscutum with median mesoscutal carina (Figure 51) .....  
 ..... *Trissolcus edessae* Fouts, p. 49
- Mesoscutum without median mesoscutal carina (Figures 89, 195, 200) ..... 8
- 8 Mesopleuron with episternal foveae distant from postacetabular sulcus and mesopleural pit, often weakly indicated (Figure 202); vertex with hyperoccipital carina weakened medially (Figure 200) ..... *Trissolcus tumidus* (Mayr), p. 148
- Mesopleuron with episternal foveae forming a continuous line of cells from postacetabular sulcus to mesopleural pit (Figures 37, 88, 133, 197, 219); vertex with hyperoccipital carina uniform and robust (Figures 72, 89) ..... 9

- 9 Frons between median ocellus and antennal scrobe with a dorsoventral furrow surrounded by area of effaced microsculpture (Figures 196–197); T2 with longitudinal striae present only in medial third of tergite (Figure 195).....  
 ..... *Trissolcus trophonius* (Nixon), p. 145
- Frons without dorsoventral furrow (Figures 84, 87, 92, 135) or if furrow present, then microsculpture not effaced (Figures 85–86); T2 with striae present throughout anterior half of tergite (Figures 36, 89, 134)..... 10
- 10 Frons above antennal scrobe with irregular raised lines (Figures 92–93); mesoscutum with microsculpture effaced posteriorly (Figure 91); median lobe of mesoscutum with oblique rugulae (Figure 91); mesoscutellum entirely smooth (Figure 91) ..... *Trissolcus kozlovi* Rjachovskij, p. 79
- Frons above antennal scrobe with transverse rugae (Figures 37–38) or rugae absent (Figures 84, 135–136, 221) but not irregular lines; mesoscutum sometimes with sculpture effaced posteriorly; rugulae on mesoscutum, if present, oriented longitudinally between notauli; mesoscutellum smooth or with microsculpture ..... 11
- 11 Frons with parallel arched rugae within and above antennal scrobe, rugae often extending onto lateral frons (Figures 37–38); genal carina usually present (Figures 37–38); mesoscutum often with longitudinal rugae posteriorly; ventral frons with facial striae usually pronounced (Figure 37); clypeus with 4 setae, lateral clypeal setae about half as long as medial setae (Figure 39) ....  
 ..... *Trissolcus corai* Talamas, sp. n., p. 41
- Frons sometimes with transverse striation directly above antennal scrobe, but not extending to median ocellus or extending onto lateral frons; genal carina absent (Figure 88); mesoscutum without rugae posteriorly; ventral frons without facial striae (Figures 84–86); clypeus with 2 or 4 setae, clypeal setae approximately equal in length (Figure 85)..... 12
- 12 Clypeus with 2 setae (Figure 221) ..... *Trissolcus vindicius* (Nixon), p. 160
- Clypeus with 4 setae (Figures 85, 135)..... 13
- 13 Frons directly below median ocellus with broad smooth area and without a dorsoventral furrow (Figures 135–136) .... *Trissolcus plautiae* (Watanabe), p. 108
- Frons directly below median ocellus with microsculpture and usually a dorsoventral furrow (Figures 84–87)..... *Trissolcus japonicus* (Ashmead), p. 74
- 14 Eyes densely setose (Figure 63–66); mesopleuron without subacropileural sulcus (Figure 64)..... *Trissolcus exerrandus* Kozlov & Lê, p. 61
- Eyes bare or with short scattered setae (Figures 69–70, 42–45); mesopleuron with subacropileural sulcus indicated by line of foveae (Figures 42, 71) ..... 15
- 15 Frons above antennal scrobe with coarse arcuate rugae (Figures 44–45) ....  
 ..... *Trissolcus cultratus* (Mayr), p. 45
- Frons between antennal scrobe and median ocellus without coarse rugae (Figures 69–70, 73, 116)..... 16

- 16 Mesoscutum with notaulus well developed, at least 1/3 length of mesoscutum (Figure 68); frons with shallow rugulae forming a circle directly above antennal scrobe (Figures 69–70); mesopleuron with episternal foveae forming a continuous line between mesopleural pit and postacetabular sulcus (Figure 67)..... *Trissolcus flavipes* (Thomson), p. 63
- Mesoscutum with notaulus abbreviated, present only at posterior margin of mesoscutum (Figures 72, 113, 115); frons above antennal scrobe with faint transverse striation (Figure 116) or with microsculpture alone (Figure 73); mesopleuron with episternal foveae distant from postacetabular sulcus (Figures 74, 114)..... 17
- 17 Mesoscutellum with microsculpture, otherwise smooth (Figure 72); setal bases on mesoscutellum simple; mandible broad (Figures 74, 76); ventral frons with facial striae pronounced (Figures 73, 75–76)..... *Trissolcus gonopsidis* (Watanabe), p. 66
- Mesoscutellum rugose, medial rugae oriented longitudinally (Figure 115); setal bases on mesoscutellum distinctly pustulate (Figures 115); mandible slender (Figure 117); ventral frons without facial striae (Figures 116–117) ... .. *Trissolcus nycteridaner* Talamas, sp. n., p. 96
- 18 Metapleuron with posteroventral portion densely setose (Figures 94, 103, 154, 189, 213), rarely sparsely setose only in ventral portion ..... 19
- Metapleuron without setae below metapleural sulcus (Figures 20, 27–28, 56–58, 78, 99, 110)..... 24 (*basalis* group)
- 19 Mesopleural carina with row of foveae along its dorsal margin (Figure 189).. .. *Trissolcus tersus* Lê, p. 142
- Mesopleural carina without foveae along its dorsal margin (Figures 154, 209), or mesopleural carina absent (Figure 94)..... 20
- 20 Mesoscutum without notauli (Figures 95–96, 104); mesopleuron with a single episternal fovea (Figures 103, 105) or foveae entirely absent (Figure 94); T1 without longitudinal striae posterior to basal costae (Figures 95, 104). 21
- Mesoscutum with notauli (Figures 155–156, 164–167, 210, 214); mesopleuron with episternal foveae extending from postacetabular sulcus to mesopleural pit (Figures 154, 209, 213); T1 with longitudinal striae posterior to basal costae (Figures 155, 210, 214)..... 22 (*thyantae* group)
- 21 T2 longitudinally striate anteromedially (Figures 95–96); mesopleuron without episternal foveae (Figure 94); mesoscutum longitudinally striate posteriorly (Figure 96); crenulate furrow present along anterior margin of metascutellum (Figures 95–96)..... *Trissolcus larides* Nixon, p. 83
- T2 entirely smooth (Figure 104); mesopleuron with one episternal fovea (Figures 103, 105); mesoscutum areolate rugulose throughout (Figure 104); line of deep punctures present along anterior margin of metascutellum (Figure 104)..... *Trissolcus levicaudus* Talamas sp. n., p. 89

- 22 Gena distinctly broad and bulging in lateral view (Figure 213); compound eye with posterior and dorsal margins separated from hyperoccipital carina by a broad furrow (Figure 213); mesoscutum with median mesoscutal carina (Figure 215)..... *Trissolcus viktorovi* Kozlov, p. 157
- Gena narrow to moderately broad in lateral view (Figures 154, 209); compound eye with posterior and dorsal margins narrowly separated from hyperoccipital carina (Figures 156–157, 212); mesoscutum with or without median mesoscutal carina ..... 23
- 23 Lateral mesoscutum with mesoscutal suprhumeral sulcus and mesoscutal humeral sulcus comprised of conspicuous cells (Figure 156); posterior vertex without medial depression (Figures 155–156, 164–167); occipital carina smoothly arched medially (Fig 164); metapleuron below metapleural sulcus with setation ventrally and posteriorly (Figure 154)..... *Trissolcus scutellaris* (Thomson), p. 120
- Lateral mesoscutum with mesoscutal suprhumeral sulcus and mesoscutal humeral sulcus comprised of smooth furrows or very small and poorly defined cells (Figures 210, 212); posterior vertex depressed medially (Figure 211); occipital carina prominent and flat medially; metapleuron below metapleural sulcus with sparse setation ventrally, without setation posteriorly (Figure 209) ..... *Trissolcus vesta* Kozlov & Lê, p. 154
- 24 Antenna with 4 clavomeres (A8–A11 with basiconic sensilla) (Figures 80, 82)... 25
- Antenna with 5 clavomeres (A7–A11 with basiconic sensilla) (Figures 6, 141–142) ..... 26
- 25 Fore wing with length of postmarginal vein equal to or less than length of stigmal vein (Figures 124–127) ..... *Trissolcus oobius* (Kozlov), p. 100
- Fore wing with length of postmarginal vein at least twice length of stigmal vein (Figure 79) ..... *Trissolcus hyalinipennis* Rajmohana & Narendran, p. 70
- 26 Antennae with distinctly large clava (Figure 107, 109); orbital furrow expanded at intersection with malar sulcus (Figures 109–111); laterotergite 1 with a line of setae along dorsal margin (Figure 110) .....
- ..... *Trissolcus mitsukuri* (Ashmead), p. 92
- Antenna with clava moderately large to slender (Figures 16, 30, 132, 178–183); orbital furrow uniform in width (Figures 30, 54, 99, 105); laterotergite 1 with or without setae ..... 27
- 27 Mesopleuron without episternal foveae (Figures 16, 132, 140); metapleuron with anteroventral extension short, not reaching ventral mesopleural carina (Figures 118, 128) ..... 28
- Mesopleuron with at least one episternal fovea (Figures 105, 114, 171) indicated **or** metapleuron with anteroventral extension extending to ventral mesopleural carina (Figures 57–58, 99, 171)..... 30

- 28 Mesopleural carina extending from mesopleural pit to ventral mesopleural carina (Figure 15); mesoscutellum rugose throughout.....  
..... *Trissolcus atys* (Nixon), p. 26
- Mesopleural carina incomplete, at most extending half the distance from the mesopleural pit to ventral mesopleural carina; mesoscutellum smooth or with shallow microsculpture ..... 29
- 29 Ventral mesopleuron distinctly bulging (Figure 132); mesocoxa oriented parallel to long axis of body (Figure 128); dorsal frons with sculpture effaced, sometimes entirely smooth and shining (Figures 131–132); A7 with two basiconic sensilla; metasoma dark brown to black (Figures 128, 130) ..  
..... *Trissolcus perepolovi* (Kozlov), p. 105
- Ventral mesopleuron not distinctly bulging (Figure 140); mesocoxa oriented at an angle of ~45° relative to long axis of body; dorsal frons evenly and densely covered in microsculpture (Figure 144); A7 with one basiconic sensillum (Figures 141–142); metasoma dark brown to bright yellow (137–139).....  
..... *Trissolcus rufiventris* (Mayr), p. 111
- 30 Metapleuron with paracoxal sulcus **and** metapleural epicoxal sulcus indicated by distinct foveae (Figures 52, 56–58) .. *Trissolcus elasmuchae* (Watanabe), p. 53
- Metapleuron with paracoxal sulcus **or** metapleural epicoxal sulcus poorly defined or not indicated externally (Figures 20, 99, 171, 225) ..... 31
- 31 Mesoscutellum smooth or with coriaecious microsculpture (Figures 20–21, 168–169) ..... 32
- Mesoscutellum coarsely rugose (Figures 29, 34, 98, 100, 226) ..... 33
- 32 Lateral pronotum with netrion sulcus complete dorsally, netrion distinct (Figures 170–171); lateral mesoscutum with mesoscutal humeral sulcus usually comprised of cells (Figure 169), occasionally present as a smooth furrow.....  
..... *Trissolcus semistriatus* (Mayr), p. 128
- Lateral pronotum with netrion sulcus incomplete dorsally, netrion often poorly defined (Figure 22); lateral mesoscutum with mesoscutal humeral sulcus present as a smooth furrow (Figures 20–21)..... *Trissolcus basalis* (Wollaston), p. 30
- 33 Mesopleuron with femoral depression coarsely rugose throughout (Figure 99); radicle yellow (Figures 99, 102)..... *Trissolcus latisulcus* (Crawford), p. 86
- Mesopleuron with femoral depression smooth or with arched rugae ventrally (Figures 28, 225); radicle dark brown to black (Figures 30–32, 222–224) ... 34
- 34 Frons directly below anterior ocellus with one or more dorsoventral rugae, sculpture effaced lateral of rugae (Figures 222, 224).....  
..... *Trissolcus yamagishii* Ryu, p. 164
- Frons with arched rugae around median ocellus or with microsculpture alone (Figures 31–33) ..... *Trissolcus comperei* (Crawford), p. 37

## Species descriptions

### *Trissolcus atys* (Nixon)

[http://bioguid.osu.edu/xbiol\\_concepts/3187](http://bioguid.osu.edu/xbiol_concepts/3187)

Figures 13–16; Morphbank<sup>1</sup>

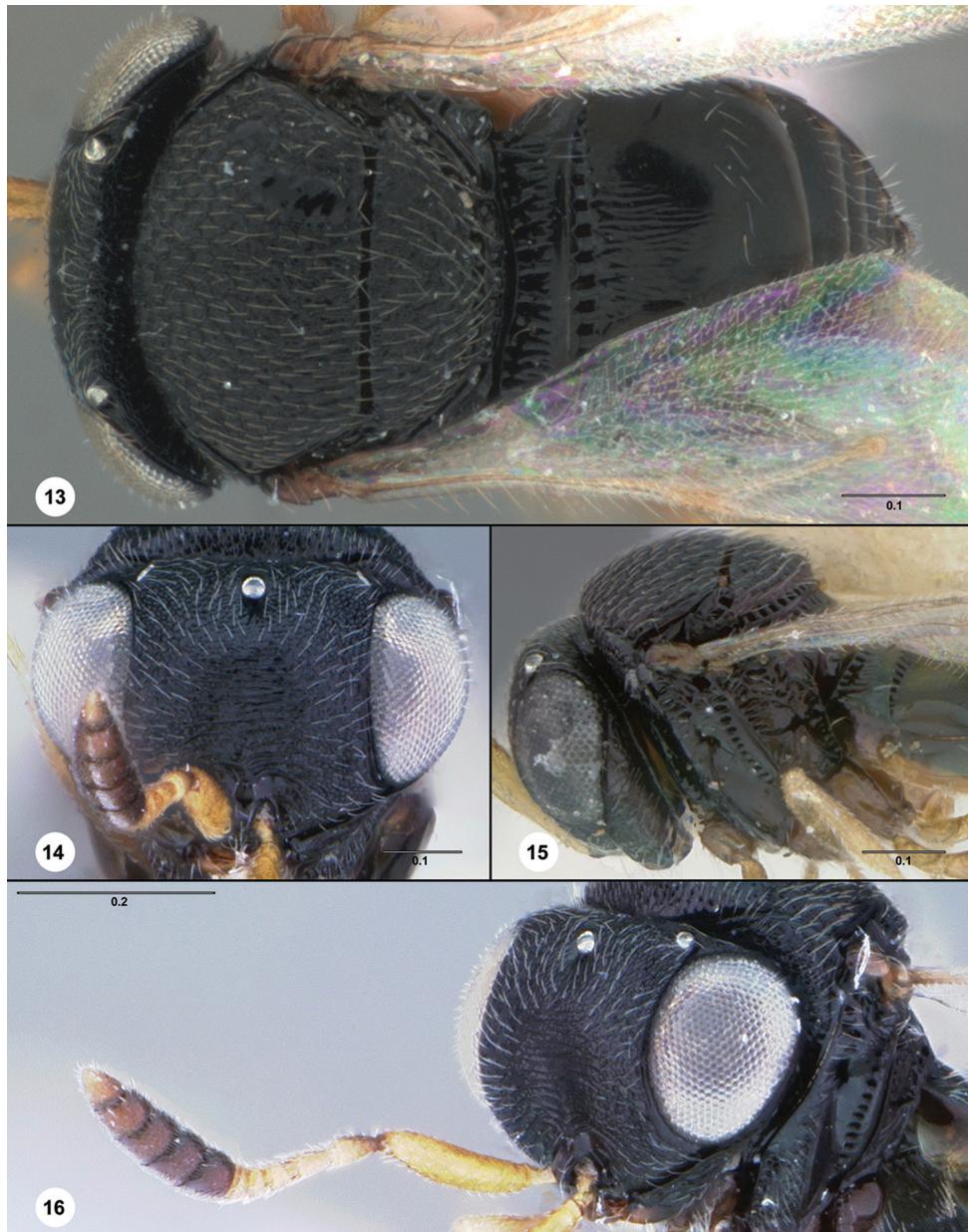
*Telenomus atys* Nixon, 1935: 76, 86, 96 (original description, keyed); Risbec, 1950: 558, 560 (description, keyed).

*Trissolcus atys* (Nixon): Masner, 1965: 124 (type information, generic transfer); Johnson, 1992: 623 (cataloged, type information).

**Description.** Female body length: 0.88–0.71 mm (n=3). Male body length: 0.74 mm (n=1). Body color: head and mesosoma black, metasoma brown.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: present. Sculpture of malar sulcus: faintly rugulose. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: transversely strigose ventrally, absent dorsally. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: areolate. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 0. Subacropleural sulcus: present. Speculum: transversely strigose; with granular microsculpture. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: irregularly rugulose. Postacetabular sulcus: formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Postero-dorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by smooth furrow with a small number of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum:



**Figures 13–16.** *T. atys*, female (USNMENT00896187) **13** female (USNMENT00896187) head, mesosoma, metasoma, dorsal view **14** female (USNMENT00896187) head, anterior view **15** female holotype (B.M. TYPE HYM. 9.245a), head and mesosoma, lateral view **16** female (USNMENT00896187) head and mesosoma, anterolateral view. Scale bars in millimeters.

areolate, longitudinally striae along posterior margin. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprathumeral sulcus: comprised of cells. Length of mesoscutal suprathumeral sulcus: about half the length of anterolateral edge

of mesoscutum. Parapsidal line: absent. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: acute. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Posterodorsal margin of axillular carina: pointed. Macrosulpture of mesoscutellum: rugose throughout. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, trochanters and proximal femora pale brown, elsewhere yellow.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: absent. Number of sublateral setae (on one side): 2. Setation of laterotergite 1: absent. Longitudinal striae of T2: faintly present anteriorly. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present.

**Diagnosis.** *Trissolcus atys* can be separated from other Palearctic species in the *basalis* group by the absence of episternal foveae (Figure 16), a rugose mesoscutellum (Figures 13, 15), fine transverse striation on the frons (Figure 14) and a mesopleural carina that extends from the mesopleural pit to the ventral mesopleural carina (Figure 15).

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3187>

**Material examined.** Holotype, female, *T. atys*: **UGANDA:** Kampala, XI-1930, reared from egg, H. Hargreaves, B.M. TYPE HYM. 9.245a (deposited in BMNH). Other material: (2 females, 1 male) **KENYA:** 1 female, 1 male, USNM-MENT01109872–01109873 (USNM). **UNITED ARAB EMIRATES:** 1 female, USNMENT00896187 (CNCI).

### *Trissolcus barrowi* (Dodd) nomen dubium

<http://bioguid.osu.edu/xbiocncepts/3188>

Figures 17–19; Morphbank<sup>2</sup>

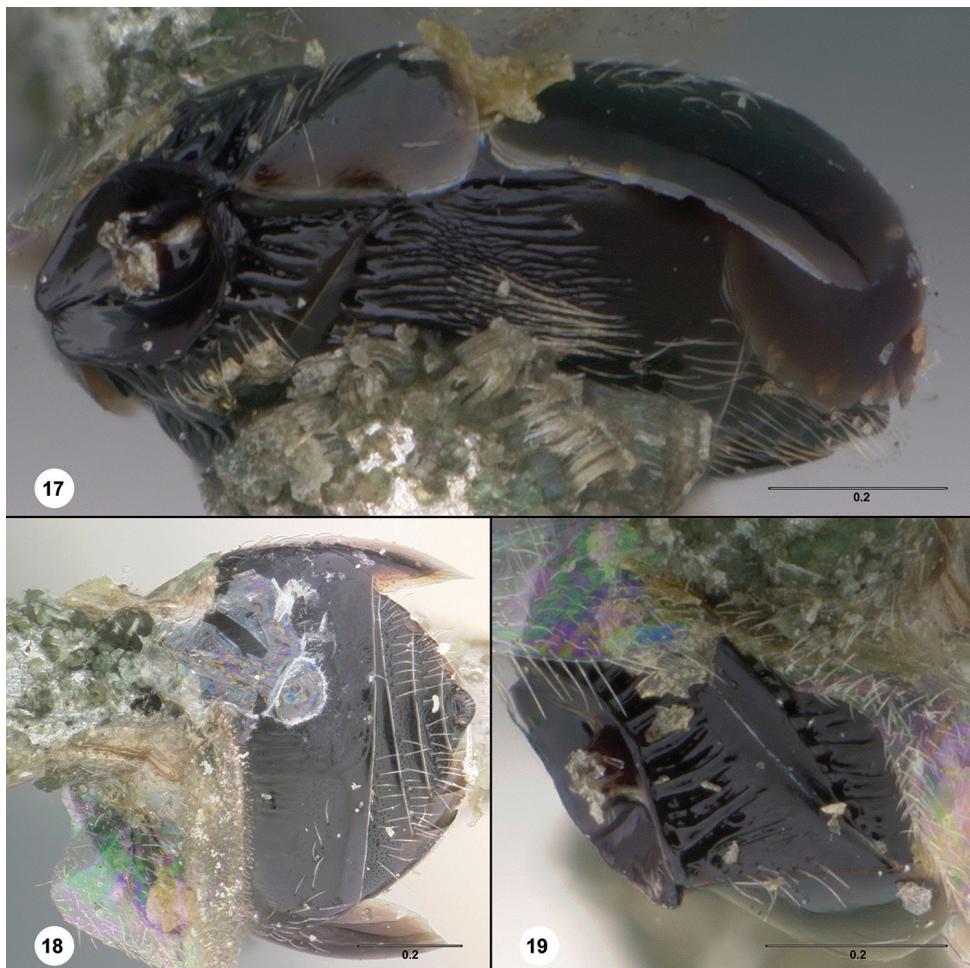
*Telenomus barrowi* Dodd, 1920: 356 (original description).

*Microphanurus barrowi* (Dodd): Nixon, 1938: 124, 137 (description, generic transfer, keyed); Nixon, 1943: 138 (keyed).

*Microphanurus borrowi* (Dodd): Risbec, 1950: 569 (keyed, error).

*Trissolcus barrowi* (Dodd): Masner, 1965: 124 (type information, generic transfer); Johnson, 1992: 623 (catalogued, type information); Rajmohana K. & Narendran, 2007: 102 (keyed).

**Description.** Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striae of T2: present in anterior two-thirds of tergite. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: sparsely present throughout area not covered by laterotergite.



**Figures 17–19.** *T. barrowi*, female holotype (B.M. TYPE HYM. 9.323) **17** metasoma, lateral view **18** metasoma, dorsal view **19** T1–T2, dorsolateral view. Scale bars in millimeters.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3188>

**Material examined.** Holotype, female, *T. barrowi*: INDIA: Himachal Pradesh St., Dalhousie, 11.VIII.1906, reared, H. J. W. Barrow, B.M. TYPE HYM. 9.323 (deposited in BMNH).

**Comments.** The holotype specimen consists of a metasoma and a wing, which are insufficient to separate this species from other species of *Trissolcus*, nor can it be confidently distinguished with the descriptions by Dodd (1920) and Nixon (1938). The condition of the type is so poor that designation of a neotype is warranted. However, this is confounded by the host association on the holotype labels that indicate that it emerged from the egg of a hawk moth (Sphingidae)- which is most likely an error. In the absence of material from vicinity of the type locality required for designation of a neotype, we presently treat *T. barrowi* as *nomen dubium*.

***Trissolcus basalis* (Wollaston)**

[http://bioguid.osu.edu/xbiol\\_concepts/3189](http://bioguid.osu.edu/xbiol_concepts/3189)

Figures 20–23; Morphbank<sup>3</sup>

*Trissolcus africanus* (Fouts) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3175](http://bioguid.osu.edu/xbiol_concepts/3175)

Morphbank<sup>4</sup>

Lectotype designation. We here designate syntype specimen MCSN 0015 (deposited in MCSN) as the lectotype of *Trissolcus africanus* (Fouts).

*Trissolcus lodosi* (Szabó) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3259](http://bioguid.osu.edu/xbiol_concepts/3259)

Morphbank<sup>5</sup>

*Trissolcus sulmo* (Nixon) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3315](http://bioguid.osu.edu/xbiol_concepts/3315)

Morphbank<sup>6</sup>

Lectotype designation. We here designate syntype specimen B.M. TYPE HYM. 9.318 (deposited in BMNH) as the lectotype of *Trissolcus sulmo* (Nixon).

*Telenomus Maderensis* Wollaston, 1858: 25 (original description, synonymized by Nixon (1935)).

*Telenomus basalis* Wollaston, 1858: 25 (original description); Kieffer, 1926: 39 (description).

*Telenomus megacephalus* Ashmead, 1894: 203, 212 (original description, synonymized by Nixon (1935)); Ashmead, 1896: 790 (keyed); Ashmead, 1900: 326 (distribution); Nixon, 1935: 100 (junior synonym of *Microphanurus basalis* (Wollaston)); Talamas, Johnson & Buffington, 2015: 64 (type information).

*Telenomus megalcephalus* Schulz: Schulz, 1906: 152 (emendation).

*Telenomus piceipes* Dodd, 1920: 354 (original description, synonymized by Nixon (1935)); Nixon, 1935: 100 (junior synonym of *Microphanurus basalis* (Wollaston)).

*Liophanurus megacephalus* (Ashmead): Kieffer, 1926: 65, 76 (description, generic transfer, keyed).

*Telenomus maderensis* Wollaston: Kieffer, 1926: 39 (description); Nixon, 1935: 100 (junior synonym of *Microphanurus basalis* (Wollaston)).

*Microphanurus africanus* Fouts, 1934: 105, 106 (original description, keyed).

*Microphanurus basalis* (Wollaston): Nixon, 1935: 96, 100 (description, generic transfer, synonymy, keyed); Nixon, 1943: 138 (keyed); Risbec, 1950: 570, 571 (variation, keyed).

*Microphanurus sulmo* Nixon, 1938: 123, 126 (original description, keyed); Nixon, 1943: 138 (keyed); Risbec, 1950: 569 (keyed).

*Asolcus basalis* (Wollaston): Delucchi, 1961: 44, 57 (description, keyed); Voegelé, 1962: 155 (variation, diagnosis); Voegelé, 1964: 28 (keyed); Voegelé, 1965: 96, 108 (variation, diagnosis, keyed); Voegelé, 1969: 151 (keyed).

*Trissolcus basalis* (Wollaston): Masner, 1965: 125 (type information, generic transfer); Safavi, 1968: 415 (keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 516 (keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 121 (de-

scription); Graham, 1984: 100 (variation); Johnson, 1985b: 432, 434 (description, keyed); Johnson, 1991: 212, 213, 214, 216 (diagnosis, keyed); Ghahari, Buhl & Kocak, 2011: 594 (listed); Mao, Valerio, Austin, Dowton & Johnson, 2012: 194 (presentation of mitochondrial genome, phylogenetic position); Fusu, Bin & Popovici, 2013: 263 (description of chromosomes); Kononova, 2014: 1425 (keyed); Talamas, Johnson & Buffington, 2015: 60, 61 (diagnosis, keyed, lectotype designation); Kononova, 2015: 263 (keyed).

*Trissolcus maderensis* (Wollaston): Masner, 1965: 126 (type information, generic transfer).

*Trissolcus piceipes* (Dodd): Masner, 1965: 127 (type information, generic transfer).

*Trissolcus sulmo* (Nixon) syn. n.: Masner, 1965: 128 (type information, generic transfer); Johnson, 1992: 638 (cataloged, type information).

*Asolcus sulmo* (Nixon): Voegelé, 1969: 151 (keyed).

*Trissolcus megacephalus* (Ashmead): Johnson, 1983: 448 (type information).

*Trissolcus africanus* (Fouts) syn. n.: Bin, 1974: 463 (generic transfer, type information); Masner, 1976: 76 (systematic position).

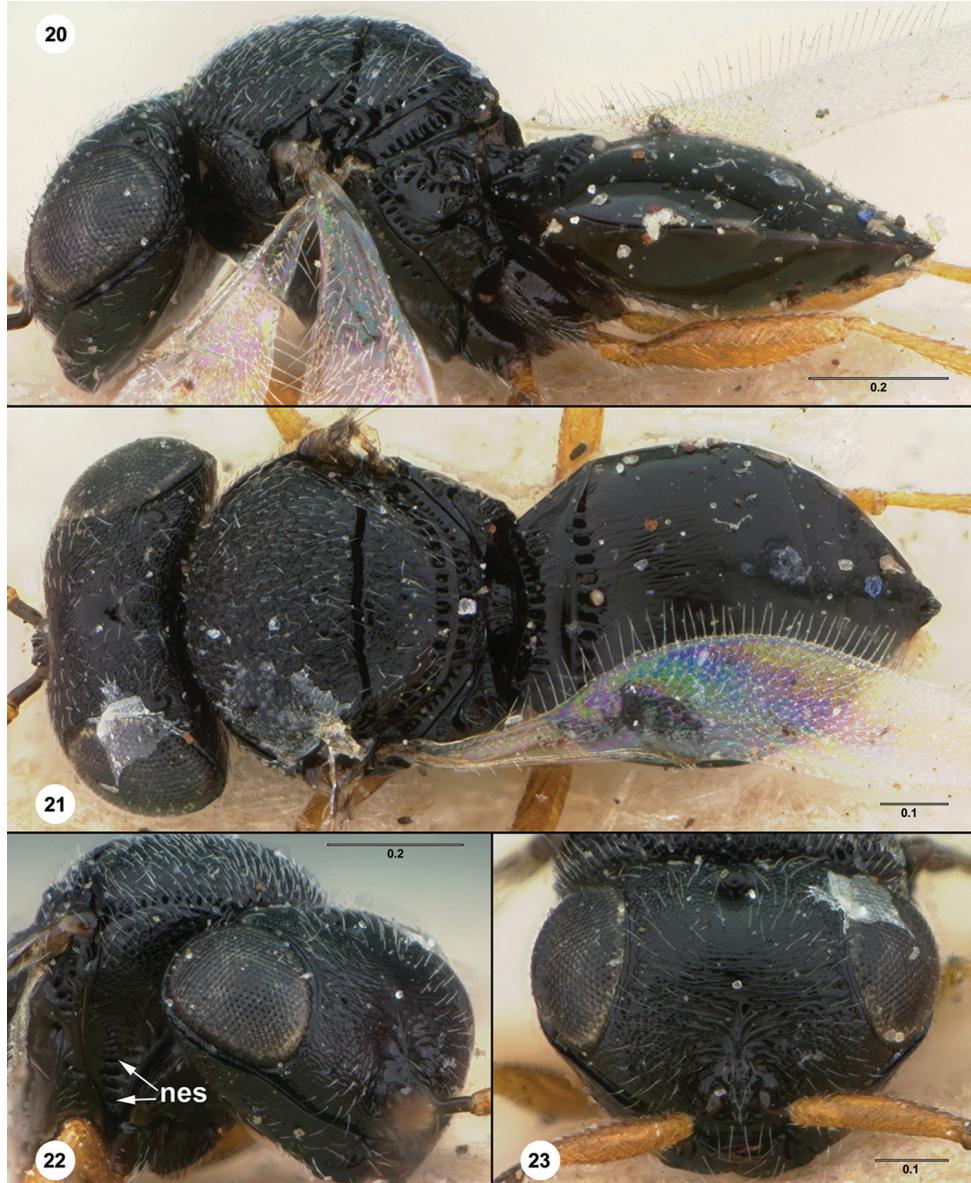
*Asolcus lodosi* Szabó, 1981: 197 (original description).

*Trissolcus lodosi* (Szabó) syn. n.: Kononova, 2014: 1425 (keyed); Kononova, 2015: 262 (keyed).

**Description.** Female body length: 1.07–1.28 mm (n=20). Male body length: 0.91–1.24 mm (n=11). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: black; brown; dark brown. Length of radicle: equal to or greater than width of clypeus. Color of A1–A6 in female: yellow, becoming brown distally. Color of A7–A11 in female: dark brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: bulging. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: smooth. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent; weakly horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: faintly striate. Netrion sulcus: incomplete. Pronotal suprnhumer al sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 2; 1. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: distinctly separate from mesopleural pit. Subacropileural sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple. Mesopleural carina: absent; well de-



**Figures 20–23.** *T. basalis*, female lectotype (B.M. TYPE HYM. 9.304) **20** head, mesosoma, metasoma, lateral view **21** head, mesosoma, metasoma, dorsal view **22** head and mesosoma, anterolateral view **23** head, anterior view. Scale bars in millimeters.

fined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: pre-

sent dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by small punctures; present as a smooth furrow. Mesopleural epicoxal sulcus: present as a smooth furrow. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: mostly smooth with faint rugulae radiating from metapleural pit. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture; present as coarse rugae. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: reticulate anteriorly, becoming longitudinally strigose posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprhumeral sulcus: comprised of cells. Length of mesoscutal suprhumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Posterodorsal margin of axillular carina: round. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: multiple rows of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown to black, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate. Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: present throughout anterior half of tergite. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present.

**Diagnosis.** Among Palearctic species of *Trissolcus*, *T. basalis* is most similar to *T. semistriatus* with which it shares episternal foveae that are distant from both the postacetabular sulcus and the mesopleural pit and an absence of coarse macrosculpture on the mesoscutum and mesoscutellum. The best feature for separating these species is the netrion sulcus, which is dorsally complete in *T. semistriatus* (Figures 170, 171) and dorsally undefined in *T. basalis* (Figure 22). The postacetabular sulcus in *T. basalis* is typically indicated by small and poorly defined cells, sometimes appearing as a smooth furrow. In *T. semistriatus* the cells of the postacetabular sulcus are distinct and regularly spaced. The mesoscutal humeral sulcus in *T. basalis* is always present as a smooth furrow whereas in *T. semistriatus* it is nearly always comprised of distinct cells. *Trissolcus basalis* is also similar to *T. elasmuchae*, from which it can be separated by the absence of a well-defined paracoxal sulcus in the ventral half of the metapleuron, and by the form of the episternal foveae, which in *T. elasmuchae* from a more or less continuous line from the postacetabular sulcus to the mesopleural pit.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3189>

**Material examined.** Lectotype, female, *T. basalis*: **PORTUGAL**: Madeira Reg. Autó., Madeira Island, VII-1855, Wollaston, B.M. TYPE HYM. 9.304 (deposited in BMNH). Lectotype, female, *Microphanurus africanus*: **SOMALIA**: Shabeellaha Dhexe Reg., Giohar (Villaggio Duca degli Abruzzi), 1.III.1926, Paoli, MCSN 0015 (deposited in MCSN). Holotype, female, *T. megacephalus*: **SAINT VINCENT AND THE GRENADINES**: Saint Vincent Island, no date, H. H. Smith, USNM Type No. 2525 (deposited in USNM). Lectotype, female, *M. sulmo*: **SRI LANKA**: Central Prov., Nuwara Eliya Dist., Talawakele (Talawakelle), 1932, C. B. R. King, B.M. TYPE HYM. 9.318 (deposited in BMNH). Paratype, female, *Asolcus lodosi*: **TURKEY**: 1 female, Hym.Typ.No. 1886, Mus.Budapest (HNHM). *Other material*: (189 females, 53 males, 54 unknowns) **AUSTRALIA**: 22 females, 4 males, USNMENT00872088–00872090, 00903007, 00954542–00954563 (USNM). **BERMUDA**: 10 unsexed, USNMENT00989422–00989423, 00989425, 00989427–00989431, 00989457–00989458 (USNM). **CUBA**: 6 unsexed, USNMENT00989407–00989412 (USNM). **CYPRUS**: 3 females, 1 male, USNMENT00916553, 00916555, 00916580, 00916582 (BMNH). **DOMINICA**: 1 unsexed, USNMENT00989459 (USNM). **DOMINICAN REPUBLIC**: 9 unsexed, USNMENT00989413–00989421 (USNM). **EGYPT**: 2 females, 2 unsexed, USNMENT00872006–00872009 (USNM). **FRANCE**: 9 females, USNMENT00896055–00896060, 00896070–00896071, 00896296 (CNCI). **HUNGARY**: 1 male, USNMENT00916996 (BMNH). **ISRAEL**: 1 female, UCRC ENT 296979 (UCRC). **ITALY**: 1 female, USNMENT00916293 (BMNH). **JORDAN**: 4 females, USNMENT00916495–00916498 (BMNH). **MALAYSIA**: 1 female, 1 male, USNMENT00916371, 00916372 (BMNH). **MONTENEGRO**: 1 female, USNMENT00896249 (CNCI). **MONTSERRAT**: 16 females, 2 males, USNMENT00954513–00954530 (USNM). **MOROCCO**: 1 female, 1 male, USNMENT00896088, 00896109 (CNCI). **PORTUGAL**: 21 females, 6 males, USNMENT00916186, 00916188, 00916196–00916200, 00916204, 00916207–00916209, 00916214, 00916219, 00916221, 00916224–00916225, 00916228–00916233, 00916239, 00916242–00916245 (BMNH). **SAINT VINCENT AND THE GRENADINES**: 13 unsexed, USNMENT00989432–00989434, 00989440–00989449 (USNM). **SPAIN**: 2 males, USNMENT00916183–00916184 (BMNH). **TRINIDAD AND TOBAGO**: 10 unsexed, USNMENT00764950–00764951, 00989450–00989456, 00989461 (USNM). **TURKEY**: 2 females, 1 male, OSUC 17739, 17742, USNMENT00916024 (BMNH). **UNITED STATES**: 105 females, 35 males, 2 unsexed, OSUC 131149–131186, 154353, 7339 (OSUC); USNMENT00872103–00872109, 00954022–00954023, 00954393, 00954436–00954437, 00954443–00954452, 00954454–00954469, 00954480–00954512, 00954531–00954541, 00954564–00954570, 01109065–01109069, 01109071–01109074, 01109077, 01109079, 01109088–01109089 (USNM). **VENEZUELA**: 1 unsexed, USNMENT00989460 (USNM).

***Trissolcus carinifrons* (Cameron)**

[http://bioguid.osu.edu/xbiol\\_concepts/3197](http://bioguid.osu.edu/xbiol_concepts/3197)

Figures 24–27; Morphbank<sup>7</sup>

*Immsia carinifrons* Cameron, 1912: 105 (original description); Kieffer, 1926: 393 (description).

*Telenomus carinifrons* (Cameron): Dodd, 1920: 355 (description, generic transfer).

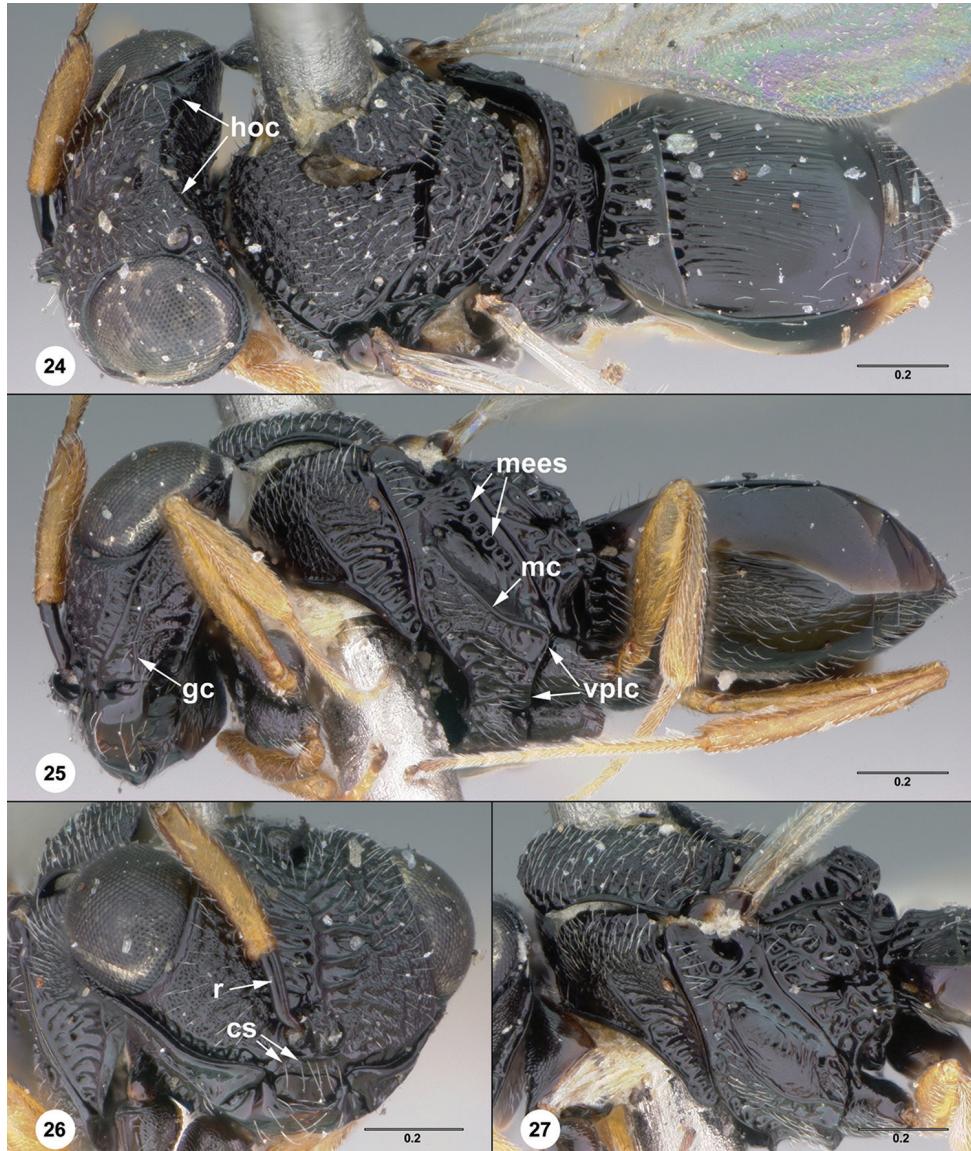
*Microphanurus carinifrons* (Cameron): Nixon, 1938: 124, 138 (description, generic transfer, keyed); Nixon, 1943: 137 (keyed); Risbec, 1950: 569 (keyed).

*Trissolcus carinifrons* (Cameron): Masner, 1965: 125 (type information, generic transfer); Mani & Sharma, 1982: 143 (description); Johnson, 1992: 624 (catalogued, type information); Rajmohana K. & Narendran, 2007: 102 (keyed).

**Description.** Female body length: 1.82 mm (n=1). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: dark brown. Length of radicle: equal to or greater than width of clypeus. Color of A1–A6 in female: yellow. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: bulging. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: coarsely rugose. Preocellar pit: present. Setation of lateral frons: moderately dense. Sculpture directly ventral to preocellar pit: absent. Macrosculpture of lateral frons: rugose. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: rugulose. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: percurrent. Number of episternal foveae: 3. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileal sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple. Mesopleural carina: complete. Sculpture of femoral depression: concentrically strigose. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: coarsely rugose. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: rugose. Posterodorsal metapleural sulcus: poorly defined to absent.



**Figures 24–27.** *T. carinifrons*, female holotype (B.M. TYPE HYM. 9.312) **24** head, mesosoma, metasoma, dorsolateral view **25** head, mesosoma, metasoma, ventrolateral view **26** head, anterior view **27** mesosoma, lateral view. Scale bars in millimeters.

Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as clearly defined line of cells. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macro-sculpture of mesoscutum: coarsely rugose, lines oriented more longitudinally along

posterior margin. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprakumeral sulcus: comprised of cells. Length of mesoscutal suprakumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: absent. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: rugose throughout. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: two rows of deep, well-defined cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae and fifth tarsomeres brown, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in most of tergite, extending posteriorly to transverse line of setae. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus carinifrons* can be separated from all the species treated here by the combination of 6 setae on the clypeus, the presence of a complete hyperoccipital carina, and a mesepimeral sulcus comprised of circular foveae.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3197>

**Material examined.** Holotype, female, *I. carinifrons*: INDIA: Uttarakhand St., Forest Research Institute (FRI / IFRI), Dehra Dun, 3.VIII.1910, at light, V. S. Iyer, B.M. TYPE HYM. 9.312 (deposited in BMNH).

### *Trissolcus comperei* (Crawford)

[http://bioguid.osu.edu/xbioc\\_concepts/3204](http://bioguid.osu.edu/xbioc_concepts/3204)

Figures 28–34; Morphbank<sup>8</sup>

*Trissolcus itoi* Ryu syn. n.

[http://bioguid.osu.edu/xbioc\\_concepts/3248](http://bioguid.osu.edu/xbioc_concepts/3248)

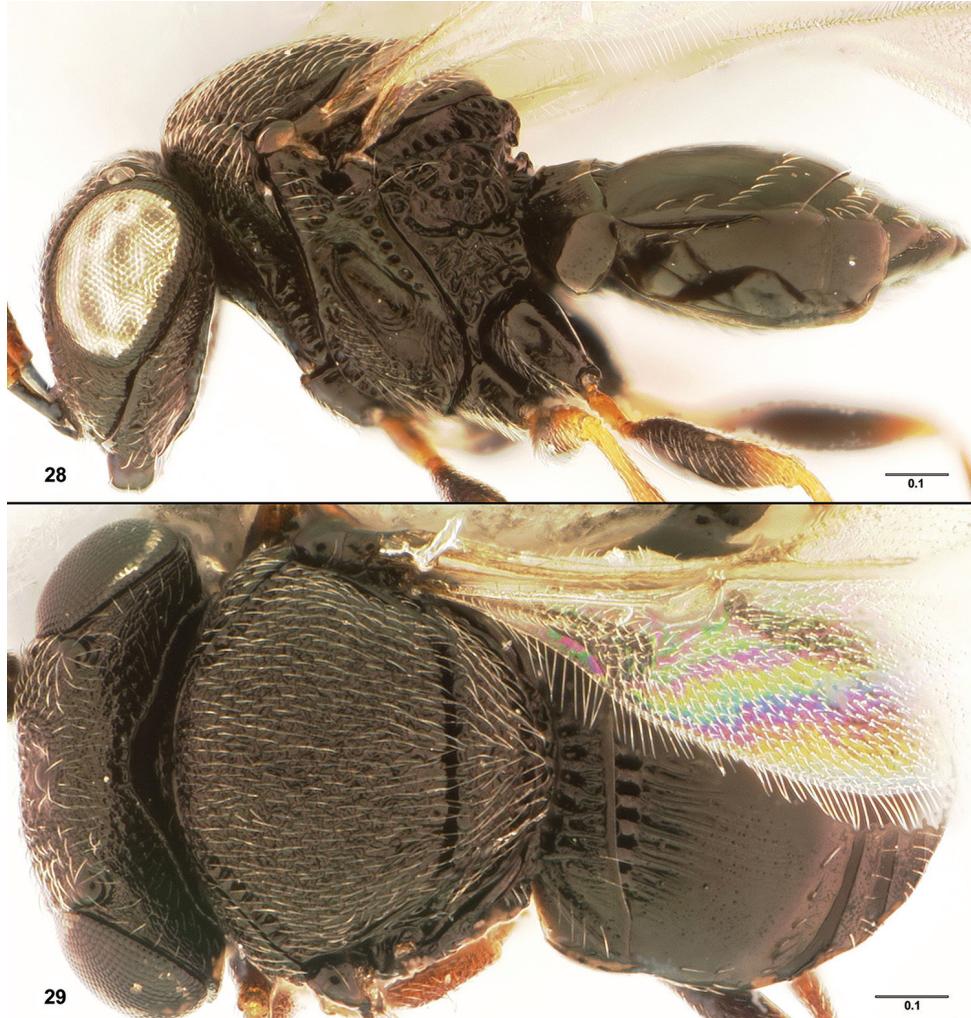
Morphbank<sup>9</sup>

*Telenomus comperei* Crawford, 1912: 1 (original description); Baltazar, 1966: 172 (cataloged, type information, distribution).

*Trissolcus comperei* (Crawford): Masner & Muesebeck, 1968: 72 (type information, generic transfer); Johnson, 1992: 625 (cataloged, type information).

*Trissolcus itoi* Ryu syn. n., 1984: 37, 52 (original description, keyed).

