
GEORGE MELIKA1, CHANG-TI TANG2, MAN-MIAO YANG2, PÉTER BIHARI3, MIKLÓS BOZSÓ3 & ZSOLT PÉNZES3

1 Budapest Plant Pest Diagnostic Laboratory, National Food Chain Safety Office, Directorate of Plant Protection, Soil Conservation and Agri-environment, Budavári str. 141–143, Budapest 1118, Hungary. E-mail: melikageorge@gmail.com. Corresponding author.
2 Department of Entomology, National Chung Hsing University, Taichung, 40227 Taiwan. E-mails: cynipidsman@gmail.com (for Chang-Ti Tang); mmyang@nchu.edu.tw (for Man-Miao Yang)
3 Biological Research Center of Hungarian Academy of Sciences, Institute of Genetics, Temesvári krt 62, Szeged, 6726 and University of Szeged, Department of Ecology, Közép fasor 52 Szeged, Hungary. E-mail: penzes@bio.u-szeged.hu (for Zsolt Pénzes); bihari.peter@gmail.com (for Péter Bihari; mikitv.bozs@gmail.com (for Miklós Bozsó)

Abstract

Two new species of cynipid inquilines, Ufo nipponicus from Japan and U. cerroneuroteri from Taiwan are described. Descriptions, diagnoses, biology, and host associations for the new species and a key to Ufo species are given. Two Ufo species, U. shirakashii (Shinji) and U. shirokashicola (Shinji) are transferred to Saphonecrus. All taxa are supported by morphological and molecular data.

Key words: Cynipidae, inquiline, Synergini, Ufo, Saphonecrus, taxonomy, morphology

Introduction

Most of the ca. 1400 described species of Cynipidae are gall inducers, however, around 180 species, classified into nine genera, develop as inquilines inside galls of other cynipids (Pujade-Villar et al. 2003, Csóka et al. 2005, Nieves-Aldrey & Medianero 2010). In a review on the gallwasps of the Eastern Palaearctic, 18 valid and 5 species with uncertain status of cynipid inquilines from seven genera (Ceroptres Hartig, Saphonecrus Dalla Torre & Kieffer, Synergus Hartig, and Ufo Melika & Pujade in oak-cynipid galls; Periclistus Förster in rose-cynipid galls and Synophromorpha Ashmead in Diastrophus-induced galls on Rubus L.) were recorded (Abe et al. 2007).

Recently, seven new species of inquilines were described from Japan and China: one new Synergus (Abe et al. 2011), four new Saphonecrus (Wang et al. 2010; Wachi et al. 2011a; Liu et al. 2012) and two new Ufo (Wachi et al. 2011b).

Ufo was described from Japan with one species, U. abei Melika & Pujade-Villar (Melika et al. 2005). Later, U. koreanus Melika, Pujade-Villar & Choi was described from Republic of Korea (Melika et al. 2007). Both species are inquilines in oak galls on Quercus subgenus Quercus section Cerris (Fagaceae). Two species, U. shirakashii (Shinji) and U. shirokashicola (Shinji), were recently described from Japan from cynipid galls associated with Quercus subgenus Cyclobalanopsis (Wachi et al. 2011b)

All Ufo species are known only from the Eastern Palaearctic, synapomorphies and generic diagnostic characters of which were discussed in details elsewhere (Melika et al. 2005, 2007). Ufo shares some morphological characters with two allied genera, Saphonecrus and Synergus. Ufo and Saphonecrus, have the radial cell along the forewing margin opened and the female antenna is 13-segmented; both Ufo and Synergus have a distinct pronotal carina but in Synergus the forewing is with a closed radial cell and the female antenna is 14-segmented (Melika et al. 2005). These shared morphological characters place Ufo into the Synergus complex of inquiline genera, phylogenetic analysis of which was recently published (Ács et al. 2010), without Ufo, the phylogenetic position of which is still uncertain.
Herein we described two new species, *Ufo cerroneuroteri* from Taiwan, and *U. nipponicus* from Japan, both inquilines in oak galls associated with section *Cerris* oaks. The taxonomic assignment of *U. shirakashii* (Shinji) and *U. shirokashicola* (Shinji) (Wachi et al. 2011b), based on morphology and DNA sequence analyses is discussed and an appropriate taxonomic status is given to them.