**Description.** 0.93–1.51 mm (n=19). Body color: head, mesosoma, and metasoma black.

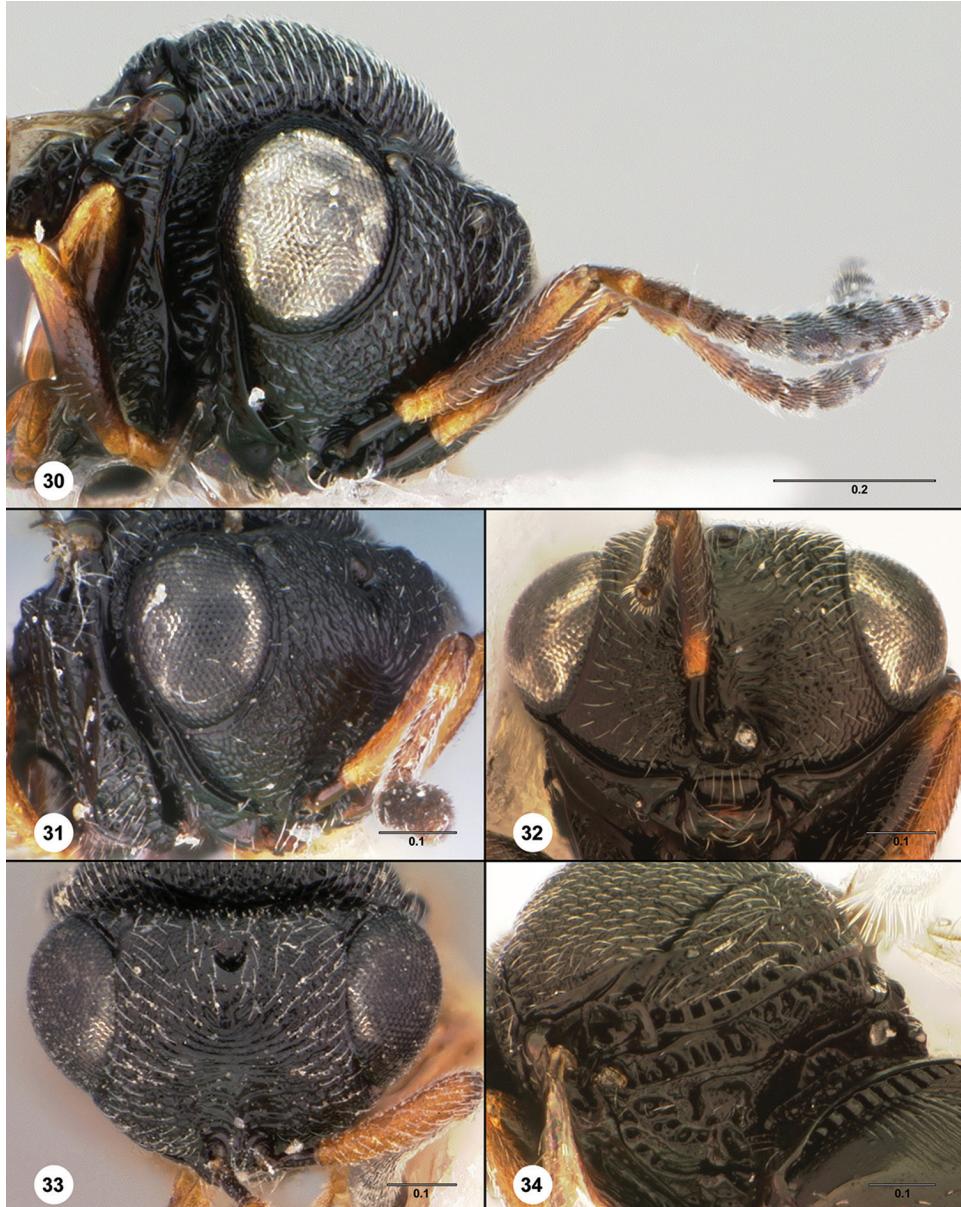


**Figures 28–29.** *T. comperei* 28 female (USNM ENT00872396), head, mesosoma, metasoma, lateral view 29 female (USNM ENT00872397), head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

**Head.** Color of radicle: black; dark brown. Length of radicle: equal to or greater than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: pale brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Micro-sculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; strigose,

roughly concentric around median ocellus. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: horizontally striate, striae of antennal scrobe extending to lateral frons; absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: rugulose; absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: antero-posteriorly striate; finely rugulose. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: posterior half of pronotum. Number of episternal foveae: 3; 2; 1. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: distinctly separate from mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose; with granular microsculpture. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: concentrically strigose. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: irregularly rugulose. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly; rugose. Posterdorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture; present as coarse rugae. Mesoscutal humeral sulcus: indicated by smooth furrow with a small number of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: rugulose; rugulose, becoming longitudinally striate posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent; indicated only at posterior margin of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent. Posterdorsal margin of axillular carina: round. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: rugose throughout. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: multiple rows of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmar-



**Figures 30–34.** *T. comperei* **30** female holotype of *T. itoi* syn. n. (Type No. 2220 Kyushu Univ.) **31** female holotype (USNMENT00989064), head, anterolateral view **32** female (USNMENT00872399), head, anterior view **33** female (USNMENT00916352), head, anterior view **34** female (USNMENT00872397), mesosoma, T1–T2, posterodorsal view. Scale bars in millimeters.

ginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, femora and tibiae yellow to pale brown, elsewhere yellow. Anteromedial portion of metasomal depression: smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 2; 1. Setation of laterotergite 1: absent. Longitudinal striae of T2: present in most of tergite, extending posteriorly to transverse line of setae. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present.

**Diagnosis.** *Trissolcus comperei* is similar to *T. yamagishii*, *T. latisulcus*, and *T. carinifrons* with which it shares a long dark radicle and coarse sculpture of the mesoscutum and mesoscutellum. *Trissolcus comperei* can be separated from them by the characters presented in the key: sculpture of the frons below the median ocellus, absence of a hyperoccipital carina, and a femoral depression without coarse rugae throughout. The rugae that are present in the femoral depression are located ventrally and are arched and parallel. This is a very useful diagnostic character for the species, although the rugae are fainter in smaller specimens. *Trissolcus aloysiisabaudiae* from East Africa shares with *T. comperei* this sculptural pattern of the femoral depression and is a very similar species, excluding the sculpture of the mesonotum and the presence of a robust longitudinal mesoscutellar carina. These two species should certainly be compared in a greater context of African species.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3204>

**Comments.** Specimens from China have bright yellow legs and non-claval flagellomeres. Specimens from Japan have darker legs and flagellomeres. The pattern of macrosculpture on the frons and the coloration of the legs and antennae are essentially identical to the pattern found in *T. semistriatus*: specimens from higher latitudes tend to be darker with more robust facial sculpture.

**Material examined.** Holotype, female, *T. comperei*: CHINA: Guangdong Prov., Guangzhou (Canton), no date, reared from egg, G. Compere, USNMENT00989064 (deposited in USNM). Holotype, female, *T. itoi*: JAPAN: Niigata Pref., Mt. Kanegura Yama, 19.VIII.1970, K. Yamagishi, Type No. 2220 Kyushu Univ. (deposited in KUEC). Other material: (16 females) CHINA: 5 females, USNMENT00916347, 00916349–00916352 (BMNH). INDIA: 1 female, USNMENT00916361 (BMNH). JAPAN: 8 females, OSUC 144487–144488, 542357, 542365, 542371, 542424 (CNCI); OSUC 75840–75841 (OSUC). SOUTH KOREA: 1 female, USNMENT00896147 (CNCI). UNITED ARAB EMIRATES: 1 female, USNMENT00896183 (CNCI).

#### *Trissolcus corai* Talamas, sp. n.

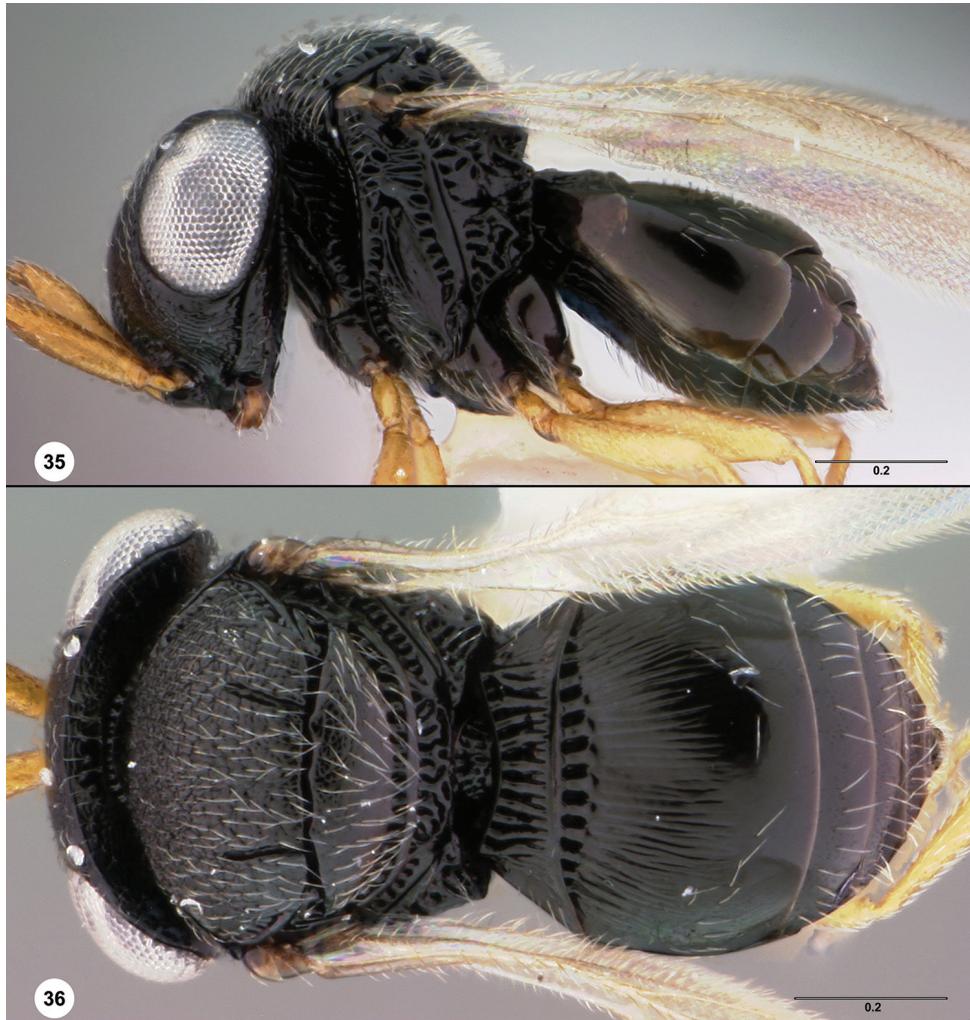
<http://zoobank.org/44FC5562-07F9-484B-8269-8C04E209DF8A>

[http://bioguid.osu.edu/xbiol\\_concepts/350942](http://bioguid.osu.edu/xbiol_concepts/350942)

Figures 35–39; Morphbank<sup>10</sup>

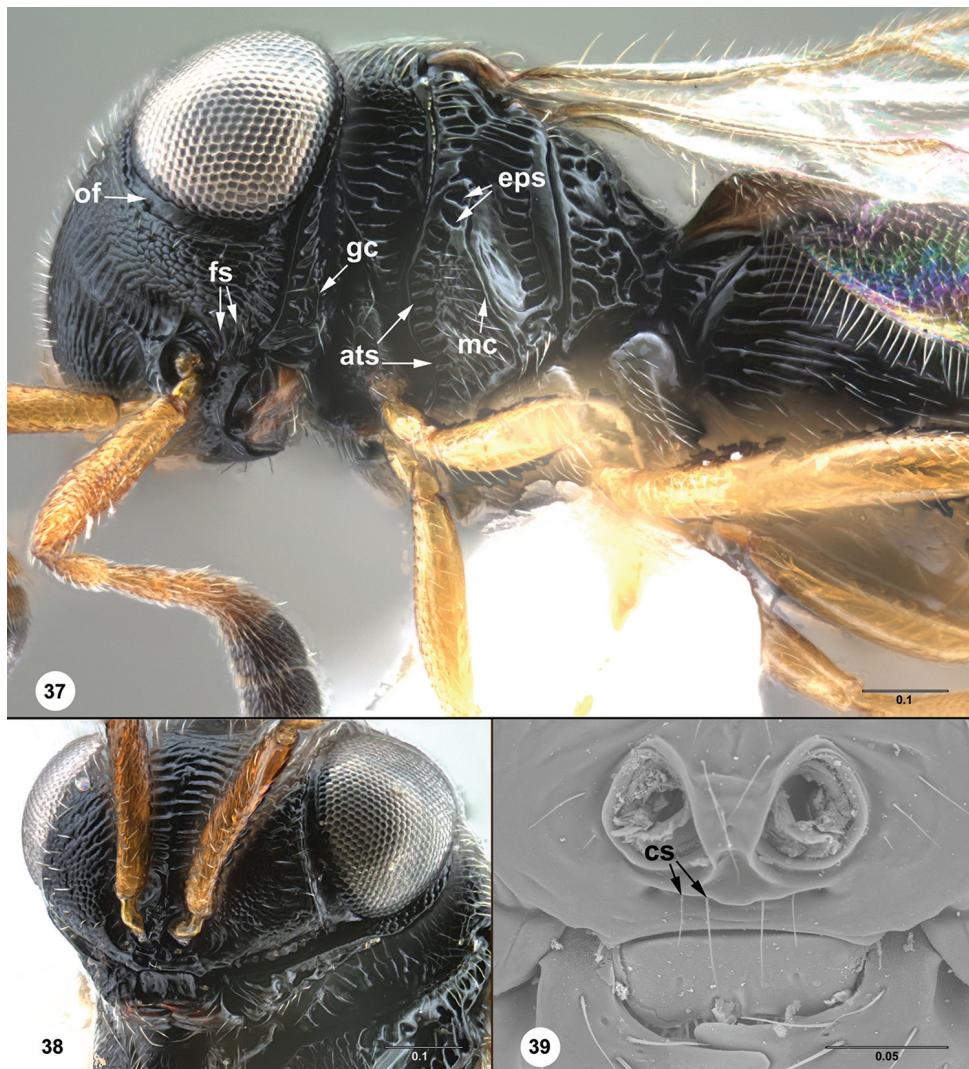
**Description.** Female body length: 1.11–1.41 mm (n=20). Male body length: 1.10–1.23 mm (n=2). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow; yellow, becoming brown distally. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as short grooves. Number of clypeal setae: 4. Micro-



**Figures 35–36.** *Trissolcus corai* female paratype (USNMENT00977542) 35 head, mesosoma, metasoma, lateral view 36 head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

culture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate; faintly rugulose. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosulpture of frons between antennal scrobe and anterior ocellus: absent; weakly transversely strigose. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: moderately dense. Sculpture directly ventral to preocellar pit: absent; microsculptured; weakly transversely striate. Macrosulpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperocapital carina: complete. Macrosulpture of posterior vertex: absent. Microsculpture



**Figures 37–39.** *Trissolcus corai* 37 female paratype (OSUC 542370), head, mesosoma, metasoma, ventrolateral view 38 female paratype (USNMENT00896028), head, mesosoma, metasoma, ventrolateral view 39 female paratype (USNMENT01223664), ventral head, anterior view. Scale bars in millimeters.

on posterior vertex along occipital carina: present; absent medially, present laterally. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit:

extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly; rugose. Posterodorsal metapleural sulcus: poorly defined to absent; indicated by a line of elongate cells. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent; weakly rugulose posteriorly; rugulose, becoming longitudinally striate posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprathumeral sulcus: comprised of cells. Length of mesoscutal suprathumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about 1.5 times as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anterior two-thirds of tergite. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus corai* belongs to the cluster of species of the *flavipes* group with 4 clypeal setae, which includes *T. japonicus*, *T. kozlovi*, and *T. plautiae*. It can be separated from all of these by the transverse sculpture on the frons and by the distinctly smaller size of the lateral clypeal setae relative to the median pair. The number of clypeal setae is the best character for separating *T. corai* from *T. vindicius*, which can be very similar, particularly because the rugae on the frons of some *T. corai* may be weakly developed. In most *T. corai*, the mesoscutum between the notauli has longitudinal rugae, which will separate *T. corai* from *T. japonicus*, *T. kozlovi*, *T. plautiae*, and *T. vindicius*.

**Etymology.** This species is named for Joe Cora, former database manager at The Ohio State University, for his multitudinous contributions to the development of cybertaxonomic tools and the bioinformatics of Platygastroidea.

**Associations.** emerged from egg of *Cappaea tibialis* Hsiano & Cheng; [Hemiptera: Heteroptera: Pentatomidae]

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=350942>

**Material examined.** Holotype, female: CHINA: Beijing Prov., Haidian, Baiwan-gshan Mountain N40°02'05.31 E116°15'21.86, 15.XII.2015, reared from egg, T. Haye, USNMENT01223979 (deposited in USNM). Paratypes: (94 females) CHINA: 8 females, USNMENT01223973–01223974, 01223977–01223978 (OSUC); USNMENT01223965, 01223970–01223972 (USNM). JAPAN: 79 females, OSUC 144392–144408, 144411–144435, 144437, 144439–144444, 144446–144454, 144456–144467, 542356, 542366–542367, 542369–542370, 542372, 542379, 542381, USNMENT00896310 (CNCI). SOUTH KOREA: 5 females, USNMENT00896027–00896028, 00896030, 00896037, 00896047 (CNCI). TAIWAN: 2 females, OSUC 63888, 76838 (OSUC). Other material: (2 females, 4 males) CHINA: 2 females, 2 males, USNMENT01223664, 01223966, 01223969, 01223976 (USNM). JAPAN: 2 males, OSUC 144409–144410 (CNCI).

### *Trissolcus cultratus* (Mayr)

[http://bioguid.osu.edu/osuc\\_concepts:13182](http://bioguid.osu.edu/osuc_concepts:13182)

Figures 40–45; Morphbank<sup>11</sup>

*Trissolcus striatellus* Kononova syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/354844](http://bioguid.osu.edu/xbiot_concepts/354844)

*Telenomus cultratus* Mayr, 1879: 699, 701, 703 (original description, keyed, synonymized by Kozlov (1968)); Kozlov, 1968: 200 (junior synonym of *Trissolcus flavipes* (Thomson)).

*Aphanurus Cultratus* (Mayr): Kieffer, 1912: 70 (description, generic transfer).

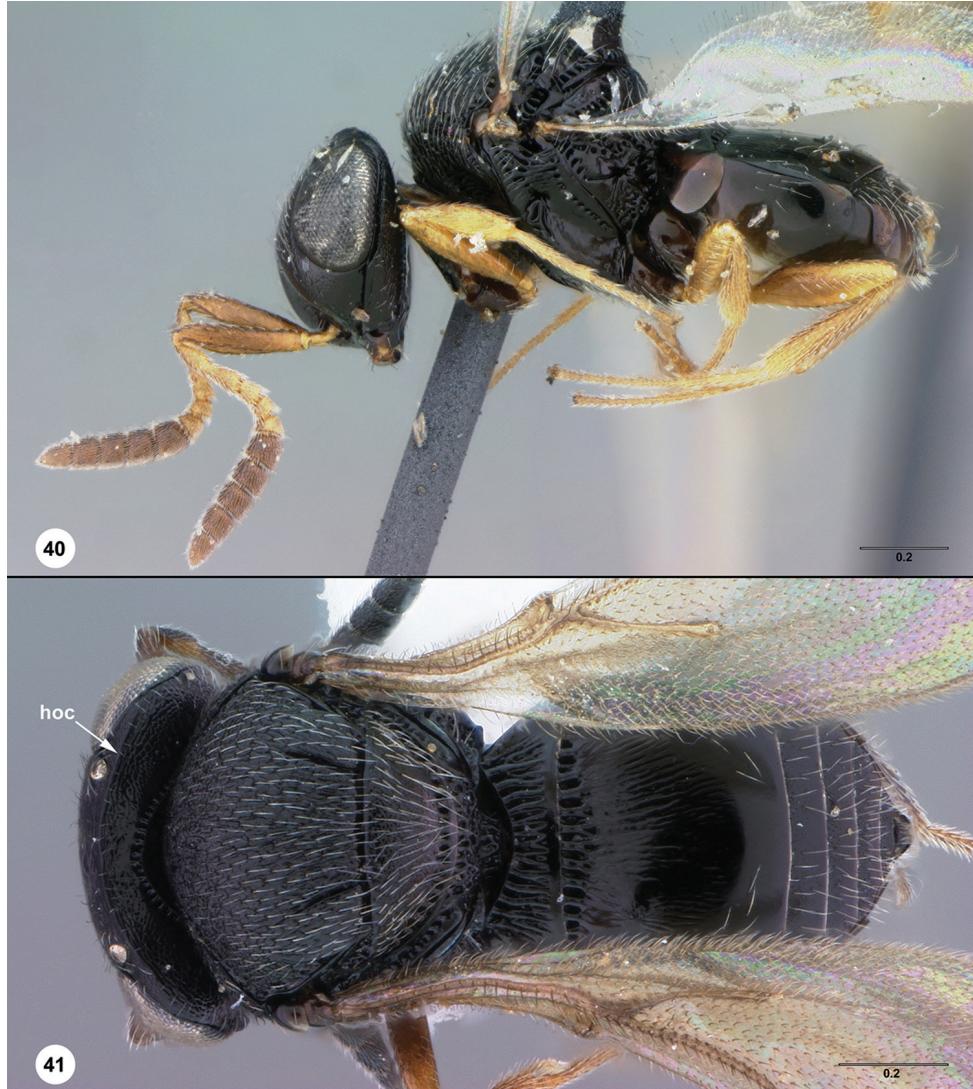
*Micromphanurus cultratus* (Mayr): Kieffer, 1926: 91, 95 (description, generic transfer, keyed); Nixon, 1939: 130, 133 (description, keyed); Rjachovskij, 1959: 83 (keyed).

*Asolcus cultratus* (Mayr): Masner, 1959: 378 (diagnosis, variation); Delucchi, 1961: 44, 51 (description, keyed).

*Trissolcus cultratus* (Mayr): Safavi, 1968: 414 (keyed); Szabó, 1975: 266, 267 (description, lectotype designation, keyed); Talamas, Johnson & Buffington, 2015: 54, 71 (removed from synonymy with *Trissolcus flavipes* (Thomson), diagnosis, keyed, type information).

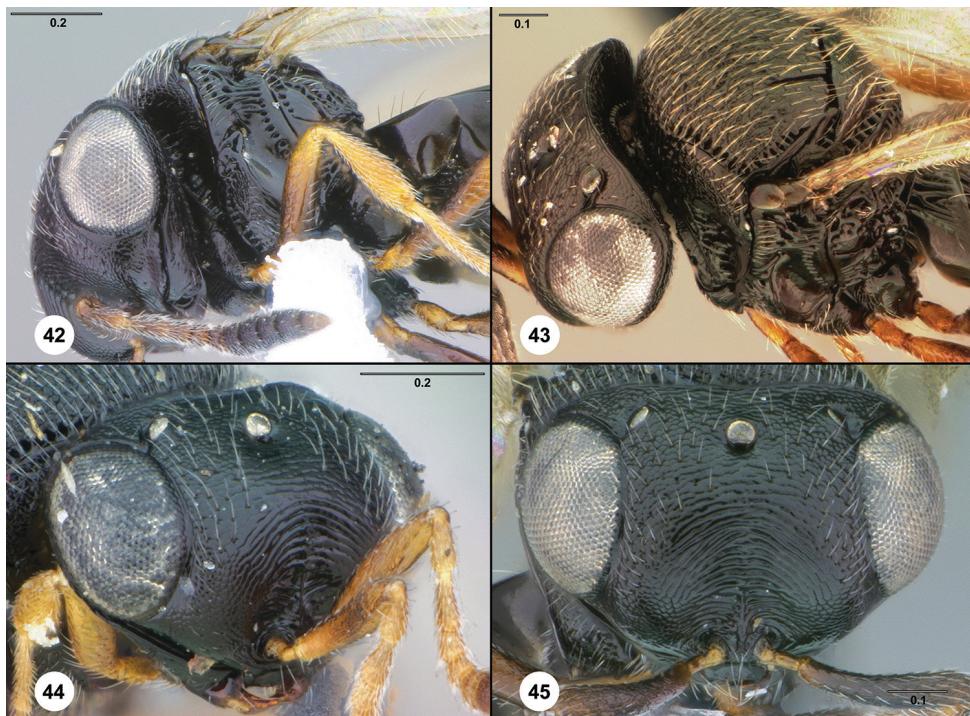
*Trissolcus striatellus* Kononova syn. n., 2014: 744 (original description, diagnosis).

**Description.** Female body length: 1.19–1.98 mm (n=20). Male body length: 1.03–1.68 mm (n=5). Body color: head, mesosoma, and metasoma black.



**Figures 40–41.** *Trissolcus cultratus* 40 female lectotype (NHW 0008A), head, mesosoma, metasoma, lateral view 41 female (USNM 00916251), head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: dark brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as short grooves. Number of clypeal setae: 2. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye; present only at base of mandible. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly



**Figures 42–45.** *Trissolcus cultratus* **42** female (USNMENT00916251), head and mesosoma, ventrolateral view **43** female (USNMENT00764849), head and mesosoma, dorsolateral view **44** female lectotype (NHMW 0008A), head, anterolateral view **45** female (USNMENT00916251), head, anterior view. Scale bars in millimeters.

striate. Macrosculpture of frons between antennal scrobe and anterior ocellus: parallel arcuate rugae. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: sparse. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: obliquely striate, striae of upper frons extending ventrolaterally. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma:** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileal sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of

femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: irregularly rugulose; absent. Postacetabular sulcus: formed by large cells; formed by small punctures. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly. Posterodorsal metapleural sulcus: present as line of foveae; poorly defined to absent. Parcoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; indicated by a line of elongate cells. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture; present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: reticulate anteriorly, becoming longitudinally strigose posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprakumeral sulcus: comprised of cells. Length of mesoscutal suprakumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent; present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent; present. Shape of dorsal margin of anterior lobe of axillar crescent: flat, appearing fused with lateral margin of mesoscutum. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose.

Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about 1.5 times as long as stigmal vein. Color of legs: coxae dark brown to black, femora and tibia yellow to dark brown, trochanters and tarsi yellow to pale brown. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0; 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in most of tergite, extending posteriorly to transverse line of setae. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: present throughout area not covered by laterotergite.

**Diagnosis.** The arched rugae on the frons of *Trissolcus cultratus* separate it from most species of the *flavipes* group, but it is shared with *T. exerrandus* and *T. corai*. *Trissolcus exerrandus* has densely setose eyes whereas those of *T. cultratus* are essentially bare. The orbital furrow in *T. corai* is well defined ventrally and that of *T. cultratus* is not (compare Figures 37, 38 to Figures 44, 45).

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=13182>

**Material examined.** Lectotype, female, *T. cultratus*: Palearctic region: no date, G. Mayr, NHMW 0008A (deposited in NHMW). Paralectotype: Palearctic region: 1 male, NHMW 0008B (NHMW). Other material: (198 females, 26 males, 4 unsexed)

**AUSTRIA:** 5 females, 2 unsexed, USNMENT00979612–00979613 (CUIC); OSUC 75765–75767 (OSUC); USNMENT00675943–00675944 (USNM). **BELGIUM:** 1 female, USNMENT00896165 (CNCI). **CHINA:** 8 females, UCRC ENT 142635, 143817 (UCRC); USNMENT00764945–00764947, 00764962–00764963, 00764983 (USNM). **CZECH REPUBLIC:** 1 female, 3 males, USNMENT00896311–00896314 (CNCI). **FRANCE:** 11 females, 1 male, USNMENT00916035, 00916037–00916038, 00916041, 00916083, 00916125, 00916131, 00916147 (BMNH); OSUC 75753–75756 (OSUC). **GERMANY:** 1 female, USNMENT00872117 (USNM). **HUNGARY:** 5 females, 1 unsexed, USNMENT00896072, 00896073 (CNCI); OSUC 75771–75773, 75783 (OSUC). **JAPAN:** 32 females, 6 males, OSUC 144472–144480, 542363, 542374, 542412, 542415, USNMENT00896136, 00896138, 00896140, 00896305, 00896307–00896309, 00896315, 00896339, 00896341 (CNCI); OSUC 75784, 75786–75788 (OSUC); UCRC ENT 297012 (UCRC); USNMENT00675730–00675737, 00675761, 00764849 (USNM). **POLAND:** 6 females, USNMENT00916604–916609 (BMNH). **RUSSIA:** 34 females, USNMENT00896048–00896054, 00896074–00896075, 00979282–00979286, 00979289 (CNCI); UCRC ENT 110944, 110951, 110963, 110983, 110985, 110992, 111001–111003, 111009, 111011, 111066, 111078, 133622, 297001–297003, 297009, 297013 (UCRC). **SOUTH KOREA:** 29 females, 3 males, OSUC 144470–144471, USNMENT00896011, 00896015–00896016, 00896018, 00896019, 00896029, 00896032, 00896044–00896046, 00896112–00896116, 00896118–00896119, 00896121–00896122, 00896134–00896135, 00896157, 00979237, 00979246–00979250, 00979253, 00979280 (CNCI). **SWEDEN:** 10 females, 4 males, USNMENT00916105–00916110, 00916112–00916114, 00916310, 00916315–00916317, 00916319 (BMNH). **SWITZERLAND:** 26 females, 2 males, USNMENT00979222–00979226 (CNCI); USNMENT00916973–00916989, 00954000–00954005 (USNM). **TAIWAN:** 2 females, OSUC 542386 (CNCI); UCRC ENT 112210 (UCRC). **UNITED KINGDOM:** 21 females, 6 males, 1 unsexed, USNMENT00916247–00916254, 00916393–00916408, 00916411–00916412, 00916416, 00916418 (BMNH).

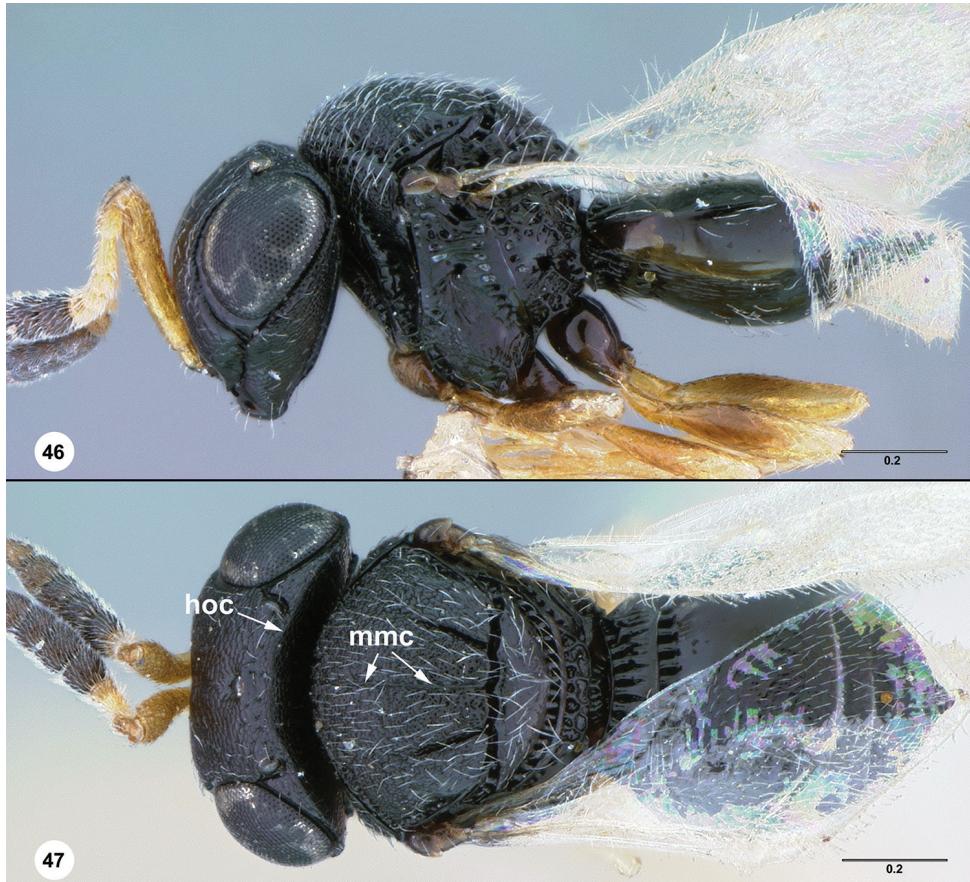
### *Trissolcus edessae* Fouts

[http://bioguid.osu.edu/xbiol\\_concepts/3221](http://bioguid.osu.edu/xbiol_concepts/3221)

Figures 46–51; Morphbank<sup>12</sup>

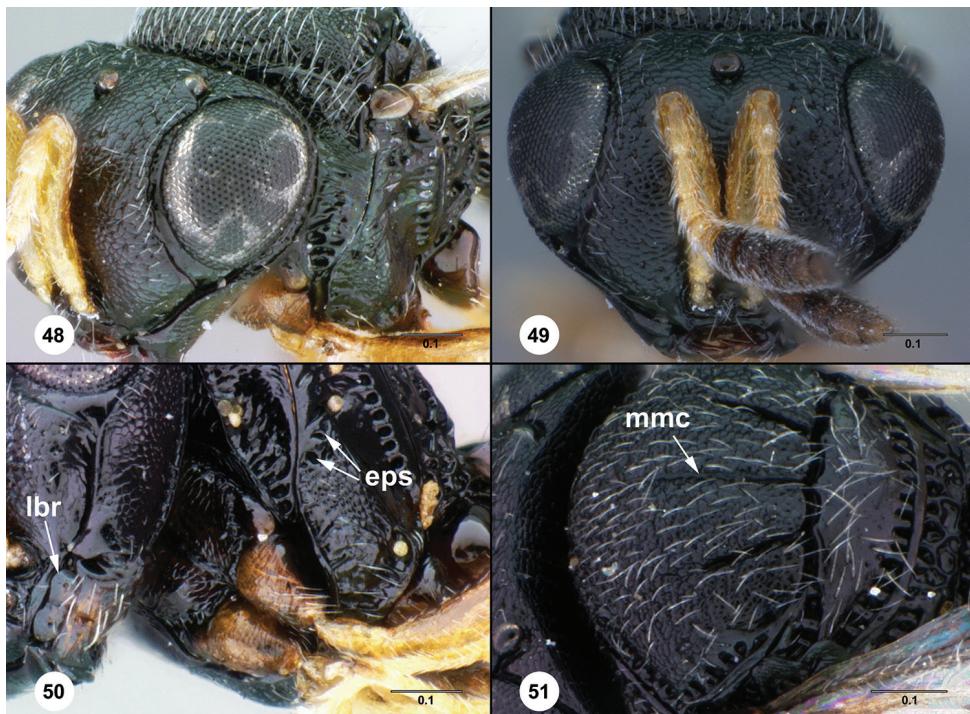
*Trissolcus edessae* Fouts, 1920: 65 (original description); Masner & Muesebeck, 1968: 72 (type information); Johnson, 1984a: 799, 801 (description, keyed); Johnson, 1987: 289, 300 (diagnosis, keyed); Johnson, 1992: 626 (cataloged, type information); Talamas, Johnson & Buffington, 2015: 56, 74 (diagnosis, keyed, type information).

**Description.** Female body length: 1.27–1.67 mm (n=31). Male body length: 1.18–1.70 mm (n=8). Body color: head, mesosoma, and metasoma black.



**Figures 46–47.** *Trissolcus edessae*, female (USNMENT00916178) 46 head, mesosoma, metasoma, lateral view 47 head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 2. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: faintly rugulose. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: transversely strigose ventrally, absent dorsally. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: sparse. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Anterior margin of occipital carina: coarsely crenulate.



**Figures 48–51.** *Trissolcus edessae*, female (USNM ENT00916178) **48** head and mesosoma, anterolateral view **49** head, anterior view **50** head and mesosoma, ventrolateral view **51** mesosoma, dorsal view. Scale bars in millimeters.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: rugose. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: weakly differentiated from sculpture of dorsal pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: distinctly separate from mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: dorsoventrally strigose in dorsal half. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth area small because cells of surrounding sulci are large. Posterdorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral

extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: present. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprathumeral sulcus: comprised of cells. Length of mesoscutal suprathumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striae of T2: absent. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striae of S2: present laterally, absent medially. Setation of S2: present posteromedially.

**Diagnosis.** *Trissolcus edessae* is unique among the species of the *flavipes* group treated here in that it has a medial mesoscutal carina. It bears no particular affinity to other Palearctic species in the *flavipes* group, but is morphologically similar to two species in the Nearctic: *T. brochymenae* and *T. euschisti*, from which it may be separated by the distinctly bicolored antennae, with A1–A6 yellow, and A7–A11 brown (Figures 46, 47). The labrum of *T. edessae* has a pair of distinct pits that are easily visible with light microscopy (Figure 50), whereas these pits in other species typically require scanning electron microscopy for observation. This character has yet to be fully explored throughout the genus because the labrum is often occluded, but we suspect that it will be informative.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3221>

**Material examined.** Holotype, female: UNITED STATES: LA, Orleans Parish, New Orleans, 23.VII.1919, C. E. Smith, USNMENT00872412 (deposited in USNM). Other material: SPAIN: 1 female, USNMENT00916178 (BMNH). (37 females, 3 males, 6 unsexed) EL SALVADOR: 5 unsexed, USNMENT00989220–00989221 (CNCI); USNMENT00764980–00764981, 00764993 (USNM). UNITED STATES: 36 females, 3 males, USNMENT00954346–00954377, 00954384–00954390 (USNM).

**Comments.** The specimen illustrated in Figures 46–51 is the only known representative of *T. edessae* outside of the Nearctic. We compared this specimen directly to the type of *T. edessae* and found nothing to suggest that it is a different species. The collecting locality of Valencia, Spain, is noteworthy given the large volume of shipping

traffic that passes through this port city and we consider it likely that *T. edessae* was delivered to Valencia on cargo. Determination of whether or not it became established in Europe will require focused sampling, as even in the Nearctic it is not a very common species. This phenomenon of species spreading around the world, as is the case with *T. edessae* and *T. japonicus* (Talamas et al. 2015), emphasizes the importance of a cosmopolitan perspective when conducting alpha taxonomy.

***Trissolcus elasmuchae* (Watanabe)**

[http://bioguid.osu.edu/xbiol\\_concepts/3224](http://bioguid.osu.edu/xbiol_concepts/3224)

Figures 52–58; Morphbank<sup>13</sup>

*Trissolcus davatchii* (Jawahery) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3210](http://bioguid.osu.edu/xbiol_concepts/3210)

Morphbank<sup>14</sup>

*Trissolcus monirus* Lê syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3268](http://bioguid.osu.edu/xbiol_concepts/3268)

Morphbank<sup>15</sup>

*Asolcus elasmuchae* Watanabe, 1954: 21, 22 (original description).

*Asolcus davatchii* Jawahery, 1968: 419, 422 (original description, keyed).

*Trissolcus polarica* Rjachovskij, 1972: 74 (original description, synonymized by Kononova (1974)); Kononova, 1974: 72 (junior synonym of *Trissolcus elasmuchae* (Watanabe)).

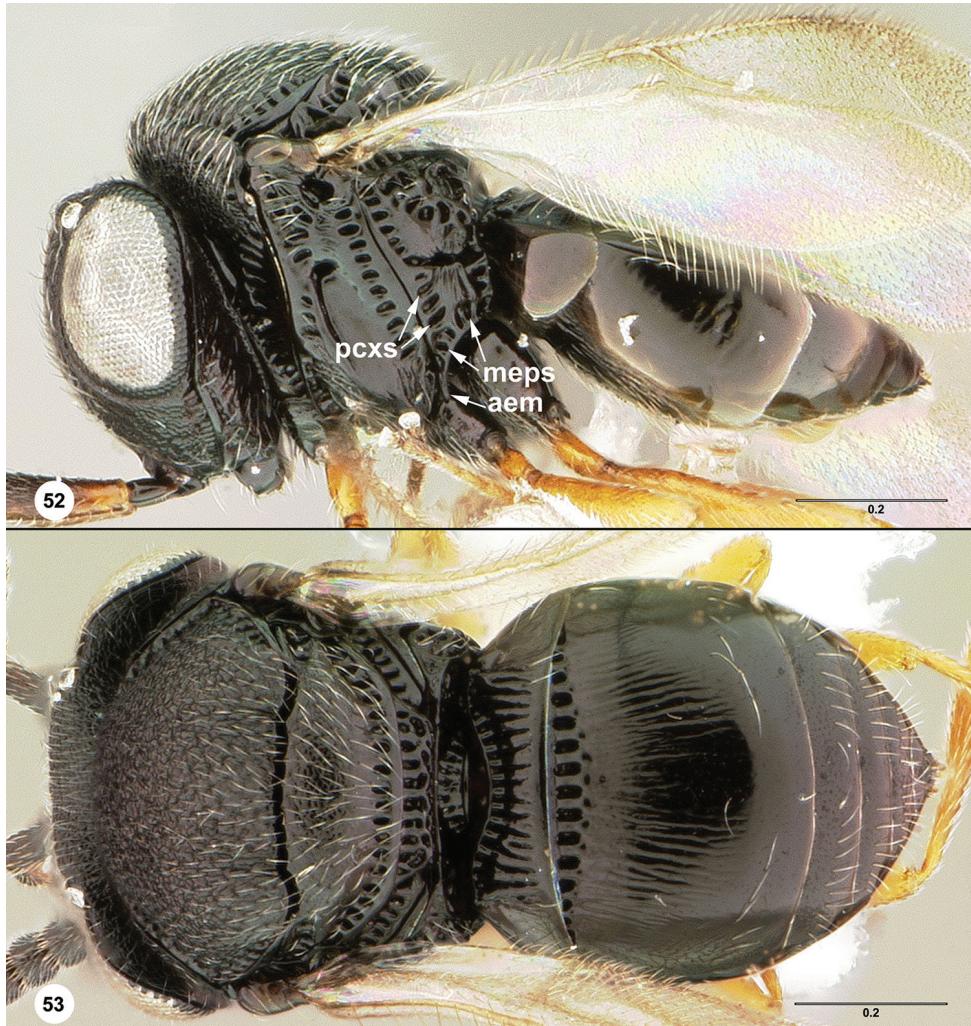
*Trissolcus elasmuchae* (Watanabe): Kononova, 1974: 72 (diagnosis, synonymy); Kozlov & Lê, 1977: 510 (keyed); Kozlov, 1978: 636 (description); Kozlov & Kononova, 1983: 109 (description); Ryu & Hirashima, 1984: 37, 55 (description, keyed); Kononova, 1995: 96 (keyed); Petrov, 2013: 326 (keyed).

*Trissolcus davatchii* (Jawahery) syn. n.: Kozlov & Lê, 1977: 516 (keyed, generic transfer); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 120 (description); Fergusson, 1984: 230 (type information).

*Trissolcus monirus* Lê syn. n., 1985: 165 (original description); Johnson, 1992: 632 (catalogued, type information); Lê, 1997: 24 (keyed); Lê, 2000: 312, 318 (description, keyed, type information).

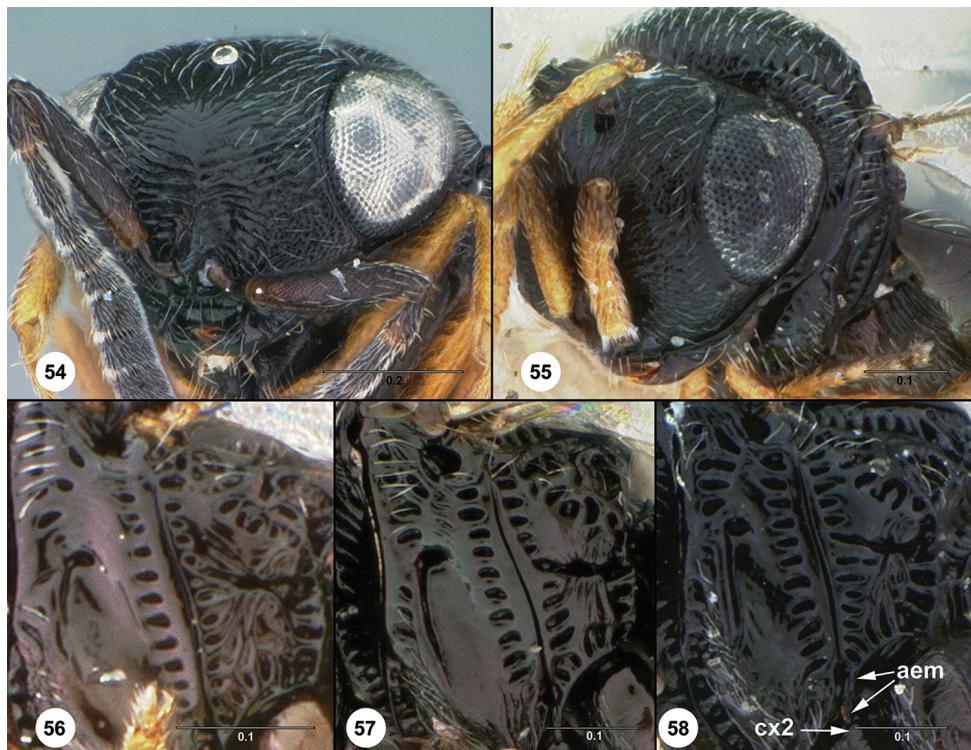
**Description.** Female body length: 1.10–1.63 mm (n=20). Male body length: 1.06–1.07 mm (n=2). Body color: head, mesosoma, and metasoma dark brown to black.

**Head.** Color of radicle: pale brown to dark brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: pale to dark brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow; moderately bulging. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: smooth; antero-



**Figures 52–53.** *T. elasmuchae*, female (USNM 00896150) **52** head, mesosoma, metasoma, lateral view **53** head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus; uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; strigose, roughly concentric around median ocellus; transversely strigose. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: dorsoventrally fluted. Macrosculpture of lateral frons: absent; rugose; horizontally striate ventrally, striae of antennal scrobe extending to lateral frons. OOL: lateral ocellus and eye without continuous scleritic separation; separated by less than one ocellar diameter. Hyperoccipital carina: present only posterior to lateral ocellus; absent. Macros-



**Figures 54–58.** *T. elasmuchae* 54 female (OSUC 144486), head, anterior view 55 female paratype (USNMENT00746982), head and mesosoma, anterolateral view 56 female paratype (USNMENT00746982), mesopleuron and metapleuron, lateral view 57 female (USNMENT00896150), mesopleuron and metapleuron, lateral view 58 female (USNMENT00916427), mesopleuron and metapleuron, lateral view. Scale bars in millimeters.

culture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosulpture of lateral pronotum directly anterior to netrion: finely rugulose; striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: posterior half of pronotum. Number of episternal foveae: 3; 2; 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropleural sulcus: present. Speculum: smooth; transversely strigose; weakly transversely wrinkled. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: absent; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae parallel to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: pre-

sent throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Mesofurcal pit: absent. Setation of posterovenital metapleuron: absent. Sculpture of dorsal metapleural area: rugose; smooth area small because cells of surrounding sulci are large. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indicated by a line of distinct foveae. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as clearly defined line of cells. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: rugulose; reticulate anteriorly, becoming longitudinally strigose posteriorly. Pattern of mesoscutal microsculpture: uniform throughout; effaced posteriorly. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present; absent. Notaulus: absent; indicated only at posterior margin of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Posterodorsal margin of axillular carina: round. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells; multiple rows of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: between 2 and 3 times as long as stigmal vein. Color of legs: coxae dark brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 2; 1. Setation of laterotergite 1: absent. Longitudinal striae of T2: present throughout anterior half of tergite; present in anteromedial portion of the tergite. Setation of T2: present in a transverse line posteriorly; present in a transverse line and along lateral margin. Setation of laterotergite 2: absent. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** Among Palearctic species, *Trissolcus elasmuchae* is most similar to *T. semistriatus* with which it shares a great deal of variability in the sculpture of the frons (compare Figures 54–55 to Figures 172–177). *Trissolcus elasmuchae* can readily be separated from *T. semistriatus* by numerous characters: the episternal foveae in *T. semistriatus* are distinctly separate from both the mesopleural pit and the dorsal limit of the posacetabular sulcus whereas in *T. elasmuchae* the episternal foveae are more numerous and form a continuous line from the postacetabular sulcus to the mesopleural pit; the paracoxal sulcus in the ventral half of the metapleuron is indicated by deep cells in *T. elasmuchae*, and indicated in *T. semistriatus* at most as spaces between rugae that radiate from the anterior margin of the metapleuron to the metapleural pit. This form of the paracoxal sulcus is found in a few species of *Trissolcus* in the New World, *T. zakotos*, *T. radix*, and *T. solocis*, but is not known

to us from any other Palearctic species. *Trissolcus elasmuchae* also has the metapleural epicoxal sulcus indicated by deep cells, which is atypical for the Palearctic fauna.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3224>

**Material examined.** Allotype of *T. elasmuchae*: JAPAN: 1 male, USNMENT00764939 (EIHU). Paratypes of *T. elasmuchae*: JAPAN: 2 females, USNMENT00764982 (EIHU); USNMENT00872005 (USNM). Holotype, female, *A. davatchii*: UNITED KINGDOM: England, Windsor and Maidenhead Unit. Auth., Silwood Park, 1966, reared, B.M. TYPE HYM. 9.796 (deposited in BMNH). Paratypes of *T. davatchii*: UNITED KINGDOM: 1 male, OSUC 17732 (BMNH). Holotype, female, *T. monirus*: VIETNAM: Dac Nong Prov., rice seed / rice, Dao Nghia, 25.V.1979, IEBR 0047 (deposited in IEBR). Other material: (45 females, 3 males) CHINA: 2 females, UCRC ENT 296991–296992 (UCRC). FRANCE: 1 female, USNMENT00916119 (BMNH). INDIA: 11 females, UCRC ENT 296980–296990 (UCRC). JAPAN: 13 females, OSUC 144391, 144484–144486, 542358, 542364, 542380, 542417, 542419–542421, USNMENT00896306, 00896328 (CNCI). SOUTH KOREA: 8 females, 2 males, OSUC 144483, USNMENT00896012, 00896020, 00896021, 00896043, 00896150, 00896151, 00896158 (CNCI); OSUC 542388–542389 (OSUC). SWEDEN: 4 females, 1 male, USNMENT00916045, 00916048, 00916111, 00916300, 00916312 (BMNH). TAIWAN: 1 female, OSUC 75842 (OSUC). UNITED KINGDOM: 5 females, USNMENT00916420, 00916426–00916428, 00916430 (BMNH).

**Comments.** With *T. davatchii* and *T. monirus* treated as junior synonyms, *T. elasmuchae* takes on a curious distribution, at least as far as we have documented it, with specimens from Japan, South Korea, India, Vietnam and Europe, reaching as far West as England. However, this distribution is consistent with a pattern that we see in the distributions of other species of *Trissolcus*. *Trissolcus flavipes*, for example, is known from Sweden, England, the Asian Far East, and SE Asia.