**Materials and methods**

**Specimen collection**

All the wasps in this study were laboratory reared from fresh galls collected in different localities in Japan and Taiwan during 2008–2012. Four oak cynipid leaf galls, *Cerroneuroterus vonkuenburgi* (Dettmer), *C. monzeni* (Dettmer), *Trichagalma acutissimae* (Monzen), and *Andricus kunugifoliae* (Shinji), were collected from *Q. acutissima* Carruth. and *Q. variabilis* Blume. Japanese species collected from *Q. acutissima* are *C. vonkuenburgi*, *C. monzeni*, *T. acutissimae*, and *A. kunugifoliae*, while *C. vonkuenburgi* was collected from *Q. variabilis* in Japan and Taiwan. Leaves with galls were put into sealed plastic bags during the field work and taken to the laboratory for rearing. Japanese galls were reared at the University of Edinburgh, UK; galls collected in Taiwan – at the National Chung Hsing University, Taichung, Taiwan. Galls were placed in plastic containers at a room temperature, with square windows cut into the lids and covered with a mesh for the proper ventilation to avoid the fungi infection. Containers were checked every day and wasps that had emerged were aspirated and placed in 99% ethanol for further laboratory processing.

**DNA extraction, sequencing, and alignment**

Genomic DNA was extracted from legs from adult specimens, following the chelex extraction method presented in Nicholls et al. (2010). A fragment of the mitochondrial cytochrome c oxidase (*cox1*) gene was amplified using the HCO-2198 (5′ TAA ACT TCA GGG TGA CCA AAA AAT CA 3′) and LCO-1490 (5′ GGT CAA CAA ATC ATA ATC ATA TGG ATA TTG G 3′) primers (Folmer et al. 1994). A fragment of the D2 expansion segment of the nuclear 28S ribosomal array (28S D2) was amplified using the primers D2 forward (5′-CGTGGTTGTGTGATAGTGCAAGC-3′) and D2 reverse (5′-CTAAAGCAGCCTTCAAAGGT-3′) (Hancock et al. 1988). Each 25 µl PCR mix consisted of 0.25 µl of 5U/µl Taq DNA polymerase (Fermentas), 2.5 µl of 10X Taq buffer, 2.0 µl MgCl2 (25 mM), 0.5 µl dNTPs (10 mM), 0.5 µl of each primers (20 pmol), 2.0 µl template DNA, and 16.75 µl purified and distilled water. Cycling conditions were 94°C for 2 minutes, followed by 35 cycles of 94°C for 30 seconds, 45°C (28S D2) or 50°C (*cox1*) for 30 seconds, and 72°C for 45 seconds, with a final step of 72°C for 10 minutes. PCR products were purified from 1% agarose gel using the Millipore Ultrafree-DA DNA extraction kit. PCR products were sequenced directly by MWG-Biotech AG (http://www.mwg-biotech.com) using cycle sequencing technology. 28S D2 regions were sequenced in both directions, while *cox1* in forward direction. Chromatograms were checked by eye using Staden package 2.0 (Bonfield et al. 1995). New haplotypes are deposited in GenBank, under accession numbers JX468357–JX468371. Sequences were aligned using Muscle 3.6 (Edgar et al. 2004) with default settings and compared to representatives of gallwasp inquilines (Synergini), known mainly from the Western Palaearctic (Ács et al. 2010, Pénzes et al. 2009, Table 1). Pairwise uncorrected p-distances among all sequences were then calculated using MEGA version 5.05 (Tamura et al. 2011). Distances between groups are defined as the minimum distances between group members. Alignment gaps in 28S D2 sequences were deleted at a pairwise manner.

**Morphological descriptions**

The terminology used to describe gallwasp morphology follows other recent cynipid studies (Melika et al. 2010; Liljeblad et al. 2008). Abbreviations for fore wing venation follow Ronquist & Nordlander (1989), cuticular surface terminology follows that of Harris (1979). Measurements and abbreviations used here include: F1–F12, 1st and subsequent flagellomeres; POL (post-ocellar distance) is the distance between the inner margins of the posterior ocelli; OOL (ocellar-ocular distance) is the distance from the outer edge of a posterior ocellus to the inner margin of the compound eye; LOL, the distance between lateral and frontal ocelli. The width of the forewing radial cell is measured from the margin of the wing to the Rs vein.