### *Trissolcus eriventus* Lê

[http://bioguid.osu.edu/xbiod\\_concepts/154380](http://bioguid.osu.edu/xbiod_concepts/154380)

Figures 59–62; Morphbank<sup>16</sup>

*Trissolcus eriventus* Lê, 1997: 23, 25 (original description, keyed); Lê, 2000: 312, 315 (description, keyed, type information).

**Description.** Female body length: 1.15–1.17 mm (n=5). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow, becoming brown distally. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as short grooves. Number of clypeal setae: 4. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye.

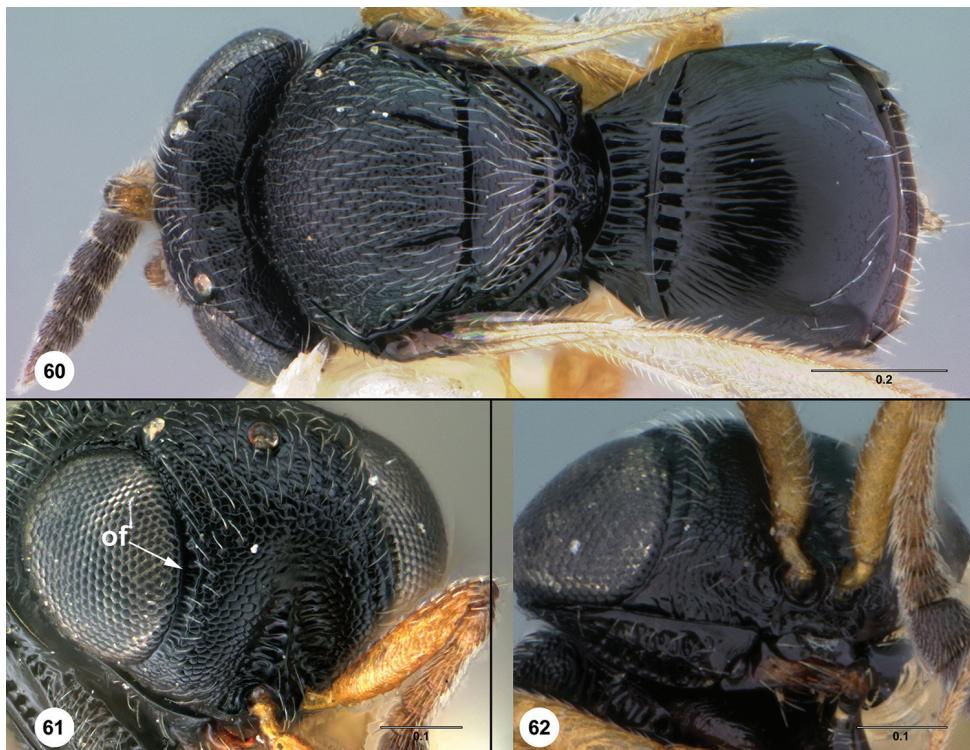


**Figure 59.** *Trissolcus eriventus* female (USNMENT00916459), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: dense. Punctuation of lateral frons: present along medial margin of orbital furrow. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: uncertain, present only posterior to lateral ocellus; uncertain, absent; uncertain, effaced medially. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum; weakly differentiated from sculpture of dorsal pronotum. Location of pronotal suprahumeral sulcus: posterior half of pronotum.

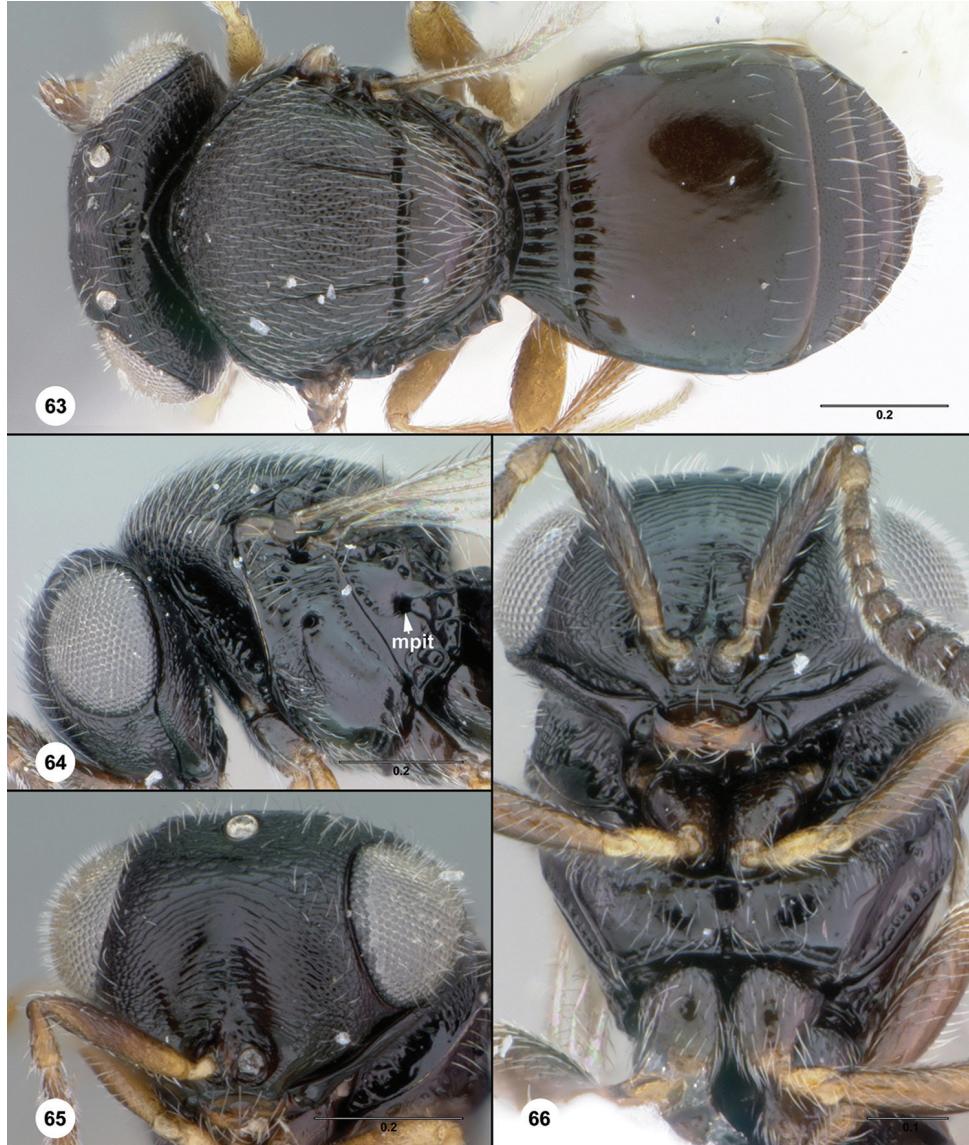
**Mesosoma.** Number of episternal foveae: 3; 2. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple. Mesopleural carina: complete. Sculpture of femoral depression: rugulose and pustulate along ventral half of mesopleural carina. Patch of striae at posteroventral end of femoral depression: uncertain, absent. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: irregularly rugulose. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed



**Figures 60–62.** *Trissolcus eriventus* **60** female (USNMENT00916458), head, mesosoma, metasoma, dorsal view **61** female (USNMENT00916457) **62** female (USNMENT00916458). Scale bars in millimeters.

by open crenulae. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: rugose. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae.

Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprhumeral sulcus: comprised of cells. Length of mesoscutal suprhumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: uncertain, absent; uncertain, present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent; present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: punctures visible in at least ventral half, not quite striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum:



**Figures 63–66.** *Trissolcus exerrandus* **63** female holotype (ZMAS 0141), head, mesosoma, metasoma, dorsal view **64** female (USNMENT00896159), head and mesosoma, lateral view; **65** female holotype (ZMAS 0141), head, anterior view **66** female (USNMENT00896159), head and mesosoma, ventral view. Scale bars in millimeters.

invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 2; 1. Setation of laterotergite 1: absent. Longitudinal stria-

tion of T2: present throughout anterior half of tergite. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus eriventus* is a straightforward species to identify; the rugosity of the orbital furrow (Figure 61) is known to us only from this species.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=154380>

**Material examined.** Holotype, female: VIETNAM: Hanoi Prov., Nghia Dô, Hanoi, 19.VIII.1982, IEBR 0046 (deposited in IEBR). Other material: CHINA: 5 females, USNMENT00916344, 00916457–00916460 (BMNH).

**Comments.** The hyperoccipital carina in this species is highly variable, ranging from complete to essentially absent between the posterior ocelli. This level of variability is unusual given the stability of this character in other species of *Trissolcus*.

#### *Trissolcus exerrandus* Kozlov & Lê

[http://bioguid.osu.edu/xbioc\\_concepts/3234](http://bioguid.osu.edu/xbioc_concepts/3234)

Figures 63–66; Morphbank<sup>17</sup>

*Trissolcus exerrandus* Kozlov & Lê, 1976: 657, 661 (original description, keyed); Kozlov & Lê, 1977: 502 (keyed); Kozlov, 1978: 629 (description); Kozlov & Kononova, 1983: 80 (description); Kononova, 1995: 92 (keyed).

**Description.** Female body length: 1.15–1.17 mm (n=5). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow, becoming brown distally. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as short grooves. Number of clypeal setae: 4. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: dense. Punctuation of lateral frons: present along medial margin of orbital furrow. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: uncertain, present only posterior to lateral ocellus; uncertain, absent; uncertain, effaced medially. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprakhumeral

sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum; weakly differentiated from sculpture of dorsal pronotum. Location of pronotal suprnhumerale sulcus: posterior half of pronotum. Number of episternal foveae: 3; 2. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple. Mesopleural carina: complete. Sculpture of femoral depression: rugulose and pustulate along ventral half of mesopleural carina. Patch of striae at posteroventral end of femoral depression: uncertain, absent. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: irregularly rugulose. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: rugose. Posterdorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprnhumerale sulcus: comprised of cells. Length of mesoscutal suprnhumerale sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: uncertain, absent; uncertain, present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent; present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: punctures visible in at least ventral half, not quite striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 2; 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: present throughout anterior half of tergite. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** The transversely arched rugae on the frons ally this species with *T. cultratus*, with which it shares a poorly defined orbital furrow at its intersection with the malar sulcus. However, it is unlikely to be confused with this species because the

densely setose eyes of *T. exerrandus* separate it from other species of Palearctic *Trissolcus*. We interpret the mesopleuron to be devoid of episternal foveae: cells at the dorsal limit of the postacetabular sulcus are sometimes slightly larger, but predominantly are the same size as the cells of ventral portion of the sulcus. Faint rugulae are present where the episternal foveae are typically present, leading us to believe that they are simply not externally developed in *T. exerrandus*. The subacropileural sulcus, present in all other Palearctic species of *Trissolcus*, is conspicuously absent in *T. exerrandus*.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3234>

**Material examined.** Holotype, female: RUSSIA: Primor'ye Terr., Shkotovo, 21.VIII.1961, M. Kozlov, ZMAS 0141 (deposited in ZIN). Paratypes: (2 females, 1 male) MONGOLIA: 1 female, USNMNT00916627 (ZIN). RUSSIA: 1 female, 1 male, USNMNT00916626, 00916628 (ZIN). Other material: (2 females) SOUTH KOREA: 1 female, USNMNT00896159 (CNCI). TAIWAN: 1 female, OSUC 542428 (CNCI).

#### *Trissolcus flavipes* (Thomson)

[http://bioguid.osu.edu/xbiol\\_concepts/3236](http://bioguid.osu.edu/xbiol_concepts/3236)

Figures 9, 67–70; Morphbank<sup>18</sup>

#### *Trissolcus circus* Kozlov & Lê syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3201](http://bioguid.osu.edu/xbiol_concepts/3201)

Morphbank<sup>19</sup>

#### *Trissolcus crassus* Kononova syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/354845](http://bioguid.osu.edu/xbiol_concepts/354845)

*Telenomus flavipes* Thomson, 1860: 170 (original description).

*Aphanurus Flavipes* (Thomson): Kieffer, 1912: 72 (description, generic transfer).

*Micrphanurus flavipes* (Thomson): Kieffer, 1926: 91, 96 (description, generic transfer, keyed).

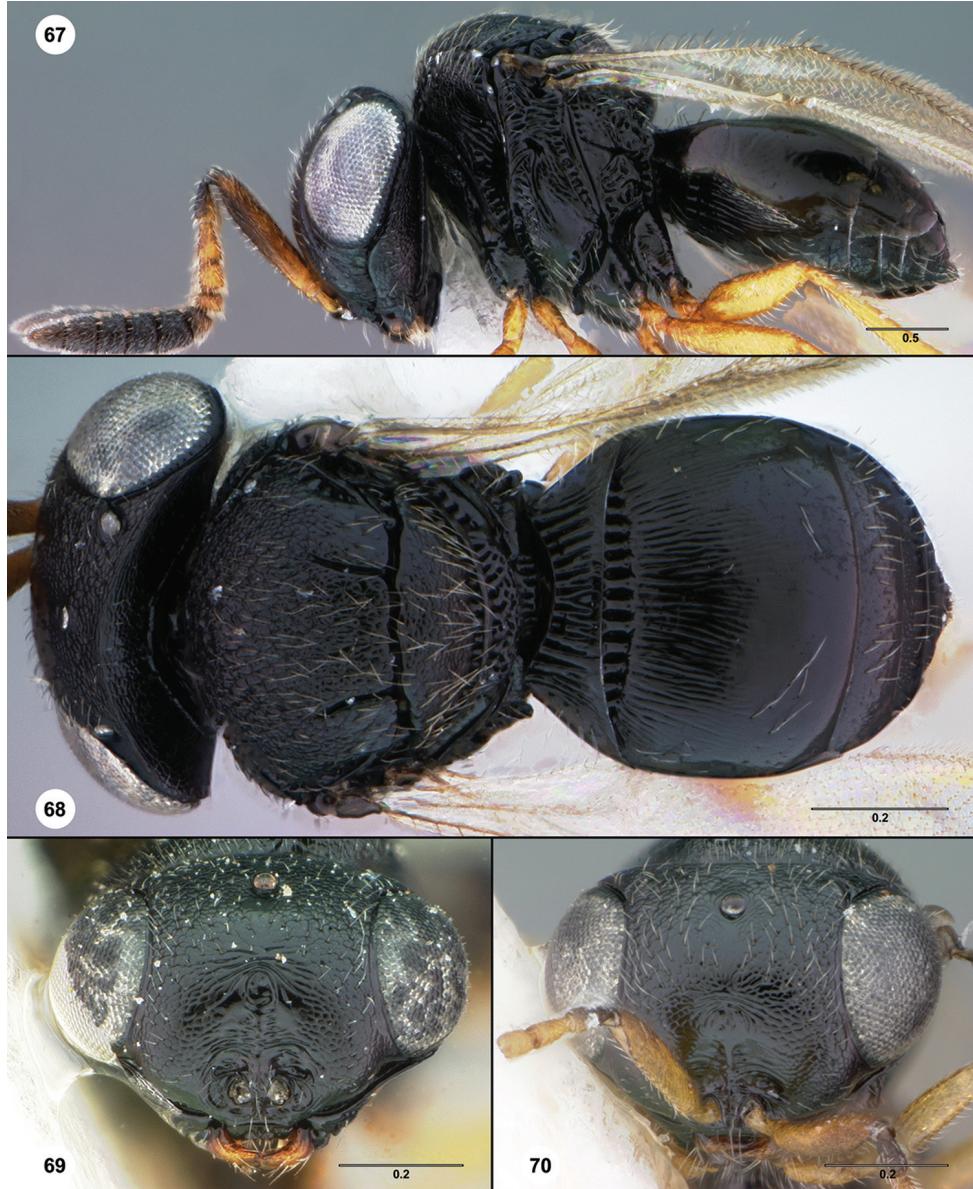
*Trissolcus flavipes* (Thomson): Kozlov, 1968: 198, 200 (description, synonymy, lectotype designation, keyed); Voegelé, 1969: 149 (keyed);

*Trissolcus circus* Kozlov & Lê syn. n., 1976: 659, 666 (original description, keyed); Kozlov & Lê, 1977: 504 (keyed); Kozlov, 1978: 629 (description); Kozlov & Kononova, 1983: 86 (description); Kononova, 1995: 92 (keyed); Samin, Shojai, Ghahari & Kocak, 2010: 8 (new distribution record for Iran); Petrov, 2013: 325 (keyed).

*Trissolcus crassus* Kononova syn. n., 2014: 745 (original description, diagnosis).

**Description.** Female body length: 1.32–1.62 mm (n=8). Body color: head and mesosoma black, metasoma black to reddish brown.

**Head.** Color of radicle: pale brown; yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: A3–A4 yellow, elsewhere yellow to brown. Color of A7–A11 in female: pale brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as short grooves. Number



**Figures 67–70.** *Trissolcus flavipes* **67** female (USNMENT00916409), head, mesosoma, metasoma, lateral view **68** female (USNMENT00916409), head, mesosoma, metasoma, dorsal view **69** female lectotype (NHRS-HEVA 000002617), head, anterior view **70** female (holotype of *T. circus*) (ZMAS 0143), head, anterior view. Scale bars in millimeters.

of clypeal setae: 2. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection

with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: with circular ring, ring marginated dorsally by arched rugae. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: moderately dense. Sculpture directly ventral to preocellar pit: absent. Macrosculpture of lateral frons: absent. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: percurrent. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent; present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout; effaced posteriorly. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent; present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent; present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: punctures visible in at least ventral half, not quite striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout; absent. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae

dark brown to black, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): uncertain, 0. Setation of laterotergite 1: absent. Longitudinal striae of T2: present in anterior two-thirds of tergite. Setation of T2: uncertain, sparsely present in posterolateral corner. Setation of laterotergite 2: absent; present. Posteriorly directed setae on medial S1: present. Striae of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: present posteromedially.

**Diagnosis.** *Trissolcus flavipes* can be easily identified by the circular impression on the frons directly above the antennal scrobe. Transverse striae may exist surrounding this impression to varying degrees but even in these cases the circular marking remains distinct. The lack of a well-defined orbital furrow near the malar sulcus, the presence of only 2 clypeal setae, and the visible dorsal limit to the cells inside of the axillar crescent (Figure 9) also help to identify this species from other members of the *flavipes* species group.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3236>

**Material examined.** Lectotype, female, *T. flavipes*: SWEDEN: Västra Götaland Co., Bohuslän Prov., no date, Boheman, NHRS-HEVA 000002617 (deposited in NHRS). Holotype, female, *T. circus*: RUSSIA: Primor'ye Terr., Troitsy Bay, 11.VII–15.VII.1972, M. Kozlov, ZMAS 0143 (deposited in ZIN). Paratypes of *T. circus*: RUSSIA: 2 females, 1 male, USNMENT00916631–00916633 (ZIN). Other material: (7 females, male) JAPAN: 4 females, OSUC 542416, 542418, 542422–542423 (CNCI). RUSSIA: 1 male, USNMENT00916634 (ZIN). THAILAND: 1 female, OSUC 523952 (OSUC). UNITED KINGDOM: 2 females, USNMENT00916409, 00916415 (BMNH).

**Comments.** *Trissolcus flavipes* has a peculiar distribution, the specimens that we examined directly are from Europe, Eastern Asia, and Thailand and among them we found no characters that suggested a European species and an Asian species. Kononova (2014) published a photograph of the frons of *T. crassus* that illustrates the circular marking that we have found to be diagnostic for the species. Her description of *T. crassus* is entirely consistent with our concept of the species, and it is on this basis that we treat *T. crassus* as a junior synonym of *T. flavipes*. The two Ukrainian specimens from which she described *T. crassus* serve to help bridge the distributional gap between the opposite ends of the Palearctic. Notable intraspecific variation occurs in the degree to which microsculpture is expressed in the femoral depression, ranging from distinctly microsculptured throughout to entirely smooth.

#### *Trissolcus gonopsidis* (Watanabe)

[http://bioguid.osu.edu/xbiol\\_concepts/3241](http://bioguid.osu.edu/xbiol_concepts/3241)

Figures 71–76; Morphbank<sup>20</sup>

#### *Trissolcus conidioles* Kozlov & Lê syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/179841](http://bioguid.osu.edu/xbiol_concepts/179841)

Morphbank<sup>21</sup>

*Asolcus gonopsidis* Watanabe, 1951: 23, 25 (original description, keyed); Watanabe, 1954: 22 (keyed).

*Trissolcus gonopsidis* (Watanabe): Kozlov, 1968: 199 (keyed); Kozlov & Lê, 1977: 510 (keyed); Kozlov, 1978: 635 (description); Kozlov & Kononova, 1983: 108 (description); Ryu & Hirashima, 1984: 37, 51 (description, keyed); Johnson, 1992: 629 (catalogued, type information); Kononova, 1995: 95 (keyed); Kononova, 2014: 1422 (keyed); Kononova, 2015: 259 (keyed).

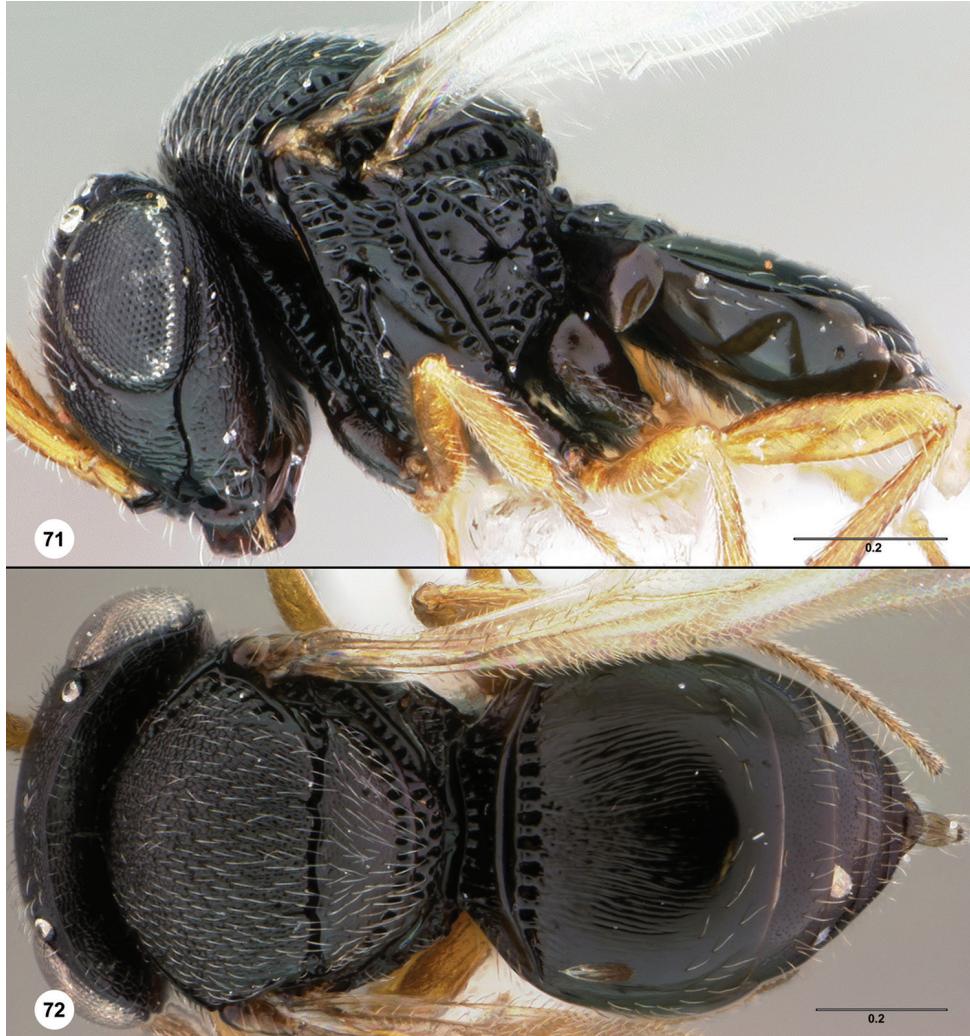
*Trissolcus conidioles* Kozlov & Lê syn. n., 2000: 314, 362 (original description).

*Trissolcus conodioles* Kozlov & Lê, 2000: 312 (keyed, misspelling).

**Description.** Female body length: 1.40 mm (n=1). Male body length: 1.19 mm (n=1). Body color: head, mesosoma, and metasoma black.

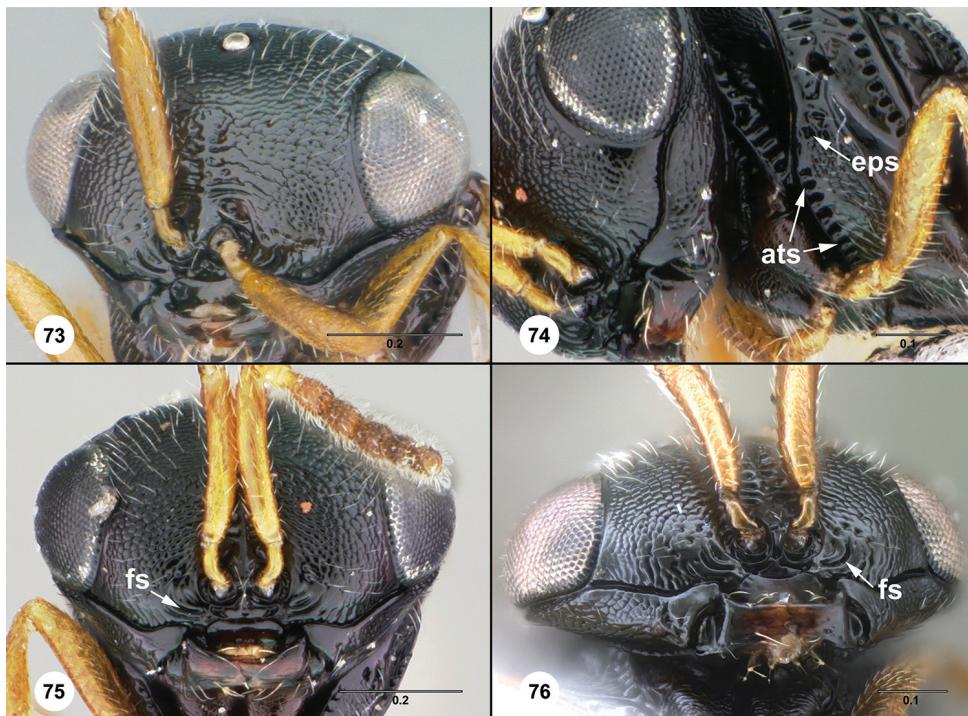
**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as short grooves. Number of clypeal setae: 2. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: uncertain, bulging; uncertain, narrow. Genal carina: absent; present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: moderately dense. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Netrion sulcus: incomplete. Pronotal suprnhumerai sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprnhumerai sulcus: anterior half of pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent. Seta patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indicated by a line of elongate cells. Anteroventral extension of metapleuron: not extending to base of meso-



**Figures 71–72.** *Trissolcus gonopspis* 71 male allotype (USNM 00764938), head, mesosoma, metasoma, lateral view 72 female (OSUC 542413), head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

coxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: weakly rugulose posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprathumeral sulcus: comprised of cells. Length of mesoscutal suprathumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: indicated only at posterior margin of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axil-



**Figures 73–76.** *Trissolcus gonopsidis* 73 female (OSUC 542413) 74 male allotype (USNMENT00764938), head and mesosoma, ventrolateral view 75 male allotype (USNMENT00764938), head, anterior view 76 female (OSUC 542413), head, ventral view. Scale bars in millimeters.

lar crescent: dorsoventrally strigose. Area bounded by axillar crescent: punctures visible in at least ventral half, not quite striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Setation of posterior scutellar sulcus: present. Form of metascutellum: multiple rows of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0; 1. Setation of laterotergite 1: absent. Longitudinal striae of T2: present in anteromedial portion of the tergite. Setation of T2: present throughout area posterior to striae. Setation of laterotergite 2: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: sparsely present throughout area not covered by laterotergites.

**Diagnosis.** *Trissolcus gonopsidis* is a distinctive species: the facial striae of *T. gonopsidis* are robust (Figures 73–76) and, in combination with episternal foveae distant from the postacetabular sulcus (Figure 74), separate it from other species of the *flavipes* group.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3241>

**Associations.** emerged from egg of *Gonopsis affinis* (Uhler): [Hemiptera: Heteroptera: Pentatomoidae: Pentatomidae]

**Material examined.** Holotype, female of *T. conidioles*: VIETNAM: Thai Nguyen Prov., Thái Nguyên, no date, IEBR 0039 (deposited in IEBR). Paratypes of *T. gonopsisidis*: JAPAN: 2 females, USNMEN00764937 (EIHU), USNMEN01197395 (ZIN). Allotype: JAPAN: 1 male, USNMEN00764938 (EIHU). Other material: JAPAN: 1 female, OSUC 542413 (CNCI).

***Trissolcus hyalinipennis* Rajmohana & Narendran**

[http://bioguid.osu.edu/xbiol\\_concepts/227946](http://bioguid.osu.edu/xbiol_concepts/227946)

Figures 77–83; Morphbank<sup>22</sup>

*Trissolcus indicus* (Subba Rao & Chacko): Fergusson, 1983: 209 (generic transfer, type information).

*Trissolcus hyalinipennis* Rajmohana & Narendran: Rajmohana K. & Narendran, 2007: 101, 102 (replacement name, keyed).

**Description.** Female body length: 0.95–0.98 mm (n=3). Male body length: 0.83 mm (n=1). Body color: head and mesosoma black, metasoma black to reddish brown.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow. Color of A7–A11 in female: pale brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 0. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: absent. Macrosculpture of lateral pronotum directly anterior to netrion: faintly striate. Netrion sulcus: complete. Pronotal suprakhumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 0. Subacropileural sulcus: present. Speculum: smooth. Mesopleural pit: simple. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present



**Figures 77–78.** *T. hyalinipennis* 77 female (USNM ENT01109062), head, mesosoma, metasoma, dorsal view 78 female (USNM ENT01109060), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by small punctures. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: absent. Anteroventral extension of

metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprathumeral sulcus: comprised of cells. Length of mesoscutal suprathumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: acute. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Posterodorsal margin of axillular carina: pointed. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: absent.

Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum.

Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown to black, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

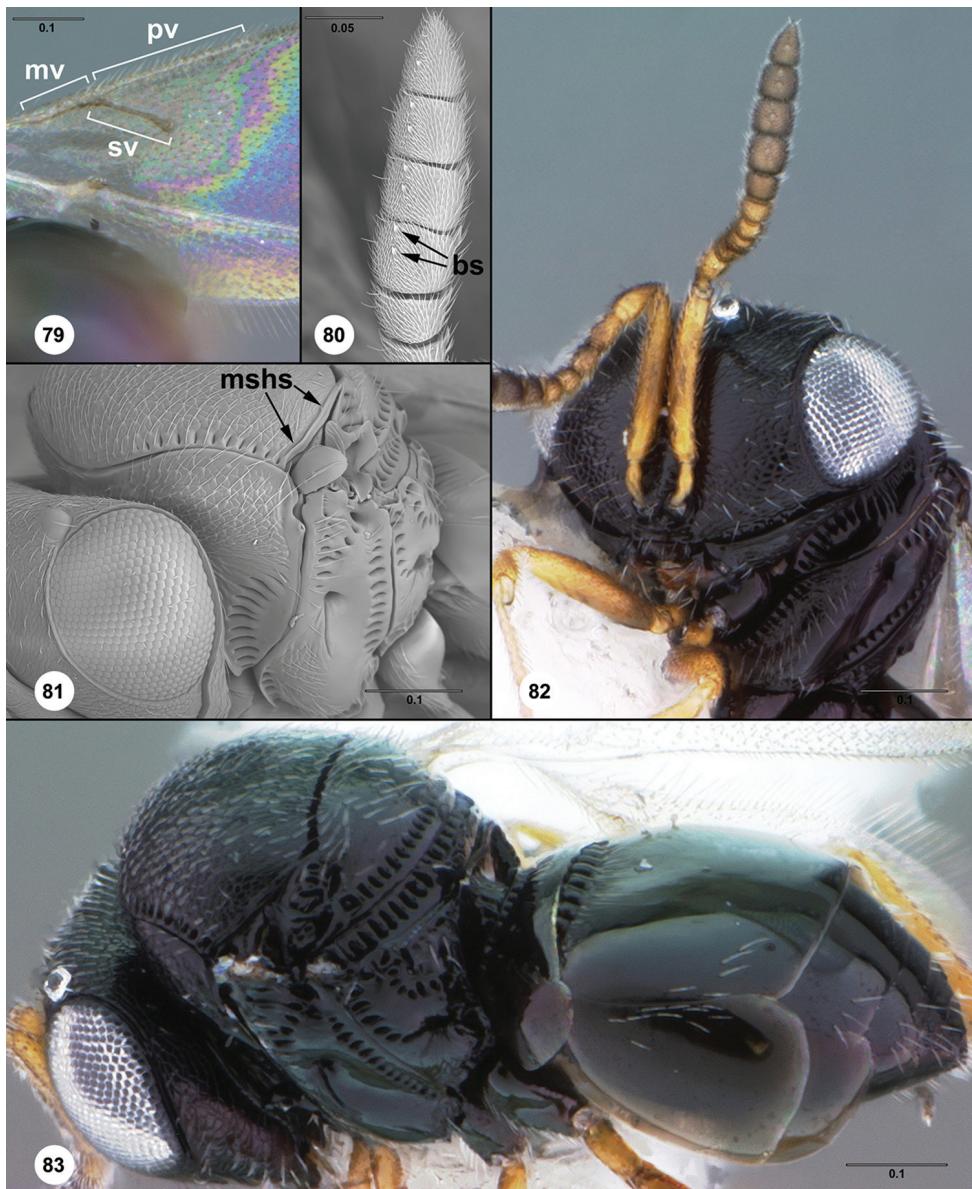
**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 1. Setation of laterotergite 1: absent. Longitudinal striae of T2: faintly present anteriorly. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Setation of S2: present only in medial third.

**Diagnosis.** *Trissolcus hyalinipennis* is most similar to *T. oobius*, with which it shares a 4-merous clava. They may be separated by wing venation: the postmarginal vein is shorter than the stigmal vein in *T. oobius* and approximately twice as long as the stigmal vein in *T. hyalinipennis* (compare Figure 79 to Figures 124–127). Apart from this character, we found no other means of separating these two species.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=227946>

**Material examined.** Other material: (6 females, 3 males) **INDIA:** 1 male, UCRC ENT 296999 (UCRC). **PAKISTAN:** 5 females, USNMENT01109060–01109064 (USNM). **PALESTINE:** 1 female, USNMNT00916601 (BMNH). **SPAIN:** 1 male, USNMNT00896154 (CNCI). **TURKEY:** 1 male, USNMNT00896194 (CNCI).

**Comments.** Our determination of these specimens is based on their consistency with the description of Subba Rao and Chacko (1961). Many of our specimens were reared from the eggs of *Bagrada hilaris* (=*Bagrada cruciferarum*) (subsequently reared on eggs of *Podisus maculiventris* Say), which is also consistent with the biology presented in the original description. The holotype of this species is now considered to be lost (Rajmohana Keloth, personal communication), and thus designation of a neotype is needed to fully stabilize the name. We refrain from doing so because the reared specimens that we have on hand were collected in Pakistan, sufficiently far from New Delhi to not be considered from the same area, and the specimen from New Delhi that we do have is a male.



**Figures 79–83.** *T. hyalinipennis* **79** female (USNMENT01109060), venation of fore wing, dorsal view **80** female (USNMENT01109061), antennal clava, ventral view **81** female (USNMENT01109061), head and mesosoma, dorsolateral view **82** female (USNMENT01109060) head and antenna, anterior view **83** female (USNMENT01109060) head, mesosoma, metasoma, dorsolateral view. Scale bars in millimeters.

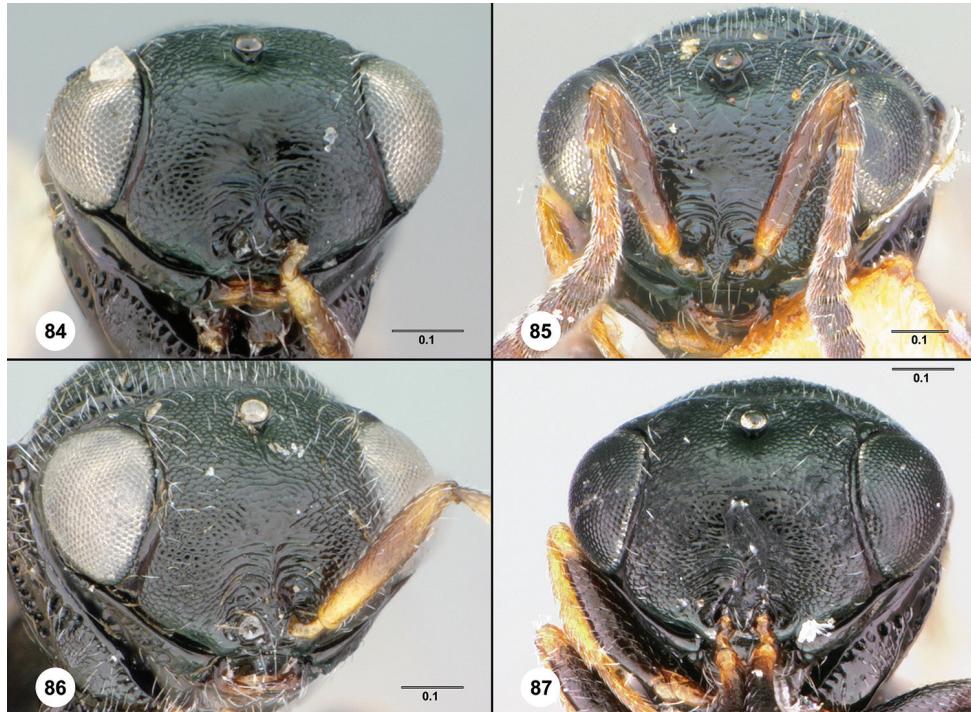
***Trissolcus japonicus* (Ashmead)**[http://bioguid.osu.edu/xbiol\\_concepts/3249](http://bioguid.osu.edu/xbiol_concepts/3249)Figures 6, 10, 84–89; Morphbank<sup>23</sup>*Trissolcus dobashii* Buhl syn. n.[http://bioguid.osu.edu/xbiol\\_concepts/223373](http://bioguid.osu.edu/xbiol_concepts/223373)Morphbank<sup>24</sup>*Trissolcus cercus* Kozlov & Lê syn. n.[http://bioguid.osu.edu/xbiol\\_concepts/3199](http://bioguid.osu.edu/xbiol_concepts/3199)Morphbank<sup>25</sup>*Trissolcus mirus* Kononova syn. n.[http://bioguid.osu.edu/xbiol\\_concepts/354848](http://bioguid.osu.edu/xbiol_concepts/354848)*Trissolcus pontus* Kozlov & Lê syn. n.[http://bioguid.osu.edu/xbiol\\_concepts/3292](http://bioguid.osu.edu/xbiol_concepts/3292)Morphbank<sup>26</sup>*Dissolcus japonicus* Ashmead, 1904: 73 (original description); Kieffer, 1926: 124, 125 (description, keyed).*Trissolcus japonicus* (Ashmead): Masner & Muesebeck, 1968: 72 (type information, generic transfer); Hirashima & Yamagishi, 1981: 153 (description, synonymy); Ryu & Hirashima, 1984: 37, 43 (description, keyed); Talamas, Buffington & Hoelmer, 2013: 114 (description, synonymy, type information).*Trissolcus cercus* Kozlov & Lê syn. n., 1976: 659, 666 (original description, keyed); Kozlov & Lê, 1977: 504 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 89 (description).*Trissolcus pontus* Kozlov & Lê syn. n., 1976: 659, 664 (original description, keyed); Kozlov & Lê, 1977: 504 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 88 (description); Kononova, 1995: 93 (keyed).*Trissolcus dobashii* Buhl syn. n., 1996: 128 (original description).*Trissolcus halyomorphae* Yang: Qiu, Yang & Tao, 2007: 62 (unavailable: nomen nudum); Yang, Yao, Qiu & Li, 2009: 40 (original description); Talamas, Buffington & Hoelmer, 2013: 114 (junior synonym of *Trissolcus japonicus* (Ashmead)).*Trissolcus mirus* Kononova syn. n., 2014: 749 (original description, diagnosis).

**Description.** Female body length: 1.16–1.85 mm (n=21). Male body length: 1.15–1.51 mm (n=20). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: orange; yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: dark brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 4. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate; faintly rugulose. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe

and anterior ocellus: absent; weakly transversely strigose. Preocellar pit: absent. Setae of lateral frons: moderately dense. Punctuation of lateral frons: sparse. Sculpture directly ventral to preocellar pit: dorsoventrally fluted. Macrosculpture of lateral frons: absent. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperocapital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: percurrent. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileal sulcus: present. Speculum: transversely strigose; weakly transversely wrinkled. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Setae of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly; rugose. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; indicated by a line of elongate cells. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture; present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent; weakly rugulose anteriorly, otherwise absent. Pattern of mesoscutal microsculpture: uniform throughout; effaced posteriorly. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent; present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout; present laterally, absent medially. Median mesoscutellar carina: absent. Setae of posterior scutellar sulcus: present. Form of metascutellum: multiple rows of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Color of legs: coxae dark brown to black, femora and tibia yellow to dark



**Figures 84–87.** **84** *Trissolcus cercus* (=*T. japonicus*), female holotype (ZMAS 0145), head, anterior view **85** *Trissolcus japonicus*, female holotype (USNMENT00831865), head, anterior view **86** *Trissolcus pontus* (=*T. japonicus*), female holotype (ZMAS 0144), head, anterior view **87** *Trissolcus dobashii* (=*T. japonicus*), female holotype (zmuc00021257), head, anterior view. Scale bars in millimeters.

brown, trochanters and tarsi yellow to pale brown. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0; 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: present throughout anterior half of tergite; present in anterior two-thirds of tergite. Setation of T2: present throughout posterolateral corner. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus japonicus* is very similar to *T. plautiae* and *T. kozlovi*. *Trissolcus japonicus* can be separated from *T. plautiae* by the sculpture directly below the median ocellus: in *T. japonicus* this area is covered with microsculpture and often a dorsoventral furrow is present. In *T. plautiae* this area is entirely smooth and without microsculpture. Matsou et al. (2013) used the presence of a sublateral setae to separate *T. japonicus* from *T. plautiae*. However, in our experience with specimens reared in quarantine, sublateral setae are not uncommon in *T. japonicus*. Our preliminary analysis of molecular data is based on DNA extracted non-destructively from specimens of *T. japonicus* collected in



**Figures 88–89.** *Trissolcus japonicus* 88 female (USNMENT00979297), head, mesosoma, metasoma, lateral view 89 female (USNMENT00675989), head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

China, Japan, and South Korea, and specimens of *T. plautiae* from China and Japan. In the specimens used for this analysis, and in the specimens used for monographic work, we found that the pattern of sculpture below the anterior ocellus is stable in both species. It is on this basis that we use this character to separate *T. plautiae* and *T. japonicus*, which is consistent with the findings of Matsuo et al. (2013).

*Trissolcus japonicus* and *T. kozlovi* can be separated by the sculpture of the frons directly above the antennal scrobe and sculpture of the mesoscutum between the notaui. The sculpture of the frons above the antennal scrobe in *T. kozlovi* is irregular whereas in *T. japonicus*, this area of the frons is either smooth or with weakly developed transverse lines of sculpture. The posteromedial mesoscutum in *T. kozlovi* is obliquely striate, with the lines of sculpture extending anterolaterally from the midline. In *T. japonicus* there is no macrosculpture in the posterior half of the mesoscutum.

The characters used to separate *T. japonicus* and *T. kozlovi* are based on examination of a small number of specimens of the latter species, and they are so similar that we considered that they may actually represent variation within a single species. However, because we are still able to consistently separate them based on morphology, we consider it best to continue to treat them as separate species. Analysis of the DNA sequence and biology of *T. kozlovi* should be a priority in the future, particularly because as BSMB spreads eastward in Europe its distribution is likely to overlap with that of *T. kozlovi*.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3249>

**Material examined.** Holotype, female, *T. dobashii*: JAPAN: Fukuoka Pref., woodland / vegetation consisting mainly of bamboo, Mount Aburayama, 10.I.1996, sweeping, P. N. Buhl, zmuc00021257 (deposited in ZMUC). Holotype, female, *T. cercus*: RUSSIA: Astrakhan' Reg., Astrakhan Nature Reserve, 20-VII, M. Y. Asse, ZMAS 0145 (deposited in ZIN). Holotype, female, *T. pontus*: RUSSIA: Primor'ye Terr., Ussuriyskiy (Suputinskiy) Nature Reserve, 2.VIII.1961, Kovalev, ZMAS 0144 (deposited in ZIN). Holotype, female, *Dissolcus japonicus*: JAPAN: Kanagawa Pref., Ashigarashimo Dist., Hakone Town, no date, Koebele, USNMENT00831865 (deposited in USNM). Paratypes: CHINA: 2 females, USNMENT00872401, 00872402 (USNM). Other material: (185 females, 97 males) CHINA: 109 females, 73 males, USNMENT00916340–00916346, 00916462–00916464 (BMNH); USNMENT00979190–00979198, 00979200–00979221 (CNCI); OSUC 75616 (OSUC); UCRC ENT 142613, 142653, 142678, 142682, 142724, 142738, 142750, 143837, 143886, 143900 (UCRC); USNMENT00675704, 00675738–00675739, 00675741–00675743, 00675746–00675749, 00675986, 00675988–00675989, 00764964, 00764984, 00916255, 00916710–00916787, 00916796, 00916801–00916813, 00916815, 00916895–00916899, 00916900–00916903, 00916918–00916930 (USNM). JAPAN: 16 females, 9 males, OSUC 542354, 542373, 542549, USNMENT00896137, 00896139–00896340 (CNCI); UCRC ENT 158378 (UCRC); USNMENT00675709–00675713, 00675715–00675716, 00675755, 00675770, 00872125–00872133 (USNM). RUSSIA: 3 females, USNMENT00979287 (CNCI); UCRC ENT 297007, 297010 (UCRC). SOUTH KOREA: 18 females, 11 males, USNMENT00896014, 00896026, 00896033–00896036, 00896038–00896042, 00896117, 00896120, 00979251, 00979254 (CNCI); USNMENT00675705–00675708, 00675718–00675720, 00675723–00675729 (USNM). TAIWAN: 2 females, UCRC ENT 112211, 296942 (UCRC).

**UNITED STATES:** 37 females, 4 males, USNMENT01109017–01109019 (CNCI); USNMENT01059357, 01059359–01059402, 01059404–01059407, 01059409–01059412, 01059414–01059417, 01059420–01059422, 01059424–01059427, 01059430, 01081080, 01109016, 01109020–01109026, 01109132, 01109134, 01109419, 01109562 (USNM).

**Comments.** *Trissolcus cercus*, which we here treat as a junior synonym, was collected in western Russia, far from the distribution of what we otherwise know to be the native range of *T. japonicus*. In the late 1960s, *Podisus maculiventris*, which is a known host of *Trissolcus japonicus*, was introduced into Eastern Europe in the late 1960's as a biological control agent (Schaefer & Panizzi 2000). The eggs associated with the holotype of *T. cercus* are included on the pin, and their morphology is consistent with that of eggs of *P. maculiventris*. The presence of *T. japonicus* in Eastern Europe may be the result of an adventive population of *T. japonicus* that followed the introduction of *P. maculiventris*, and then declined along with the stink bug population.

***Trissolcus kozlovi* Rjachovskij**

[http://bioguid.osu.edu/xbiol\\_concepts/3250](http://bioguid.osu.edu/xbiol_concepts/3250)

Figures 90–93; Morphbank<sup>27</sup>

*Trissolcus amplus* Kononova syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/354847](http://bioguid.osu.edu/xbiol_concepts/354847)

*Trissolcus Kozlovi* Rjachovskij, 1975: 4 (original description).

*Trissolcus kozlovi* Rjachovskij: Kozlov & Lê, 1977: 504 (keyed); Kozlov, 1978: 629 (description); Kozlov & Kononova, 1983: 85 (description); Johnson, 1992: 630 (catalogued, type information); Kononova, 2014: 1421 (keyed); Kononova, 2015: 258 (keyed).

*Trissolcus amplus* Kononova syn. n., 2014: 747 (original description, diagnosis).