Images of wasp anatomy were produced with a digital Nikon Coolpix 4500 camera attached to a Leica DMLB compound microscope, followed by processing in CombineZP (Alan Hadley) and Adobe Photoshop 6.0.
The type material is deposited in the following institutions: NMNS, National Museum of Natural Science, Taichung, Taiwan (curator Ming-Luen Jeng); BPDL, Budapest Pest Diagnostic Laboratory, Budapest, Hungary (curator G. Melika); NCHU, Department of Entomology, National Chung Hsing University, Taichung, Taiwan (curator Chang-Ti Tang); USNM, U.S. National Museum of Natural History, Smithsonian Institution, Washington, DC, U.S.A. (curator M. Buffington); BLKU, Biosystematics Laboratory, Graduate School of Social and Cultural Studies, Kyushu University, Fukuoka, Japan (curator Y. Abe).

**TABLE 1.** GenBank accession number of haplotype sequences involved in the estimation of the genetic distances. New haplotypes are shown in bold with sample sizes (n).

<table>
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<tr>
<th>Species (n)</th>
<th>coxI haplotype</th>
<th>28S D2 haplotype</th>
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<tbody>
<tr>
<td><em>Ufo cerroneuroteri</em>, sp.n. (2)</td>
<td>JX468357-58</td>
<td>JX468367</td>
</tr>
<tr>
<td><em>Ufo nipponicus</em>, sp. n. (3)</td>
<td>JX468359-61</td>
<td>JX468367</td>
</tr>
<tr>
<td><em>Saphonecrus shirokashicolae</em> (Shinji) (4)</td>
<td>JX468362-63</td>
<td>JX468368</td>
</tr>
<tr>
<td><em>Saphonecrus sp TWT112</em> (2)</td>
<td>JX468364</td>
<td>JX468369</td>
</tr>
<tr>
<td><em>Saphonecrus shirakashii</em> (Shinji) (3)</td>
<td>JX468365</td>
<td>JX468370</td>
</tr>
<tr>
<td><em>Saphonecrus sp JP03</em> (1)</td>
<td>JX468366</td>
<td>JX468371</td>
</tr>
<tr>
<td><em>Saphonecrus connatus</em> (Hartig)</td>
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<td>EF487125</td>
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<tr>
<td><em>Saphonecrus andalatus</em> (Mayr)</td>
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<td>EF487133</td>
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<td><em>Saphonecrus haimi</em> (Mayr)</td>
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<td>EF487126</td>
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<tr>
<td><em>Saphonecrus lusitanicus</em> (Tavares)</td>
<td>EF486881</td>
<td>EF487131</td>
</tr>
<tr>
<td><em>Saphonecrus barbotini</em> Pujade-Villar &amp; Nieves-Aldrey</td>
<td>EF486877</td>
<td>EF487124</td>
</tr>
<tr>
<td><em>Synergus irani</em> Melika &amp; Pujade-Villar</td>
<td>-</td>
<td>EF487127</td>
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<tr>
<td><em>Synergus chinensis</em> Melika, Ács &amp; Bechtold</td>
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<td>EF487140</td>
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<td>EF487191</td>
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<td><em>Synergus physocerus</em> Hartig</td>
<td>EF486950</td>
<td>EF487185</td>
</tr>
<tr>
<td><em>Synergus xiaolongmeni</em> Melika, Ács &amp; Bechtold</td>
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<td>EF487220</td>
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<td><em>Synergus consobrinus</em> Giraud</td>
<td>EF486954</td>
<td>EF487189</td>
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<td><em>Synergus japonicus</em> Walker</td>
<td>EF486927</td>
<td>EF487167</td>
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<td><em>Synergus mikoi</em> Melika &amp; Pujade-Villar</td>
<td>EF486928</td>
<td>EF487169</td>
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<td><em>Synergus flavipes</em> Hartig</td>
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<td>EF487151</td>
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<td><em>Synergus variabilis</em> Mayr</td>
<td>EF486967</td>
<td>EF487219</td>
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<tr>
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<td>EF486952</td>
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<td><em>Synergus crassicornis</em> (Curtis)</td>
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<td><em>Synophus politus</em> Hartig</td>
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<td><em>Synophus pilulae</em> Houard</td>
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<td><em>Synophus olivieri</em> Kieffer</td>
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<td>EF583959</td>
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<td><em>Rhoophilus loewi</em> Mayr</td>
<td>EF486876</td>
<td>EF487123</td>
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<tr>
<td><em>Ceroptres clavicorns</em> Hartig</td>
<td>EF486871</td>
<td>EF487120</td>
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</table>

**Results**

*Ufo* is a genus within the oak gall-associated inquiline genera (Cynipidae: Synergini, *Synergus* complex) which is characterized by the next morphological characters: the head is trapezoid (in females) or ovate (in males) in...
anterior view; strongly transverse, 2.5–2.8˚ broader than high in dorsal view; the frons and vertex are alutaceous or smooth; the interocellar triangle very narrow, posterior edge of the frontal ocellus lies on a line between anterior edges of lateral ocelli; the occiput and postgena are smooth; the anterior part of the pronotum is rectangular in dorsal view, anterior and lateral sides form a right angle; the pronotum descending vertically to propleura; the lateral part of pronotum going down from the dorsal part also nearly at a right angle; a strong pronotal carina divides the lateral part from the frontal, both of which are also oriented almost at a right angle to each other; tarsal claws with distinct acute basal lobe.

In the allied genera, *Synergus* and *Saphonecrus*, the head usually is rounded, quadrangular or slightly ovate in anterior view; less transverse in dorsal view, only 1.6–2.1˚ as broad as high; the frons and vertex always clearly sculptured, at least delicately coriaceous; interocellar triangle much broader; the occiput is sculptured; the lateral pronotal carina, when present, never with a rectangular aspect in dorsal view, the pronotum more rounded in dorsal view; the base of the tarsal claw is broadened, and the basal lobe present, however, not in a form of an acute lobe. A 636 bp fragment of the *cox1* gene and 561–562 bp fragment of 28S D2 were successfully amplified for 2–4 specimens of the *Ufo cerroneuroteri*, *U. nipponicus*, and two species described by Wachi et al. (2011) as *U. shirakashii* and *U. shirokashicola* (Table 1). Furthermore specimens from two undescribed *Saphonecrus* species from Japan (referred as JP03) and Taiwan (TWT112), reared from galls on *Quercus glauca* Thunb. and *Q. gilva* Blume repectively, were involved in the analyses in order to illustrate diversity of the Eastern Palaearctic inquilines (Table 1). For *Saphonecrus* sp TWT112, a shorter fragment for 28S D2 was obtained (502 bp). Minimal pairwise distances among taxa are given in Table 2.

**TABLE 2.** Range or minimal p-distance among haplotypes (Table 1) for (A) *cox1* and (B) 28S D2.

<table>
<thead>
<tr>
<th>A (cox1)</th>
<th>Ufo cerroneuroteri</th>
<th>Ufo nipponicus</th>
<th>Saphonecrus sp. TWT112</th>
<th>Saphonecrus shirakashii</th>
<th>Saphonecrus shirokashicola</th>
<th>Saphonecrus sp. JP03</th>
<th>Synergus</th>
<th>Saphonecrus</th>
<th>Synophorus</th>
<th>Rhoophilus</th>
<th>Ceroptres</th>
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<tbody>
<tr>
<td>Ufo cerroneuroteri</td>
<td>0.0016</td>
<td>0.0126–0.0173</td>
<td>0.1116–0.1132</td>
<td>0.1352–0.1368</td>
<td>0.1478–0.1525</td>
<td>0.1478</td>
<td>0.1289</td>
<td>0.1336</td>
<td>0.1572</td>
<td>0.1509</td>
<td>0.1352</td>
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<tr>
<td>Ufo nipponicus</td>
<td>0.0016–0.0031</td>
<td>0.1132–0.1148</td>
<td>0.1352–0.1384</td>
<td>0.1494–0.1495</td>
<td>0.1447–0.1462</td>
<td>0.1274</td>
<td>0.1258</td>
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<td>0.1494</td>
<td>0.1305</td>
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<td>Saphonecrus sp. TWT112</td>
<td>0</td>
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<td>0.1447</td>
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<td>0.1321</td>
<td>0.1352</td>
<td>0.1462</td>
<td>0.1478</td>
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<td>0.1226</td>
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<td>0.1431</td>
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<td>0.1509</td>
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<td></td>
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<tr>
<td>Saphonecrus sp. JP03</td>
<td>–</td>
<td>0.1226</td>
<td>0.1447</td>
<td>0.1336</td>
<td>0.1321</td>
<td>0.1352</td>
<td>0.1462</td>
<td>0.1478</td>
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<table>
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<th>B (28S D2)</th>
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<th>Saphonecrus shirakashii</th>
<th>Saphonecrus shirokashicola</th>
<th>Saphonecrus sp. JP03</th>
<th>Synergus</th>
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<td>0.0963</td>
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</table>
**Ufo cerroneuroteri** Tang & Melika, new species
Figs 1–17


The female holotype, 8 female and 3 male paratypes are deposited in NMNS, 12 female and 3 male paratypes in BPDL, 2 female and 1 male paratypes in USNM, 6 female paratypes in NCHU.