**Description.** Female body length: 1.08–1.33 mm (n=7). Body color: head, mesosoma, and metasoma black.

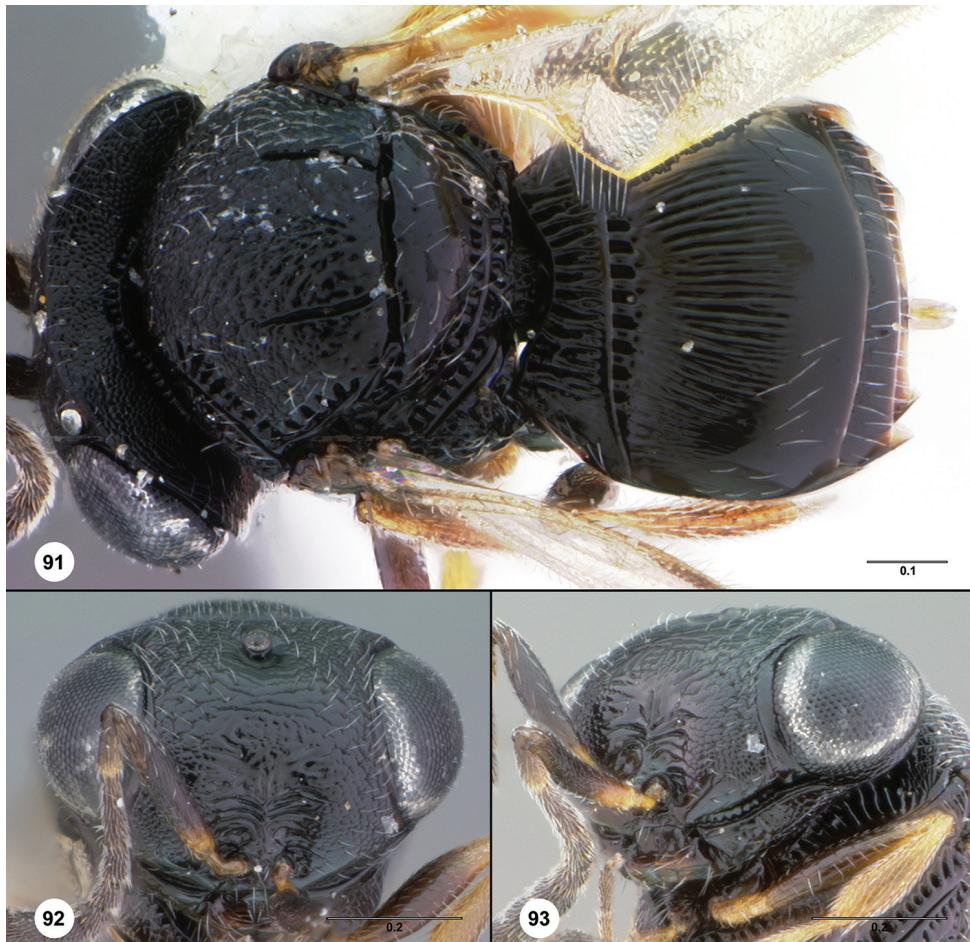
**Head.** Color of radicle: yellow; brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: basal A1 and distal A2 yellow, elsewhere brown. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 4; 2. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: irregularly rugose, rugae effaced. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: present along medial margin of orbital furrow. Sculpture directly ventral to preocellar pit: absent. Macrosculpture of



**Figure 90.** *Trissolcus kozlovi*, female holotype (ZMAS 0147), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

lateral frons: absent. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprhumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprhumeral sulcus: percurrent. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Seta-



**Figures 91–93.** *Trissolcus kozlovi* 91 female (USNM 00916624), head, mesosoma, metasoma, dorsal view 92 female holotype (ZMAS 0147), head, anterior view 93 female holotype (ZMAS 0147), head, anterolateral view. Scale bars in millimeters.

tion of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; indicated by a line of elongate cells. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: rugulose, with oblique symmetry in relation to longitudinal midline. Pattern of mesoscutal microsculpture: effaced posteriorly. Mesoscutal suprähumeral sulcus: comprised of cells. Length of mesoscutal suprähumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: extending at

least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: flat, appearing fused with lateral margin of mesoscutum. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: striate; punctures visible in at least ventral half, not quite striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: absent. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown, femora yellow to dark brown, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anterior two-thirds of tergite. Setation of T2: sparsely present in posterolateral corner. Setation of laterotergite 2: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3250>

**Material examined.** Holotype, female, *T. kozlovi*: RUSSIA: Voronezh Reg., Ramon', 13.VIII.1972, V. Rjachovskij, ZMAS 0147 (deposited in ZIN). Paratypes: RUSSIA: 3 females, USNMENT00916623–00916625 (ZIN). Other material: MOLDOVA: 3 females, USNMENT00916620–00916622 (ZIN).

**Diagnosis.** *Trissolus kozlovi* is a difficult species to treat taxonomically because it is represented by a small number of specimens that are extremely similar to *T. japonicus* and *T. plautiae*. It remains diagnosable among the specimens at hand by subtle, but seeming reliable characters: from both *T. japonicus* and *T. plautiae* it may be separated by the obliquely oriented sculpture on the posterior mesoscutum between the notaui. The sculpture on the frons above the interantennal process is also useful for separating *T. kozlovi* from these species: in *T. kozlovi* the frons has irregular lines of sculpture; in *T. plautiae* this part of the frons is entirely smooth and in *T. japonicus* it is covered with microsculpture, sometimes with weak transvere striation or a dorsoventral furrow below the median ocellus. Assessment of this character's utility for species-level identification requires additional specimens and, if possible, corroboration with molecular data.

**Comments.** In most specimens, including the holotype, there are 4 clypeal setae present. The lateral setae are about half the length of the median pair, and in some specimens the lateral setae appear to be absent. In some cases a seta is absent from one side only, in some, the lateral setae are appressed to the labrum or clypeus, probably as a preservation artifact, in others neither are evident. We suspect that these setae are broken off, but because we cannot be certain, the description for this character is coded as having both 2 and 4 setae.

***Trissolcus larides* (Nixon)**

[http://bioguid.osu.edu/xbiol\\_concepts/3252](http://bioguid.osu.edu/xbiol_concepts/3252)

Figures 94–97; Morphbank<sup>28</sup>

*Microphanurus larides* Nixon, 1943: 138, 141 (original description, keyed); Risbec, 1950: 569 (keyed).

*Trissolcus larides* (Nixon): Masner, 1965: 126 (type information, generic transfer); Johnson, 1992: 630 (catalogued, type information).

**Description.** Female body length: 1.00–1.19 mm (n=4). Body color: head and mesosoma black, metasoma black to reddish brown.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow. Color of A7–A11 in female: pale brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent; present as short grooves. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; weakly transversely strigose. Preocellar pit: absent. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: weakly horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: absent. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus; absent. Netrion sulcus: incomplete. Pronotal suprakumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 0. Subacropileal sulcus: present. Speculum: smooth. Mesopleural pit: simple. Mesopleural carina: complete; absent; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by small punctures. Setation of posteroventral metapleuron: present. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: longitudinally striate posteriorly, otherwise absent. Pattern of mesoscutal microsculp-

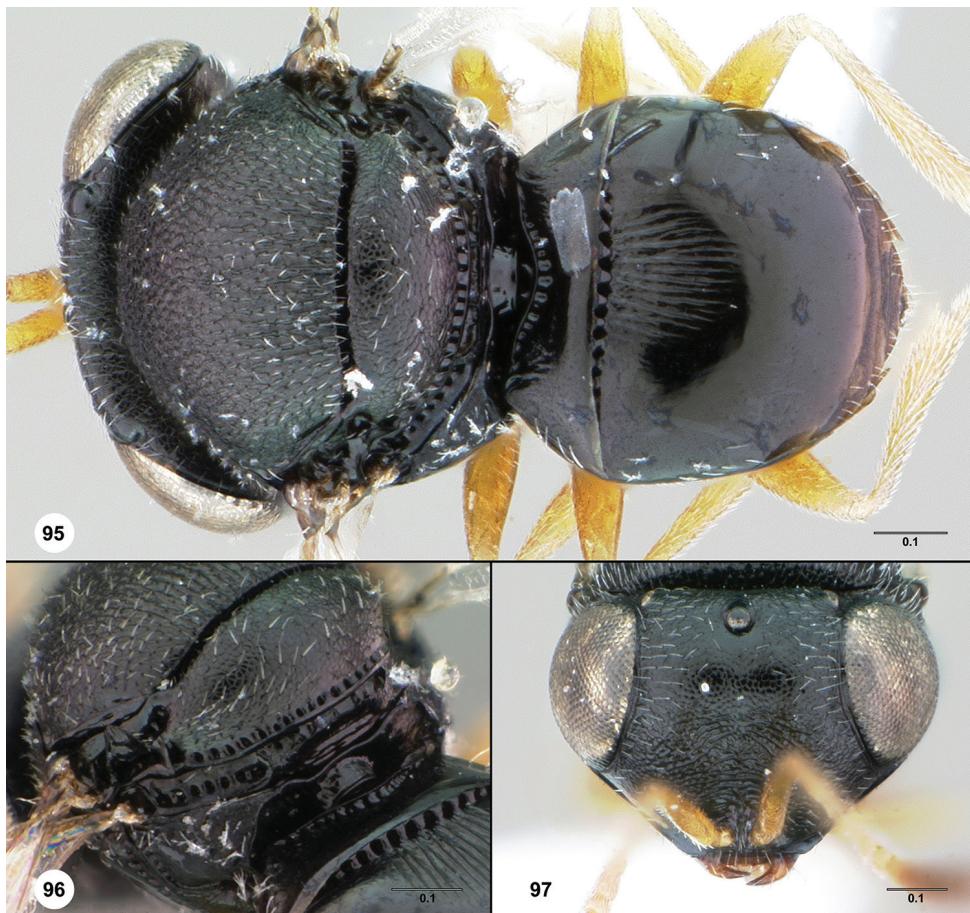


**Figures 94.** *Trissolcus larides* female (USNMENT00896166), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

ture: uniform throughout. Mesoscutal supralueal sulcus: absent. Parapsidal line: absent. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: acute. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: absent. Form of metascutellum: furrow with broad interspaces between crenulae. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: undifferentiated from remainder of propodeum. Length of postmarginal vein: about 1.5 times as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: weakly striate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: absent. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anteromedial portion of the tergite. Setation of T2: absent. Setation of laterotergite 2: present. Striation of S2: absent. Setation of S2: present only in medial third.

**Diagnosis.** *Trissolcus larides* is unique among species with a setose metapleuron in that the episternal foveae are entirely absent. It is most similar to *T. levicaudus* with which it shares an antero-posteriorly compact habitus, the absence of notauli, a smooth speculum, and T1 smooth posterior to the basal costae. The two may be separated by a number of characters: the anteromedial portion of T2 is striate in *T. larides* and smooth in *T. levicaudus*.



**Figures 95–97.** *Trissolcus larides* 95 female (USNMENT00896174), head, mesosoma, metasoma, dorsal view 96 female (USNMENT00896174), mesosoma, posterolateral view 97 female (USNMENT00896216), head, anterior view. Scale bars in millimeters

*caudus*; the mesoscutal humeral and mesoscutal suprashumeral sulci are smooth furrows in *T. larides* and comprised of cells in *T. levicaudus*; *T. levicaudus* has a single episternal fovea and *T. larides* has none; the prespecular sulcus extends ventrally to the mesopleural pit in *T. levicaudus* but not in *T. larides*; the cells along the anterior margin of the metascutellum are deep punctures in *T. levicaudus* and in *T. larides* this sulcus is a furrow with broad interspaces between crenulae; the wing membrane at the junction of the marginal, postmarginal, and stigmal veins is pigmented in *T. larides* and hyaline in *T. levicaudus*.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=354381>

**Material examined.** Holotype, female, *Microphanurus larides*: SENEGAL: Diourbel Rég., Bambey, 31.V.1939, reared from egg, J. Risbec, B.M. TYPE HYM. 9.310 (deposited in BMNH). Other material: UNITED ARAB EMIRATES: 4 females, USNMENT00896166, 00896174, 00896184, 00896216 (CNCI).

***Trissolcus latisulcus* (Crawford)**

[http://bioguid.osu.edu/xbiol\\_concepts/3253](http://bioguid.osu.edu/xbiol_concepts/3253)

Figures 98–102; Morphbank<sup>29</sup>

***Trissolcus felis* Kozlov & Lê, syn. n.**

[http://bioguid.osu.edu/xbiol\\_concepts/179842](http://bioguid.osu.edu/xbiol_concepts/179842)

Morphbank<sup>30</sup>

***Trissolcus legatarius* Lê, syn. n.**

[http://bioguid.osu.edu/xbiol\\_concepts/3254](http://bioguid.osu.edu/xbiol_concepts/3254)

Morphbank<sup>31</sup>

*Telenomus latisulcus* Crawford, 1913: 244 (original description); Baltazar, 1966: 172  
(cataloged, type information, distribution).

*Telenomus oecleus* Dodd, 1913: 163, 168 (original description, keyed, synonymized  
by Johnson (1991)); Johnson, 1991: 223 (junior synonym of *Trissolcus latisulcus*  
(Crawford)).

*Telenomus darwinensis* Dodd, 1915: 7 (original description, synonymized by Johnson  
(1991)); Johnson, 1991: 223 (junior synonym of *Trissolcus latisulcus* (Crawford)).

*Telenomus erigone* Dodd, 1915: 8 (original description, synonymized by Johnson (1991)).

*Aphanurus banksi* Gahan, 1921: 349 (original description, synonymized by Johnson  
(1991)); Johnson, 1991: 223 (junior synonym of *Trissolcus latisulcus* (Crawford)).

*Microphanurus oecleus* (Dodd): Kieffer, 1926: 93, 95, 111 (description, generic transfer,  
keyed).

*Microphanurus priapus* Nixon, 1938: 125, 133 (original description, keyed, syn-  
onymized by Johnson (1991)); Nixon, 1943: 139 (keyed); Risbec, 1950: 570  
(keyed); Johnson, 1991: 223 (junior synonym of *Trissolcus latisulcus* (Crawford)).

*Trissolcus priapus* (Nixon): Masner, 1965: 127 (type information, generic transfer).

*Microphanurus banksi* (Gahan): Baltazar, 1966: 173 (cataloged, type information, dis-  
tribution).

*Trissolcus banksi* (Gahan): Masner & Muesebeck, 1968: 71 (type information).

*Trissolcus latisulcus* (Crawford): Masner & Muesebeck, 1968: 73 (type information);  
Johnson, 1991: 213, 223 (description, synonymy, keyed); Rajmohana K. & Naren-  
dran, 2007: 102 (keyed).

*Asolcus priapus* (Nixon): Voegelé, 1969: 151 (keyed).

*Trissolcus legatarius* Lê syn. n., 1982: 223 (original description); Johnson, 1992: 631 (cata-  
loged, type information); Lê, 2000: 312, 317 (description, keyed, type information).

*Trissolcus darwinensis* (Dodd): Johnson, 1988: 239 (lectotype designation, generic  
transfer).

*Trissolcus erigone* (Dodd): Johnson, 1988: 239 (type information, generic transfer).

*Trissolcus oecleus* (Dodd): Johnson, 1988: 240 (lectotype designation, generic transfer).

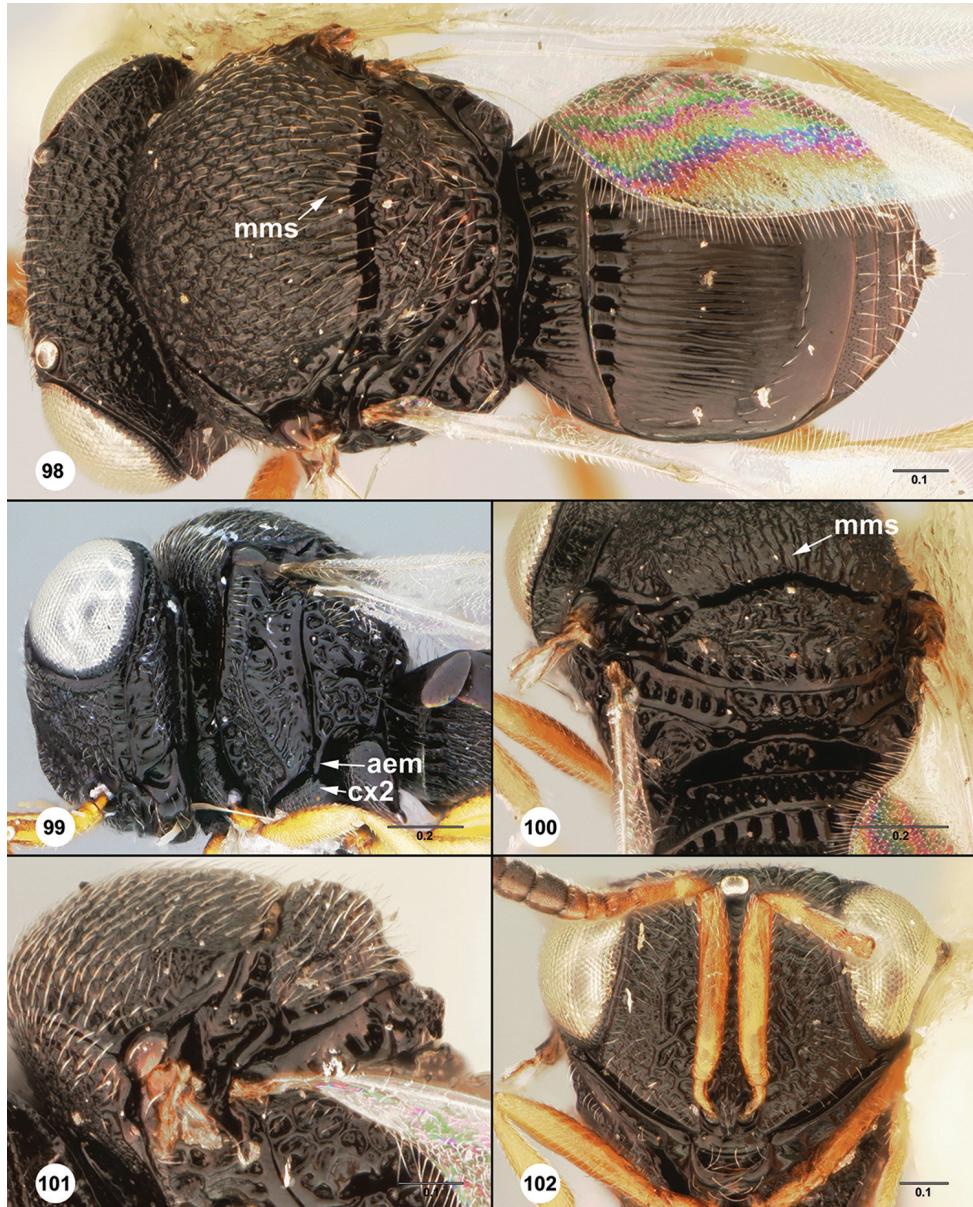
*Trissolcus felis* Kozlov & Lê syn. n., 2000: 312, 316, 363 (original description, keyed).

**Description.** Female body length: 1.13–2.17 mm (n=21). Male body length: 1.16–  
1.97 mm (n=7). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow; yellow, becoming brown distally. Color of A7–A11 in female: pale brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: moderately bulging. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: coarsely rugose. Preocellar pit: present. Setation of lateral frons: sparse; moderately dense. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: absent; microsculptured; dorsoventrally carinate. Macrosculpture of lateral frons: rugose. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: present only posterior to lateral ocellus. Macrosculpture of posterior vertex: rugulose. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: rugose. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: weakly differentiated from sculpture of dorsal pronotum. Location of pronotal suprahumeral sulcus: posterior half of pronotum. Number of episternal foveae: 3; 2; 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileal sulcus: present. Speculum: smooth; weakly transversely wrinkled; with granular microsculpture. Mesopleural pit: uncertain, simple. Mesopleural carina: complete. Sculpture of femoral depression: rugose perpendicular to long axis of femoral depression. Patch of striae at posteroventral end of femoral depression: uncertain, present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: coarsely rugose. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: rugose. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae.

Mesoscutal humeral sulcus: indicated by a line of cells; indicated by smooth furrow with a small number of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: rugulose, becoming longitudinally striate posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: indicated only at posterior margin of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent. Area bounded by axillar crescent: smooth. Macrosculpture of meso-



**Figures 98–102.** *T. latisulcus* **98** female holotype (USNMENT00989065), head, mesosoma, metasoma, dorsal view **99** female (OSUC 523953), head and mesosoma, ventrolateral view **100** female holotype (USNMENT00989065), mesosoma, posterodorsal view **101** female holotype (USNMENT00989065), dorsal mesosoma, lateral view **102** female holotype (USNMENT00989065), head, anterior view. Scale bars in millimeters.

cutellum: rugose throughout. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent; present. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae

occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown to black, elsewhere yellow. Anteromedial portion of metasomal depression: smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in most of tergite, extending posteriorly to transverse line of setae. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: present throughout area not covered by laterotergite.

**Diagnosis.** The coarse sculpture found throughout the femoral depression (Figure 99) distinguishes *T. latisulcus* from other Palearctic species in the genus. The femoral depression in *T. comperei* and *T. carinifrons* has parallel arched rugae (Figures 27, 28) but these are limited to the ventral portion of this area. The anterior margin of the mesoscutellum often is distinctly raised, creating the appearance of an enlarged scutellellar sulcus (Figure 101), which is also useful for identifying this species.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3253>

**Material examined.** Holotype, female, *T. latisulcus*: **TAIWAN:** Taipei Special Muni., Taipei (Taihoku), VI-1911, T. Shiraki, USNMENT00989065 (deposited in USNM). Paratype of *T. latisulcus*: **TAIWAN:** 1 female, USNMENT00872011 (USNM). Holotype, female, *A. banksi*: **PHILIPPINES:** Laguna Prov., Los Baños, 15.VII.1918, C. S. Banks, USNMENT00989095 (deposited in USNM). Holotype, female: **VIETNAM:** Hoa Binh Prov., Van Mai, 30.V.1982, IEBR 0040 (deposited in IEBR). Holotype, female, *T. legatarius*: **VIETNAM:** Gia Lai Prov., forest, Ha Nung, 8.XI.1979, X. H. Lê, IEBR 0045 (deposited in IEBR). *Other material:* (18 females, 9 males, 1 unsexed) **CHINA:** 4 females, 1 male, USNMENT00916465–00916468, 00916470 (BMNH). **INDIA:** 4 females, 1 male, 1 unsexed, USNMENT00916358, 00916360 (BMNH); OSUC 144507 (CNCI); USNMENT00872013–00872015 (USNM). **LAOS:** 2 females, USNMENT00764922, 00764924 (BPBM). **MALAYSIA:** 4 females, 4 males, OSUC 144516, 542429–542435 (CNCI). **PHILIPPINES:** 1 male, USNMENT00872016 (USNM). **THAILAND:** 4 females, 2 males, USNMENT00764926 (BPBM); OSUC 144510, 144513–144514 (CNCI); OSUC 523953 (OSUC); UCRC ENT 134998 (UCRC).

**Comments.** We observe significant size variation in this species, suggesting that it is a generalist attacking eggs of a variety of sizes, and perhaps this contributes to the expansive distribution of *Trissolcus latisulcus* from eastern Australia to India.

#### *Trissolcus levicaudus* Talamas, sp. n.

<http://zoobank.org/4191C626-701D-4FD3-A890-FE125A5C0B9F>

[http://bioguid.osu.edu/xbioc\\_concepts/354382](http://bioguid.osu.edu/xbioc_concepts/354382)

Figures 103–106; Morphbank<sup>32</sup>

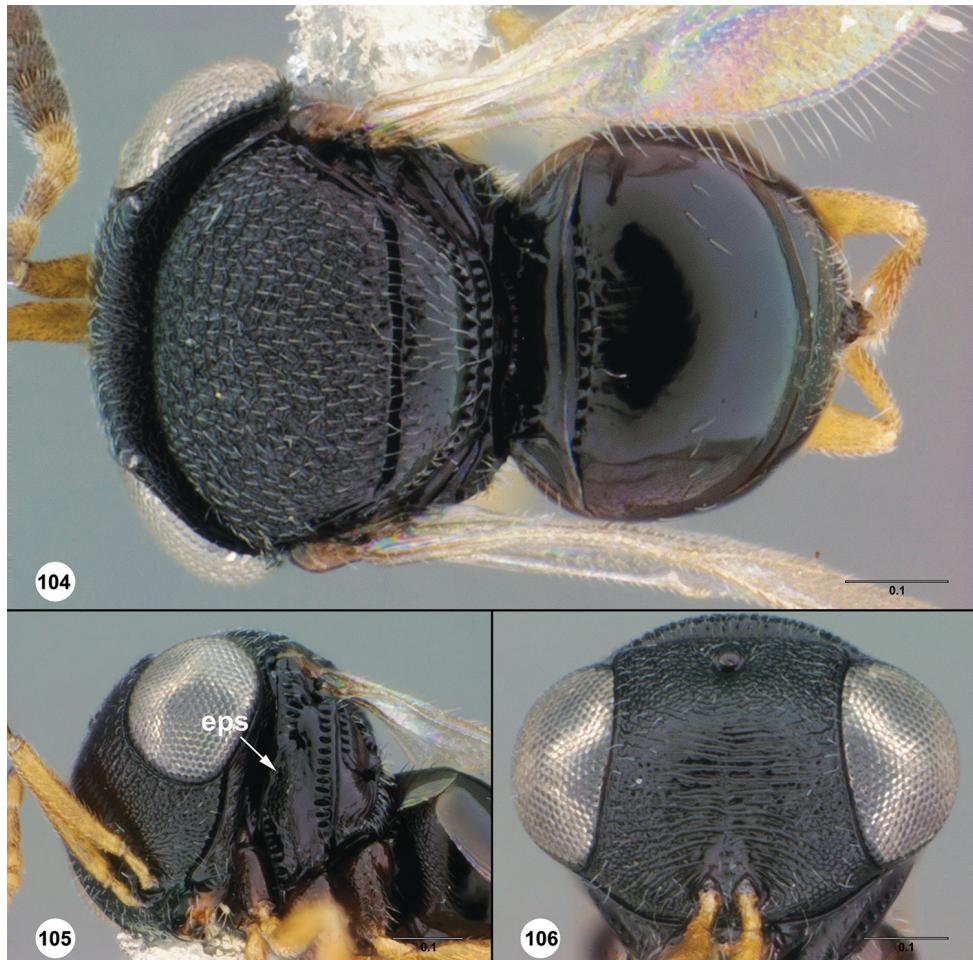
**Description.** Female body length: 0.74–0.80 mm (n=7). Body color: head and mesosoma black, metasoma black to reddish brown.



**Figure 103.** *Trissolcus levicaudus* female holotype (OSUC 144511), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow. Color of A7–A11 in female: brown; pale brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; transversely strigose ventrally, absent dorsally. Preocellar pit: absent; present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: absent. Macrosculpture of lateral pronotum directly anterior to netrion: absent. Pronotal suprakumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 1. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: distinctly separate from mesopleural pit.



**Figures 104–106.** *Trissolcus levicaudus* **104** female holotype (OSUC 144511), head, mesosoma, metasoma, dorsal view **105** female holotype (OSUC 144511), head and mesosoma, ventrolateral view **106** female paratype (OSUC 144508), head, anterior view. Scale bars in millimeters.

Subacropleural sulcus: present. Speculum: smooth. Mesopleural pit: simple. Mesopleural carina: complete. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Setation of posteroventral metapleuron: present. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture

of mesoscutum: rugulose. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprathumeral sulcus: comprised of cells. Length of mesoscutal suprathumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: acute. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout; absent; present laterally, absent medially. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: mostly smooth, with furrow along ventral margin. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: absent. Number of sublateral setae (on one side): 0; 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: absent. Setation of T2: present in a transverse line medially. Setation of laterotergite 2: absent; present. Striation of S2: absent. Setation of S2: present posteromedially.

**Diagnosis.** *Trissolcus levicaudus* is closest morphologically to *T. larides*, with which it shares a setose posterior metapleuron, absence of notauli, a smooth speculum, and T1 without striae posterior to the cells along the anterior margin. It may be separated from *T. larides* by the absence of striation on T2, a metapostnotum extending to the lateral margin of the metascutellum in dorsal view, and the entirely hyaline fore wing.

**Etymology.** The species epithet “levicaudus”, meaning “without knots” or “smooth” refers to the smoothness of the metasomal tergites.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=354382>

**Material examined.** Holotype, female: **THAILAND:** Uthai Thani Prov., Khao Nang Rum Wildlife Research Station, 400m, V-1986, malaise trap, M. Allen, OSUC 144511 (deposited in CNCI). Paratypes: (6 females) **INDIA:** 3 females, OSUC 144505, 144508–144509 (CNCI). **THAILAND:** 1 female, OSUC 144512 (CNCI). **UNITED ARAB EMIRATES:** 2 females, USNMENT00896167, 00896173 (CNCI).

### *Trissolcus mitsukurii* (Ashmead)

[http://bioguid.osu.edu/xbiol\\_concepts/3267](http://bioguid.osu.edu/xbiol_concepts/3267)

Figures 7, 107–111; Morphbank<sup>33</sup>

### *Trissolcus rudus* Lê syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3297](http://bioguid.osu.edu/xbiol_concepts/3297)

Morphbank<sup>34</sup>

*Telenomus mitsukurii* Ashmead, 1904: 72 (original description, keyed); Esaki, Hori, Hozawa, Ishii, Issiki, Kawada, Kawamura, Kinoshita, Kishida, Koidzumi, Kojima, Kuwana, Kuwayama, Marumo, Niijima, Oguma, Okamoto, Shinji, Shiraki, Taka-

hashi, Uchida, Ueno, Yamada, Yano, Yokoyama & Yuasa, 1932: 345 (description, distribution).

*Liophanurus mitsukurii* (Ashmead): Kieffer, 1912: 61 (generic transfer).

*Telenomus oecleoides* Dodd, 1914: 122 (original description, synonymized by Johnson (1991)).

*Microphanurus oecleoides* (Dodd): Kieffer, 1926: 95, 116 (description, generic transfer, keyed).

*Phanurus mitsukurii* (Ashmead): Kieffer, 1926: 50, 56 (description, generic transfer, keyed).

*Asolcus mitsukurii* (Ashmead): Watanabe, 1951: 22, 25 (generic transfer, description, keyed); Watanabe, 1954: 22 (keyed); Tachikawa, 1965: 284 (description).

*Trissolcus mitsukurii* (Ashmead): Masner & Muesebeck, 1968: 73 (lectotype designation, generic transfer); Safavi, 1968: 415 (keyed); Voegelé, 1969: 149 (keyed); Kozlov & Lê, 1976: 659 (keyed); Kozlov & Lê, 1977: 506 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 92 (description); Ryu & Hirashima, 1984: 36, 39 (description, keyed); Johnson, 1991: 213, 224 (description, synonymy, keyed); Kononova, 1995: 95 (keyed); He et al., 2004: 318 (description).

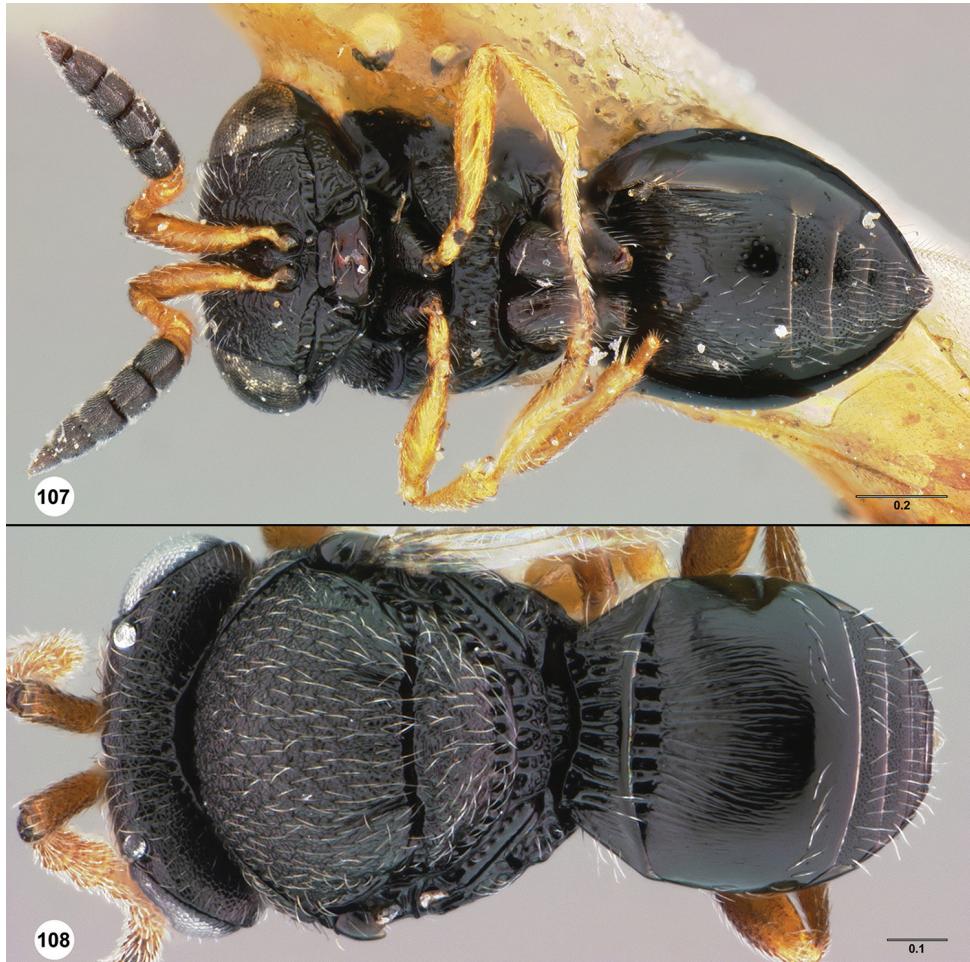
*Trissolcus rudus* Lê syn. n., 1983: 24, 25 (original description, keyed); Johnson, 1992: 635 (cataloged, type information); Lê, 1997: 23 (keyed); Lê, 2000: 311, 320 (description, keyed, type information).

*Trissolcus oecleoides* (Dodd): Johnson, 1988: 240 (type information, generic transfer); Johnson, 1991: 224 (junior synonym of *Trissolcus mitsukurii* (Ashmead)).

**Description.** Female body length: 1.04–1.74 mm (n=20). Male body length: 0.90–1.53 mm (n=19). Body color: head, mesosoma, and metasoma black.

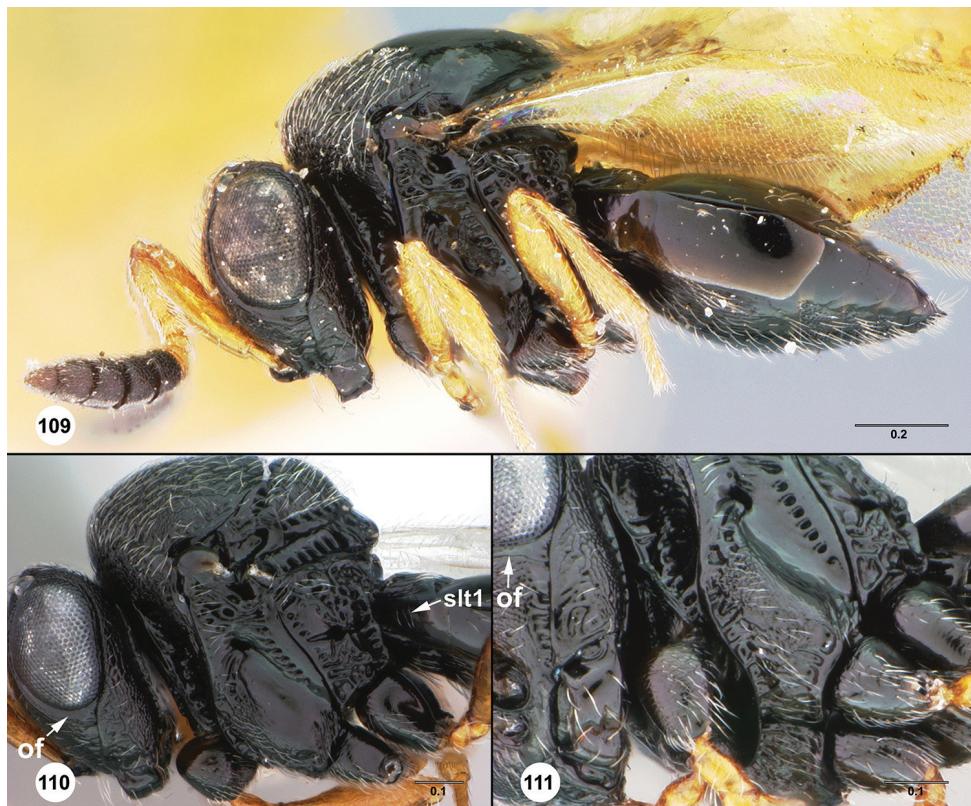
**Head.** Color of radicle: orange. Length of radicle: less than width of clypeus. Color of A1–A6 in female: apical A1 and dorsal A2 brown, elsewhere orange. Color of A7–A11 in female: black. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: moderately bulging. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: rugose. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: dorsoventrally fluted. Macrosculpture of lateral frons: weakly horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: present only posterior to lateral ocellus. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: antero-posteriorly striate. Netrion sulcus: complete. Pronotal suprähumerale sulcus in posterior half of pronotum: weakly differentiated from sculpture of dorsal pronotum. Location of pronotal suprähumerale sulcus: posterior half of pronotum. Number of episternal foveae: 3; 2. Course of episternal foveae ventrally: distinctly



**Figures 107–108.** *T. mitsukurii* 107 female holotype (USNMENT00989031), head, mesosoma, metasoma, ventral view 108 female (USNMENT00675722). Scale bars in millimeters.

separate from postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: irregularly rugulose. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly. Posterodorsal metapleural sulcus:



**Figures 109–111.** *T. mitsukurii* 109 female holotype (USNMENT00989031), head, mesosoma, metasoma, lateral view 110 female (USNMENT00675722), head and mesosoma, lateral view 111 female (USNMENT00675722), head and mesosoma, ventrolateral view. Scale bars in millimeters.

poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture; present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: rugulose. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprathumeral sulcus: comprised of cells. Length of mesoscutal suprathumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: absent. Posterodorsal margin of axillular carina: round. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: rugose throughout. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: foveate, foveae

occupying more than half of metanotal height. Metapostnotum: undifferentiated from remainder of propodeum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae and femora dark brown to black, elsewhere yellow to pale brown and becoming darker at distal tarsomeres.

**Metasoma.** Anteromedial portion of metasomal depression: antero-posteriorly striate. Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 2; 1. Setation of laterotergite 1: present. Longitudinal striation of T2: present throughout anterior half of tergite. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present.

**Diagnosis.** Among Palearctic species in the *basalis* group *T. mitsukurii* can be identified by the combination of the greatly enlarged antennae clava (A7–A11) in females (Figures 107, 109), the size of which is emphasized in comparison to the compressed A4–A6, an orbital furrow that is expanded at its intersection with the malar sulcus (Figures 109–111), and the line of setae along the dorsal margin of the first laterotergite (Figure 110). During the course of this revision we examined a number of species from southeast Asia that share the above-mentioned diagnostic characters, but to our knowledge the distributions of these species do not extend into temperate Asia.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3267>

**Material examined.** Holotype, female, *T. mitsukurii*: JAPAN: Shizuoka Pref., Atami City, no date, Koebele, USNMENT00989031 (deposited in USNM). Paratype of *T. mitsukurii*: JAPAN: 1 female, USNMENT00675967 (USNM). Holotype, female, *T. rudus*: VIETNAM: Hanoi Prov., Nghia Dô, Hanoi, 7-VII-1978, X. H. Lê, IEBR 0042 (deposited in IEBR). Other material: (39 females, 29 males, 5 unsexed) CHINA: 1 female, USNMENT00916469 (BMNH). JAPAN: 28 females, 27 males, 5 unsexed, OSUC 542353, 542355, 542362, 542376–542378, 542425, USNMENT00896316 (CNCI); USNMENT00675721–00675722, 00675750–00675754, 00675756–00675760, 00675762–00675769, 00675771, 00675847–00675859, 00675968–00675979, 00764853, 00872000–00872004 (USNM). SOUTH KOREA: 1 female, USNMENT00896149 (CNCI). THAILAND: 5 females, OSUC 542391–542395 (OSUC). UNITED STATES (quarantine): 4 females, 2 males, USNMENT00872119–00872124 (USNM).

#### *Trissolcus nycteridaner* Talamas, sp. n.

<http://zoobank.org/15188D07-AF20-4DE1-A466-F31CF7C30840>

[http://bioguid.osu.edu/xbioc\\_concepts/354383](http://bioguid.osu.edu/xbioc_concepts/354383)

Figures 12, 112–117; Morphbank<sup>35</sup>

**Description.** Female body length: 1.50–1.79 mm (n=10). Male body length: 1.60 mm (n=1). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow, becoming brown distally. Color of A7–A11 in female: pale brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2.



**Figures 112–113.** *Trissolcus nycteridaner*, female holotype (USNM 00896182) 112 head, mesosoma, metasoma, lateral view 113 head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

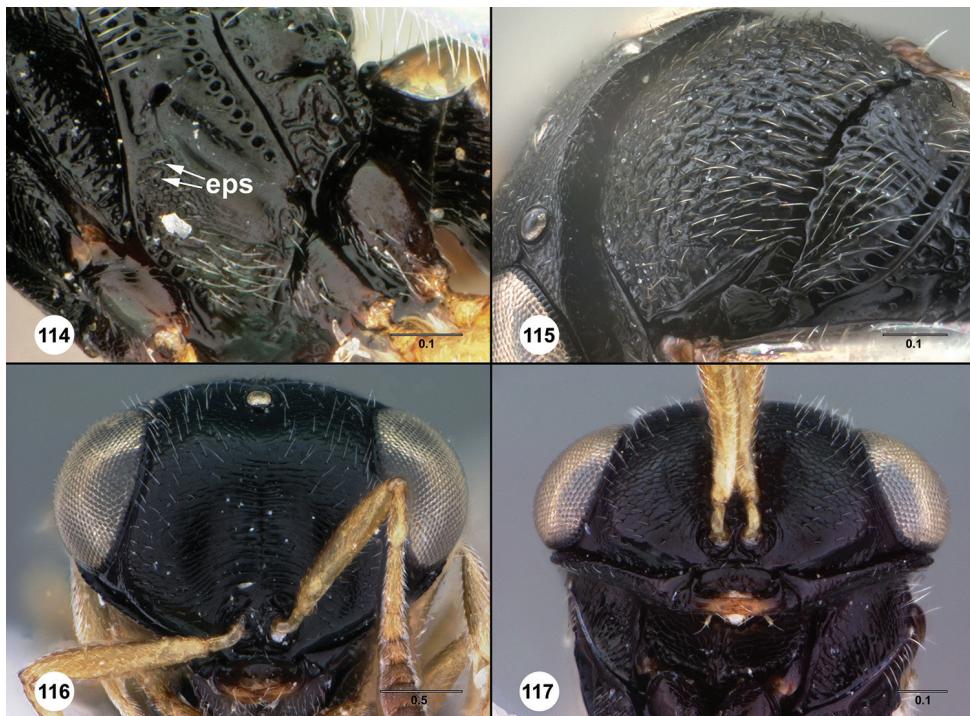
Facial striae: absent. Number of clypeal setae: 2. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: faintly rugulose. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: moderately dense. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: absent. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: rugose. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 3; 4 or more. Course of episternal foveae ventrally:

distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropalpal sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple. Mesopleural carina: complete. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by open crenulae; formed by small punctures. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Postero-dorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: reticulate anteriorly, becoming longitudinally strigose posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal supraventral sulcus: comprised of cells; absent. Length of mesoscutal supraventral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: indicated only at posterior margin of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Shape of dorsal margin of anterior lobe of axillar crescent: acute. Sculpture of anterior lobe of axillar crescent: absent. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: longitudinally strigose medially. Microsculpture on mesoscutellum: absent. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: absent. Form of metascutellum: coarsely rugose. Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present throughout anterior half of tergite. Setation of T2: present throughout posterolateral corner and lateral portions of tergite. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally, absent medially. Setation of S2: present only in medial third.

**Diagnosis.** *Trissolcus nycteridaner* can be identified by the presence of a hyperocapital carina, the undefined orbital furrow at the malar sulcus, the extremely slender mandibles, and the longitudinal sculpture on the mesoscutellum and posterior mesoscutum. It is similar to *T. gonopsidis*, but can be easily distinguished by the slender mandibles and absence of facial striae. Among species of the *flavipes* group, it is unusual in that the mesoscutal humeral sulcus is a mostly smooth furrow.



**Figures 114–117.** *Trissolcus nycteridaner* 114 female holotype (USNMENT00896182), mesosoma, lateral view 115 female holotype (USNMENT00896182), head and mesosoma, posterodorsal view 116 female paratype (USNMENT00896175), head, anterior view 117 female holotype (USNMENT00896182), head, anteroventral view. Scale bars in millimeters.

**Etymology.** The name of this species was inspired by young Luke Meladossi of Scarsdale, New York, who inquired if a species could be named for the superhero Batman. Like Batman, species of *Trissolcus* are dark in color, rarely seen by the public, kill bad guys (stink bugs) for the benefit of humankind, and are at times unfairly vilified on the basis of their name (parasitic wasp). The epithet derives from the Greek words “nycteris,” meaning “bat”, and “aner,” meaning “man”, and is treated as a noun in apposition.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=354383>

**Material examined.** Holotype, female: UNITED ARAB EMIRATES: #8173, 25°24'N 56°17'E, Wadi Wurayah, 25.III.2007, sweeping, F. Menzel & A. Stark, USNMENT00896182 (deposited in CNCI). Paratypes: UNITED ARAB EMIRATES: 9 females, USNMENT00896175–00896178, 00896180–00896181, 00896185–00896186, 00896218 (CNCI). Other material: UNITED ARAB EMIRATES: 1 male, USNMENT00896179 (CNCI).

***Trissolcus oobius* (Kozlov)**

[http://bioguid.osu.edu/xbiol\\_concepts/3281](http://bioguid.osu.edu/xbiol_concepts/3281)

Figures 118–127; Morphbank<sup>36</sup>

*Trissolcus aglaope* (Kozlov & Lê) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3176](http://bioguid.osu.edu/xbiol_concepts/3176)

Morphbank<sup>37</sup>

*Trissolcus dirrhope* (Kozlov & Lê) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3216](http://bioguid.osu.edu/xbiol_concepts/3216)

Morphbank<sup>38</sup>

*Trissolcus dryope* (Kozlov & Lê) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3220](http://bioguid.osu.edu/xbiol_concepts/3220)

Morphbank<sup>39</sup>

*Trissolcus lampe* (Kozlov & Lê) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3251](http://bioguid.osu.edu/xbiol_concepts/3251)

*Trissolcus merope* (Kozlov & Lê) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3266](http://bioguid.osu.edu/xbiol_concepts/3266)

Morphbank<sup>40</sup>

*Trissolcus niceppe* (Kozlov & Lê) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3272](http://bioguid.osu.edu/xbiol_concepts/3272)

Morphbank<sup>41</sup>

*Aporophlebus oobius* Kozlov, 1972: 670 (original description); Kononova, 1973: 439, 440 (description, keyed); Kozlov & Lê, 1976: 350 (keyed).

*Aporophlebus dirrhope* Kozlov & Lê, 1976: 351, 368 (original description, keyed).

*Aporophlebus dryope* Kozlov & Lê, 1976: 351, 365 (original description, keyed).

*Aporophlebus lampe* Kozlov & Lê, 1976: 350, 360 (original description, keyed).

*Aporophlebus merope* Kozlov & Lê, 1976: 350, 359 (original description, keyed).

*Aporophlebus niceppe* Kozlov & Lê, 1976: 351, 369 (original description, keyed).

*Trissolcus oobius* (Kozlov); Kozlov & Lê, 1977: 518 (generic transfer, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 126 (description); Kononova, 1995: 98 (keyed); Petrov, 2013: 326 (keyed).

*Aporophlebus aglaope* Kozlov & Lê, 1976: 351, 363 (original description, keyed).

*Trissolcus aglaope* (Kozlov & Lê) syn. n.: Kozlov & Lê, 1977: 519 (generic transfer, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 133 (description).

*Trissolcus dirrhope* (Kozlov & Lê) syn. n.: Kozlov & Lê, 1977: 519 (generic transfer, keyed); Kozlov, 1978: 638 (description); Kozlov & Kononova, 1983: 134 (description).

*Trissolcus dryope* (Kozlov & Lê) syn. n.: Kozlov & Lê, 1977: 519 (generic transfer, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 132 (description); Kononova, 1995: 98 (keyed); Ghahari, Buhl & Kocak, 2011: 595 (listed).

*Trissolcus lampe* (Kozlov & Lê) syn. n.: Kozlov & Lê, 1977: 518 (generic transfer, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 129 (description).

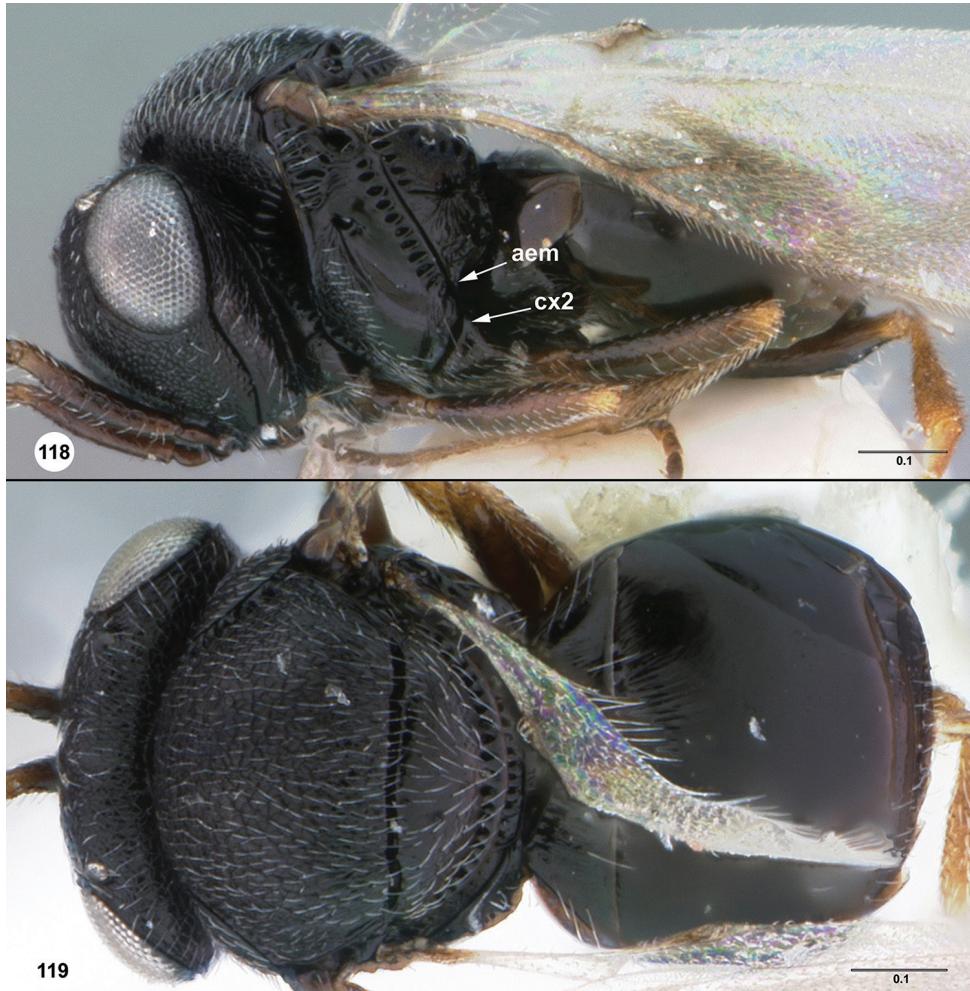
*Trissolcus merope* (Kozlov & Lê) syn. n.: Kozlov & Lê, 1977: 518 (generic transfer, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 124 (description); Kononova, 1995: 98 (keyed).