**Etymology.** The species is named after the host, *Cerroneuroterus* spp. (*Cynipini*), from whose galls the adults of the new species emerged.

**Diagnosis.** Most closely resembles *U. nipponicus* and *U. koreanus* in *U. cerroneuroteri* notaui are complete (Fig. 12) (incomplete in *U. nipponicus*, Fig. 26 and *U. koreanus*, Fig. 45); the 2nd metasomal tergite strongly incised posterodorsally (Fig. 16) (straight, not incised in *U. nipponicus*, Fig. 29 and *U. koreanus*, Fig. 47).

**Description.** FEMALE. Head and mesosoma black or very dark brown; antennae light brown, mouthparts, maxillary and labial palps yellowish; legs yellowish brown with darker coxae; wings with very pale venation; 1st metasomal tergite always black, rest of metasoma dark brown to reddish brown.

Head smooth, glabrous, with some parts alutaceous. Lower face, malar space and clypeus with relatively dense white setae, row of setae present along inner margin of eye; frons with only few scattered setae; gena behind eye, postgena occiput and vertex with few setae; posterior areas aside hypostomata with dense setae. Head trapezoid, 1.4′ broader than high in frontal view; slightly broader than mesosoma, 2.5′ broader than long in dorsal view. Height of eye 1.5–1.7′ higher than length of malar space. Malar space without malar sulcus, with delicate striae radiating from clypeus and reaching eye. Clypeus very small, alutaceous, slightly impressed, ventrally straight, not emarginate; epistomal sulcus indistinct and clypeus smoothly joins central area of lower face; anterior tentorial pits small and indistinct; clypeo-pleurostomal line indistinct. Lower face with distinct striae radiating from clypeus and extending to lower level of toruli and eyes; central elevated area narrow, alutaceous, without striae. Frons uniformly alutaceous to microreticulate, with scattered piliferous points (micropunctures). Transfacial distance 1.1′ longer than height of eye; distance between inner margin of eye and antennal torulus slightly shorter than diameter of torulus; diameter of torulus 1.2′ longer than distance between toruli. POL 3.6′ longer than OOL and 2.2′ longer than LOL; OOL 1.3′ longer than length of lateral ocellus; posterior edge of median ocellus lies on a line between anterior edges of lateral ocelli. Vertex very narrow, smooth, shiny. Occiput smooth, shiny, descending nearly vertically, not concave backwards; occipital carina absent. Gena not broadened behind eye in anterior view,
smooth, delicately alutaceous, with some setae. Postgena smooth, shiny. Postgenal bridge reduced to long, narrow median strip; postgenal sulci united well before reaching hypostomata; posterior tentorial pits distinct, area around occipital foramen well-impressed, smooth, shiny. Antenna with 11 flagellomeres, pedicel 1.8 longer than broad, F1 1.35 longer than F2 and 2.1 longer than pedicel; F2=F3, F11 nearly 2.0 longer than F10; placoid sensillae on F2–F11.

FIGURES 1–9. *Ufocerroneuroteri*, new species: 1–4, head, female: 1, anterior view, 2, dorsal view, 3, posterior view. 4, lateral view, 5–7, head, male: 5, anterior view, 6, dorsal view, 7, posterior view. 8–9, antenna: 8, female, 9, male.