*Trissolcus niceppe* (Kozlov & Lê) syn. n.: Kozlov & Lê, 1977: 519 (generic transfer, keyed); Kozlov, 1978: 638 (description); Kozlov & Kononova, 1983: 135 (description).

**Description.** Female body length: 0.68–1.04 mm (n=8). Body color: head and mesosoma black, metasoma black to reddish brown.

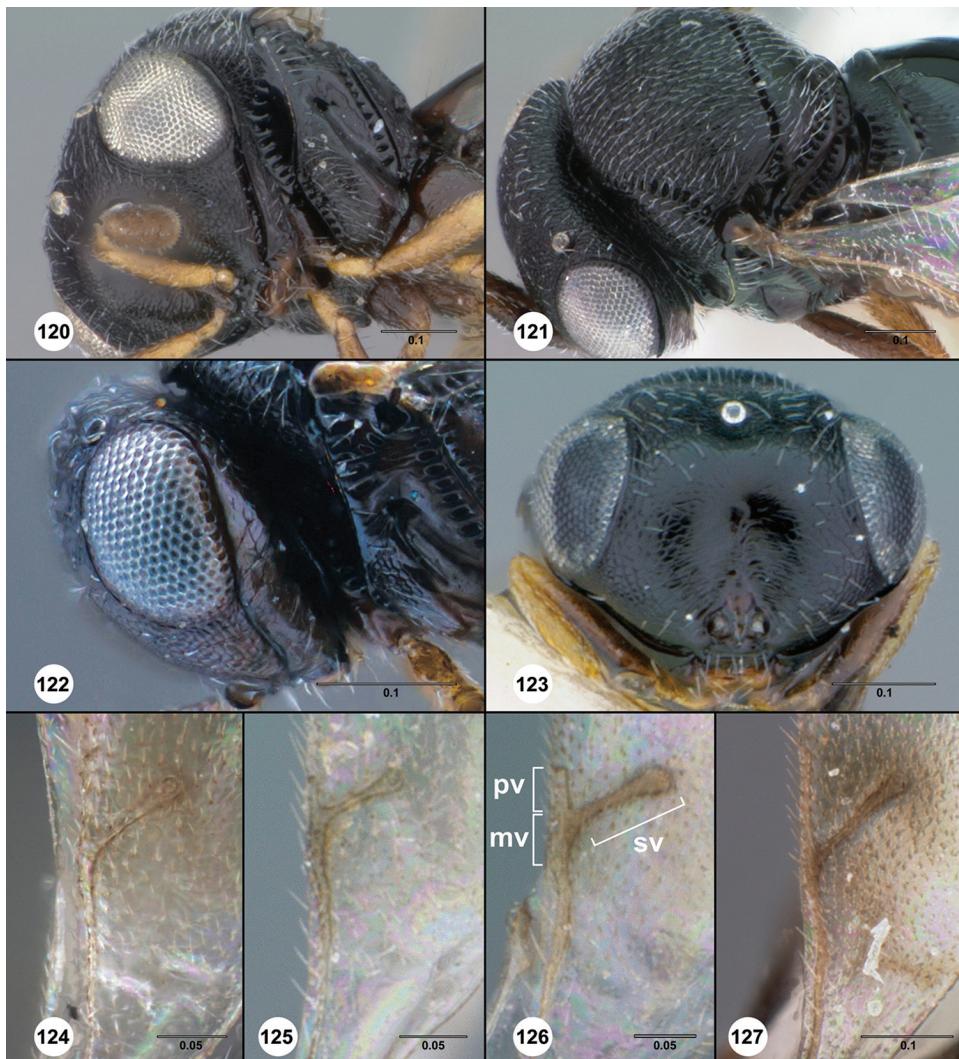
**Head.** Color of radicle: pale brown; yellow; brown. Length of radicle: less than width of clypeus. Color of A7–A11 in female: pale brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 0. Color of A1–A7 in female: yellow; pale brown. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent; present. Shape of ventral gena in lateral view: narrow. Genal carina: absent; present and extending dorsally to vicinity of lower margin eye; present only at base of mandible. Malar striae: absent. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; weakly transversely strigose. Preocellar pit: absent; present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent; weakly horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: lateral ocellus and eye without continuous scleritic separation; separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: absent. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprathumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 0. Subacropileural sulcus: present. Speculum: weakly transversely wrinkled. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent; present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout; present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by small punctures. Mesopleural epicoxal sulcus: formed by open crenulae. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Posterdorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent; weakly rugulose posteriorly.



**Figures 118–119.** *T. oobius*, female paratype (USNMENT00916617) 118 head, mesosoma, metasoma, lateral view 119 head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprakumeral sulcus: comprised of cells. Length of mesoscutal suprakumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent; indicated only at posterior margin of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent. Shape of dorsal margin of anterior lobe of axillar crescent: flat, appearing fused with lateral margin of mesoscutum. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Posterodorsal margin of axillular carina: round. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout; absent; present laterally, absent medially. Median mesoscutellar carina: absent. Seta-



**Figures 120–127.** *T. oobius* **120** female paratype of *T. niceppe* (USNMENT00916279), head and mesosoma, ventrolateral view **121** female paratype of *T. oobius* (USNMENT00916617), head, mesosoma, T1–T2, dorsolateral view **122** female paratype of *T. merope* (USNMENT00916614), head and anterior mesosoma, lateral view **123** female paratype of *T. dirrhope* (USNMENT00916275), head, anterior view **124** female paratype of *T. merope* (USNMENT00916614), venation of fore wing, dorsal view **125** female paratype of *T. dirrhope* (USNMENT00916275), venation of fore wing, dorsal view **126** female paratype of *T. niceppe* (USNMENT00916279), venation of fore wing, dorsal view **127** female paratype of *T. oobius* (USNMENT00916619), venation of fore wing, dorsal view. Scale bars in millimeters.

tion of posterior scutellar sulcus: absent. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: shorter than length of stigmal vein. Color of legs: coxae brown, femora and

tibiae yellow to pale brown, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate; smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present; absent; weakly present. Number of sublateral setae (on one side): 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: absent; faintly present anteriorly. Setation of T2: sparsely present in posterolateral corner. Setation of laterotergite 2: present.

**Diagnosis.** *Trissolcus oobius* shares with *T. hyalinipennis* a 4-merous antennal clava in females. This character, in combination with a postmarginal vein that is shorter than the stigmal vein, unambiguously separates it from all Palearctic species. Kozlov described numerous species based on small differences in the length of the postmarginal vein, and we here treat most of them as junior synonyms. The length of the postmarginal vein varies from nearly absent to approaching the length of the stigmal vein in a continuous gradient such that separation based on arbitrary lengths is not useful for species identification (see Figures 124–127).

**Material examined.** Holotype, female, *T. oobius*: RUSSIA: Altay Terr., Kosh-Agach, 17.VI.1964, Kozlov, ZMAS 0130 (deposited in ZIN). Paratypes of *T. oobius*: RUSSIA: 4 unsexed, USNMENT00916616–00916619 (ZIN). Holotype, female, *T. aglaope*: TURKMENISTAN: Lebap Prov., Repetek, 6.VI.1968, Sugonyaev, ZMAS 0117 (deposited in ZIN). Paratype of *T. oobius*: TURKMENISTAN: 1 male, USNMENT00916326 (ZIN). Holotype, female, *T. dirrhope*: TURKMENISTAN: Lebap Prov., Halaç (Khalach), 25.VI.1967, ZMAS 0123 (deposited in ZIN). Paratype of *T. dirrhope*: TURKMENISTAN: 1 female, USNMENT00916275 (ZIN). Holotype, female, *T. dryope*: KAZAKHSTAN: Atyrau (Gurev) Reg., shore, Lake Inder, 11.VII.1974, V. V. Kostjukov, ZMAS 0124 (deposited in ZIN). Paratype of *T. dryope*: MONGOLIA: 1 female, USNMENT00916277 (ZIN). Holotype, female, *T. lampe*: KAZAKHSTAN: Atyrau (Gurev) Reg., Ural River Floodplain, Inderbor (Inderborskiy), 8.VII.1974, V. V. Kostjukov, ZMAS 0126 (deposited in ZIN). Holotype, female, *T. merope*: RUSSIA: Altay Terr., Kosh-Agach, 11.VII.1964, Kozlov, ZMAS 0127 (deposited in ZIN). Paratype of *T. merope*: RUSSIA: 1 female, USNMENT00916614 (ZIN). Paratypes of *T. niceppe*: (2 females) ARMENIA: 1 female, USNMENT00916279 (ZIN). TURKMENISTAN: 1 female, ZMAS 0129 (ZIN). Other material: (4 females) IRAN: 1 female, USNMENT00896237 (CNCI). ISRAEL: 2 females, USNMENT00896142, 00896145 (CNCI). TURKMENISTAN: 1 female, UCRC ENT 296993 (UCRC).

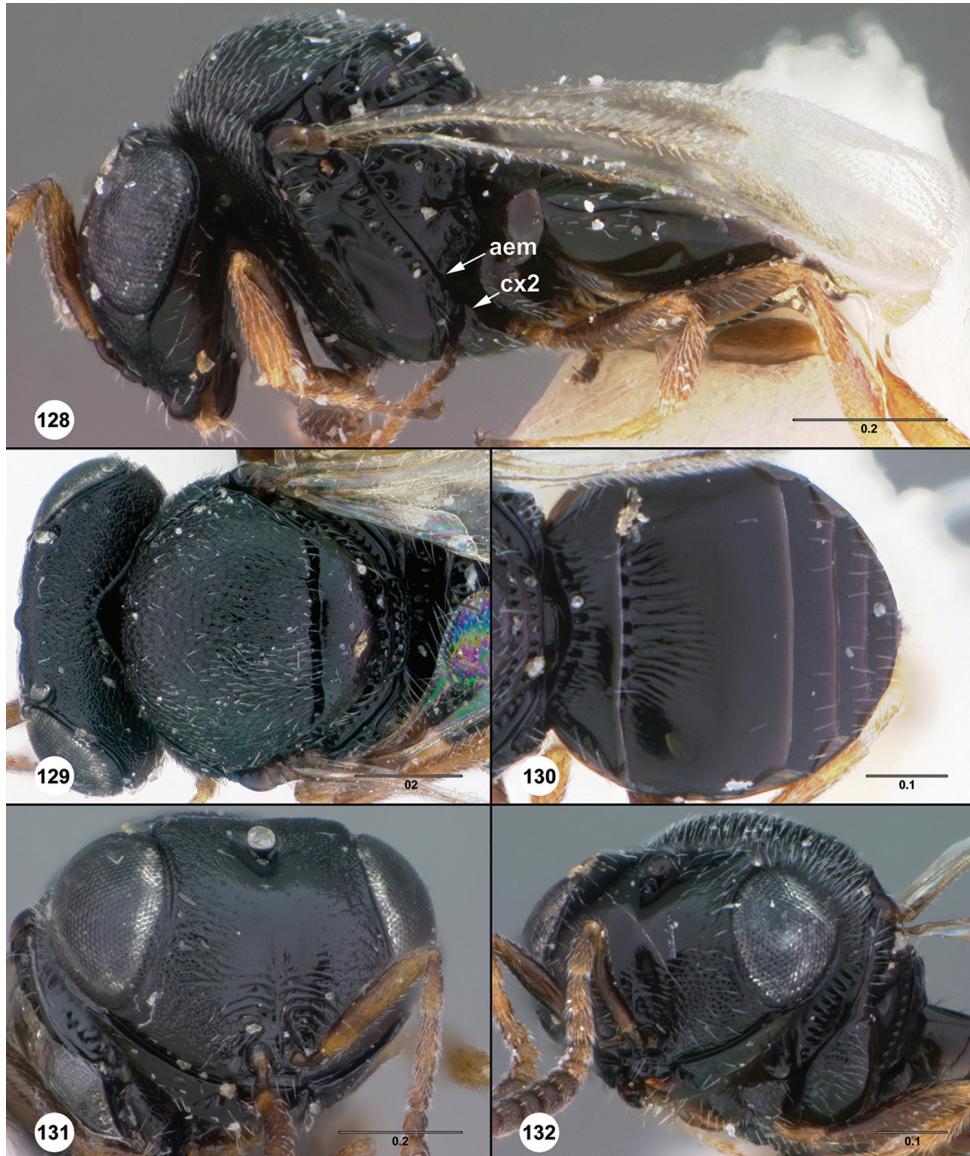
**Comments.** The degree to which longitudinal rugae extend from the basal costae of T1 is variable, ranging from essentially absent to distinctly present. Similarly, anterior T1 may be faintly striate or entirely smooth. Microsculpture on the mesoscutellum varies from present throughout to absent, and in some specimens the microsculpture is only present laterally. Specimens in the type series of *T. oobius* are larger than the specimens in the type series of species here treated as junior synonyms. These larger specimens have coarser sculpture on the frons and a distinct preocellar pit. In the smallest specimens the preocellar pit is absent and in specimens of intermediary size the pit is absent or very small.

***Trissolcus perepelovi* (Kozlov)**[http://bioguid.osu.edu/xbiol\\_concepts/3287](http://bioguid.osu.edu/xbiol_concepts/3287)Figures 128–132; Morphbank<sup>42</sup>*Trissolcus deserticola* (Kozlov) syn. n.[http://bioguid.osu.edu/xbiol\\_concepts/3214](http://bioguid.osu.edu/xbiol_concepts/3214)Morphbank<sup>43</sup>*Trissolcus dircus* Kozlov & Lê syn. n.[http://bioguid.osu.edu/xbiol\\_concepts/3215](http://bioguid.osu.edu/xbiol_concepts/3215)Morphbank<sup>44</sup>*Aporophlebus deserticola* Kozlov, 1972: 668 (original description); Kozlov & Lê, 1976: 350 (keyed).*Aporophlebus perepelovi* Kozlov, 1972: 669 (original description); Kozlov & Lê, 1976: 350 (keyed).*Trissolcus deserticola* (Kozlov) syn. n.: Kozlov & Lê, 1977: 518 (generic transfer, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 127 (description); Kononova, 1995: 98 (keyed).*Trissolcus perepelovi* (Kozlov): Kozlov & Lê, 1977: 518 (generic transfer, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 129 (description); Kononova, 1995: 98 (keyed).*Trissolcus dircus* Kozlov & Lê syn. n., 1977: 516, 521 (original description, keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 120 (description); Radjabi, 2001: 111 (keyed).

**Description.** Female body length: 1.00–1.54 mm (n=5). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent; present and extending dorsally to vicinity of lower margin eye; present only at base of mandible. Malar striae: absent. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: absent. Macrosculpture of lateral frons: absent; horizontally striate ventrally, striae of antennal scrobe extending to lateral frons. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present.

**Mesosoma.** Epomial carina: absent. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum:



**Figures 128–132.** *T. perepolovi* 128 female paratype (USNMENT00916339), head, mesosoma, metasoma, lateral view 129 female paratype of *T. dircus* syn. n. (USNMENT00916278), head and mesosoma, dorsal view 130 female paratype (USNMENT00916338), mesosoma, dorsal view 131 female paratype of *T. dircus* syn. n. (USNMENT00916278), head, anterior view 132 female paratype (USNMENT00916338), head, anterolateral view. Scale bars in millimeters.

undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 0. Subacropileural sulcus: present. Speculum: smooth. Mesopleural pit: simple; extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: absent; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femo-

ral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent; present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: absent; present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by small punctures; present as a smooth furrow. Mesopleural epicoxal sulcus: formed by open crenulae; present as a smooth furrow. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture; present as coarse rugae. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprhumeral sulcus: comprised of cells. Length of mesoscutal suprhumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: flat, appearing fused with lateral margin of mesoscutum. Sculpture of anterior lobe of axillar crescent: absent. Posterodorsal margin of axillular carina: round. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: absent. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about equal to length of stigmal vein. Color of legs: coxae dark brown, femora yellow to dark brown, elsewhere yellow. Anteromedial portion of metasomal depression: smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: absent. Number of sublateral setae (on one side): 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anteromedial portion of the tergite. Setation of T2: sparsely present in posterolateral corner. Setation of laterotergite 2: present.

**Diagnosis.** *Trissolcus perepelovi* can be distinguished by the distinctly bulging ventral mesopleuron, the absence of episternal foveae, striation on T2 that is limited to the anteromedial portion of the tergite, and the smooth area on the frons between the antennal scrobe and the median ocellus. Variability occurs in the extent to which the microsculpture on the frons is effaced. In the paratypes of *T. deserticola* and *T. dircus* that we examined, the area does not extend to the inner margins of the compound eyes, whereas in the type series of *T. perepelovi* it may either extend to the margin of the compound eye or be separated by a patch of microsculpture. The expanded smooth area in the type series of *T. perepelovi* corresponds to a reduction in surface sculpture of the gena and reduction in the size of the genal carina, which are much more pronounced in the paratypes of *T. deserticola* and *T. dircus*. As in many other species of *Trissolcus*, the color of the antennal segments preceding the clava is not stable and A3–A6 vary from yellow to brown. Similar to *T. semistriatus* and *T. comperei*, the extent to which the striae

of the antennal scrobe extend onto the ventral frons is variable within this species. The paratype of *T. dircus* shows definitive striation on the ventral frons, whereas this striation is very weak in the type series of *T. perepelovi* and absent in the paratype of *T. deserticola*.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3287>

**Material examined.** Holotype, female, *Aporophlebus perepelovi*: MONGOLIA:

Bayanhongor Prov., buckwheat / saxaul, 24–35km E Dzamiin Bilgihi (Talin-Bilgekh) Spring, 17.VIII.1969, M. Kozlov, ZMAS 0131 (deposited in ZIN). Paratypes: MONGOLIA: 3 females, USNM 00916338–00916339, 00916615 (ZIN). Holotype, female, *Trissolcus dircus* TURKMENISTAN: Lebap Prov., 70km NW Türkmenabat (Chardzhou), 31.V.1965, M. Kozlov, ZMAS 0122 (deposited in ZIN). Paratype of *T. dircus*: TURKMENISTAN: 1 female, USNM 00916278 (ZIN). Holotype, female, *Aporophlebus deserticola*: TURKMENISTAN: Lebap Prov., 70km NW Türkmenabat (Chardzhou), 30.V.1965, M. Kozlov, ZMAS 0121 (deposited in ZIN). Paratype of *A. deserticola*: TURKMENISTAN: 1 female, USNM 00916325 (ZIN).

### *Trissolcus plautiae* (Watanabe)

[http://bioguid.osu.edu/xbiol\\_concepts/13208](http://bioguid.osu.edu/xbiol_concepts/13208)

Figures 133–136; Morphbank<sup>45</sup>

*Asolcus plautiae* Watanabe, 1954: 18, 22 (original description, keyed, synonymized by Hirashima & Yamagishi (1981)); Johnson, 1992: 630 (type information).

*Trissolcus plautiae* (Watanabe): Kozlov, 1968: 198 (keyed); Kozlov & Lê, 1976: 658 (keyed); Kozlov & Lê, 1977: 504 (keyed); Kozlov, 1978: 629 (description); Hirashima & Yamagishi, 1981: 153 (junior synonym of *Trissolcus japonicus* (Ashmead)); Kozlov & Kononova, 1983: 86 (description); Kononova, 1995: 92 (keyed); Kononova, 2014: 1421 (keyed); Kononova, 2015: 258 (keyed).

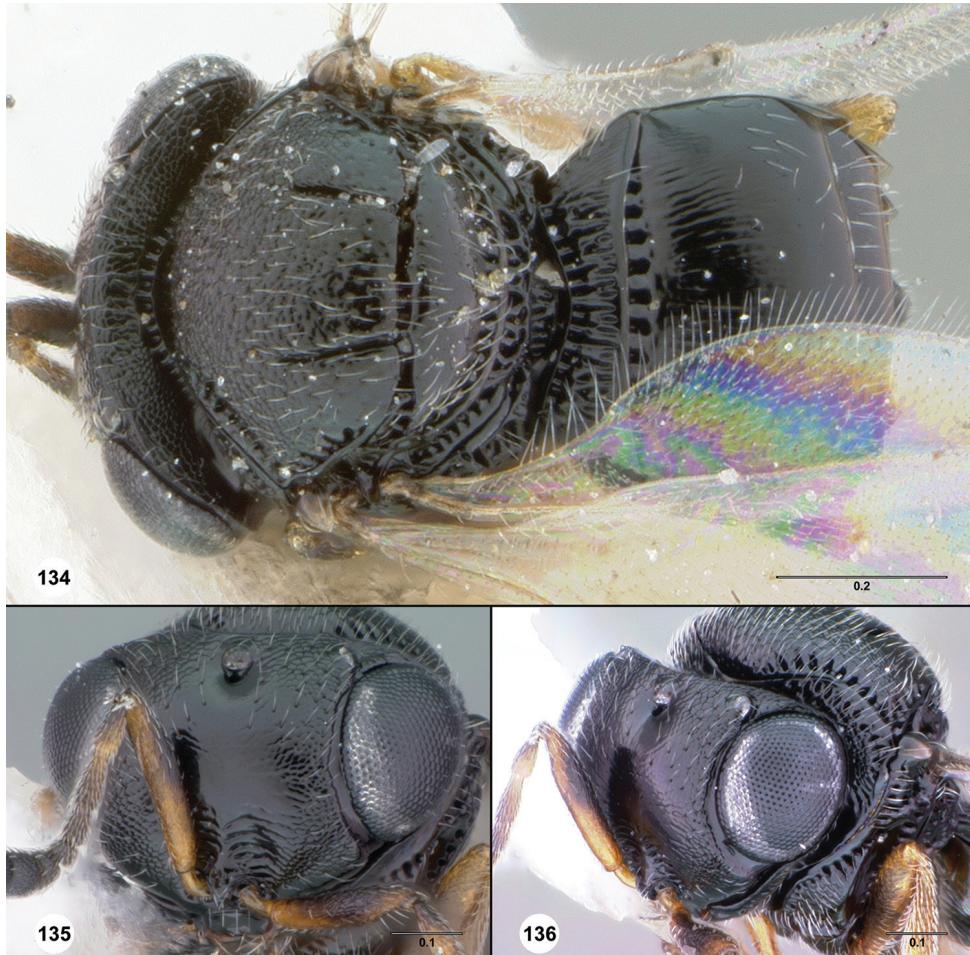
**Description.** Female body length: 1.03–1.39 mm (n=26). Male body length: 0.92–1.26 mm (n=20). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: orange; pale brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: dark brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 4. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: sparse. Sculpture directly ventral to preocellar pit: absent. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.



**Figure 133.** *Trissolcus plautiae* female (USNM 00916880), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

**Mesosoma.** Epomial carina: present. Macrosulpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: percurrent. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileal sulcus: present. Speculum: smooth; weakly transversely wrinkled. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells; formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly; rugose. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; indicated by a line of elongate cells. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: effaced posteriorly. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: extending to antero-admedian line. Parapsidal line: absent. Notaulus: extending at least 1/3 length of mes-



**Figures 134–136.** *Trissolcus plautiae* 134 female paratype (USNMENT00903180), head, mesosoma, metasoma, dorsal view 135 female (USNMENT00872403), head, anterior view 136 female paratype (USNMENT00872403), head and mesosoma, anterolateral view. Scale bars in millimeters.

oscutum. Median protuberance on anterior margin of mesoscutellum: absent; present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: striate. Macrosulpture of mesoscutellum: absent. Microsculpture on mesoscutellum: absent. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown, femora yellow to dark brown, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0; 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anterior two-thirds of tergite. Setation of T2: present throughout posterolateral corner. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: present throughout area not covered by laterotergite.

**Diagnosis.** See diagnosis of *T. japonicus*.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=13208>

**Material examined.** Paratypes: JAPAN: 2 females, USNMENT00903180–00903181 (USNM). Other material: (122 females, 25 males, 1 unsexed) CHINA: 90 females, 23 males, UCRC ENT 142662, 143855, 143907 (UCRC); USNMENT00872403, 00916690–00916709, 00916795, 00916840–00916859, 00916861–00916894, 00916904–00916917, 00916931–00916951 (USNM). JAPAN: 8 females, 1 male, 1 unknown, OSUC 144489, 398858, 542359, 542414 (CNCI); OSUC 75843–75848 (OSUC). RUSSIA: 6 females, UCRC ENT 297000, 297006, 297008, 297011, 329910, 329920 (UCRC). SOUTH KOREA: 18 females, USNMENT00979227–00979236, 00979238–00979240, 00979242–00979245, 00979252 (CNCI). TAIWAN: 1 male, OSUC 144515 (CNCI).

### *Trissolcus rufiventris* (Mayr)

[http://bioguid.osu.edu/xbiol\\_concepts/3298](http://bioguid.osu.edu/xbiol_concepts/3298)

Figures 137–144; Morphbank<sup>46</sup>

### *Trissolcus protogyne* (Voegelé) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/309567](http://bioguid.osu.edu/xbiol_concepts/309567)

Morphbank<sup>47</sup>

*Telenomus rufiventris* Mayr, 1907: 158 (original description).

*Prophanurus Rufiventris* (Mayr): Kieffer, 1912: 41, 59 (description, generic transfer).

*Dissolcus rufiventris* (Mayr): Kieffer, 1926: 124 (description, generic transfer, keyed); Meier, 1940: 79, 80 (description, keyed); Rjachovskij, 1959: 82 (keyed).

*Microphanurus anitus* Nixon, 1939: 131, 132 (original description, keyed, synonymized by Delucchi (1961)); Delucchi, 1961: 54 (junior synonym of *Asolcus rufiventris* (Mayr)).

*Asolcus rufiventris* (Mayr): Masner, 1959: 380 (diagnosis, variation); Delucchi, 1961: 45, 54 (description, synonymy, keyed); Viktorov, 1964: 1014, 1023 (description, keyed); Voegelé, 1964: 28 (keyed); Szabó, 1976: 176 (keyed).

*Telenomus rubriventris* Szabó, 1959: 169 (original description, synonymized by Kozlov (1968)); Kozlov, 1968: 211 (junior synonym of *Trissolcus rufiventris* (Mayr)).

*Trissolcus rufiventris* (Mayr): Viktorov, 1967: 91 (generic transfer, keyed); Safavi, 1968: 415 (keyed); Kozlov, 1968: 199, 211 (description, lectotype designation, keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 514 (keyed); Kozlov, 1978: 636 (description); Kozlov & Kononova, 1983: 117 (description); Kononova, 1995: 96

(keyed); Koçak & Kilinçer, 2003: 303, 313 (keyed, description); Ghahari, Buhl & Kocak, 2011: 596 (listed); Guz, Kocak & Kilincer, 2013: 87 (description, phylogenetic relationships); Petrov, 2013: 326 (keyed).

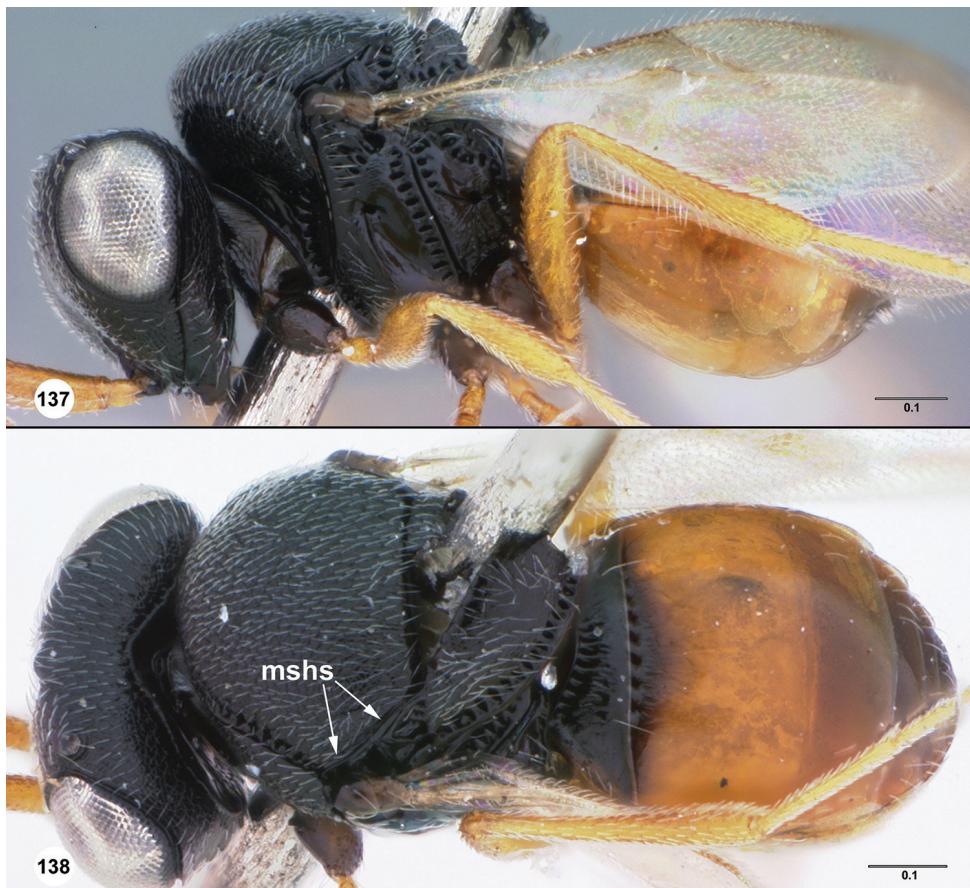
*Asolcus rufiventris rufiventris* (Mayr): Voegelé, 1969: 151 (keyed).

*Asolcus rufiventris protogyne* Voegelé syn. n., 1969: 151 (original description, keyed, considered a valid species but described as a subspecies).

**Description.** Female body length: 0.99–1.24 mm (n=18). Male body length: 1.08–1.24 mm (n=6). Body color: head, mesosoma and T1 reddish brown to black, remainder of metasoma yellow to reddish brown.

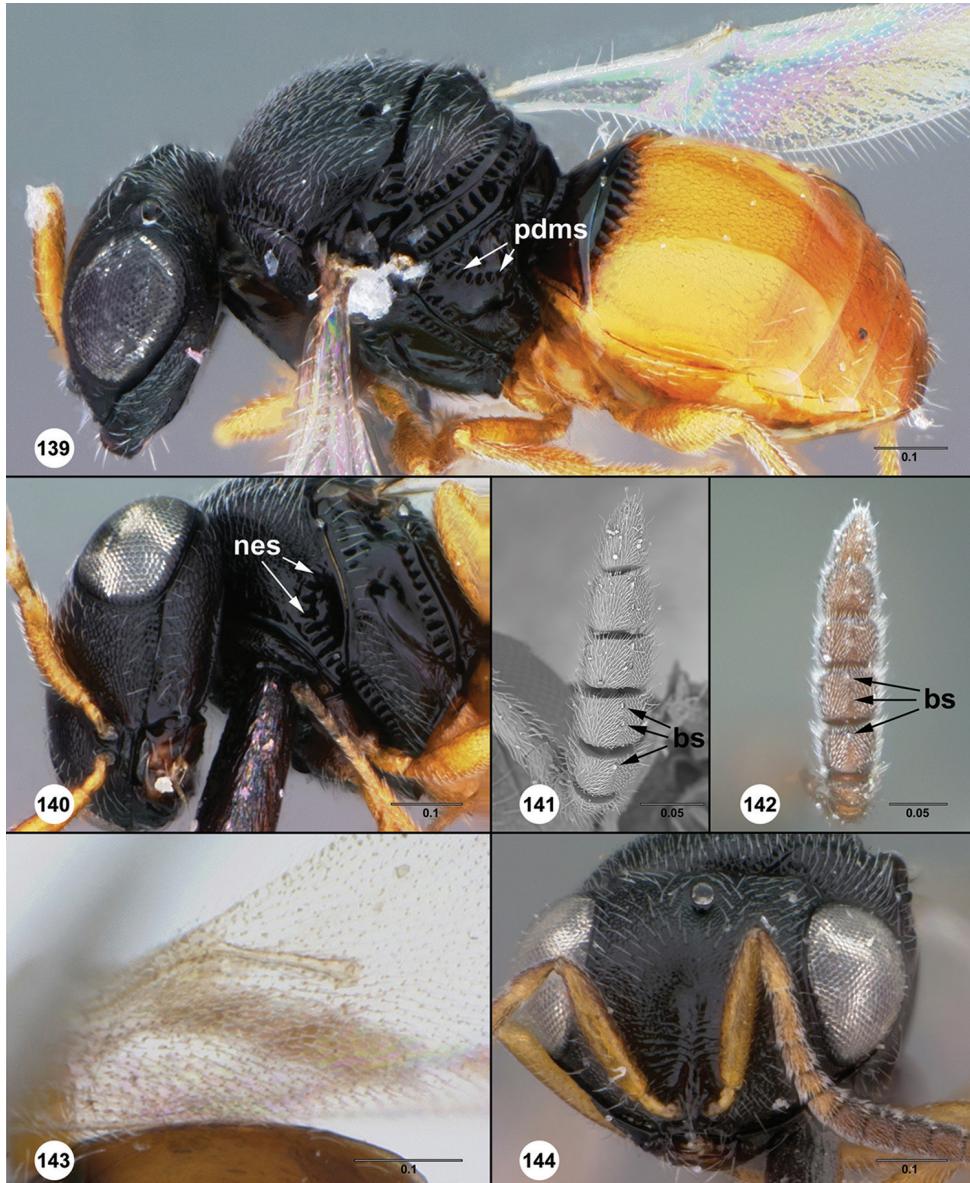
**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: pale to dark brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 1. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent; present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 0. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple; extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by small punctures. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of meso-



**Figures 137–138.** *T. rufiventris* female lectotype (NHMW 0005) 137 head, mesosoma, metasoma, lateral view 138 head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

cutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprhumeral sulcus: comprised of cells. Length of mesoscutal suprhumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: acute. Sculpture of anterior lobe of axillar crescent: uncertain, dorsoventrally strigose. Posterodorsal margin of axillular carina: pointed. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow. Antero-medial portion of metasomal depression: punctate or crenulate.



**Figures 139–144.** *T. rufiventris* 139 female (USNMENT01059199), head, mesosoma, metasoma, dorsolateral view 140 female (USNMENT01059197), head, mesosoma, ventrolateral view 141 female (USNMENT00675886), antennal clava, ventral view 142 female (USNMENT00675886), antennal clava, ventral view 143 female lectotype (NHMW 0005), venation of fore wing, dorsal view 144 female (USNMENT00989158), head, anterior view. Scale bars in millimeters.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 1. Setation of laterotergite 1: absent. Longitudinal striation of T2: absent; faintly present anteriorly. Setation of T2: sparsely present in

posterolateral corner. Setation of laterotergite 2: present. Striation of S2: absent. Setation of S2: present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus rufiventris* is usually easily identifiable by the color of the metasoma, which in some cases is bright yellowish-orange in color. This color pattern is not known to us from other species and thus can be used effectively to confirm the identity of this species. However, the metasoma may be dark brown, approaching black, and thus color should not be used to exclude specimens from this species. Although it is less accessible, the most reliable character for *T. rufiventris* is the presence of a single basiconic sensillum on A7. All other species of Palearctic *Trissolcus* have either 2 basiconic sensilla on A7 or none.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3298>

**Material examined.** Lectotype, female, *T. rufiventris*: RUSSIA: Rostov Reg., Rostov-na-Donu (Rostow am Don) City, V-1905, reared, I. Vassiliev, NHMW 0005 (deposited in NHMW). Paralectotypes: RUSSIA: 3 females, 2 males, 1 unsexed, USNMENT00989158–00989159, 01059035–01059037 (NHMW). Other material: (30 females, 15 males) ARMENIA: 1 female, USNMENT00979996 (ZIN). FRANCE: 2 females, USNMENT00896293, 00896330 (CNCI). ISRAEL: 1 female, USNMENT00896143 (CNCI). ITALY: 1 female, USNMENT00896204 (CNCI). MOROCCO: 4 females, 5 males, USNMENT00896091 (CNCI); USNMENT01059197, 01059200–01059207 (MNHN). TURKEY: 20 females, 10 males, USNMENT00675860–00675889 (USNM). TURKMENISTAN: 1 female, UCRC ENT 296994 (UCRC).

### *Trissolcus saakowi* (Mayr)

[http://bioguid.osu.edu/xbiol\\_concepts/3301](http://bioguid.osu.edu/xbiol_concepts/3301)

Figures 11, 145–153; Morphbank<sup>48</sup>

*Trissolcus mentha* Kozlov & Lê, syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3265](http://bioguid.osu.edu/xbiol_concepts/3265)

Morphbank<sup>49</sup>

*Trissolcus radjabii* Iranipour, syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/244989](http://bioguid.osu.edu/xbiol_concepts/244989)

Morphbank<sup>50</sup>

*Telenomus Saakowi* Mayr, 1903: 397 (original description).

*Microphanurus saakowi* (Mayr): Kieffer, 1926: 91, 95 (description, generic transfer, keyed).

*Trissolcus saakovi* (Mayr): Kozlov, 1968: 198, 202 (description, emendation, lectotype designation, keyed); Fabritius, 1972: 30 (keyed); Szabó, 1975: 266 (keyed); Kozlov & Lê, 1976: 658 (keyed); Kozlov & Lê, 1977: 504 (keyed); Kozlov, 1978: 629 (description); Kozlov & Kononova, 1983: 84 (description).

*Trissolcus mentha* Kozlov & Lê syn. n.: Kozlov & Lê, 1977: 510 (keyed); Kozlov & Lê, 1977: 1253 (original description); Kozlov, 1978: 635 (description); Kozlov & Kononova, 1983: 107 (description); Ghahari, Buhl & Kocak, 2011: 596 (listed).

*Trissolcus radjabii* Iranipour syn. n., 2010: 66 (original description, diagnosis); Ghahari, Buhl & Kocak, 2011: 596 (listed).

*Trissolcus saakowi* (Mayr): Ghahari, Buhl & Kocak, 2011: 596 (listed).

**Description.** Female body length: 1.06–1.94 mm (n=9). Male body length: 1.69 mm (n=1). Body color: head, mesosoma, and metasoma black.

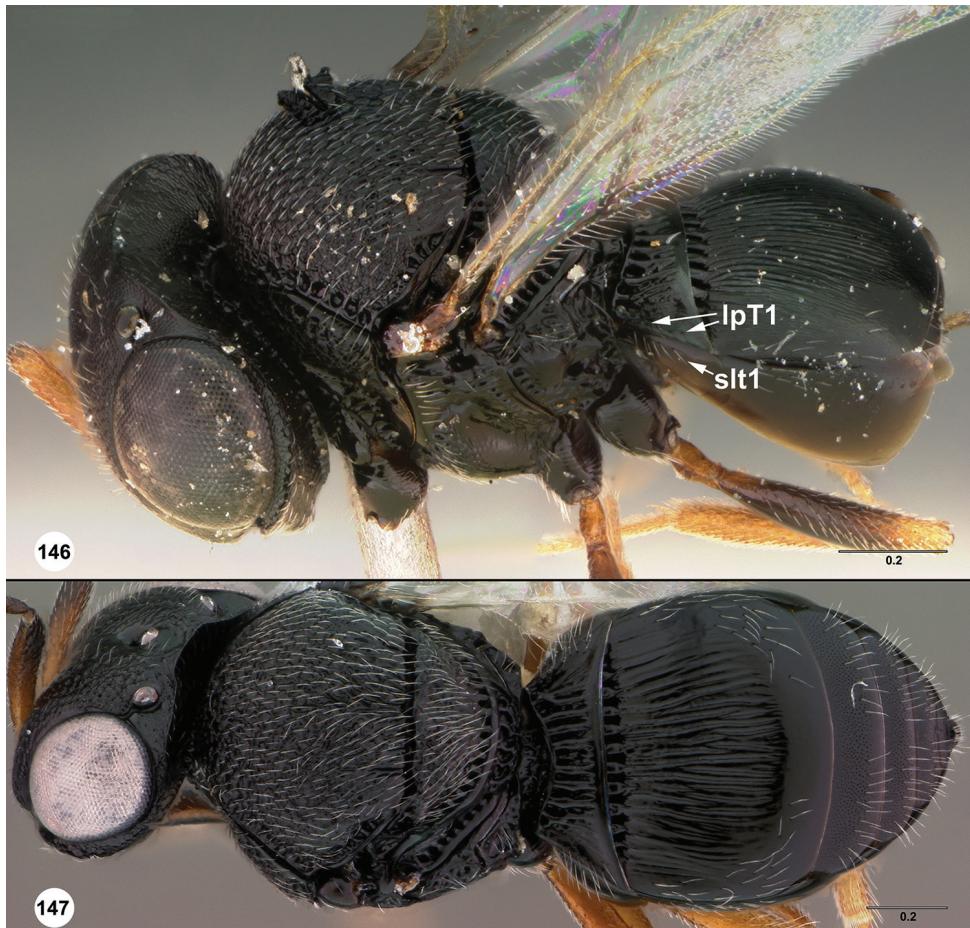
**Head.** Color of radicle: orange; pale brown; yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: pale brown; yellow; yellow, becoming brown distally. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent; present as short grooves. Number of clypeal setae: 2. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; weakly transversely strigose. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: sparse; dense. Sculpture directly ventral to preocellar pit: dorsoventrally fluted; microsculptured. Macrosculpture of lateral frons: absent; horizontally striate ventrally, striae of antennal scrobe extending to lateral frons. OOL: separated by less than one ocellar diameter. Hyperocapital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus; rugose. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileural sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple; extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: ab-



**Figure 145.** *Trissolcus saakowi* female lectotype (NHMW 0003), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

sent; reticulate anteriorly, becoming longitudinally strigose posteriorly; longitudinally striae posteromedially, otherwise absent; longitudinally striae posteriorly, otherwise absent; longitudinally striae. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprähumeral sulcus: comprised of cells. Length of mesoscutal suprähumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: absent; indicated only at posterior margin of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: uncertain, absent; uncertain, present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: rugulose punctate. Macrosculpture of mesoscutellum: rugose throughout; rugose laterally. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about 1.5 times as long as stigmal vein. Color of legs:

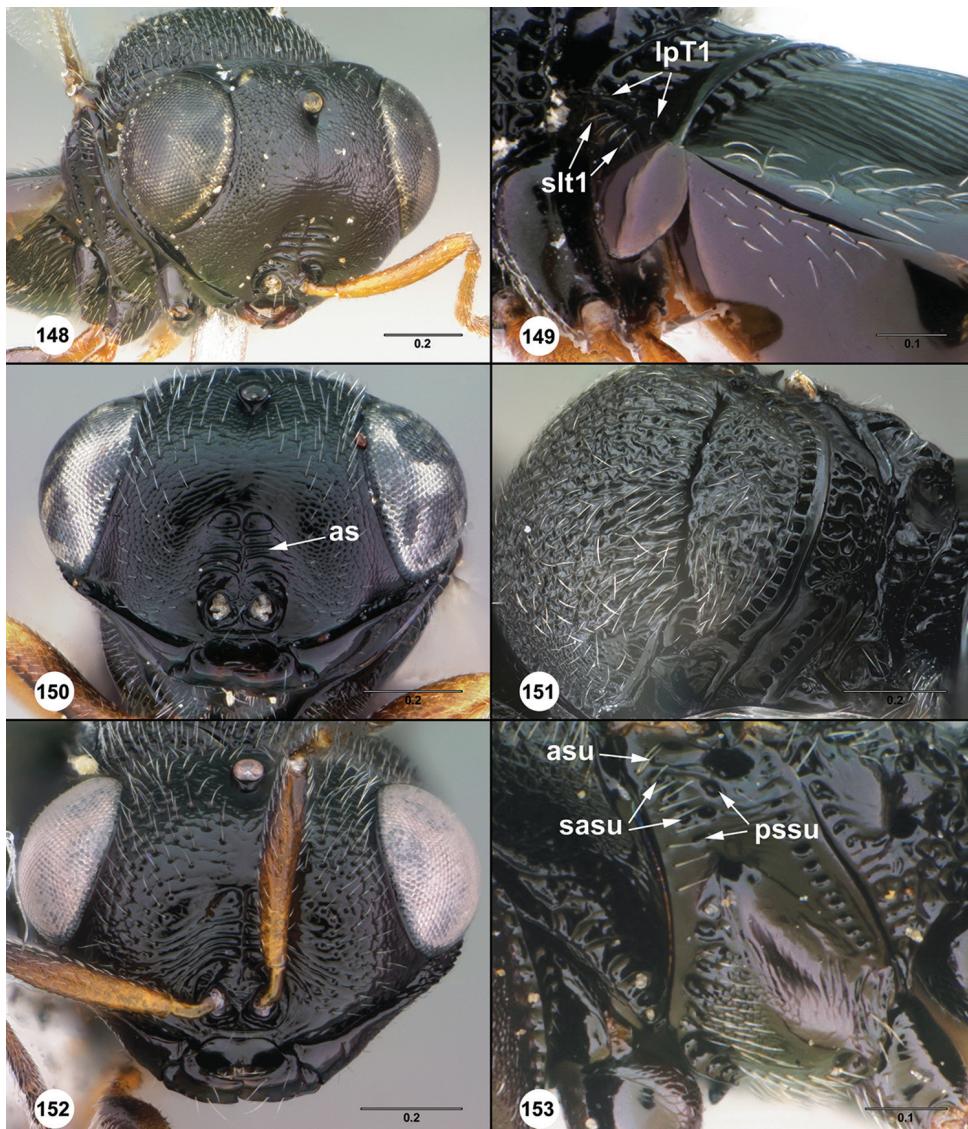


**Figures 146–147.** *Trissolcus saakowi* 146 female lectotype (NHMW 0003), head, mesosoma, metasoma, dorsolateral view 147 female (USNMENT00977544), head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

coxae dark brown to black, trochanters and femora yellow to brown, elsewhere yellow to orange. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: present. Longitudinal striation of T2: present in most of tergite, extending posteriorly to transverse line of setae. Setation of T2: present throughout posterolateral corner. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally, absent medially; absent. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** Setation on the first laterotergite unambiguously separates *T. saakowi* from all Palearctic species in the *flavipes* group. This character occurs in *T. stoicus*, *T. mitsukurii*, and rarely in *T. semistriatus*, all of which are quite different species in terms



**Figures 148–153.** *Trissolcus saakowi* 148 female lectotype (NHMW 0003), head, anterolateral view 149 female (USNMENT00977544), T1–T2, posterolateral view 150 female (OSUC 259830, paratype of *T. radjabii* syn. n.) 151 female (USNMENT00977544), mesosoma, posterodorsal view 152 female (USNMENT00977544), head, anterior view 153 female lectotype (NHMW 0003), mesosoma, lateral view. Scale bars in millimeters.

of their diagnostic characters and general appearance. Most similar to *T. saakowi* in the Palearctic is *T. tumidus*, with which it shares the punctate-rugulose interior of the axillar crescent (Figures 8, 11). *Trissolcus saakowi* may be separated from *T. tumidus* by setation of the first laterotergite and the absence of a well defined orbital furrow

at its intersection with the malar sulcus. These two species have similar distributions, stretching from the Middle East to Far Eastern Asia.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3301>

**Material examined.** Lectotype, female, *T. saakowi*: TURKMENISTAN: Askhabad (Askabad) Dist., VII-1902, reared, J. Vassillief, NHMW 0003 (deposited in NHMW). Paralectotype of *T. saakowi*: TURKMENISTAN: 1 female, USNMENT01059011 (NHMW). Holotype, female, *T. mentha*: UZBEKISTAN: Samarkand Reg., Samarqand (Samarkand), 13.VII.1957, E. Popova, ZMAS 0146 (deposited in ZIN). Paratypes of *T. radjabii*: IRAN: 5 females, OSUC259828–259832 (OSUC). Other material: (23 females, 14 males) AFGHANISTAN: 3 females, 1 male, USNMENT00916471-00916474 (BMNH). CHINA: 1 female, USNMENT00977544 (USNM). GREECE: 1 female, 1 male, USNMENT00916066 (BMNH); USNMENT00896234 (CNCI). INDIA: 1 female, 1 male, USNMENT00916359 (BMNH); OSUC 144506 (CNCI). IRAN: 2 females, USNMENT00916481, 00916484 (BMNH). MOROCCO: 10 females, 9 males, USNMENT00896068, 00896077-00896078, 00896081-00896082, 00896092, 00896095-00896102, 00896104-00896105, 00896108, 00896327, 00896332 (CNCI). PAKISTAN: 2 females, 2 males, USNMENT00916354-00916357 (BMNH). SPAIN: 1 female, USNMENT00896334 (CNCI). TURKEY: 2 females, CNC424591, CNC424592T (CNCI).