Mesosoma 1.4 longer than high in lateral view. Side of pronotum rectangular in dorsal view, anterior and lateral sides form a right angle; pronotum descending vertically to propleura; lateral part of pronotum descending from dorsal part nearly at right angle; strong pronotal carina divides lateral from frontal part, which oriented almost
at right angle to each other; pronotum coriaceous, laterally with some striae, area between them weakly coriaceous or almost smooth, shiny. Propleuron alutaceous with some transverse striae in lower half. Mesoscutum slightly longer than broad measuring along anterior edge of tegulae, with white setae, denser between notauli; uniformly densely micropunctured, area between them delicately coriaceous. Notaulus complete, reaching pronotum, slightly broadened posteriorly, with smooth shiny bottom. Anterior parallel lines very indistinct, present in anterior 1/4 of mesoscutum, indicated by smooth glabrous surface. Parapsidal lines very narrow, extending to half length of mesoscutum; distinct parascutal carina present only along tegula; median mesoscutal line in a form of very short triangle posteriorly or invisible. Dorsoaxillar area very finely coriaceous, shiny, with micropunctures; lateroaxillar area joins dorsoaxillar area at acute angle. Mesoscutellum 1.4’ longer than broad in dorsal view, emarginate and rugose laterally and posteriorly, uniformly delicately coriaceous centrally. Scutellar foveae transverse with smooth bottom, separated by distinct median carina. Mesopleuron smooth, shiny, with parallel longitudinal striae, especially in central and posterodorsal parts. Metapleural sulcus reaches mesopleuron in most upper 1/4 of its height. Propodeum smooth, glabrous, with sparse short white setae laterally of central propodeal area; lateral propodeal carinae distinct, uniformly thin, slightly curved outwards in mid-height; central propodeal area delicately coriaceous, without striae. Metascutellum indistinct, much shorter than ventral impressed area; metanotal trough smooth, shiny, without setae; propodeal spiracle transversely ovate, with strong raised carina along anterior border. Nucha black, with longitudinal parallel ridges.

Forewing veins very pale, hardly traceable; margin with long cilia; radial cell opened, 2.8–3.0’ as long as broad; Rs and R1 straight, areolet absent. Legs with short white setae, tarsal claws with distinct basal lobe.

Metasoma longer than head+mesosoma and slightly longer than in lateral view. Second metasomal tergite with few white setae anterolaterally, smooth, shiny, glabrous; posterodorsally strongly incised. Subsequent tergites and hypopygium micropunctate; prominent part of ventral spine of hypopygium very short and slender, with very few short white setae ventrally. Body length 1.7–2.2 mm (n =15).

**MALE.** Similar to female but head more rounded in frontal view; antenna with 12 flagellomeres, F1 slightly curved and broadened apically, 1.6’ longer than F2; placoid sensillae on F3–F11. Body length 1.5–1.8 mm (n = 6).

**Biology.** This species was reared exclusively from the spangle galls of the asexual generation of *Cerroneuroterus vonkuenburgi* (Dettmer) (Fig. 48) on *Quercus variabilis* Blume. Galls were collected in October – December, the adult inquilines emerged during November–December.

**Distribution.** Currently known only from Taiwan in Nantou County, Hsinchu County, and Taoyuan County.

*Ufo nipponicus* Melika, new species

Figs 18–29


The female holotype and 22 female paratypes are deposited in BPD L, 2 paratypes in USNM, 4 paratypes in BLKU, 2 paratypes in NMNS, and 2 paratypes in NCHU.

**Etymology.** Named after the country, Japan, where the new species occurs.

**Diagnosis.** Most closely resembles *Ufo koreanus*, both have notauli incomplete, extending the most to the half length of the mesoscutum, the median mesoscutal line absent (Figs 26, 44); the 2nd metasomal tergite straight, not incised posterodorsally (Figs 29, 47). In *U. nipponicus* the head is trapezoid in anterior view (Fig. 18) (ovate in *U. koreanus*, Fig. 40) and F1 of the female antenna 2.0’ longer than the pedicel (Fig. 22) (1.4’ in *U. koreanus*, Fig. 42).
Description. FEMALE. Head and mesosoma black or very dark brown; antennae light brown, mouthparts, maxillary and labial palps yellowish; legs yellowish brown with darker coxae; wings with very pale venation; 1st metasomal tergite always black, rest of metasoma dark brown to reddish brown.