**Comments.** *Trissolcus saakowi* exhibits variability in the sculpture of the mesonotum and the punctuation and sculpture of the frons lateral to the antennal scrobe. The mesoscutum may be longitudinally striate throughout, reticulate anteriorly with longitudinal lines medially or posteriorly, or there may be no pronounced macrosculpture at all. The notaulus is typically very short, but may be indistinguishable from mesoscutal striation or even entirely absent. The holotype of *T. mentha* is smaller than most specimens of *T. saakowi*, which we attribute to development in a smaller host egg. It also exhibits less pronounced surface sculpture than the larger specimens of *T. saakowi* and the notauli are absent. Female specimens from Pakistan and China have dense punctuation on the lateral frons and striation that extends laterally from the antennal scrobe onto the ventrolateral frons. Two males from Pakistan have label data identical to that of the females, and have the sparse punctuation and absence of macrosculpture on the frons as do males from other regions.

### *Trissolcus scutellaris* (Thomson)

[http://bioguid.osu.edu/xbiol\\_concepts/3303](http://bioguid.osu.edu/xbiol_concepts/3303)

Figures 154–167; Morphbank<sup>51</sup>

### *Trissolcus choaspes* (Nixon) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3200](http://bioguid.osu.edu/xbiol_concepts/3200)

Morphbank<sup>52</sup>

### *Trissolcus evanescens* Kieffer syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3233](http://bioguid.osu.edu/xbiol_concepts/3233)

Morphbank<sup>53</sup>

*Trissolcus festivae* (Viktorov) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3235](http://bioguid.osu.edu/xbiot_concepts/3235)

Morphbank<sup>54</sup>

*Trissolcus ghorfii* (Delucchi & Voegle) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3240](http://bioguid.osu.edu/xbiot_concepts/3240)

Morphbank<sup>55</sup>

*Trissolcus histani* (Voegle) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3243](http://bioguid.osu.edu/xbiot_concepts/3243)

Morphbank<sup>56</sup>

*Trissolcus simoni* (Mayr) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3308](http://bioguid.osu.edu/xbiot_concepts/3308)

Morphbank<sup>57</sup>

*Trissolcus vassilliewi* (Mayr) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3328](http://bioguid.osu.edu/xbiot_concepts/3328)

Morphbank<sup>58</sup>

*Trissolcus volgensis* (Viktorov) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3332](http://bioguid.osu.edu/xbiot_concepts/3332)

Morphbank<sup>59</sup>

*Telenomus scutellaris* Thomson, 1860: 171 (original description); Mayr, 1879: 699, 706 (description, keyed).

*Telenomus Simoni* Mayr, 1879: 699, 705 (original description, keyed); Mayr, 1903: 398 (description of male, emendation of Mayr (1879)).

*Telenomus simonii* Mayr: Dalla Torre, 1898: 519 (emendation).

*Telenomus Vassilliewi* Mayr, 1903: 399 (original description).

*Trissolcus evanescens* Kieffer syn. n., 1904: 47 (original description); Kieffer, 1926: 126, 127 (description, keyed); Dessart, 1975: 9 (type information).

*Aphanurus Scutellaris* (Thomson): Kieffer, 1912: 76 (description, generic transfer).

*Trissolcus Evanescens* Kieffer: Kieffer, 1912: 20 (description).

*Trissolcus Simoni* (Mayr): Kieffer, 1912: 21 (description, generic transfer).

*Microphanurus scutellaris* (Thomson): Kieffer, 1926: 91, 99 (description, generic transfer, keyed).

*Microphanurus vassilliewi* (Mayr): Kieffer, 1926: 91, 97 (description, generic transfer, keyed).

*Trissolcus simoni* (Mayr): Kieffer, 1926: 126, 127 (description, keyed); Meier, 1940: 79, 80 (description, keyed); Rjachovskij, 1959: 82 (keyed); Safavi, 1968: 414 (keyed); Kozlov, 1968: 198, 204, 207, 210 (description, lectotype designation, synonymy, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 30 (keyed); Szabó, 1975: 266 (description, lectotype designation, keyed); Kozlov & Lê, 1977: 506 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 96 (description); Koçak & Kilinçer, 2003: 302, 303 (keyed, description); Ghahari, Buhl & Kocak, 2011: 597 (listed); Guz, Kocak & Kilinçer, 2013: 87 (description, phylogenetic relationships); Petrov, 2013: 325 (keyed).

*Microphanurus choaspes* Nixon, 1939: 130, 131 (original description, keyed).

*Microphanurus vassilievi* (Mayr): Meier, 1940: 80 (description, emendation, keyed).

*Trissoscelio evanescens* (Kieffer): Kelner-Pillault, 1958: 152 (type information, spelling error).

*Asolcus scutellaris* (Thomson): Masner, 1959: 379 (diagnosis, variation); Kozlov, 1963: 295 (diagnosis); Viktorov, 1964: 1013, 1018 (description, keyed); Szabó, 1976: 176 (keyed).

*Trissolcus (Micropghanurus) vassilievi* (Mayr): Rjachovskij, 1959: 83 (keyed).

*Asolcus ghorfi* Delucchi & Voegele: Delucchi, 1961: 44, 48 (description, keyed); Delucchi & Voegelé, 1961: 37 (original description); Voegelé, 1964: 28 (keyed); Voegelé, 1965: 111 (keyed); Baur, 2001: 67 (type information).

*Asolcus simoni reticulatus* Delucchi, 1961: 44, 49 (original description, keyed, synonymized by Kozlov (1968)); Kozlov, 1968: 210 (junior synonym of *Trissolcus simoni* (Mayr)); Baur, 2001: 67 (type information).

*Asolcus vassilievi* (Mayr): Delucchi, 1961: 44, 45 (description, keyed); Viktorov, 1964: 1013 (keyed); Voegelé, 1964: 28 (keyed); Voegelé, 1965: 111 (keyed).

*Asolcus simoni* (Mayr): Kozlov, 1963: 295 (diagnosis); Delucchi, 1963: 13 (diagnosis); Viktorov, 1964: 1013, 1016 (diagnosis, keyed); Voegelé, 1964: 28 (keyed); Voegelé, 1965: 111 (keyed).

*Asolcus reticulatus* Delucchi: Delucchi, 1963: 13 (diagnosis, changed to species status); Viktorov, 1964: 1015 (variation); Voegelé, 1964: 28 (keyed); Voegelé, 1965: 111, 112 (keyed).

*Asolcus festivae* Viktorov, 1964: 1013, 1020 (original description, keyed).

*Asolcus reticulatus reticulatus* (Delucchi): Viktorov, 1964: 1013 (keyed).

*Asolcus reticulatus volgensis* Viktorov, 1964: 1013, 1015 (original description, keyed).

*Asolcus histani* Voegele, 1965: 109, 111, 112 (original description, keyed).

*Trissolcus scutellaris* (Thomson): Viktorov, 1967: 91 (generic transfer, keyed); Safavi, 1968: 414 (keyed); Kozlov, 1968: 199, 210 (diagnosis, lectotype designation, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 510 (keyed); Kozlov, 1978: 634 (description); Kozlov & Kononova, 1983: 105 (description); Kononova, 1995: 95 (keyed); Petrov, 2013: 325 (keyed).

*Trissolcus reticulatus reticulatus* (Delucchi): Viktorov, 1967: 91 (generic transfer, keyed).

*Trissolcus reticulatus volgensis* (Viktorov): Viktorov, 1967: 91 (generic transfer, keyed).

*Trissolcus reticulatus* (Delucchi): Safavi, 1968: 414 (keyed).

*Trissolcus festivae* (Viktorov) syn. n.: Viktorov, 1967: 91 (generic transfer, keyed); Safavi, 1968: 414 (keyed); Kozlov, 1968: 199, 211 (description, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 510 (keyed); Kozlov, 1981: 187 (keyed); Kozlov & Kononova, 1983: 635 (description); Kozlov & Kononova, 1983: 107 (description); Kononova, 1995: 95 (keyed); Ghahari, Buhl & Kocak, 2011: 595 (listed); Guz, Kocak & Kilincer, 2013: 87 (description, phylogenetic relationships); Petrov, 2013: 325 (keyed).

*Trissolcus vassilievi* (Mayr) syn. n.: Viktorov, 1967: 91 (generic transfer, keyed); Safavi, 1968: 414 (keyed); Kozlov, 1968: 199, 208 (description, lectotype designation, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 508 (keyed); Kozlov, 1978: 634 (description); Kozlov & Kononova, 1983: 103 (de-

scription); Kononova, 1995: 95 (keyed); Koçak & Kilinçer, 2003: 302, 303 (keyed, description); Ghahari, Buhl & Kocak, 2011: 598 (listed); Guz, Kocak & Kilincer, 2013: 87 (description, phylogenetic relationships); Petrov, 2013: 325 (keyed).

*Trissolcus choaspes* (Nixon) syn. n.: Kozlov, 1968: 199, 210 (diagnosis, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 507 (keyed); Kozlov, 1978: 634 (description); Kozlov & Kononova, 1983: 102 (description); Johnson, 1992: 625 (catalogued, type information); Petrov, 2013: 325 (keyed); Kononova, 2014: 1423 (keyed); Kononova, 2015: 260 (keyed).

*Trissolcus ghorfii* (Delucchi & Voegele) syn. n.: Safavi, 1968: 414 (keyed); Voegelé, 1969: 149 (keyed); Kozlov & Lê, 1977: 507 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 99 (description).

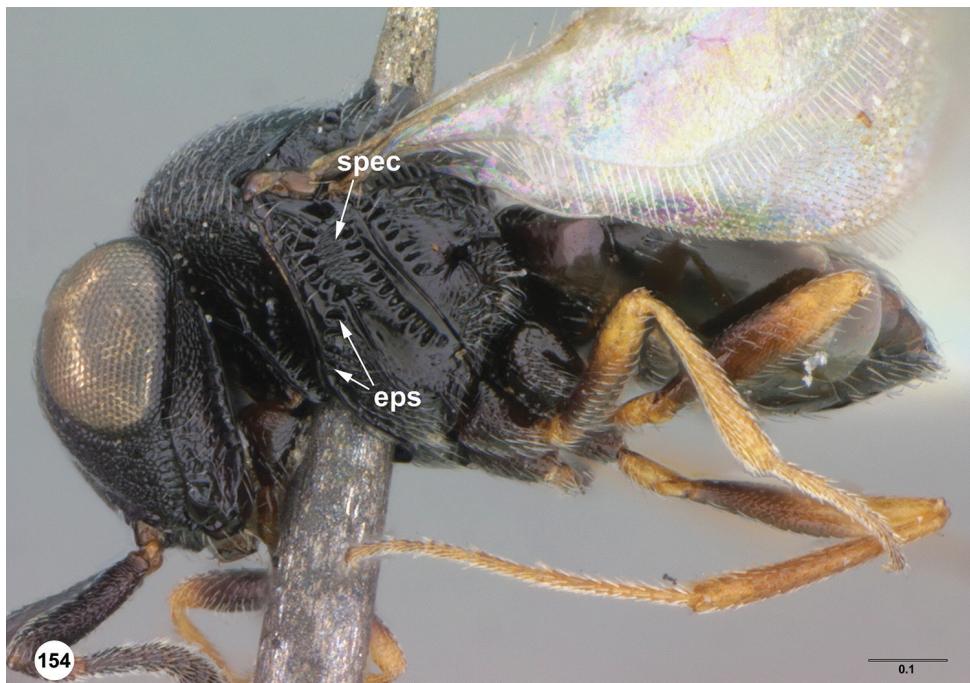
*Trissolcus histani* (Voegele) syn. n.: Safavi, 1968: 414 (keyed); Voegelé, 1969: 149 (keyed); Kozlov & Lê, 1977: 507 (keyed); Kozlov, 1978: 632 (description); Kozlov, 1981: 187 (keyed); Kozlov & Kononova, 1983: 99 (description).

*Trissolcus volgensis* (Viktorov) syn. n.: Safavi, 1968: 414 (keyed); Kozlov, 1968: 198 (change to species status, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 30 (keyed); Kozlov & Lê, 1977: 506 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 94 (description); Kononova, 1995: 95 (keyed); Petrov, 2013: 325 (keyed).

**Lectotype designation.** The specimen selected by Kozlov as the lectotype of *T. simoni* (NHMW 0004) was sent to Mayr by A. Saakow in 1901 according to Mayr (1903). Because this specimen was not part of the original type series it is ineligible to be designated as a lectotype. Szabó (1975) designated a lectotype from Mayr's syntype series, but did not indicate which of the three specimens on the pin was meant to be the lectotype. To stabilize the nomenclature, we here select one of these specimens (USNM-ENT01029022b, deposited in NHMW) as the lectotype.

**Description.** Female body length: 0.89–1.47 mm (n=11). Male body length: 0.91–1.06 mm (n=5). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: pale brown to dark brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: variably yellow to black. Color of A7–A11 in female: pale brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; rugose; areolate. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent; sparse; dense. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: areolate; absent; rugose. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: rugulose;



**Figures 154.** *Trissolcus scutellaris* female lectotype of *T. simoni* (USNMENT01059022b), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate; finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprähumerale sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileal sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete; well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by open crenulae; formed by small punctures. Mesopleural epicoxal sulcus: formed by open crenulae; formed by small punctures; present as a smooth furrow. Setation of posteroventral metapleuron: present. Sculpture of dorsal metapleural area: absent; smooth posteriorly, cells of metapleural sulcus extending posteriorly into horizontal striae. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa.

Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent; present. Macrosculpture of mesoscutum: rugulose; absent; longitudinally striate posteriorly, otherwise absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprhumeral sulcus: comprised of cells. Length of mesoscutal suprhumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: flat, appearing fused with lateral margin of mesoscutum. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout; absent; faintly present posteriorly. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: absent; present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: between 2 and 3 times as long as stigmal vein. Color of legs: coxae dark brown to black, femora yellow to brown, trochanters and distal tarsomeres sometimes brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

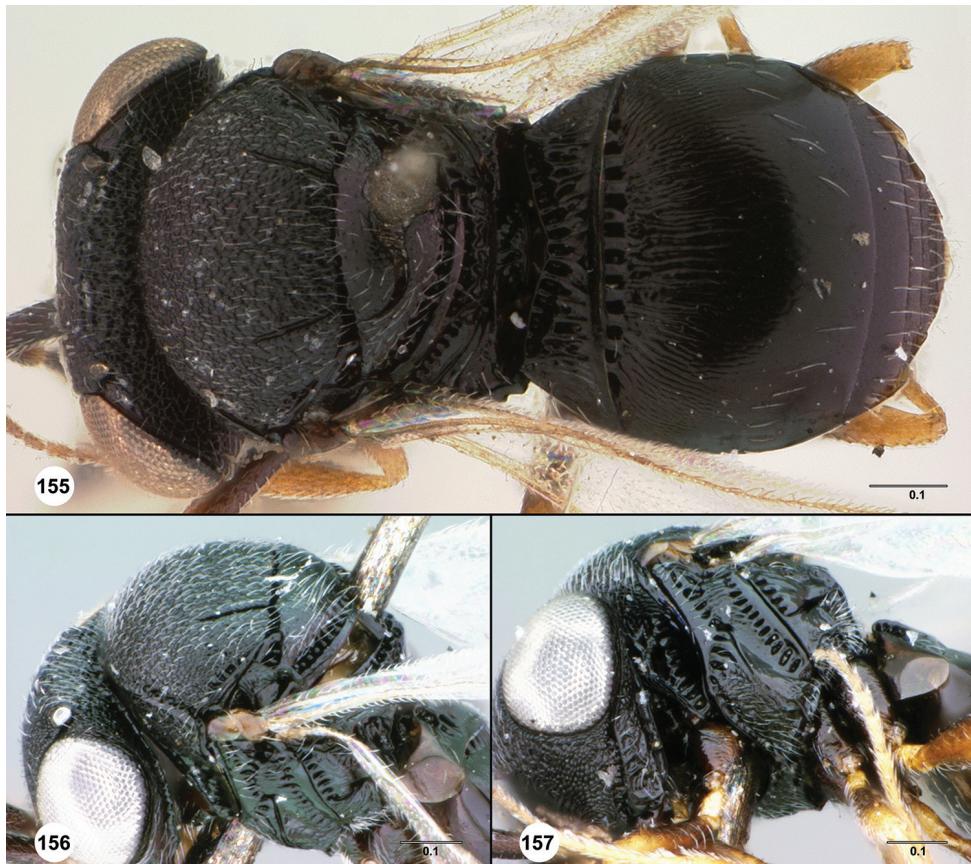
**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striae of T2: present throughout anterior half of tergite. Setation of T2: sparsely present in posterolateral corner. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: absent; present in anterior half of sternite not covered by laterotergites. Setation of S2: present posteromedially.

**Diagnosis.** Among Palearctic species in the *thyantae* group, *T. scutellaris* is closest to *T. vesta* from which it may be separated by composition of the mesoscutal suprhumeral sulcus, the shape of the vertex and setation of the metapleuron (see couplet 23 of the key).

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3308>

**Associations.** emerged from egg of *Eurygaster integriceps* Puton: [Hemiptera: Heteroptera: Pentatomoidea: Scutelleridae]; emerged from egg of *Eurygaster integriceps* Puton: [Hemiptera: Heteroptera: Pentatomoidea: Scutelleridae]; egg parasite of sunn pest : [Hemiptera: Heteroptera: Pentatomoidea]

**Material examined.** Paratypes of *T. choaspes*: **GERMANY**: 1 female, 1 male, OSUC 17713, USNMENT0119670 (BMNH). Holotype, female, *T. evanescens*: **AUSTRIA**: Wien (Vienna), Lainz, VII-1892, J. J. Kieffer, MNHN 0079 (deposited in MNHN). Paratypes of *T. festivae*: **RUSSIA**: 1 female, 1 male, USNMENT00916329, 00916335 (ZIN). Lectotype, female, *T. Simoni*: **PALEARCTIC**: no date, USNMENT01059022b (deposited in NHMW). Paralectotypes of *T. Simoni*: **PALEARCTIC**: 2 females, USNMENT01059022a, 01059022c (NHMW). Lectotype, female, *T. Vassiliewi*: **PALEARCTIC**: no date, G. Mayr, NHMW 0006 (deposited in

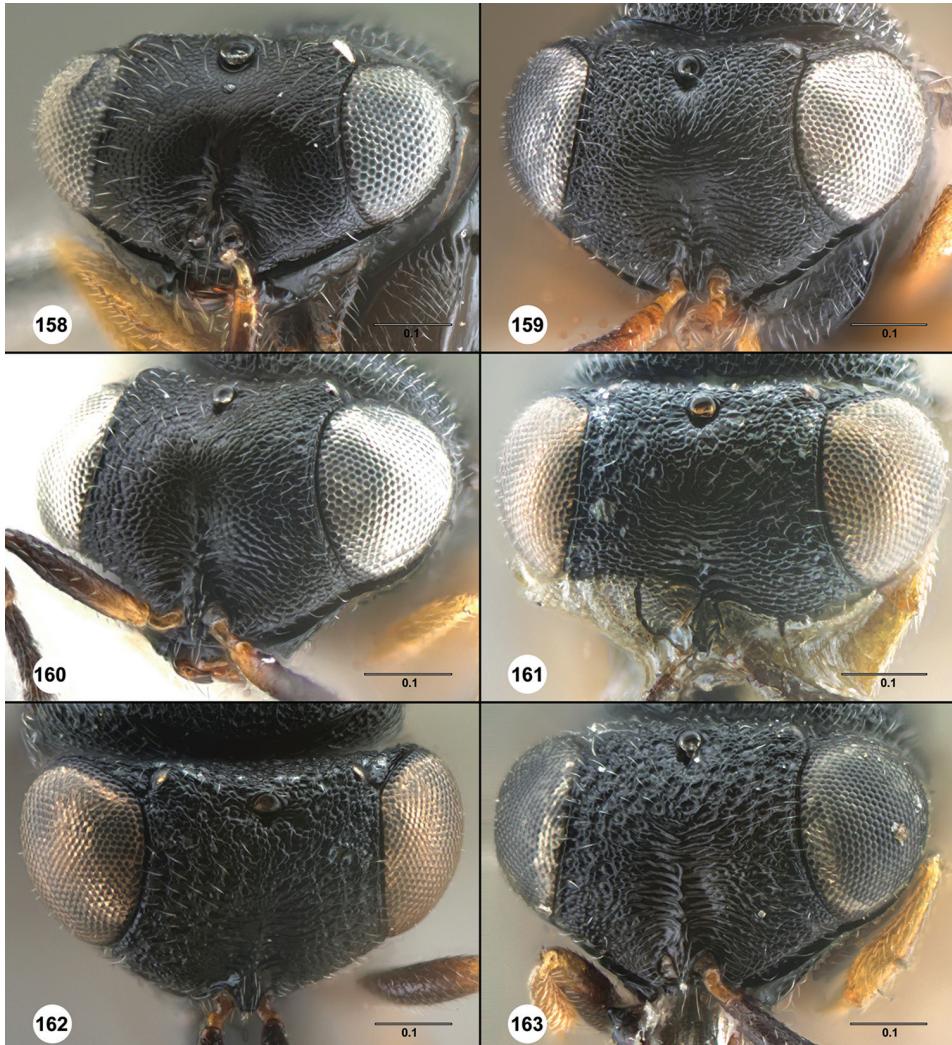


**Figures 155–157.** *Trissolcus scutellaris* 155 female lectotype of *T. simoni* (USNMENT01059022b), head, mesosoma, metasoma, dorsal view 156 female (NHMW 0004), head and mesosoma, dorsolateral view 157 female (NHMW 0004), head and mesosoma, ventrolateral view. Scale bars in millimeters.

NHMW). Paralectotypes of *T. Vassilliewi*: TURKMENISTAN: 3 females, 11 males, 7 unsexed, USNMENT00979609 (CUIC); USNMENT00916667–00916675, 01029319, 01059012–01059021 (NHMW). Paratypes of *T. volgensis*: RUSSIA: 1 female, 2 males, USNMENT00916328, 00916336, 00916337 (ZIN). Lectotype, female, *T. scutellaris*: SWEDEN: Smaland, no date, C. H. Boheman, NHRS-HEVA 000003871 (deposited in NHRS). Other material: (80 females, 15 males, 15 unsexed) BULGARIA: 1 female, USNMENT00872172 (BMNH). CROATIA: 3 females, USNMENT00872407, 00916590, 00916594 (BMNH). FRANCE: 10 females, 4 males, USNMENT00916039, 00916076–00916077, 00916086, 00916128, 00916133 (BMNH); USNMENT00896125, 00896230, 00896252–00896253, 00896289, 00896329, 00896335–00896336 (CNCI). GEORGIA: 8 females, 1 male, 10 unsexed, NHMW 0004, USNMENT00916656–00916666, 01059025, 01059029–01059034 (NHMW). GREECE: 3 females, USNMENT00916055, 00916065 (BMNH); USNMENT00896233 (CNCI). HUNGARY: 1 female,

OSUC 523954 (OSUC). **ITALY:** 3 females, 1 male, USNMENT00916091 (BMNH); USNMENT00896206–00896207, 00896209 (CNCI). **MACEDONIA:** 1 male, USNMENT00916595 (BMNH). **MOROCCO:** 13 females, 2 males, USNMENT00916999 (BMNH); USNMENT00896079–00896080, 00896083–00896086, 00896089–00896090, 00896094, 00896103, 00896106–00896107, 00896326, 00896337 (CNCI). **PORTUGAL:** 11 females, 1 male, USNMENT00916187, 00916189, 00916192–00916193, 00916195, 00916205, 00916218, 00916220, 00916227, 00916235, 00916240 (BMNH); USNMENT00896304 (CNCI). **RUSSIA:** 2 females, USNMENT00896069, 00896110 (CNCI). **SOUTH KOREA:** 7 females, OSUC 542399–542402, 542404–542406 (OSUC). **SPAIN:** 4 females, USNMENT00916162, 00916164 (BMNH); USNMENT00896323–00896324 (CNCI). **SWEDEN:** 3 females, 2 males, NHRS-HEVA 000003872 (NHRS); USNMENT00916069, 00916072, 00916301, 00916318 (BMNH). **SYRIA:** 1 female, OSUC 17708 (BMNH). **TURKEY:** 8 females, 3 males, USNMENT00675772–00675780, 00675965–00675966 (USNM). **UNKNOWN:** 2 females, 5 unsexed, USNMENT00979610 (CUIC); 01059010, 01059023–01059024, 01059026–01059028 (NHW).

**Comments.** Examination of specimens across a wide geographical range revealed that the characters used by previous authors to separate *T. volgensis* and *T. scutellaris*, (and *T. ghorfii* from *T. histani*) are variable. The microsculpture of the mesoscutellum varies from distinctly present throughout to entirely absent (Figures 164–167). Mesoscutal characters are similarly variable: posteromedial striation, a median mesoscutal carina, and raised rugulose sculpture vary along a continuous gradient from absent to moderately pronounced (Figures 164–167). Kozlov's 1968 key to Palearctic *Trissolcus* used the distance between the notaui (referred to as parapsidal grooves) to separate *T. ghorfii* and *T. histani*, specifically that the distance between the notaui (measured posteriorly) is more than twice the length of the notaui in the latter species. We examined a series of *T. histani* that was compared to the holotype and determined by Voegele, and in none of these specimens is this the case. The sculpture of the dorsal frons was not mentioned in the most recent keys by Kononova (2013), Petrov (2013) and Kozlov & Kononova (1983). Were it not for a continuous spectrum of variation, the sculptural development of the frons might separate *T. vassilliewi* from *T. scutellaris*. We present a plate of images (Figs 158–163) that illustrate the variation that occurs within this species, even within Mayr's type series of *T. simoni*. In the lectotype of *T. vassilliewi* the frons outside of the antennal scrobe has microsculpture but is otherwise smooth (as in Figure 158). In other specimens, smooth shallow punctures are present along the inner orbits (Fig. 160) or across the dorsal frons (Fig. 161). The punctures may be surrounded by slightly raised rugulae, or, as in the lectotypes of *T. simoni* and *T. volgensis*, the rugae are coarse (Figures 162–163). Similarly, the degree of transverse striation directly above the antennal scrobe varies from absent to pronounced. Other structures that vary within this species are the epomial carina, which is always present, but may be robustly or weakly indicated, and the median mesoscutal carina, which is either absent or weakly indicated.



**Figures 158–163.** *Trissolcus scutellaris* 158 male, paralectotype of *T. vassilliewi* (USNMENT01029319), head, anterior view 159 female (USNMENT00896094), head, anterior view 160 female (USNMENT00896103), head, anterolateral view 161 female paralectotype of *T. simoni* (USNMENT01059022a), head, anterior view 162 female lectotype of *T. simoni* (USNMENT01059022b), head, anterodorsal view 163 female (USNMENT01059024), head, anterodorsal view. Scale bars in millimeters

#### *Trissolcus semistriatus* (Nees von Esenbeck)

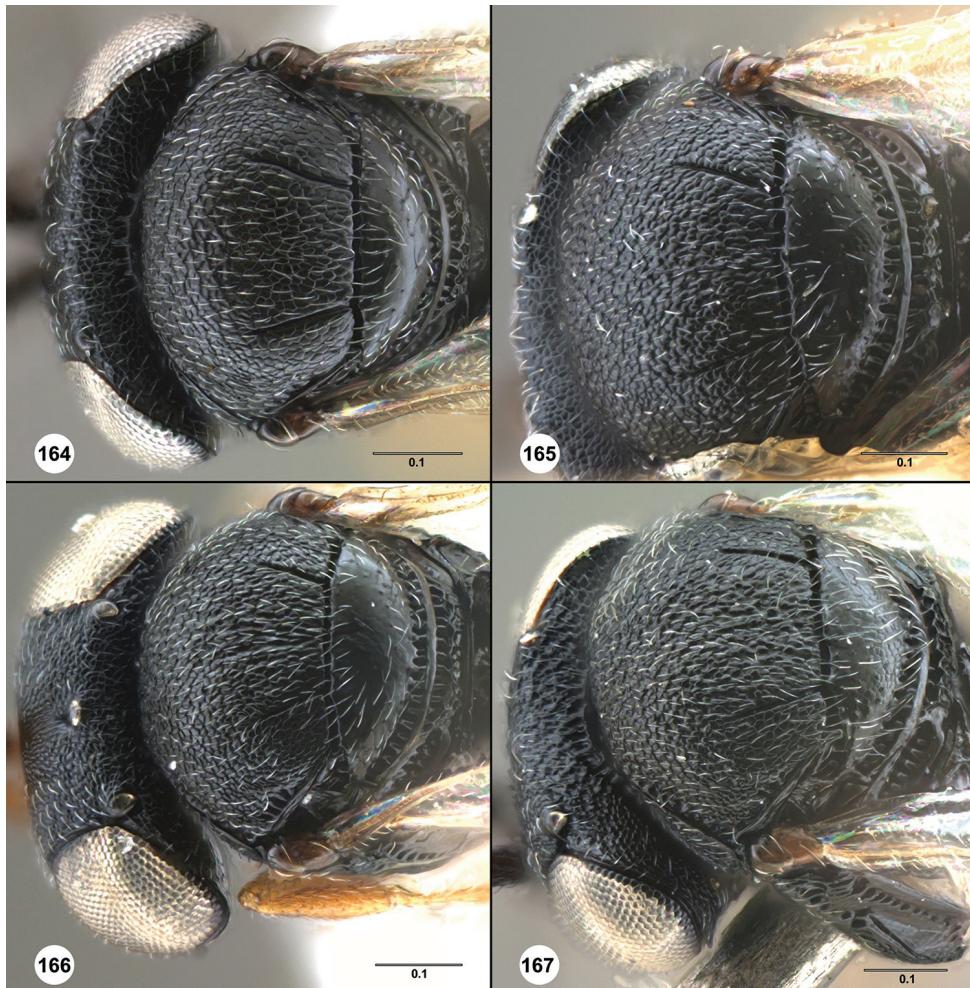
[http://bioguid.osu.edu/xbiol\\_concepts/3305](http://bioguid.osu.edu/xbiol_concepts/3305)

Figures 168–183; Morphbank<sup>60</sup>

#### *Trissolcus artus* Kozlov & Lê syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3185](http://bioguid.osu.edu/xbiol_concepts/3185)

Morphbank<sup>61</sup>



**Figures 164–167.** *Trissolcus scutellaris* 164 female (USNMENT00896335), head and mesosoma, dorsal view 165 female (USNMENT00872172), head and mesosoma, dorsal view 166 female (USNMENT00896206), head and mesosoma, dorsal view 167 female (USNMENT01059030), head and mesosoma, dorsal view. Scale bars in millimeters.

*Trissolcus djadetshko* (Rjachovskij) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3218](http://bioguid.osu.edu/xbiol_concepts/3218)

Morphbank<sup>62</sup>

*Trissolcus grandis* (Thomson) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3242](http://bioguid.osu.edu/xbiol_concepts/3242)

Morphbank<sup>63</sup>

*Trissolcus manteroi* (Kieffer) syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/3260](http://bioguid.osu.edu/xbiol_concepts/3260)

Morphbank<sup>64</sup>

*Trissolcus nigripedius* (Nakagawa) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3274](http://bioguid.osu.edu/xbiot_concepts/3274)

Morphbank<sup>65</sup>

Neotype designation. Watanabe (1951) determined specimen EIHU 0003 to be *T. nigripedius* based on the original description of Nakagawa. It is on this basis that we designate EIHU 0003 as the neotype for this species.

*Trissolcus pentatomae* (Rondani) syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3285](http://bioguid.osu.edu/xbiot_concepts/3285)

Morphbank<sup>66</sup>

*Teleas semistriatus* Nees von Esenbeck, 1834: 290 (original description); Ratzeburg, 1852: 182 (description).

*Telenomus frontalis* Thomson, 1860: 170 (original description, synonymized by Kozlov (1968)); Kozlov, 1968: 214 (junior synonym of *Trissolcus grandis* (Thomson)).

*Telenomus grandis* Thomson, 1860: 169 (original description).

*Telenomus nigripes* Thomson, 1860: 170 (original description, synonymized by Kozlov (1968)); Kozlov, 1968: 214 (junior synonym of *Trissolcus grandis* (Thomson)); Fergusson, 1984: 230 (lectotype designation).

*Telenomus Nigrita* Thomson, 1860: 172 (original description, synonymized by Kozlov (1968)); Kozlov, 1968: 214 (junior synonym of *Trissolcus grandis* (Thomson)).

*Telenomus ovulorum* Thomson, 1860: 171 (original description, synonymized by Mayr (1879)); Mayr, 1879: 704 (junior synonym of *Telenomus semistriatus* (Nees von Esenbeck)).

*Telenomus semistriatus* (Nees von Esenbeck): Thomson, 1860: 171 (description, generic transfer); Mayr, 1879: 699, 701, 704 (description, synonymy, keyed).

*Teleas (?) Pentatomae* Rondani: Rondani, 1874: 135 (nomen nudum).

*Teleas pentatomae* Rondani, 1877: 199 (original description).

*Telenomus pentatomae* (Rondani): Dalla Torre, 1898: 518 (generic transfer).

*Telenomus nigritus* Thomson: Dalla Torre, 1898: 517 (emendation).

*Asolcus nigripedius* Nakagawa, 1900: 17 (original description); Watanabe, 1951: 21, 26 (description, type information, keyed); Watanabe, 1954: 22 (keyed).

*Telenomus Manteroi* Kieffer, 1909: 268 (original description).

*Aphanurus Frontalis* (Thomson): Kieffer, 1912: 81 (description, generic transfer).

*Aphanurus Grandis* (Thomson): Kieffer, 1912: 76 (description, generic transfer).

*Aphanurus Nigrita* (Thomson): Kieffer, 1912: 79 (description, generic transfer).

*Aphanurus nigripes* (Thomson): Kieffer, 1912: 75 (description, generic transfer).

*Aphanurus Semistriatus* (Nees von Esenbeck): Kieffer, 1912: 74 (description, generic transfer).

*Liophanurus Pentatomae* (Rondani): Kieffer, 1912: 69 (description, generic transfer).

*Aphanurus Manteroi* (Kieffer): Kieffer, 1912: 84 (description, generic transfer).

*Liophanurus pentatomae* (Rondani): Kieffer, 1926: 71 (description).

*Microphanurus frontalis* (Thomson): Kieffer, 1926: 91, 103 (description, generic transfer, keyed).

- Microphanurus grandis* (Thomson): Kieffer, 1926: 91, 99 (description, generic transfer, keyed); Debauche, 1947: 256 (diagnosis).
- Microphanurus nigripes* (Thomson): Kieffer, 1926: 91, 98 (description, generic transfer, keyed).
- Microphanurus nigritus* (Thomson): Kieffer, 1926: 91, 100 (description, generic transfer, keyed).
- Microphanurus manteroi* (Kieffer): Kieffer, 1926: 91, 102 (description, generic transfer, keyed); Boldaruyev, 1969: 163, 170 (description, keyed).
- Microphanurus semistriatus* (Nees von Esenbeck): Kieffer, 1926: 91, 97 (description, generic transfer, keyed); Nixon, 1939: 131, 134 (description, keyed); Meier, 1940: 80 (description, keyed); Rjachovskij, 1959: 84 (keyed).
- Microphanurus alexeevi* Meier, 1949: 114 (original description, not seen: reference from Kozlov (1963), synonymized with *Asolcus semistriatus* (Nees von Esenbeck) by Kozlov (1963)); Rjachovskij, 1959: 83 (keyed); Kozlov, 1963: 295 (junior synonym of *Asolcus semistriatus* (Nees von Esenbeck)).
- Microphanurus schtepelnikovae* Meier, 1949: 114 (original description, not seen: reference from Kozlov (1963), synonymized with *Asolcus semistriatus* (Nees von Esenbeck) by Kozlov (1963)); Kozlov, 1963: 295 (junior synonym of *Asolcus semistriatus* (Nees von Esenbeck)).
- Asolcus semistriatus* (Nees von Esenbeck): Masner, 1959: 376 (diagnosis, variation); Delucchi, 1961: 44, 59 (diagnosis, taxonomic status, keyed); Kozlov, 1963: 295 (synonymy); Viktorov, 1964: 1013, 1020 (variation, keyed); Kochetova, 1966: 558 (description of immature stages); Javahery, 1968: 419 (keyed); Voegelé, 1969: 150 (keyed); Szabó, 1976: 176, 178 (description, neotype designation, keyed).
- Microphanurus djadetshko* Rjachovskij, 1959: 84, 87 (original description, keyed).
- Microphanurus stschepe tilnicovae* Meier: Rjachovskij, 1959: 83 (keyed, spelling error).
- Asolcus grandis* (Thomson): Delucchi, 1961: 44, 60 (description, keyed); Voegelé, 1964: 28 (keyed); Javahery, 1968: 419 (keyed); Voegelé, 1969: 150 (keyed).
- Asolcus nigribasalis* Voegelé, 1962: 155 (original description); Voegelé, 1964: 28 (keyed); Voegelé, 1965: 96, 108 (variation, diagnosis, keyed); Voegelé, 1969: 151 (junior synonym of *Asolcus djadetshko* (Rjachovskij)).
- Asolcus djadetshko* (Rjachovskij): Viktorov, 1964: 1015, 1021 (description, generic transfer, removed from synonymy with *Telenomus scutellaris* Thomson, keyed).
- Trissolcus nigripedius* (Nakagawa) syn. n.: Masner, 1964: 146 (generic transfer); Ryu & Hirashima, 1984: 37, 56 (description, keyed); He et al., 2004: 321 (description).
- Trissolcus djadetshko* (Rjachovskij): Viktorov, 1967: 91 (generic transfer, keyed); Saffavi, 1968: 415 (keyed); Kozlov, 1968: 200 (keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 512 (keyed); Kozlov, 1978: 636 (description); Kozlov, 1981: 187 (keyed); Kozlov & Kononova, 1983: 115 (description); Kononova, 1995: 96 (keyed); Koçak & Kilinçer, 2000: 171 (description, diagnosis, new distribution record for Turkey); Koçak & Kilinçer, 2003: 303, 313 (keyed, description); Ghahari, Buhl & Kocak, 2011: 595 (listed); Petrov, 2013: 326 (keyed).

*Trissolcus grandis* (Thomson): Viktorov, 1967: 91 (generic transfer, keyed); Safavi, 1968: 416 (keyed); Kozlov, 1968: 200, 214 (description, lectotype designation, synonymy, keyed); Viggiani & Mineo, 1974: 156, 160, 161 (description, keyed); Kozlov & Lê, 1977: 512 (synonymy, keyed); Kozlov, 1978: 636 (description); Kozlov, 1981: 187 (keyed); Kozlov & Kononova, 1983: 110 (description); Kononova, 1995: 96 (keyed); Doganlar, 2001: 112 (description); Koçak & Kilinçer, 2003: 302, 307 (keyed, description); Buhl & O'Connor, 2010: 154 (distribution); Ali, 2011: 10 (keyed); Ghahari, Buhl & Kocak, 2011: 596 (host association, listed); Guz, Kocak & Kilincer, 2013: 87 (description, phylogenetic relationships); Petrov, 2013: 326 (keyed).

*Trissolcus manteroi* (Kieffer) syn. n.: Kozlov, 1968: 199 (keyed); Fabritius, 1972: 31 (keyed); Bin, 1974: 462 (type information); Kozlov & Lê, 1977: 514 (keyed); Kozlov, 1978: 636 (description); Kozlov & Kononova, 1983: 117 (description); Koçak & Kilinçer, 2000: 174 (description, diagnosis, new distribution record for Turkey); Koçak & Kilinçer, 2003: 302, 310 (keyed, description of female); Koçak & Kodan, 2006: 41 (description of male); Ghahari, Buhl & Kocak, 2011: 596 (listed); Kononova, 2014: 1424 (keyed); Kononova, 2015: 262 (keyed).

*Asolcus nixomartini* Javahery, 1968: 419, 429 (original description, keyed, synonymized by Kozlov & Lê (1977)); Kozlov & Lê, 1977: 512 (junior synonym of *Trissolcus grandis* (Thomson)).

*Trissolcus semistriatus* (Nees von Esenbeck): Safavi, 1968: 416 (keyed); Kozlov, 1968: 200 (keyed); Fabritius, 1972: 31 (keyed); Kozlov & Lê, 1977: 512 (keyed); Kozlov, 1978: 636 (description); Kozlov & Kononova, 1983: 113 (description); Graham, 1984: 92 (variation); Kononova, 1995: 96 (keyed); Koçak & Kilinçer, 2003: 302, 305 (keyed, description); Ali, 2011: 10 (keyed); Ghahari, Buhl & Kocak, 2011: 597 (listed); Guz, Kocak & Kilincer, 2013: 87 (description, phylogenetic relationships); Petrov, 2013: 326 (keyed).

*Asolcus silwoodensis* Javahery, 1968: 419, 425 (original description, keyed, synonymized by Kozlov & Lê (1977)); Kozlov & Lê, 1977: 512 (junior synonym of *Trissolcus grandis* (Thomson)).

*Asolcus djadestshko* (Rjachovskij): Voegelé, 1969: 151 (synonymy, keyed, spelling error).

*Trissolcus pentatomae* (Rondani): Bin, 1974: 463 (generic transfer, lectotype designation).

*Trissolcus artus* Kozlov & Lê syn. n., 1977: 512, 519 (original description, keyed); Kozlov, 1978: 636 (description); Kozlov & Kononova, 1983: 112 (description); Kononova, 1995: 96 (keyed).

*Trissolcus nigribasalis* (Voegelé): Kozlov & Lê, 1977: 518 (keyed); Kozlov, 1978: 637 (description); Kozlov & Kononova, 1983: 124 (description).

*Trissolcus nigripes* (Thomson): Fergusson, 1978: 120 (generic transfer).

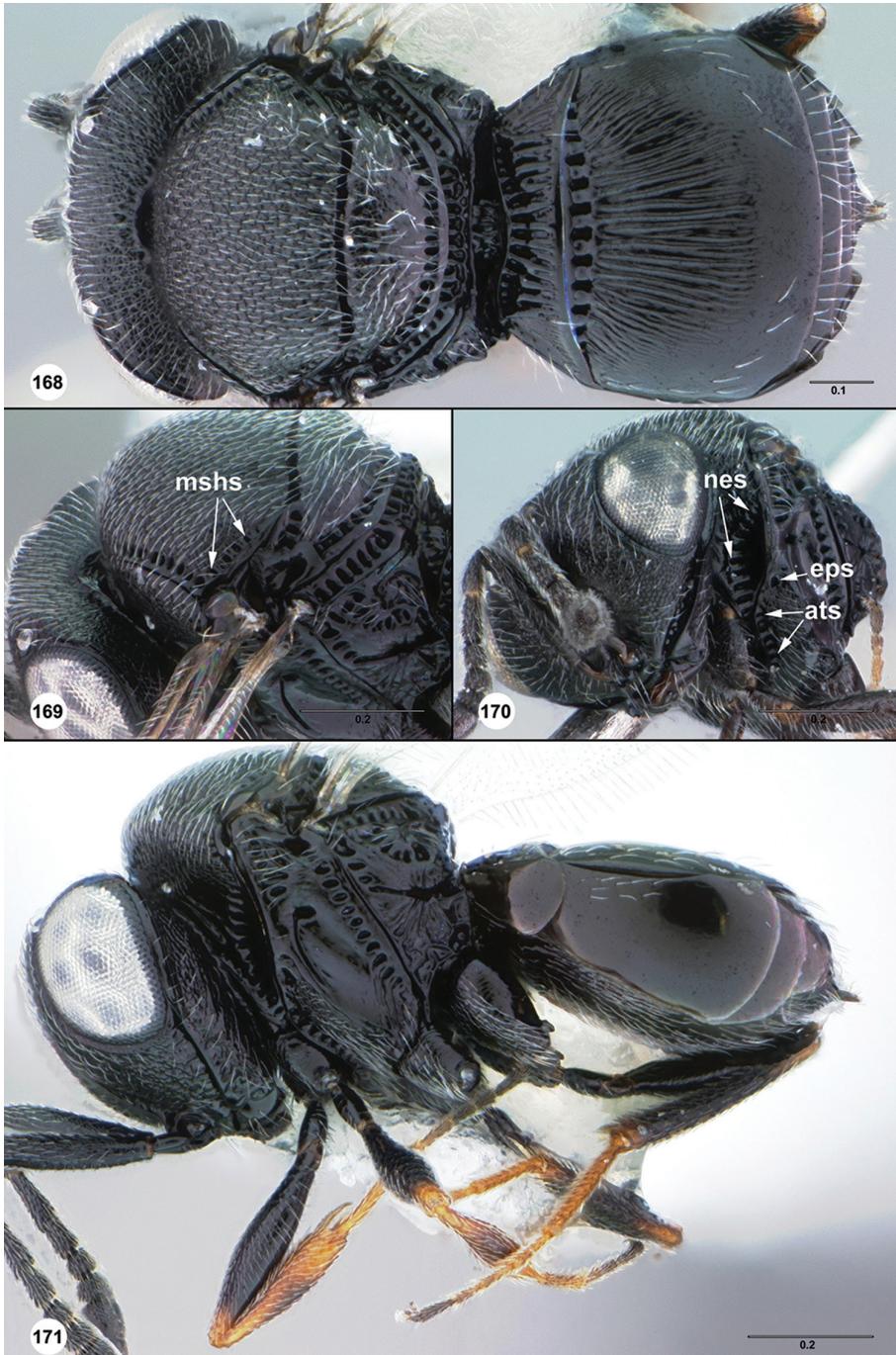
*Trissolcus nixomartini* (Javahery): Fergusson, 1978: 120 (generic transfer); Fergusson, 1984: 230 (type information).

*Trissolcus silwoodensis* (Javahery): Fergusson, 1978: 120 (generic transfer); Fergusson, 1984: 230 (type information).

**Description.** Female body length: 0.99–1.33 mm (n=20). Male body length: 0.94–1.20 mm (n=20). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: dark brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: variably yellow to black. Color of A7–A11 in female: pale brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent; present. Shape of ventral gena in lateral view: narrow. Genal carina: present only at base of mandible. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: sparse; moderately dense. Punctuation of lateral frons: absent; sparse. Sculpture directly ventral to preocellar pit: dorsoventrally fluted. Macrosculpture of lateral frons: horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 3; 2. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: distinctly separate from mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: reticulate anteriorly, becoming longitudinally strigose posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: absent. Shape of dorsal margin of anterior lobe of axillar crescent: acute. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area



**Figures 168–171.** *T. semistriatus* **168** female (USNMENT01109059), head, mesosoma, metasoma, dorsal view **169** female (USNMENT01109059), head and mesosoma, dorsolateral view **170** female neotype (NHMW 0007A), head and mesosoma, anteroventral view **171** female (USNMENT01109059), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: absent. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown to black, femora and tibia yellow to dark brown, trochanters and tarsi yellow to pale brown. Anteromedial portion of metasomal depression: punctate or crenulate.

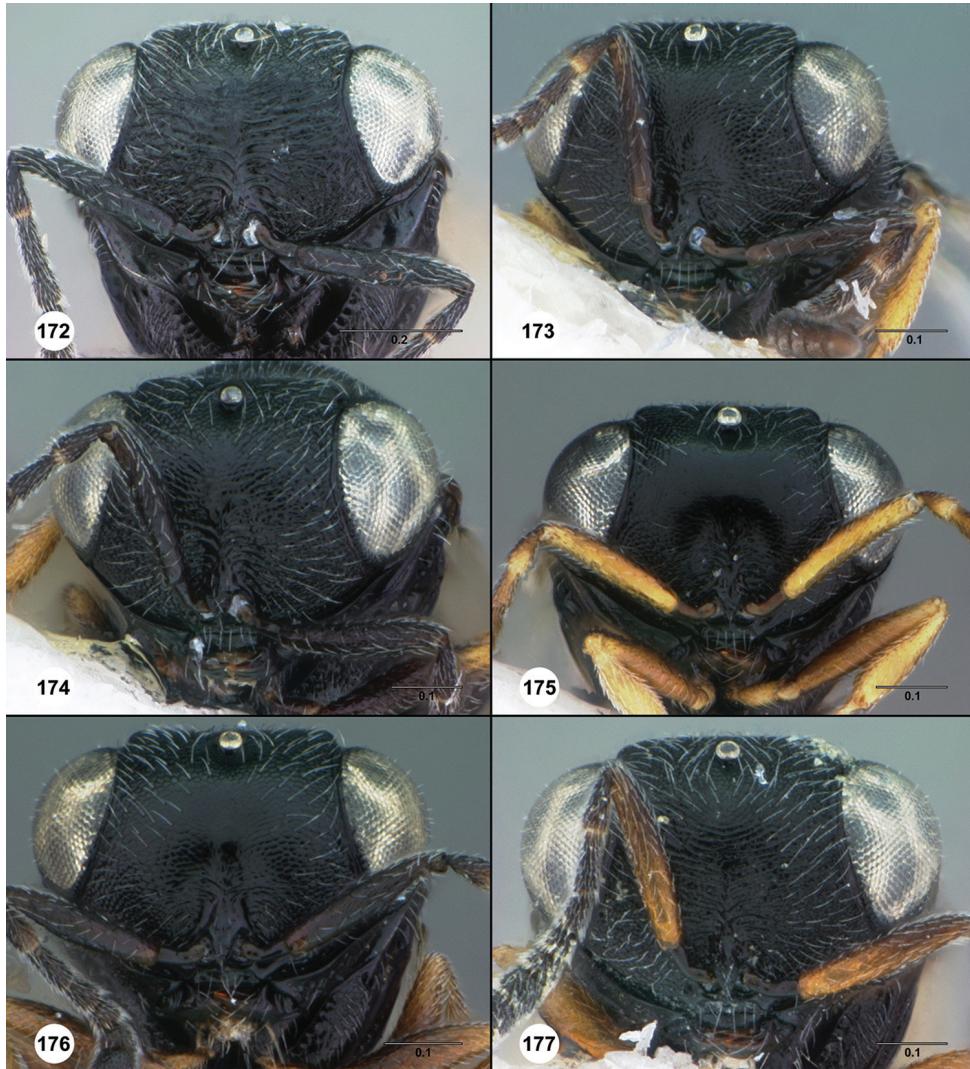
**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 1. Setation of laterotergite 1: absent; present. Longitudinal striation of T2: present in anterior two-thirds of tergite. Setation of T2: present in a transverse line and along lateral margin. Setation of laterotergite 2: present.

**Diagnosis.** *Trissolcus semistriatus* is most similar to *T. basalis* from which it can be separated by the complete netrion sulcus, distinct and regular cells of the postacetabular sulcus and, in most cases, by the distinct cells of the mesoscutal humeral sulcus (always indicated by a smooth furrow in *T. basalis* and very rarely so in *T. semistriatus*). It is also similar to *T. elasmuchae* from which it can be separated by the absence of a well defined paracoxal sulcus in the ventral portion of the metapleuron.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3305>

**Comments.** The immense geographical distribution of *Trissolcus semistriatus*, in combination with its capacity for variation in size, color, and surface sculpture (Figures 172–183) have resulted in numerous redescriptions of this species. It is by examining specimens across the Palearctic land mass that we have been able to document intermediate forms that connect phenotypes previously treated as discreet. The general trend is that specimens from higher latitudes tend to be larger, darker, and have more robust sculpture on the frons. The sculpture on the frons in *Trissolcus semistriatus*, *T. basalis* and *T. elasmuchae* have similar patterns when rugae are present and they share the same spectrum of sculptural development, varying from coarsely rugose to absent. Preliminary results on a study of phenotypic plasticity in *Trissolcus* indicate that color and size are directly influenced by temperature and host species. Species with distributions as large as *T. semistriatus*, *T. basalis*, and *T. elasmuchae* are likely to be oligophagous or polyphagous, increasing the degree of phenotypic variation that can occur.

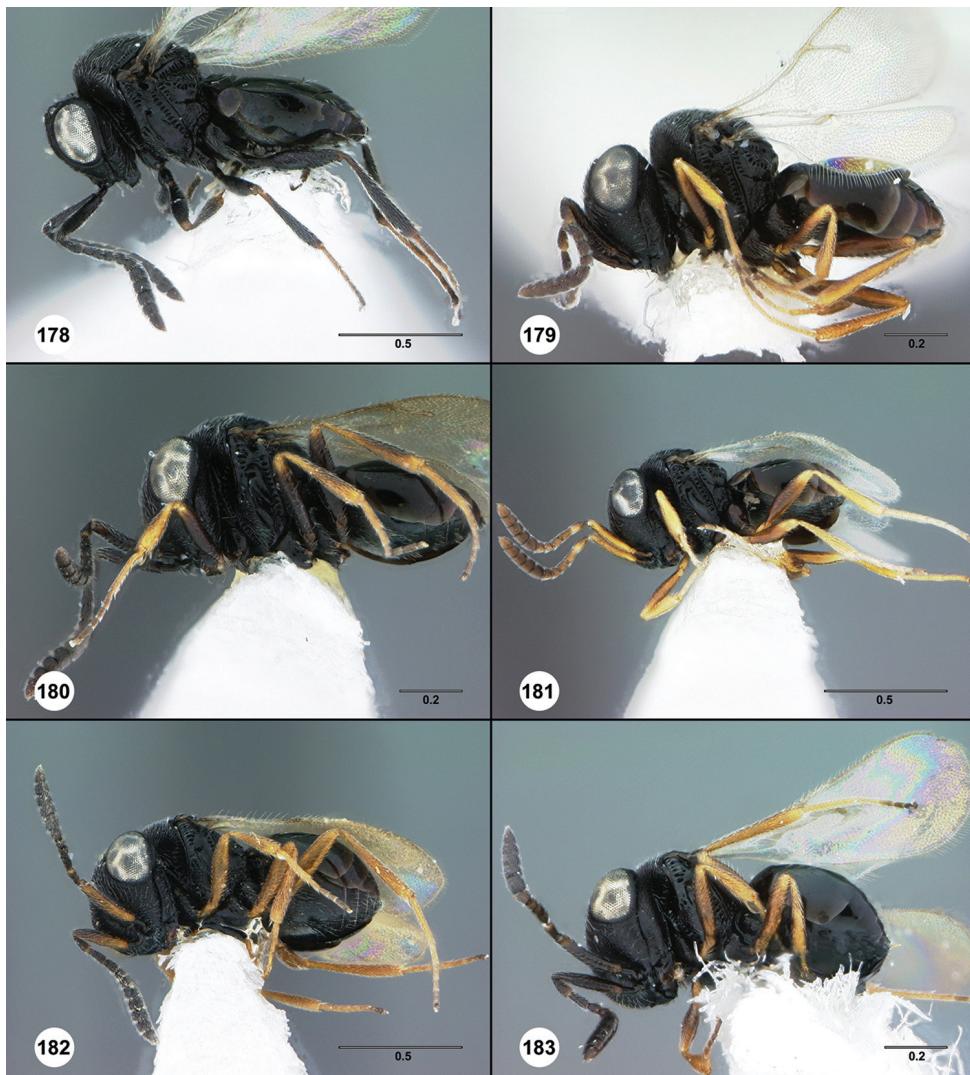
**Material examined.** Neotype, female, *T. semistriatus*: PALEARCTIC: no date, NHMW 0007A (deposited in NHMW). Neoparatype: PALEARCTIC: 1 female, NHMW 0007B (NHMW). Holotype, female, *T. artus*: RUSSIA: Altay Terr., Kosh-Agach, 6.VII.1964, Kozlov, ZMAS 0119 (deposited in ZIN). Paratype of *T. artus*: RUSSIA: 1 female, USNMENT00916276 (ZIN). Paratypes of *T. djadetshko*: UKRAINE: 5 females, USNMENT00954012–00954016 (ZIN). Lectotype, female, *T. grandis*: SWEDEN: Dalarna (Dalecarlia), no date, C. H. Boheman, NHRS-HEVA 000003869 (deposited in NHRS). Holotype, female, *T. manteroi*: ITALY: Liguria, Genoa, 9.VIII.1997, G. Mantero, MCSN 0013 (deposited in MCSN). Lectotype, male, *T. pentatomae*: ITALY: no date, MZUF 0001 (deposited in MZUF). Other material: (417 females, 86 males, 7 unsexed) AUSTRIA: 18 females, USNMENT00916100–00916104,



**Figures 172–177.** *T. semistriatus* **172** female (USNMENT00896318), head, anterior view **173** female (USNMENT00896062), head, anterior view **174** female (USNMENT00896262), head, anterior view **175** female (USNMENT00896226), head, anterior view **176** female (USNMENT00896205), head, anterior view **177** female (USNMENT00896254), head, anterior view. Scale bars in millimeters.

00916290–00916292, 00916295–00916299, 00916320–00916324 (BMNH). **BULGARIA:** 2 females, USNMENT00872173, 00872174 (BMNH). **CHINA:** 19 females, UCRC ENT 142621, 142628, 142631, 142641, 142649, 142657, 142666, 142672, 142677, 142707, 142737, 142744, 143823, 143841, 143857, 143859, 143882, 143909 (UCRC); USNMENT00979424 (USNM). **CROATIA:** 11 females, 1 male, USNMENT00872405–00872406, 00872408–00872409, 00916588–00916589, 00916598 (BMNH); USNMENT00896155–00896156 (CNCI);

USNMENT00675788–00675790 (USNM). **CYPRUS:** 69 females, 6 males, USNMENT00916500–00916513, 00916515–00916523, 00916525, 00916527–00916528, 00916530–00916549, 00916551–00916552, 00916554, 00916557–00916579, 00916581, 00916583–00916584 (BMNH). **CZECH REPUBLIC:** 2 females, USNMENT00896164, 00896217 (CNCI). **FRANCE:** 66 females, 14 males, 1 unsexed, USNMENT00916074, 00916078, 00916080, 00916082, 00916087–00916089, 00916115, 00916117, 00916123, 00916126, 00916130, 00916136, 00916139, 00916141, 00916148, 00916150 (BMNH); USNMENT00896066, 00896123–00896124, 00896126–00896130, 00896132–00896133, 00896231–00896232, 00896235–00896236, 00896241–00896246, 00896251, 00896254–00896259, 00896261–00896288, 00896290–00896292, 00896294, 00896298–00896299, 00896302–00896303, 00896338 (CNCI). **GREECE:** 16 females, 2 males, USNMENT00916054, 00916056–00916058, 00916062, 00916064, 00916499, 00916585–00916586 (BMNH); USNMENT00896061–00896065, 00896131, 00896247–00896248, 00896250 (CNCI). **HUNGARY:** 7 females, USNMENT00896211–00896214, 00896219 (CNCI); OSUC 523955–523956 (OSUC). **IRAN:** 11 females, 6 males, 2 unsexed, USNMENT00916475–00916476, 00916480, 00916482, 00916485, 00916487 (BMNH); OSUC 145630, USNMENT00896225–00896229, 00896238–00896240 (CNCI); OSUC 556692–556693 (HMIM); OSUC 556691, 76299 (OSUC). **IRAQ:** 4 females, USNMENT00916488–00916491 (BMNH). **IRELAND:** 1 female, 1 unsexed, USNMENT00916138, 00916425 (BMNH). **ISRAEL:** 1 female, USNMENT00896141 (CNCI). **ITALY:** 17 females, USNMENT00916042, 00916092–00916099, 00916285, 00916597 (BMNH); USNMENT00896201–00896203, 00896205, 00896208, 00896220 (CNCI). **JAPAN:** 3 females, OSUC 542382 (CNCI); OSUC 70461–70462 (OSUC). **KAZAKHSTAN:** 1 female, USNMENT00916599 (BMNH). **LEBANON:** 1 female, USNMENT00916602 (BMNH). **MACEDONIA:** 1 female, USNMENT00916596 (BMNH). **MOROCCO:** 18 females, 10 males, 1 unsexed, USNMENT00916000–00916009, 00916990–00916994, 00916998 (BMNH); USNMENT00896087, 00896093, 00896333 (CNCI); USNMENT01059170–01059172, 01059174–01059177, 01059179–01059181 (MNHN). **PORTUGAL:** 21 females, 2 males, 1 unsexed, USNMENT00916170, 00916172–00916175, 00916177, 00916185, 00916190–00916191, 00916201–00916203, 00916206, 00916210–00916213, 00916215–00916217, 00916223–00916234, 00916236–00916237 (BMNH). **RUSSIA:** 2 females, USNMENT00896111 (CNCI); UCRC ENT 133647 (UCRC). **SERBIA:** 4 females, 3 males, USNMENT00916592 (BMNH); USNMENT00675782–00675787 (USNM). **SLOVAKIA:** 1 female, USNMENT00916603 (BMNH). **SOUTH KOREA:** 2 males, OSUC 542387, 542390 (OSUC). **SPAIN:** 16 females, 1 male, USNMENT00916151, 00916154–00916157, 00916159–00916161, 00916166, 00916168–00916169, 00916179 (BMNH); USNMENT00896153, 00896320–00896322, 00896325 (CNCI). **SWEDEN:** 10 females, 5 males, USNMENT00916046–00916047, 00916051–00916053, 00916067–00916068, 00916070, 00916305–00916311 (BMNH); USNMENT00896067



**Figures 178–183.** *T. semistriatus* 178 female (USNMENT00896318), head, mesosoma, metasoma, lateral view 179 female (USNMENT00896062), head, mesosoma, metasoma, lateral view 180 female (USNMENT00896262), head, mesosoma, metasoma, lateral view 181 female (USNMENT00896226), head, mesosoma, metasoma, ventrolateral view 182 female (USNMENT00896254), head, mesosoma, metasoma, ventrolateral view 183 female (USNMENT00896205), head, mesosoma, metasoma, ventrolateral view. Scale bars in millimeters.

(CNCI). **SWITZERLAND:** 20 females, 4 males, USNMENT00896297 (CNCI); 00916952–00916972, 01109058–01109059 (USNM). **TURKEY:** 49 females, 27 males, OSUC 17730, USNMENT00916032–00916034, 00916071 (BMNH); USNMENT00896190–00896193, 00896195–00896199, 00896223, 00896319 (CNCI); USNMENT00675791–00675810, 00675812–00675846, 00675980–

00675984 (USNM). **UNITED KINGDOM:** 26 females, 3 males, 1 unsexed, USNMENT00916246, 00916410, 00916419, 00916422–00916424, 00916429, 00916431–00916437, 00916439–00916441, 00916444–00916454, 00916456 (BMNH); USNMENT00896318 (CNCI).

***Trissolcus stoicus* (Nixon)**

[http://bioguid.osu.edu/xbiol\\_concepts/3312](http://bioguid.osu.edu/xbiol_concepts/3312)

Figures 184–188; Morphbank<sup>67</sup>

*Microphanurus stoicus* Nixon, 1938: 124, 135 (original description, keyed); Nixon, 1943: 138 (keyed); Risbec, 1950: 569 (keyed).

*Trissolcus stoicus* (Nixon): Masner, 1965: 128 (type information, generic transfer).

*Telenomus stoicus* (Nixon): Lê, 1981: 13 (generic transfer, keyed).

**Description.** Female body length: 0.93–1.11 mm (n=2). Body color: head, mesosoma, and metasoma black.

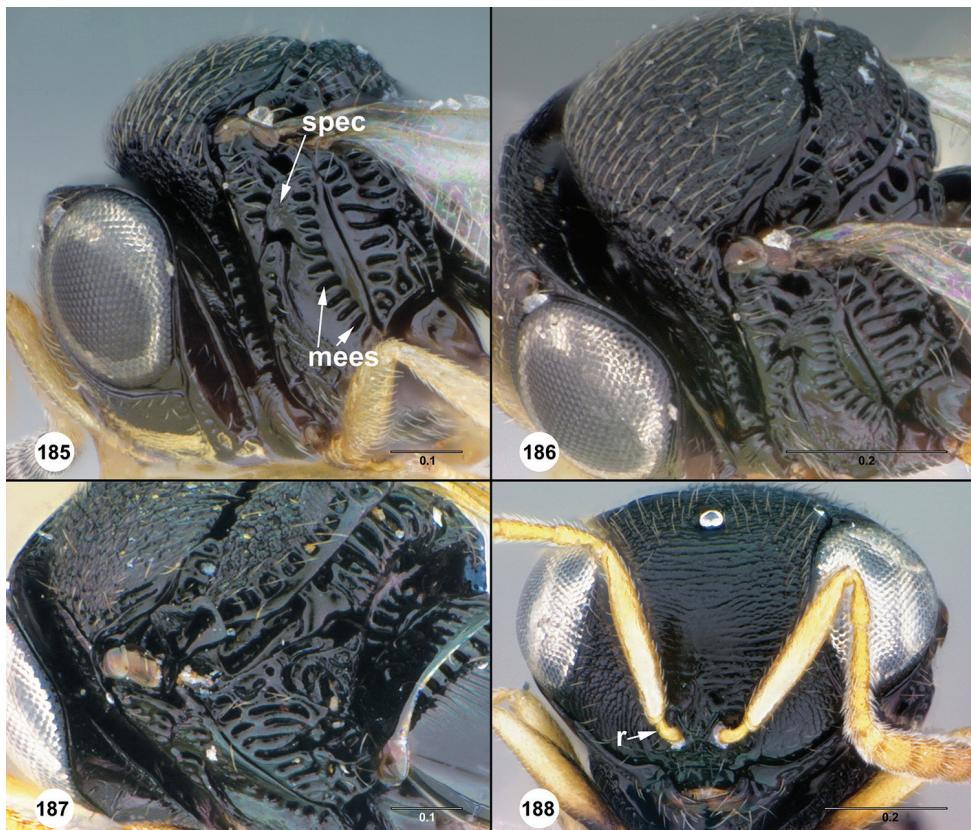
**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow. Color of A7–A11 in female: pale brown; yellow, becoming darker distally. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: weakly transversely strigose. Preocellar pit: absent. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent. Macrosculpture of lateral frons: weakly horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present medially, absent laterally. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: posterior half of pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileural sulcus: present. Speculum: dorsoventrally bisected by deep furrow. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete. Sculpture of femoral depression: rugulose and pustulate along ventral half of mesopleural carina. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of femoral depression: absent. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral



**Figure 184.** *Trissolcus stoicus*, female (OSUC 285262), head, mesosoma, metasoma, dorsal view. Scale bar in millimeters.

mesopleuron: coarsely rugose. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: present. Sculpture of dorsal metapleural area: cells of metapleural sulcus extending posteriorly into rugae. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indicated by a line of elongate cells. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: present. Macrosculpture of mesoscutum: coarsely areolate. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprakumeral sulcus: comprised of cells. Length of mesoscutal suprakumeral sulcus: about half the length of anterolateral edge of mesoscutum. Notaulus: absent; indicated only at posterior margin of mesoscutum. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: rugose throughout. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent; present. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: mostly smooth, with furrow along ventral margin. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about 1.5 times as long as stigmal vein. Color of legs: coxae dark brown to black, trochanters and femora yellow to brown, elsewhere yellow to orange. Anteromedial portion of metasomal depression: antero-posteriorly striate.



**Figures 185–188.** *Trissolcus stoicus* 185 female holotype (B.M. TYPE HYM. 9.314), head and mesosoma, lateral view 186 female holotype (B.M. TYPE HYM. 9.314), head and mesosoma, dorsolateral view 187 female (OSUC 285262), mesosoma, posterolateral view 188 female (OSUC 285262), head, anterior view. Scale bars in millimeters.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: present. Longitudinal striation of T2: present laterally, absent medially. Setation of T2: present at posterior termination of striae. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present laterally and in anterior half of median third. Setation of S2: present posteromedially.

**Diagnosis.** *Trissolcus stoicus* can be distinguished from most species treated here by having 6 clypeal setae and a complete hyperoccipital carina, a combination which is otherwise known to us only from *T. carinifrons*. These are otherwise dissimilar species and can be separated by the sculpture of the gena (coarse in *T. carinifrons* and smooth in *T. stoicus*) and the shape of the foveae that form the mesepimeral sulcus (circular in *T. carinifrons* and elongate in *T. stoicus*). The form of the metanotal trough, in which the cells are present at the bottom of a narrow furrow is shared with *T. exerrandus*, from which it may be separated by the presence of dense setation on the eyes in the latter. The

distribution of striae on T2 in *T. stoicus*, in which striae are present laterally and absent medially, is unusual for *Trissolcus*, at least in our experience. However, this character is not fully visible in the holotype specimen and we are thus hesitant to use it for identification with a sample size of only three specimens, particularly when a wealth of other characters exists to identify this species.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3312>

**Associations.** emerged from egg of *Coffea* Linnaeus: [Rubiaceae]; emerged from egg of *Hemiptera* : [Hemiptera]; emerged from egg of *Lepidoptera* : [Lepidoptera]

**Material examined.** Lectotype, female, *M. stoicus*: **MALAYSIA:** Pahang St., Malay Peninsula, Pahang, 16.VI.1932, G. H. Corbett, B.M. TYPE HYM. 9.314 (deposited in BMNH). **MALAYSIA:** 1 female, UCRC ENT 297004 (UCRC). **THAILAND:** 1 female, OSUC 285262 (OSUC).

**Lectotype designation.** We here designate specimen B.M. TYPE HYM. 9.314 (deposited in BMNH) to be the lectotype of this species.

**Comments.** *Trissolcus stoicus* exhibits two characters that suggest it may be an intermediate form between the *flavipes* and *thyantae* species groups. The hyperoccipital carina and setation of the first laterotergite ally it with the *flavipes* group. However, the presence of 6 clypeal setae and 2 large setae in the posteroventral metapleuron suggest relation to the *thyantae* group.

### *Trissolcus tersus* Lê

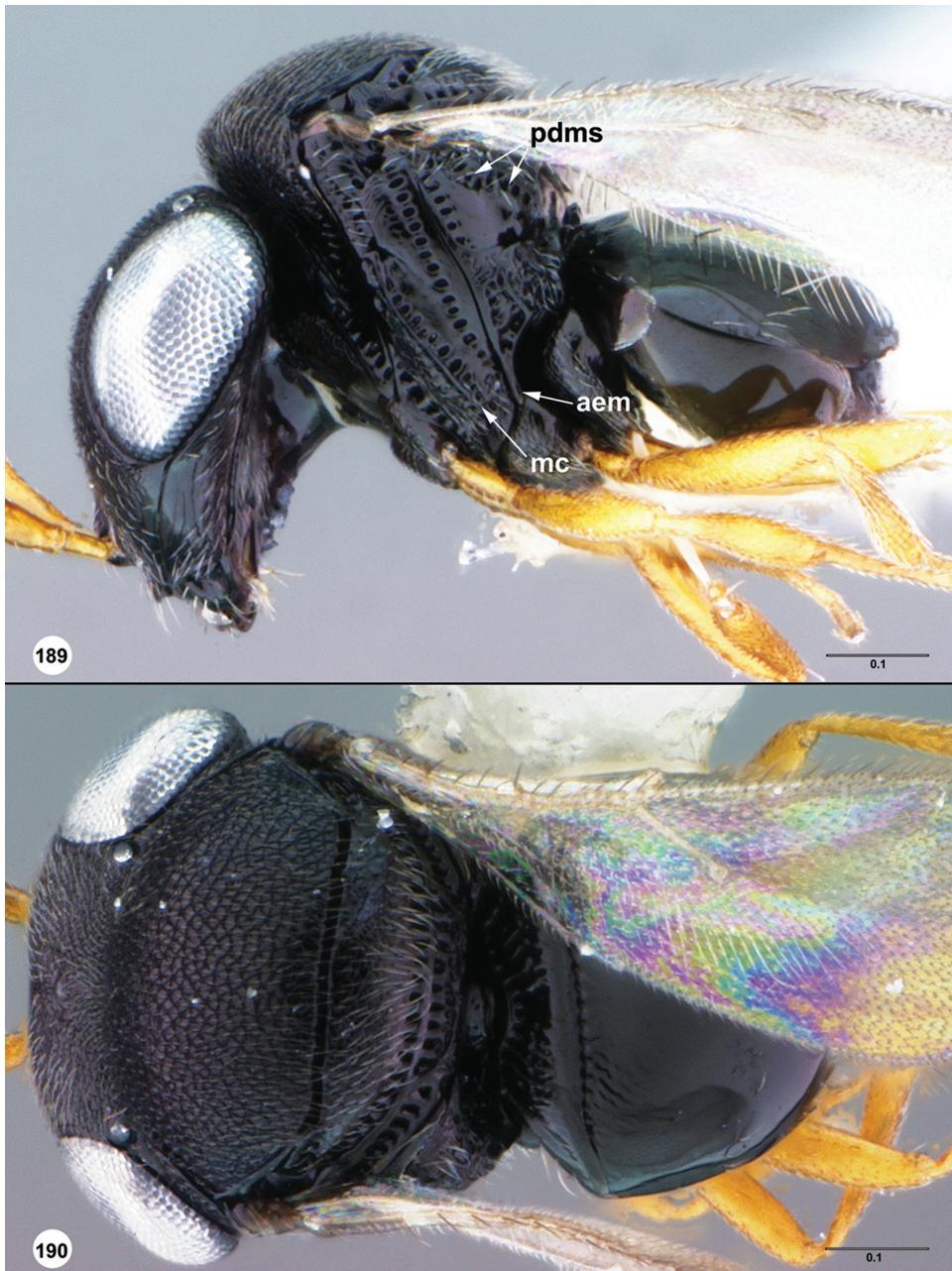
[http://bioguid.osu.edu/xbioc\\_concepts/3318](http://bioguid.osu.edu/xbioc_concepts/3318)

Figures 189–193; Morphbank<sup>68</sup>

*Trissolcus tersus* Lê, 1985: 166 (original description); Johnson, 1992: 638 (cataloged, type information); Lê, 2000: 312, 320 (description, keyed, type information).

**Description.** Female body length: 0.99–0.81 mm (n=2). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: basal A1 and distal A2 yellow, elsewhere pale brown. Color of A7–A11 in female: dark brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as elongate striation. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: present only at base of mandible. Malar striae: present. Sculpture of malar sulcus: smooth. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: absent. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: lateral ocellus and eye without continuous scleritic separation. Hyperoccipital carina: complete. Anterior margin of occipital carina: simple.



**Figures 189–190.** *Trissolcus tersus* female (EMBT ENT 0001839) 189 head, mesosoma, metasoma, lateral view 190 head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

**Mesosoma.** Epomial carina: absent. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprähumerale sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pro-

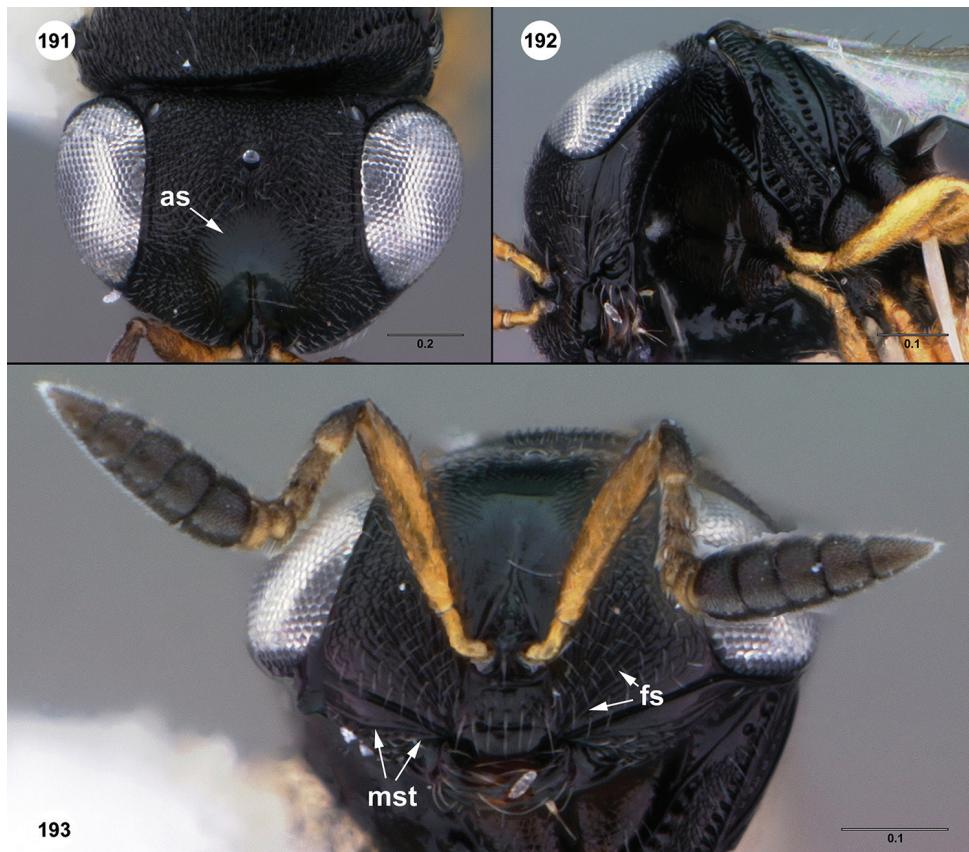
notum. Posterior pronotal sulcus: absent. Number of episternal foveae: 3. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileal sulcus: present. Speculum: weakly transversely wrinkled. Mesopleural pit: simple. Mesopleural carina: complete. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: absent. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: present. Sculpture of dorsal metapleural area: smooth area large, surrounded by well defined sulci. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about 1.5 times as long as stigmal vein. Color of legs: coxae dark brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: smooth.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: absent. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: absent.

**Diagnosis.** *Trissolcus tersus* can be identified by the line of foveae along the dorsal margin of the mesopleural carina (Figures 189, 192), a character known to us so only from this species. The setation of the posteroventral metapleuron (Figure 189) and the presence of facial and malar striae (Figure 193) are also useful for its identification.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=3318>

**Material examined.** Holotype, female: VIETNAM: Hoa Binh Prov., rice field, Thuong Tien, 11.XI.1978, IEBR 0043 (deposited in IEBR). Other material: (9 females) INDONESIA: 1 female, CNC424618 (CNCI). THAILAND: 7 females, CNC424502–424505, CNC424607, CNC424619 (CNCI); EMBT ENT 0001839 (USNM).



**Figures 191–193.** *Trissolcus tersus* female (EMBT ENT 0001839) 191 head, mesosoma, anterodorsal view 192 head and mesosoma, ventrolateral view 193 head, anterior view. Scale bars in millimeters.

#### *Trissolcus trophonius* (Nixon)

[http://bioguid.osu.edu/xbiol\\_concepts/3323](http://bioguid.osu.edu/xbiol_concepts/3323)

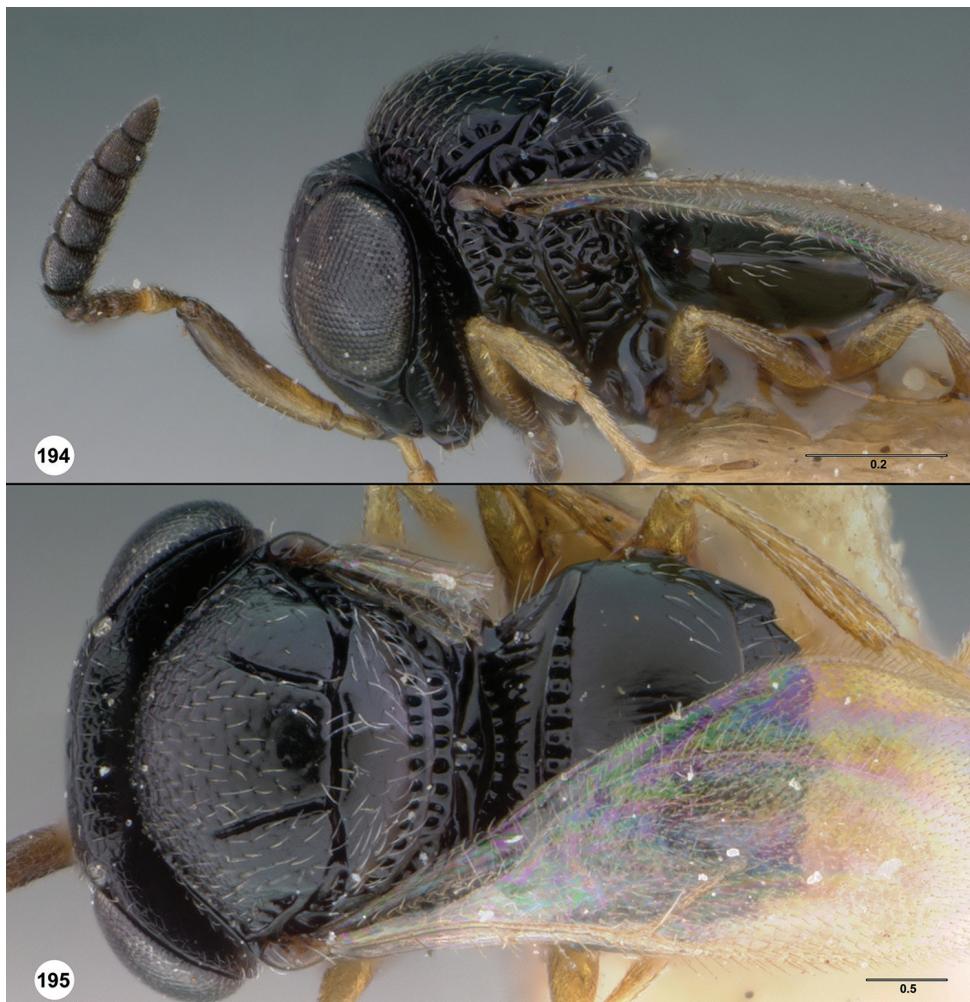
Figures 194–198; Morphbank<sup>69</sup>

*Microphanurus trophonius* Nixon, 1938: 123, 127 (original description, keyed); Nixon, 1943: 136, 140 (diagnosis, keyed); Risbec, 1950: 568 (keyed).

*Trissolcus trophonius* (Nixon): Masner, 1965: 128 (type information, generic transfer).

**Description.** Female body length: 0.94–1.08 mm (n=2). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: equal to or greater than width of clypeus; less than width of clypeus. Color of A1–A6 in female: yellow, becoming brown distally; basal A1 and distal A2 yellow, elsewhere pale brown. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla



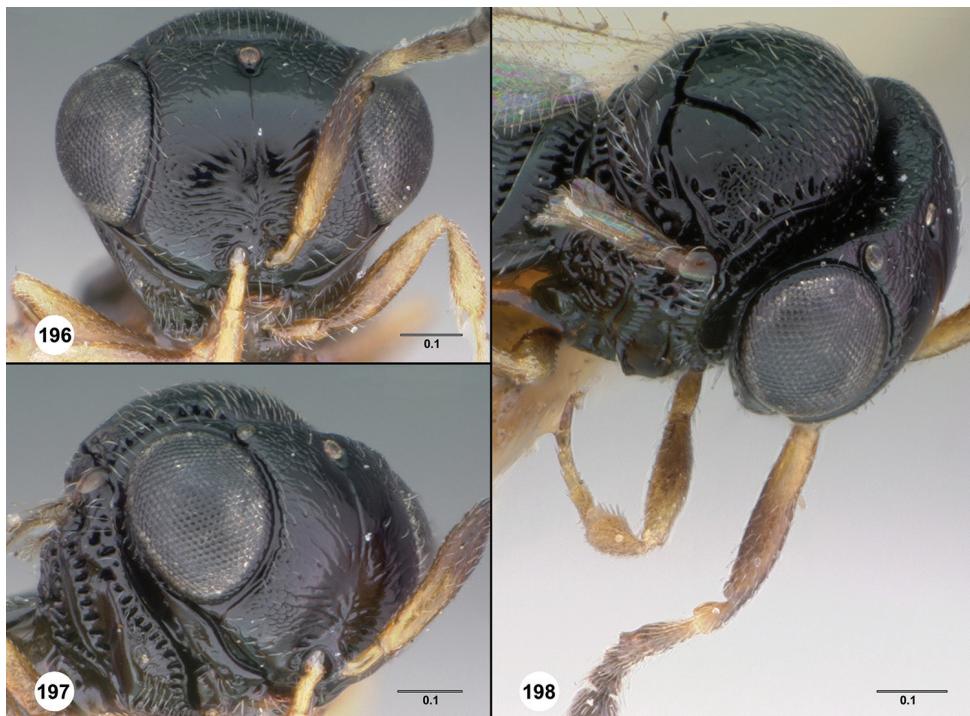
**Figures 194–195.** *Trissolcus trophonius*, female holotype (B.M. TYPE HYM. 9.315) 194 head, mesosoma, metasoma, lateral view 195 head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

on A7: 2. Facial striae: absent. Number of clypeal setae: 4. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: smooth. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: dorsoventrally fluted. Macrosculpture of lateral frons: weakly horizontally striate, striae of antennal scrobe extending to lateral frons. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: absent. Anterior margin of occipital carina: coarsely crenulate.

Mesosoma: Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: finely rugulose. Netrion sulcus: complete. Pronotal suprähumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprähumeral sulcus: uncertain, percurrent. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropleural sulcus: present. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by open crenulae. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: rugose. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indicated by a line of elongate cells. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent; weakly rugulose anteriorly, otherwise absent. Pattern of mesoscutal microsculpture: effaced posteriorly. Mesoscutal suprähumeral sulcus: comprised of cells. Length of mesoscutal suprähumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: absent. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: absent. Area bounded by axillar crescent: striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about 1.5 times as long as stigmal vein. Color of legs: coxae brown, legs elsewhere yellow; coxae and femora brown, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striae of T2: present in anteromedial portion of the tergite. Setation of T2: sparsely present in posterolateral corner. Setation of laterotergite 2: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: present posteromedially.

**Diagnosis.** The presence of 4 clypeal setae and posteriorly effaced sculpture of the mesoscutum are shared with *T. plautiae*, *T. japonicus*, and *T. kozlovi*. It may be separated from them by the dorsoventral groove that extends from the median ocellus to the an-



**Figures 196–198.** *Trissolcus trophonius*, female holotype (B.M. TYPE HYM. 9.315) 196 head, anterior view 197 head and mesosoma, anterolateral view 198 head and mesosoma, dorsolateral view. Scale bars in millimeters.

tennal scrobe, the effaced sculpture lateral to this groove, and the striation on T2 that is limited to the anteromedial portion of the tergite.

**Lectotype designation.** We here designate specimen B.M. TYPE HYM. 9.315 (deposited in BMNH) to be the lectotype of this species.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3323>

**Material examined.** Lectotype, female, *M. trophonius*: INDONESIA: Sumatera Utara Prov., Asahan Regency, Negaga Estate, 50–60m, 10.XII.1934, reared, Schneider, B.M. TYPE HYM. 9.315 (deposited in BMNH). Other material: THAILAND: 1 female, UCRC ENT 297005 (UCRC).

#### *Trissolcus tumidus* (Mayr)

[http://bioguid.osu.edu/xbioc\\_concepts/3325](http://bioguid.osu.edu/xbioc_concepts/3325)

Figures 8, 199–208; Morphbank<sup>70</sup>

#### *Trissolcus cephalotes* Kozlov & Lê syn. n.

[http://bioguid.osu.edu/xbioc\\_concepts/3198](http://bioguid.osu.edu/xbioc_concepts/3198)

Morphbank<sup>71</sup>

*Trissolcus delucchii* Kozlov syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/3212](http://bioguid.osu.edu/xbiot_concepts/3212)

Morphbank<sup>72</sup>

*Trissolcus pierrot* Mineo, O'Connor & Ashe syn. n.

[http://bioguid.osu.edu/xbiot\\_concepts/274651](http://bioguid.osu.edu/xbiot_concepts/274651)

Morphbank<sup>73</sup>

*Telenomus tumidus* Mayr, 1879: 699, 703 (original description, keyed).

*Aphanurus Tumidus* (Mayr): Kieffer, 1912: 74 (description, generic transfer).

*Microphanurus tumidus* (Mayr): Kieffer, 1926: 91, 96 (description, generic transfer, keyed).

*Asolcus tumidus* (Mayr): Delucchi, 1961: 44, 52 (description, keyed); Voegelé, 1964: 28 (keyed).

*Trissolcus delucchii* Kozlov syn. n., 1968: 198, 203 (original description, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 30 (keyed); Kozlov & Lê, 1976: 658 (keyed); Kozlov & Lê, 1977: 506 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 90 (description); Ryu & Hirashima, 1984: 36, 41 (description, keyed); Ghahari, Buhl & Kocak, 2011: 595 (listed, note on incorrect Lepidopteran association from Modarres Awal (1997)).

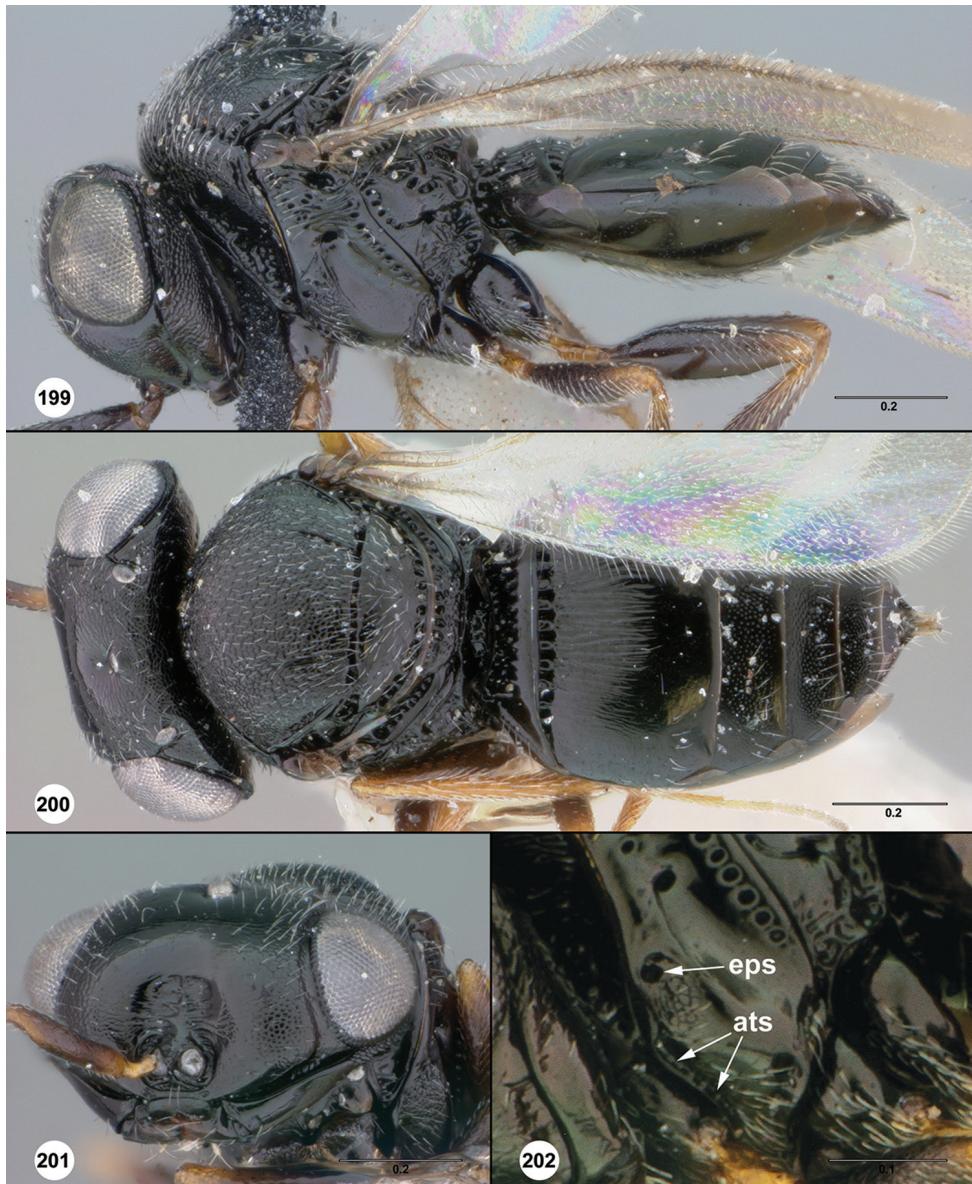
*Trissolcus tumidus* (Mayr): Safavi, 1968: 415 (keyed); Kozlov, 1968: 198, 204 (diagnosis, keyed); Voegelé, 1969: 149 (keyed); Fabritius, 1972: 30 (keyed); Kozlov & Lê, 1976: 658 (keyed); Kozlov & Lê, 1977: 504 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 89 (description); Ryu & Hirashima, 1984: 36, 42 (description, keyed); Kononova, 1995: 95 (keyed); Ghahari, Buhl & Kocak, 2011: 598 (listed); Petrov, 2013: 324 (keyed).

*Trissolcus cephalotes* Kozlov & Lê syn. n., 1976: 658, 661 (original description, keyed); Kozlov & Lê, 1977: 506 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 93 (description).

*Trissolcus pierrot* Mineo, O'Connor & Ashe syn. n., 2010: 27 (original description, placement within *Trissolcus pierrot* group); Kononova, 2014: 1421 (keyed); Kononova, 2015: 258 (keyed).

**Description.** Female body length: 0.94–1.53 mm (n=21). Male body length: 0.89–1.03 mm (n=3). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow; brown; dark brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: variably yellow to black. Color of A7–A11 in female: dark brown to black. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 2. Micro-sculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: bulging; narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent. Sculpture directly ventral to pre-

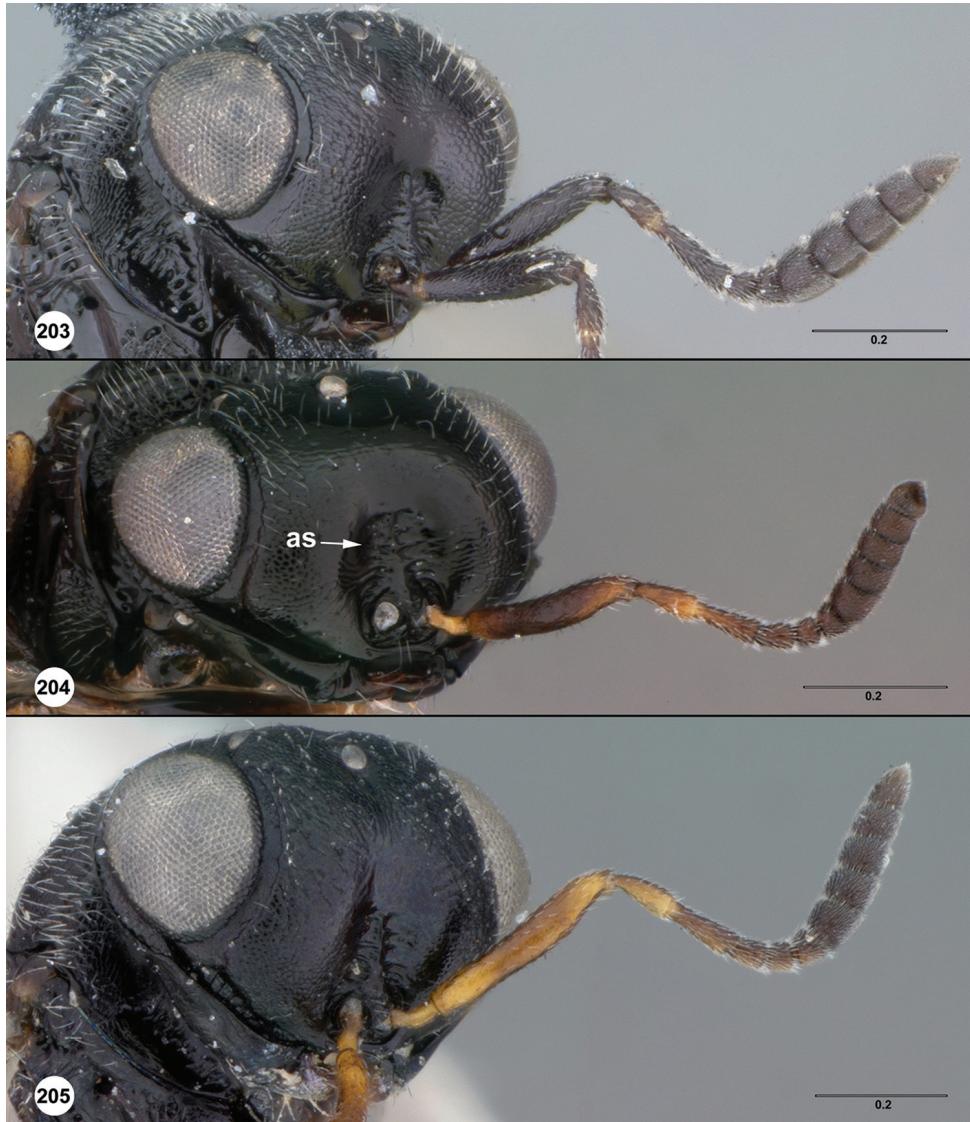


**Figures 199–202.** *Trissolcus tumidus* 199 female holotype (NHMW 0002), head, mesosoma, metasoma, lateral view 200 female holotype of *T. cephalotes* syn. n. (ZMAS 0142), head, mesosoma, metasoma, dorsal view 201 female holotype of *T. cephalotes* syn. n. (ZMAS 0142), head, anterior view 202 female (USNM 00979425), mesopleuron, lateral view. Scale bars in millimeters.

ocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: effaced medially. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: present. Macrosulpture of lateral pronotum directly anterior to netrion: finely rugulose; striae, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum; weakly differentiated from sculpture of dorsal pronotum. Location of pronotal suprahumeral sulcus: posterior half of pronotum. Number of episternal foveae: 3; 2. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: distinctly separate from mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression; present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosulpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by open crenulae; formed by small punctures. Mesopleural epicoxal sulcus: formed by large cells; formed by small punctures. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: absent. Posterodorsal metapleural sulcus: present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosulpture of mesoscutum: absent; longitudinally striate posteromedially, otherwise absent; longitudinally striate posteriorly, otherwise absent. Pattern of mesoscutal microsculpture: uniform throughout; effaced posteriorly lateral of notaulus. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: rugulose punctate. Macrosulpture of mesoscutellum: absent. Microsculpture on mesoscutellum: absent. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown to black, femora and tibia yellow to dark brown, trochanters and tarsi yellow to pale brown. Anteromedial portion of metasomal depression: punctate or crenulate.