Head smooth, glabrous, with some parts alutaceous. Lower face, malar space and clypeus with relatively dense white setae, row of setae present along inner margin of eye; frons with only few scattered setae; gena behind eye, postgena, occiput and vertex with few setae; posterior areas aside hypostomata with denser setae. Head trapezoid, 1.3’ broader than high in anterior view; slightly broader than mesosoma, 2.4’ broader than long in dorsal view. Height of eye 1.8–2.0’ longer than length of malar space. Malar space without malar sulcus, with delicate striae radiating from clypeus and reach eye. Clypeus very small, alutaceous, slightly impressed, ventrally straight, not emarginate; epistomal sulcus indistinct; anterior tentorial pits small, indistinct; clypeo-pleurostomal line indistinct. Lower face with distinct striae radiating from clypeus and extending to lower level of torulus and eye; central elevated area narrow, alutaceous, without striae. Frons uniformly alutaceous to microreticulate. Transfacial distance 1.1’ longer than height of eye; distance between eye and antennal torulus equal to diameter of torulus; diameter of torulus only very slightly longer than distance between toruli. POL 3.5’ longer than OOL and 1.8’ longer than LOL; OOL 1.5’ longer than length of lateral ocellus; posterior edge of median ocellus lies on a line between anterior edges of lateral ocelli. Vertex narrow, smooth, shiny. Occiput smooth, shiny, descending nearly vertically, not concave backwards; occipital carina absent. Gena not broadened behind eye in anterior view, smooth, delicately alutaceous, with some setae. Postgena smooth, shiny. Postgenal bridge reduced to long, narrow median strip; postgenal sulci united well before reaching hypostomata; posterior tentorial pits distinct, area around occipital foramen well-impressed, smooth and shiny. Antenna with 11 flagellomeres, pedicel 1.7’ longer than...
broad, F1 1.5´ longer than F2 and 2.0´ longer than pedicel; F2=F3, F11 nearly 2.0´ longer than F10; placoid sensillae on F2–F11.

Mesosoma 1.3’ longer than high in lateral view. Side of pronotum rectangular in dorsal view, anterior and lateral sides form right angle; pronotum descending vertically to propleura; lateral part of pronotum descending from dorsal part nearly at right angle; strong pronotal carina divides lateral from frontal part, which oriented almost at right angle to each other; pronotum coriaceous, laterally with some striae, area between them weakly coriaceous or almost smooth, shiny. Propleuron alutaceous, with some transverse striae in lower half. Mesoscutum with white setae, denser between notaulli; slightly longer than broad measuring along anterior edge of tegulae; uniformly delicately coriaceous with piliferous points. Notauli incomplete, extending to half length of mesoscutum, slightly broadened posteriorly, with smooth, shiny bottom; anterior parallel lines very indistinct, present in anterior 1/4 of mesoscutum, indicated by smooth, glabrous surface. Parapsidal lines very narrow, extending to 1/3 of mesoscutum length; distinct parascutal carina present only along tegula; median mesoscutal line absent. Dorsoaxillar area very finely coriaceous, shiny, with micropunctures; lateroaxillar area joins dorsoaxillar area at an acute angle. Mesoscuteullum 1.4’ longer than broad in dorsal view, emarginate and rugose along lateral and posterior edges, uniformly delicately coriaceous centrally. Scutellar foveae transverse, with smooth bottom, separated by distinct median carina. Mesopleuron smooth, shiny, with parallel longitudinal striae, especially in central and posterodorsal parts. Metapleural sulcus reach mesopleuron in most upper 1/4 of its height. Propodeum smooth, glabrous, with sparse short white setae laterally of central propodeal area; lateral propodeal carinae distinct, uniformly thin, slightly curved outwards in mid-height; central propodeal area delicately coriaceous, without striae. Metascutellum indistinct, much shorter than ventral impressed area; metanotal trough smooth, shiny, without setae; propodeal spiracle transversely ovate, with strong raised carina along anterior border. Nucha black, with longitudinal parallel ridges.

Forewing veins very pale, hardly traceable; margin with long cilia; radial cell opened, 2.8´ as long as broad; Rs and R1 straight, areolet absent. Legs with short white setae, tarsal claws with distinct basal lobe.

Metasoma longer than head+mesosoma and slightly longer than high from lateral view. Second metasomal tergite with few white setae anterolaterally, smooth, shiny, glabrous, posterodorsally straight, not incised. Subsequent tergites and hypopygium micropunctate; prominent part of ventral spine of hypopygium very short and slender, with very few short white setae ventrally. Body length 1.5–1.8 mm (n =15).

MALE. Unknown.

**Biology.** This species was reared from spangle galls of asexual generations of *Cerroneuroterus monzeni* (Dettmer) (Fig. 49) and *C. vonkuenburgi* (Fig. 48), and also from asexual galls of *Trichagalma acutissimae* (Monzen) (Fig. 51) on *Q. variabilis* and *Q. acutissima*. A few wasps emerged from leaf galls, collected on *Q. variabilis* and which were identified as *Andricus kunugifolii* (Shinji) (Fig. 52) [for the current status of this species see Abe *et al*. 2007].

**Distribution.** Known from Japan: Kyushu, Fukuoka (Mt. Hiyama, Mt. Aburayama, Dazaifu city) and Honshu, Kyoto (Mt. Hiei and Matsugasaki).