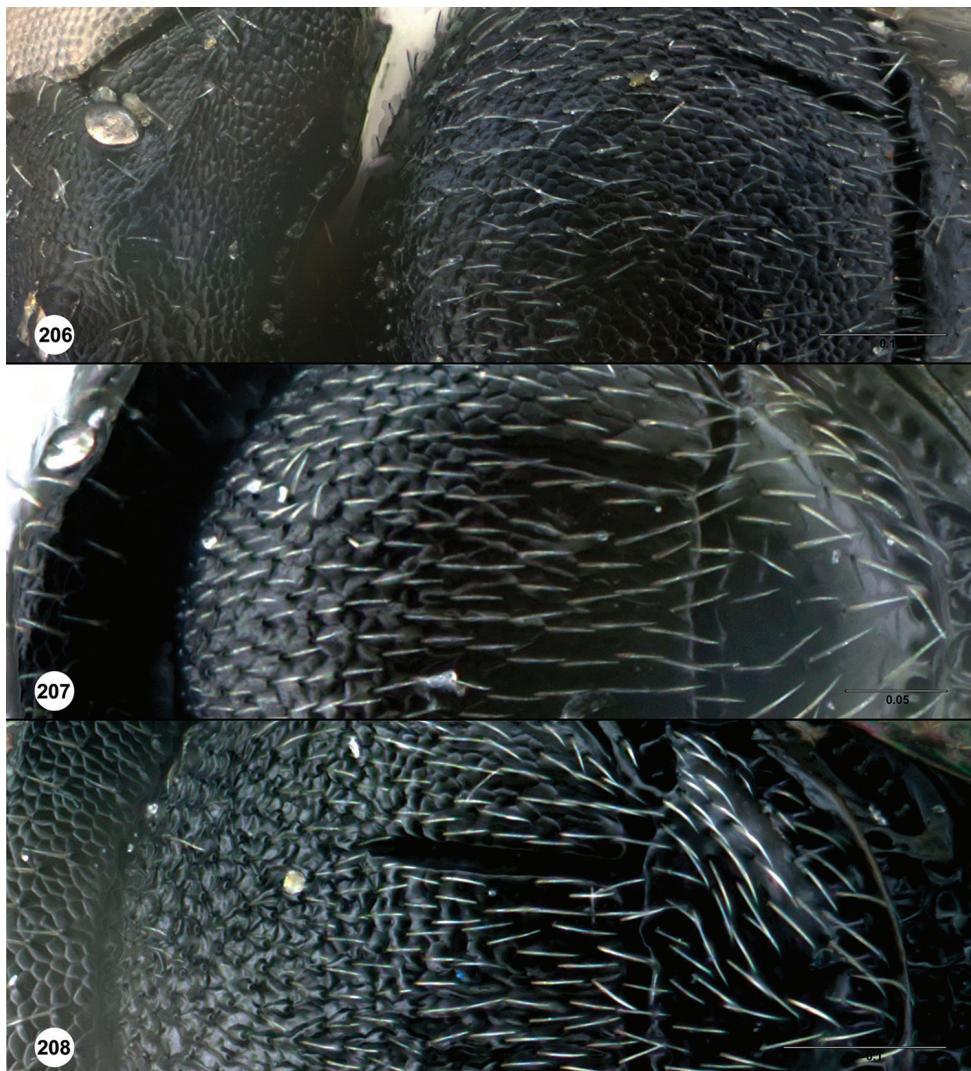
**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striae of T2: present throughout anterior half of tergite; present in anteromedial portion of the tergite. Setation of T2: uncertain, present throughout posterolateral corner. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1:



**Figures 203–205.** 203 *Trissolcus tumidus*, female holotype (NHW 0002), head and antennae, anterolateral view 204 *Trissolcus cephalotes*, female holotype (ZMAS 0142), head and antenna, anterolateral view 205 *Trissolcus delucchii*, female holotype (ZMAS 0148). Scale bars in millimeters.

absent. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus tumidus* is unusual among Palearctic species in the *flavipes* group because the episternal foveae are clearly separated from the cells of the postacetabular sulcus and the mesopleural pit, a character shared with *T. gonopsidis* and *T. nycteridaner*. In most species of the *flavipes* group these foveae form a more or less



**Figures 206–208.** *Trissolcus tumidus* 206 female paratype of *T. delucchii* syn. n. (USNM 00916636), head and mesosoma, dorsal view 207 female (USNM 00979425), mesosoma, dorsal view 208 female (OSUC 523869), mesosoma, dorsal view. Scale bars in millimeters.

continuous line between the postacetabular sulcus and the mesopleural pit. This character, in combination with a glabrous first laterotergite and a well-defined and ventrally expanded orbital furrow, separate it from other species of the *flavipes* group.

**Material examined.** Holotype, female, *T. tumidus*: AUSTRIA: Lower Austria St., Markt Piesting, 1872, Tschek, NHMW 0002 (deposited in NHMW). Holotype, female, *T. cephalotes*: TAJIKISTAN: Dushanbe Indep. City, Pavlovsky Institute of Zoology and Parasitology (IZIP), trees, Dushanbe, 18.X.1961, V. Triapitsyn, ZMAS 0142 (deposited in ZIN). Paratype of *T. cephalotes*: TAJIKISTAN: 1 female, USN-

MENT00916629 (ZIN). Holotype, female, *T. delucchii*: **ARMENIA**: Erevan City, Yerevan (Erevan), 23.VI.1959, A. Avetjan, ZMAS 0148 (deposited in ZIN). Paratypes of *T. delucchii*: (4 females) **ARMENIA**: 3 females, USNMENT00916635–00916637 (ZIN). Holotype, female, *T. pierrot*: **ITALY**: Genova, San Lorenzo di Cas., VIII-1936, F. Solari, MCSN 0014 (deposited in MCSN). *Other material*: (34 females, 5 males) **AFGHANISTAN**: 1 male, USNMENT00916640 (ZIN). **CHINA**: 29 females, 4 males, USNMENT00979423, 00979425–00979429, 00979620–00979646 (USNM). **RUSSIA**: 1 female, OSUC 523869 (OSUC). **SOUTH KOREA**: 1 female, USNMENT00896013 (CNCI). **TAJIKISTAN**: 1 female, USNMENT00916641 (ZIN). **TURKEY**: 2 females, USNMENT00916030–00916031 (BMNH). **TURKMENISTAN**: 2 females, USNMENT00916630, 00916639 (ZIN).

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3325>

**Comments.** Petrov (2013) used the longitudinal striation of the mesoscutum between the notaui and the smooth and shining frons between the antennal scrobe and median ocellus as identifying characters. In the lectotype of *T. tumidus*, longitudinal striation is present between the notaui but the frons is not entirely smooth and shining. Our examination reveals that both of these characters are size dependent. Large specimens tend to have longitudinal striation between the notaui, pustulate microsculpture throughout the mesoscutum (Figure 208), microsculpture throughout the frons (Figures 203, 205), and a gena that does not sharply recede behind the compound eye. Smaller specimens have less development of mesoscutal sculpture (Figures 206–207), the frons is smooth and shining (Figure 204), there is no striation between the notaui (Figure 206), and the gena recedes sharply behind the compound eye.

### *Trissolcus vesta* Kozlov & Lê

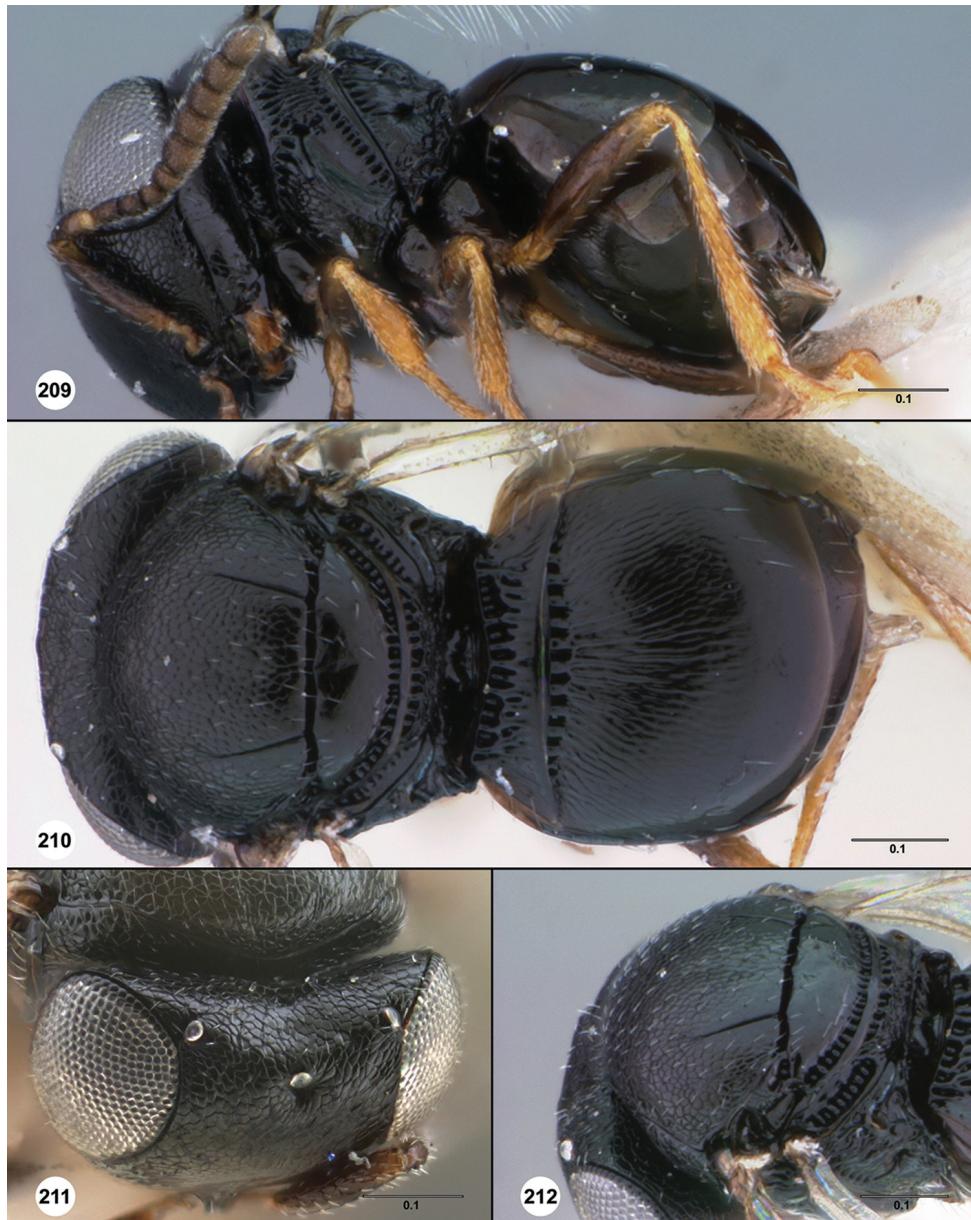
[http://bioguid.osu.edu/xbiol\\_concepts/3329](http://bioguid.osu.edu/xbiol_concepts/3329)

Figures 209–212; Morphbank<sup>74</sup>

*Trissolcus vesta* Kozlov & Lê: Kozlov & Lê, 1977: 507 (keyed); Kozlov & Lê, 1977: 1253 (original description); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 97 (description); Kononova, 1995: 95 (keyed).

**Description.** Female body length: 0.85–0.88 mm (n=2). Body color: head and mesosoma black, metasoma black to reddish brown.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: brown. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: absent. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: smooth. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: absent. Setation of lateral frons: sparse. Punctuation of lateral frons: absent. Sculpture directly ventral to preocellar pit: micro-



**Figures 209–212.** *Trissolcus vesta* female paratype (USNMENT00916613) 209 head, mesosoma, metasoma, lateral view 210 head, mesosoma, metasoma, dorsal view 211 head and mesosoma, anterodorsal view 212 mesosoma, dorsolateral view. Scale bars in millimeters.

sculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropalpal sulcus: present. Speculum: transversely strigose. Mesopleural pit: simple. Mesopleural carina: complete. Sculpture of femoral depression: faintly rugulose. Patch of striae at posteroventral end of femoral depression: present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: present as a smooth furrow. Mesopleural epicoxal sulcus: formed by small punctures; present as a smooth furrow. Setation of posteroventral metapleuron: present. Sculpture of dorsal metapleural area: absent; smooth posteriorly, cells of metapleural sulcus extending posteriorly into horizontal striae. Posterdorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprahumeral sulcus: absent. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: flat, appearing fused with lateral margin of mesoscutum. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: faintly present posteriorly. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present. Form of metascutellum: single row of cells. Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about three times as long as stigmal vein. Color of legs: coxae and femora brown, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anterior two-thirds of tergite. Setation of T2: present in a transverse line posteriorly. Setation of laterotergite 2: present. Striation of S2: absent. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Associations.** emerged from egg of *Capnoda nigroaenea* Jakovlev: [Hemiptera: Heteroptera: Pentatomidae: Pentatomidae]

**Material examined.** Holotype, female: RUSSIA: Altay Terr., Kurayskiy Mts., Kosh-Agach, 2400m, 22.VII.1964, Kozlov, ZMAS 0134 (deposited in ZIN). Paratypes: RUSSIA: 2 females, USNM 00916613, 00916648 (ZIN).

**Diagnosis.** *Trissolcus vesta* is likely to be one of the more difficult species to identify due to the subtlety of some of its diagnostic characters, specifically the posterior vertex and the setation in the ventral metapleuron. In addition to metapleuron setation it has the suite of characters that delimit the *thyantae* group: notauli, 6 clypeal setae, and well defined episternal foveae that extend from the mesopleural pit to the dorsal limit of the acetabular carina. In *T. vesta* the posterior vertex is medially depressed, creating a triangular area in dorsal view that serves as an important diagnostic character that was recognized by Kozlov (1978), but also one that is best interpreted in the context of other species. Of additional use are the mesoscutal humeral and suprahumeral sulci, which are comprised of smooth furrows or very small and irregular cells, contrasting the large cells found in the most similar Palearctic species, *T. scutellaris*.

**Comments.** The key to species of Palearctic *Trissolcus* by Kozlov (1978) used microsculpture of the mesoscutellum as a diagnostic character for this species. Contrary to his key, we observed that the sculpture of the mesoscutellum is significantly different from that of the mesoscutum: the mesoscutum is distinctly coriacieous throughout and microsculpture can be seen only very faintly on the posterior portion of the mesoscutellum under high magnification.

***Trissolcus viktorovi* Kozlov**

[http://bioguid.osu.edu/xbiol\\_concepts/3330](http://bioguid.osu.edu/xbiol_concepts/3330)

Figures 213–216; Morphbank<sup>75</sup>

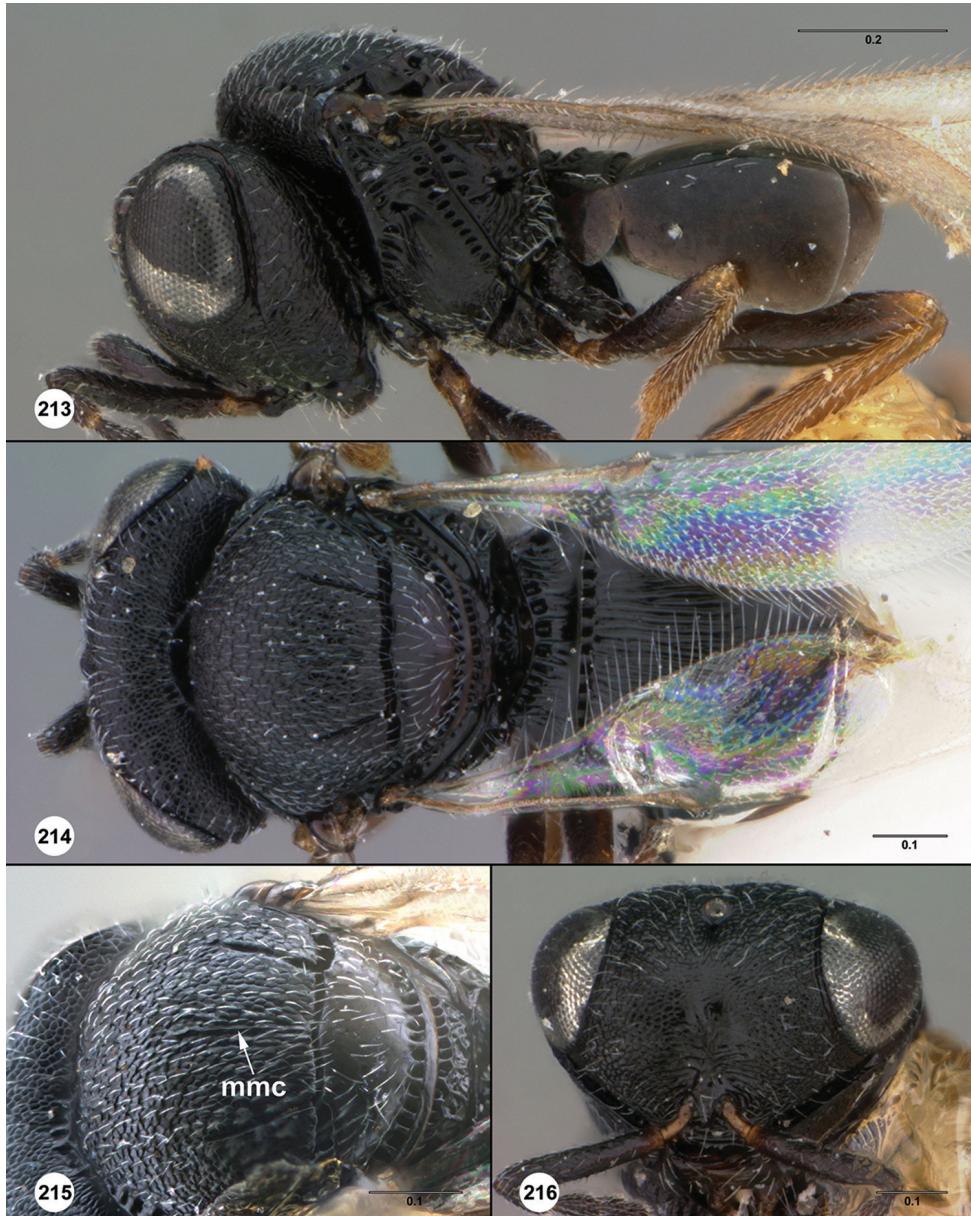
*Trissolcus viktorovi* Kozlov, 1968: 198, 206 (original description, keyed); Fabritius, 1972: 30 (keyed); Kozlov & Lê, 1977: 507 (keyed); Kozlov, 1978: 632 (description); Kozlov & Kononova, 1983: 101 (description); Petrov, 2013: 325 (keyed).

*Trissolcus Viktorovi* Kozlov: Voegelé, 1969: 149 (keyed, emendation).

*Tissoleus victorovi* Kozlov: Kozlov, 1981: 187 (keyed, spelling errors).

**Description.** Female body length: 1.03–1.16 mm (n=16). Male body length: 0.94–1.26 mm (n=6). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: brown. Length of radicle: less than width of clypeus. Color of A1–A6 in female: brown. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: bulging. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: uniform in width between midpoint of eye and malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent. Preocellar pit: present. Setation of lateral frons: sparse. Punctuation of lateral frons: absent; sparse. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital



**Figures 213–216.** *Trissolcus viktorovi* 213 female paratype (USNMENT00916021), head, mesosoma, metasoma, lateral view 214 female paratype (USNMENT00916647), head, mesosoma, metasoma, dorsal view 215 female paratype (USNMENT00916010), mesosoma, dorsal view 216 female paratype (USNMENT00916014), head, anterior view. Scale bars in millimeters.

carina: present only posterior to lateral ocellus. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: coarsely crenulate.

**Mesosoma.** Epomial carina: absent. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: rugose anteroventrally. Patch of striae at posteroventral end of femoral depression: present, striae weakly developed and perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosulpture of anteroventral mesopleuron: absent. Postacetabular sulcus: present as a smooth furrow. Mesopleural epicoxal sulcus: present as a smooth furrow. Setation of posteroventral metapleuron: present. Sculpture of dorsal metapleural area: cells of metapleural sulcus extending posteriorly into rugae. Posterodorsal metapleural sulcus: poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; absent. Anteroventral extension of metapleuron: not extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: present as a simple furrow; indicated by a line of cells. Median mesoscutal carina: present. Macrosulpture of mesoscutum: absent. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprahumeral sulcus: comprised of cells. Length of mesoscutal suprahumeral sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: flat, appearing fused with lateral margin of mesoscutum. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: smooth. Macrosulpture of mesoscutellum: absent. Microsculpture on mesoscutellum: absent. Setation of posterior scutellar sulcus: absent. Form of metascutellum: thick, with only a narrow band of small punctures anteriorly. Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae and femora brown, elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anteromedial portion of the tergite. Setation of T2: sparsely present in posterolateral corner. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: sparsely present throughout area not covered by laterotergite.

**Diagnosis.** *T. viktorovi* is a distinctive species that can be identified from other species of the *thyantae* group by the broad gena, the smooth furrow between the hypero-

cipital carina and the dorsal and posterior margins of the compound eye. The median mesoscutal carina is distinct in *T. viktorovi* and is useful for confirming its identity, but this feature may also be found in other Palearctic species of the *thyantae* group.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3330>

**Associations.** emerged from egg of *Dolycoris baccarum* (Linnaeus): [Hemiptera: Heteroptera: Pentatomidea: Pentatomidae]; emerged from egg of *Eurydema festivum* (Linnaeus): [Hemiptera: Heteroptera: Pentatomidea: Pentatomidae]; emerged from *Eurydema ventralis* Kolenati: [Hemiptera: Heteroptera: Pentatomidea: Pentatomidae]; emerged from egg of *Pentatominae* Leach: [Hemiptera: Heteroptera: Pentatomidea: Pentatomidae]

**Material examined.** Holotype, female: ARMENIA: Tavus Prov., Noyemberyan-skiy Dist., 4.VII.1960, G. Viktorov, ZMAS 0138 (deposited in ZIN). Paratypes: ARMENIA: 3 females, 3 males, USNMENT00916642–00916647 (ZIN). Other material: (13 females, 3 males) PORTUGAL: 3 females, USNMENT00916222, 00916226, 00916241. TURKEY: 10 females, 3 males, USNMENT00916010–00916014, 00916016–00916022, 00916029 (BMNH).

### *Trissolcus vindicius* (Nixon)

[http://bioguid.osu.edu/xbiot\\_concepts/3331](http://bioguid.osu.edu/xbiot_concepts/3331)

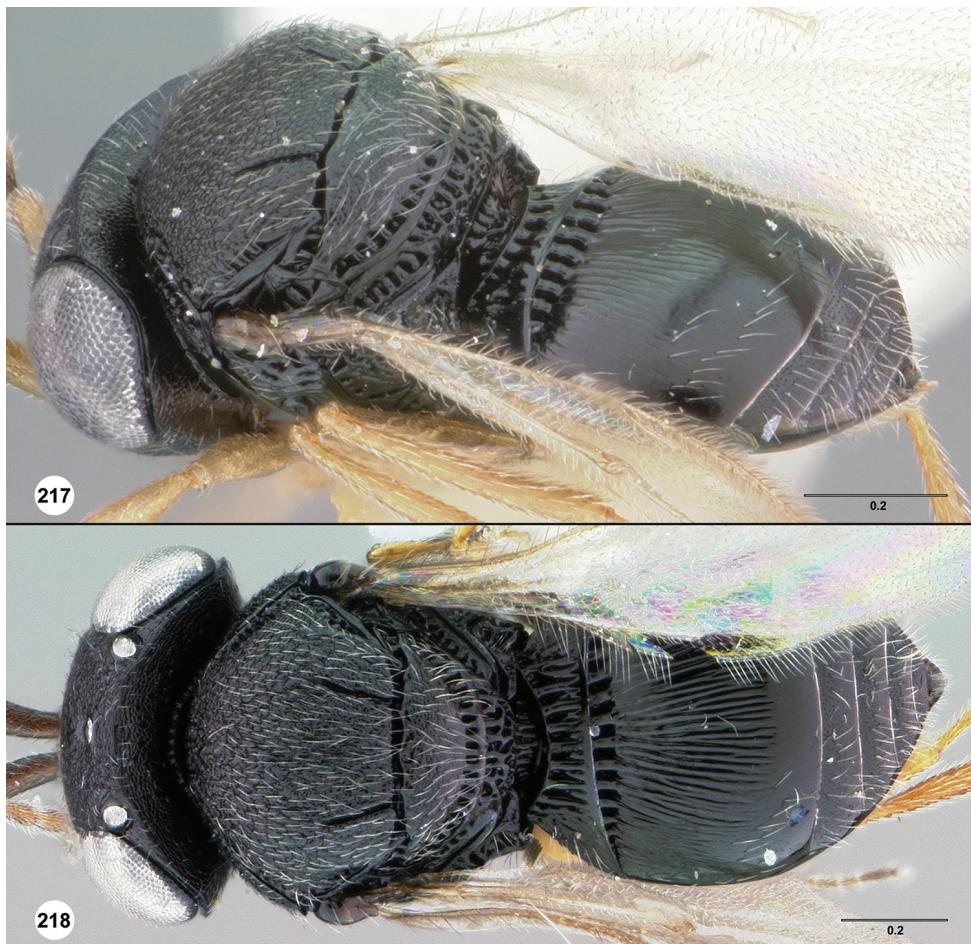
Figures 217–221; Morphbank<sup>76</sup>

*Microphanurus vindicius* Nixon, 1938: 123, 128 (original description, keyed); Nixon, 1943: 137 (keyed); Risbec, 1950: 569 (keyed).

*Trissolcus vindicius* (Nixon): Masner, 1965: 128 (type information, generic transfer); Lê, 1983: 24 (keyed); Johnson, 1992: 640 (cataloged, type information); Lê, 2000: 312, 323 (description, keyed).

**Description.** Female body length: 0.99–1.63 mm (n=18). Male body length: 1.44 mm (n=1). Body color: head, mesosoma, and metasoma black.

**Head.** Color of radicle: yellow. Length of radicle: less than width of clypeus. Color of A1–A6 in female: yellow to brown. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: absent. Number of clypeal setae: 2. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: narrow. Genal carina: absent. Malar striae: absent. Sculpture of malar sulcus: antero-posteriorly striate. Orbital furrow: expanding in size ventrally, strongly so at intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: absent; weakly transversely strigose. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: moderately dense. Sculpture directly ventral to preocellar pit: microsculptured. Macrosculpture of lateral frons: absent. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: complete. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along oc-



**Figures 217–218.** *Trissolcus vindicius* 217 female holotype (B.M. TYPE HYM. 9.316), head, mesosoma, metasoma, dorsolateral view 218 female (USNM 00896037), head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

cipital carina: present. Anterior margin of occipital carina: coarsely crenulate; finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: complete. Pronotal suprahumeral sulcus in posterior half of pronotum: clearly indicated by cells. Location of pronotal suprahumeral sulcus: percurrent. Number of episternal foveae: 4 or more. Course of episternal foveae ventrally: abutting postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropleural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: well defined anteriorly, poorly defined to absent posteriorly. Sculpture of femoral depression: smooth. Patch of striae at posteroventral end of femoral depression:

absent. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present dorsally. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by large cells. Mesopleural epicoxal sulcus: formed by large cells. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: smooth in anterodorsal corner, coarsely rugose posteriorly; cells of metapleural sulcus extending posteriorly into rugae. Posterodorsal metapleural sulcus: present as line of foveae; poorly defined to absent. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent; indicated by a line of elongate cells. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: present as clearly defined line of cells; present as coarse rugae. Mesoscutal humeral sulcus: indicated by a line of cells. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: absent; weakly rugulose anteriorly, otherwise absent. Pattern of mesoscutal microsculpture: uniform throughout; effaced posteriorly. Mesoscutal suprähumerale sulcus: comprised of cells. Length of mesoscutal suprähumerale sulcus: about half the length of anterolateral edge of mesoscutum. Parapsidal line: present. Notaulus: extending at least 1/3 length of mesoscutum. Median protuberance on anterior margin of mesoscutellum: absent; present. Protruberance on anterior margin of mesoscutellum directly posterior to notaulus: present. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Area bounded by axillar crescent: striate. Macrosculpture of mesoscutellum: absent. Microsculpture on mesoscutellum: present throughout. Median mesoscutellar carina: absent. Setation of posterior scutellar sulcus: present.

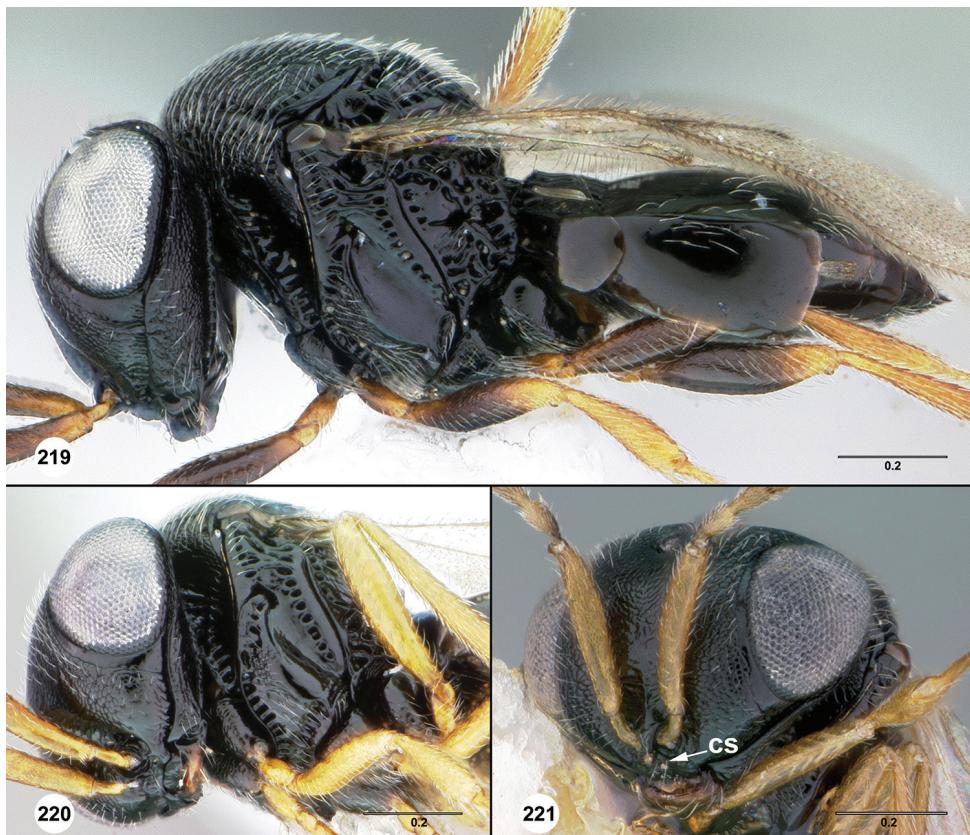
Form of metascutellum: coarsely rugose. Metanotal trough: foveate, foveae occupying more than half of metanotal height. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae dark brown, legs elsewhere yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 0. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anterior two-thirds of tergite. Setation of T2: present throughout posterolateral corner and lateral portions of tergite. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: present in anterior half of sternite not covered by laterotergites. Setation of S2: present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus vindicius* is delimited more by a unique combination of characters than by a single distinctive feature. It can be separated from other species in the *flavipes* group by the presence of 2 clypeal setae, a well-defined and ventrally expanded orbital furrow, episternal foveae that extend from the postacetabular sulcus to the mesopleural pit, and a mesoscutum without a median mesoscutal carina. See also diagnosis of *T. corai*.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3333>

**Lectotype designation.** We here designate specimen B.M. TYPE HYM. 9.316 (deposited in BMNH) as the lectotype for *T. vindicius*.



**Figures 219–221.** *Trissolcus vindicius* 219 female (USNMENT00896037), head, mesosoma, metasoma, lateral view 220 female (USNMENT00896024), head and mesosoma, ventrolateral view 221 female holotype (B.M. TYPE HYM. 9.316), head, anterolateral view. Scale bars in millimeters.

**Material examined.** Lectotype, female, *M. vindicius*: INDONESIA: Jawa Tengah Prov., Java Isl., Wonogiri Regency, 2000ft, 1937, J. S. Phillips, B.M. TYPE HYM. 9.316 (deposited in BMNH). Other material: (18 females, 1 male) INDONESIA: 1 female, USNMENT00916385 (BMNH). JAPAN: 10 females, 1 male, OSUC 144436, 144438, 144445, 144455, 144468, 542360–542361, 542368, 542375, 542426–542427 (CNCI). NEPAL: 2 females, OSUC 76418–76419 (OSUC). SOUTH KOREA: 5 females, USNMENT00896022–00896025, 00896148 (CNCI).

**Comments.** The two specimens from Nepal fit within our concept of *T. vindicius*, but exhibit some notable variation. They are much smaller, have broader mandibles, the microsculpture of the mesoscutum is slightly effaced posteriorly, and the occipital carina is finely crenulate and nearly smooth along its anterior margin. In one specimen the episternal foveae are fewer in number and dorsoventrally elongate relative to the roughly circular shape that is typical for *T. vindicius*, possibly an allometric consequence of its smaller size.

***Trissolcus yamagishii* Ryu**

[http://bioguid.osu.edu/xbiol\\_concepts/3334](http://bioguid.osu.edu/xbiol_concepts/3334)

Figures 222–226; Morphbank<sup>77</sup>

*Trissolcus artatus* Kozlov & Lê, syn. n.

[http://bioguid.osu.edu/xbiol\\_concepts/179840](http://bioguid.osu.edu/xbiol_concepts/179840)

Morphbank<sup>78</sup>

*Trissolcus yamagishii* Ryu, 1984: 37, 53 (original description, keyed).

*Trissolcus artatus* Kozlov & Lê, syn. n., 2000: 312, 313, 361 (original description, keyed).

**Description.** Female body length: 1.33–1.76 mm (n=19). Male body length: 1.29–1.58 mm (n=2). Body color: head, mesosoma, and metasoma black.

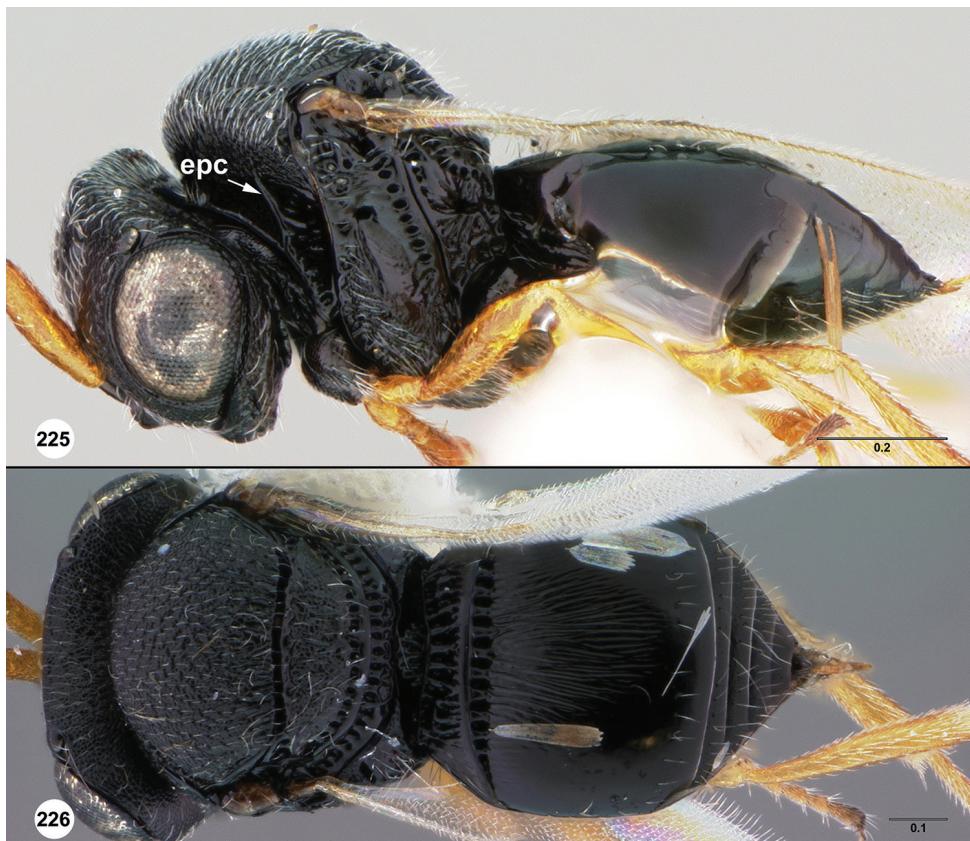
**Head.** Color of radicle: black. Length of radicle: equal to or greater than width of clypeus. Color of A1–A6 in female: yellow, becoming brown distally. Color of A7–A11 in female: brown. Number of basiconic sensilla on A6: 0. Number of basiconic sensilla on A7: 2. Facial striae: present as short grooves. Number of clypeal setae: 6. Microsculpture on gena directly above mandibular condyle: present. Shape of ventral gena in lateral view: moderately bulging. Genal carina: present and extending dorsally to vicinity of lower margin eye. Malar striae: absent. Sculpture of malar sulcus: smooth; antero-posteriorly striate. Orbital furrow: medially delimited by ridge or carina at midpoint of eye, poorly defined or absent near intersection with malar sulcus. Macrosculpture of frons between antennal scrobe and anterior ocellus: small number of dorsoventral striae directly ventral to anterior ocellus. Preocellar pit: present. Setation of lateral frons: moderately dense. Punctuation of lateral frons: absent. Macrosculpture of lateral frons: rugose. OOL: separated by less than one ocellar diameter. Hyperoccipital carina: absent. Macrosculpture of posterior vertex: absent. Microsculpture on posterior vertex along occipital carina: present. Anterior margin of occipital carina: finely crenulate to smooth.

**Mesosoma.** Epomial carina: present. Macrosculpture of lateral pronotum directly anterior to netrion: striate, striae formed by elongation of cells of netrion sulcus. Netrion sulcus: incomplete. Pronotal suprahumeral sulcus in posterior half of pronotum: undifferentiated from sculpture of dorsal pronotum. Number of episternal foveae: 3; 2. Course of episternal foveae ventrally: distinctly separate from postacetabular sulcus. Course of episternal foveae dorsally: extending to mesopleural pit. Subacropileural sulcus: present. Speculum: transversely strigose. Mesopleural pit: extending ventrally into dorsoventral furrow parallel to mesopleural carina. Mesopleural carina: complete. Sculpture of femoral depression: faintly rugulose. Patch of striae at posteroventral end of femoral depression: present, striae perpendicular to long axis of femoral depression. Setal patch at posteroventral end of femoral depression: present. Microsculpture of anteroventral mesopleuron: present throughout. Macrosculpture of anteroventral mesopleuron: absent. Postacetabular sulcus: formed by open crenulae. Mesopleural epicoxal sulcus: formed by open crenulae. Mesofurcal pit: absent. Setation of posteroventral metapleuron: absent. Sculpture of dorsal metapleural area: mostly smooth with faint rugulae radiating from metapleural pit. Posterdorsal metapleural sulcus:



**Figures 222–224.** *T. yamagishii* 222 female holotype (Type No. 2221 Kyushu Univ.), head, anterior view 223 female holotype (Type No. 2221 Kyushu Univ.), head and mesosoma, anteroventral view 224 female (USNMENT00896189), head and antennae, anterior view. Scale bars in millimeters.

present as line of foveae. Paracoxal sulcus in ventral half of metapleuron: indistinguishable from sculpture to absent. Anteroventral extension of metapleuron: extending to base of mesocoxa. Metapleural epicoxal sulcus: absent or indistinguishable from sculpture. Mesoscutal humeral sulcus: present as a simple furrow. Median mesoscutal carina: absent. Macrosculpture of mesoscutum: reticulate anteriorly, becoming longitudinally strigose posteriorly. Pattern of mesoscutal microsculpture: uniform throughout. Mesoscutal suprakumeral sulcus: comprised of cells. Length of mesoscutal suprakumeral sulcus: about half the length of anterolateral edge of mesoscutum. Notaulus: absent. Median protuberance on anterior margin of mesoscutellum: absent. Shape of dorsal margin of anterior lobe of axillar crescent: round. Sculpture of anterior lobe of axillar crescent: dorsoventrally strigose. Posterodorsal margin of axillular carina: pointed. Area bounded by axillar crescent: smooth. Macrosculpture of mesoscutellum: longitudinally strigose medially, rugulose laterally. Microsculpture on mesoscutellum: present



**Figures 225–226.** *T. yamagishii* **225** female holotype (Type No. 2221 Kyushu Univ.), head, mesosoma, metasoma, lateral view **226** female (USNMENT00903336), head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

throughout. Median mesoscutellar carina: absent; present. Setation of posterior scutellar sulcus: present. Form of metascutellum: coarsely rugose. Metanotal trough: smooth in dorsal half, with line of foveae ventrally. Metapostnotum: invaginated near lateral edge of metascutellum. Length of postmarginal vein: about twice as long as stigmal vein. Color of legs: coxae black; trochanters and femora brown, with femora becoming much lighter distally, tibiae and tarsi pale brown to yellow. Anteromedial portion of metasomal depression: punctate or crenulate.

**Metasoma.** Longitudinal striae on T1 posterior to basal costae: present. Number of sublateral setae (on one side): 2; 1; 3. Setation of laterotergite 1: absent. Longitudinal striation of T2: present in anterior two-thirds of tergite. Setation of T2: present in a transverse line and along lateral margin. Setation of laterotergite 2: present. Posteriorly directed setae on medial S1: present. Striation of S2: absent. Setation of S2: present throughout area not covered by laterotergite.

**Diagnosis.** *Trissolcus yamagishi* can be distinguished from other Palearctic *Trissolcus* in the *basalis* group by the complete mesopleural carina and the characteristic sculpture of the frons in which a dorsoventral carina below the anterior ocellus is flanked by areas of effaced microsculpture (Figures 222, 224). The characters used to separate *T. yamagishii* and *T. comperei* (= *T. itoi*) in the key to species by Ryu (1984) are not reliable. Variation occurs in the degree of rugosity in the mesoscutellum in both *T. yamagishii* and *T. comperei*, and the antennae and legs are subject to color variability. Specifically, the legs in *T. yamagishii* have two color forms, one in which the legs are entirely yellow beyond the coxae and one in which the trochanters and basal femora are brown, becoming lighter distally. We examined a single male of this species which had bright yellow legs beyond the coxae.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3334>

**Material examined.** Holotype, female, *T. yamagishi*: **SOUTH KOREA:** Mt. Sudosan, 9.VII–12.VII.1971, K. Yamagishi, Type No. 2221 Kyushu Univ. (deposited in KUEC). Holotype, female, *T. artatus*: **VIETNAM:** Thai Nguyen Prov., Thái Nguyên, 14.IV.1986, A. Sharkov, IEBR 0038 (deposited in IEBR). Other material: (19 females, 2 males) **INDIA:** 1 female, 1 male, USNMENT00916366–00916367 (BMNH). **LAOS:** 1 female, USNMENT00903336 (BPBM). **SOUTH KOREA:** 1 female, USNMENT00896017 (CNCI). **UNITED ARAB EMIRATES:** 16 females, 1 male, USNMENT00896005–00896010, 00896160, 00896168–00896172, 00896188–00896189, 00896215, 00896295, 00896331 (CNCI).

**Comments.** We here significantly expand the known distribution of this species to include India, Laos, Vietnam and the United Arab Emirates.

### *Phanuromyia biroi* (Szabó), comb. n.

[http://bioguid.osu.edu/xbioc\\_concepts/3193](http://bioguid.osu.edu/xbioc_concepts/3193)

Figures 227–228; Morphbank<sup>79</sup>

*Asolcus biroi* Szabó, 1965: 425 (original description).

*Trissolcus biroi* (Szabó): Johnson, 1992: 624 (cataloged, type information).

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3193>

**Material examined.** Paratype: **SERBIA:** 1 female, Hym.Typ.No. 4611, Mus.Budapest (HNHM).

**Comments.** This species clearly does not belong in *Trissolcus* and we place it in *Phanuromyia* Dodd sensu Taekul et al. (2013) based on the rugulose sculpture throughout T2 and the apparently 4-merous antennal clava. We were unable to assess the characters of the ventral frons, but given our confidence in transferring this species to *Phanuromyia*, we did not find it necessary to attempt dissolving the surrounding glue.



**Figures 227–228.** *Phanuromyia biroi*, female paratype (Hym. Typ. No. 4611, Mus. Budapest) **227** head, mesosoma, metasoma, lateral view **228** head, mesosoma, metasoma, dorsal view. Scale bars in millimeters.

***Telenomus fulmeki* (Soyka), comb. n.**

[http://bioguid.osu.edu/xbioc\\_concepts/3238](http://bioguid.osu.edu/xbioc_concepts/3238)

Figures 229–230; Morphbank<sup>80</sup>

*Microphanurus fulmeki* Soyka, 1942: 175 (original description).

*Trissolcus fulmeki* (Soyka): Kononova, 2014: 1426 (possibly in *Telenomus*); Kononova, 2015: 264 (possibly in *Telenomus*).

**Lectotype designation.** For the stability of nomenclature, we here designate specimen SDEI 0001A (deposited in SDEI) as the lectotype for *Telenomus fulmeki*.

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3238>

**Material examined.** Lectotype, female, *M. fulmeki*: AUSTRIA: Burgenland, Eisenberg, 17.VI.1941, reared, L. Fulmek, SDEI 0001A (deposited in SDEI). *Paralectotype*: AUSTRIA: 1 female, SDEI 0001B (SDEI).

**Comments.** We transfer this species to *Telenomus* based on the 3-merous antennal clava and T2 that is wider than long. The sculptural details of the head are difficult



**Figures 229–230.** *Telenomus fulmeki* 229 female lectotype (SDEI 0001A), head, mesosoma, metasoma, lateral view 230 male paralectotype (SDEI 0001B), head, mesosoma, metasoma, lateral view. Scale bars in millimeters.

to assess because of the state of the lectotype and paralectotype specimens. The visible characters, including the transverse rugae of the dorsal frons, place this species in the *laricis* species group of *Telenomus* sensu Johnson (1984b) and Huggert (1983).

#### *Telenomus testaceus* Lê, comb. n.

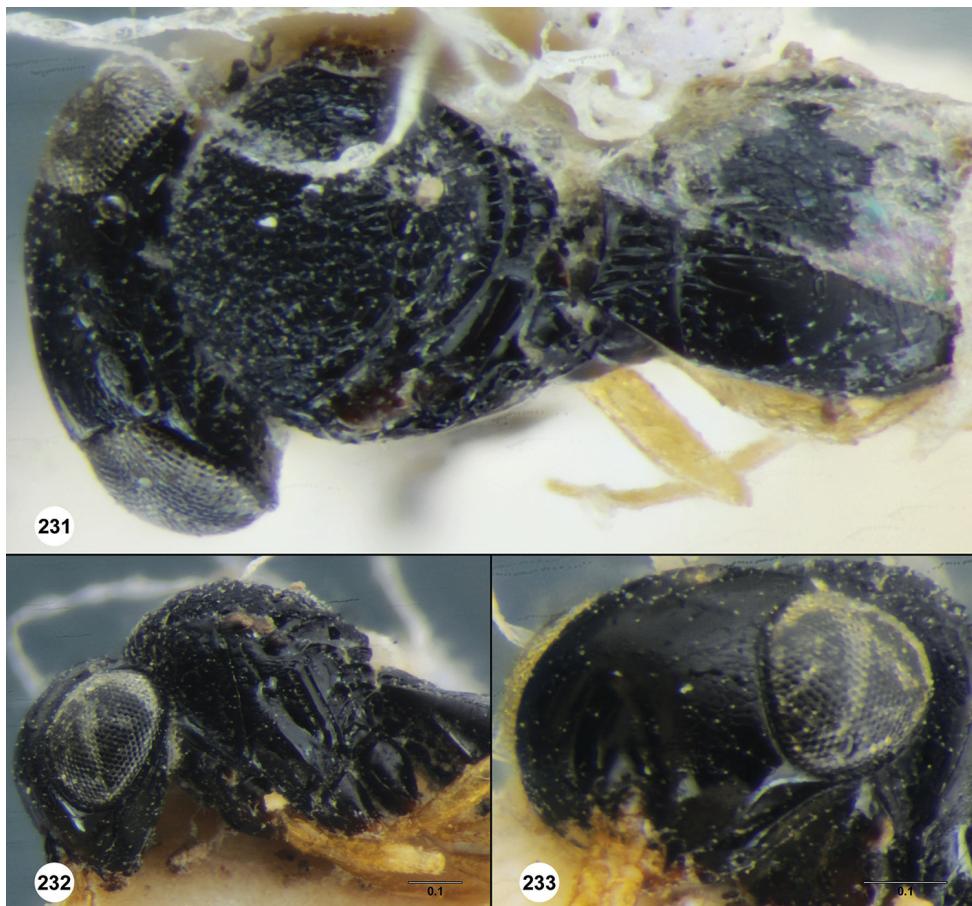
[http://bioguid.osu.edu/xbiol\\_concepts/3319](http://bioguid.osu.edu/xbiol_concepts/3319)

Figures 231–233; Morphbank<sup>81</sup>

*Trissolcus testaceus* Lê, 1983: 24 (original description, keyed); Johnson, 1992: 638 (catalogued, type information); Lê, 2000: 312, 321 (description, keyed, type information).

**Link to distribution map.** <http://hol.osu.edu/map-large.html?id=3319>

**Material examined.** Holotype, female: VIETNAM: Gia Lai Prov., K'Bang Dist., forest edge, Buôn Luói, 27.XI.1978, IEBR 0041 (deposited in IEBR).



**Figures 231–233.** *Telenomus testaceus*, female holotype (IEBR 0041) 231 head, mesosoma, metasoma, dorsal view 232 head and mesosoma, lateral view 233 head, anterolateral view. Scale bars in millimeters.

## Acknowledgments

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## Endnotes

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## **Supplementary material I**

### **URI table of HAO morphological terms**

Authors: Elijah Talamas, Matthew L. Buffington, Kim Hoelmer

Data type: Microsoft Excel Spreadsheet (.xls)

Explanation note: This table lists the morphological terms used in this publication and their associated concepts in the Hymenoptera Anatomy Ontology.

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