**Ufo abei** Melika & Pujade-Villar

Figs 30–39

**Diagnosis.** Differs from all other *Ufo* species by the smooth, glabrous head (particularly smooth frons) and the short malar space. The body is uniformly reddish brown to black; the head is transversely ovate; the frons is
smooth, shiny; the compound eye 1.1’ longer than the malar space; the lower face with sparse white setae (Figs 30–33); notauli are incomplete, extending maximum to the half length of the mesoscutum (Fig. 37); the 2nd metasomal tergite not or very slightly incised posterodorsally.

**Distribution and Biology.** Known only from Honshu (Hiroshima), Japan; collected from *Q. variabilis*, from an unknown host (Melika et al. 2005). Females known only.

**Ufo koreanus** Melika, Pujade-Villar & Choi
Figs 40–47

**Diagnosis.** For *Ufo koreanus* three female paratypes were designated originally: two with the same labels as the holotype, and one female labelled: KOREA, NIAST, 10. Oct. 1997. YPT. J.Y. Choi (Melika et al. 2007). Detail examination of *U. koreanus* holotype and paratypes showed that the one female paratype labelled “KOREA, NIAST, 10. Oct. 1997. YPT. J.Y. Choi” belongs to the herein newly described species, *Ufo cerroneuroteri.*

Females emerged at the beginning of October from leaf spangle galls of *Cerroneuroterus nawai* (Ashmead), on *Q. variabilis* (Melika et al. 2007). *Ufo koreanus* differs from *U. cerroneuroteri* by incomplete notauli, extending the most to the half length of the mesoscutum; the median mesoscutal line absent and the 2nd metasomal tergite not incised posterodorsally (Fig. 44). Also *U. koreanus* differs from *U. nipponicus* by the head ovate in anterior view (Fig. 40)(trapezoid in *U. nipponicus*, Fig. 18) and F1 in the female antenna 1.4’ longer than the pedicel (Fig. 42) (2.0’ in *U. nipponicus*, Fig. 22).

**Distribution.** Known from Republic of Korea, Suwon, Mt. Yeo Gi (Melika et al. 2007).

**Ufo shirakashii** (Shinji) and **U. shirokashicola** (Shinji)

Recently two *Andricus* Hartig species were transferred to *Ufo*, and re-described as *Ufo shirakashii* (Shinji) and *U. shirokashicola* (Shinji) (Wachi et al. 2011b). However, these two species we erroneously put into the *Ufo* genus. Both species must be transferred to the undulatus/haimi/irani clade of *Saphonecrus* Dalla Torre & Kieffer (Pénzes et al. 2009, Ács et al. 2010).

Morphological characters, given for the two species by Wachi et al. (2011) resembles those of *Saphonecrus* and not *Ufo* (see diagnostic characters to both genera above in the first paragraph to Results). These two species belong to the *undulatus/haimi/irani* clade of *Saphonecrus*, which is characterized by a strong lateral pronotal carina, the pronotum with sharp angles in dorsal view, however, the mesosoma anteriorly never has a strong rectangular aspect as in *Ufo* (Pénzes et al. 2009, Ács et al. 2010).

*Saphonecrus shirakashii* (Shinji, 1940), **comb. nov.** (Figs 53–68) was collected by GM in Japan (Dazaifu city nr. Fukuoka, from undescribed leaf galls on *Q. glauca*; the same gall is given under figure C-059 in Yukawa & Masuda (1996); five females and two males), and by CT-T from different sites in Taiwan (Nantou Co., Lushan and from Huisun Forest Station, Renai Township; Taichung Co., Mt. Tungmau, Heping Township; Hsinchu Co., Jianshih Township), from undescribed leaf galls on *Q. glauca* and *Q. globosa* (dozens of females and males were reared from collected galls).

*Saphonecrus shirokashicola* (Shinji, 1941), **comb. nov.** (Figs 69–78) was collected by GM in Japan (Honshu, Mt. Aburayama, Fukuoka, from undescribed leaf galls on *Q. glauca*; the same gall is given under figure C-057 in Yukawa & Masuda (1996); 4 females and two males), and by CT-T in Taiwan (Nantou Co., Mt. Guandau, Renai Township), from undescribed leaf galls on *Q. longinux* (Figs ) (dozens of females and males were reared from collected galls).

Both species are characterized by an ovate or quadrangular head in anterior view; the frons is smooth, shiny or alutaceous, without or with very few delicate indistinct striae; F1 of the male antenna only 1.5’ longer or only slightly longer than F2; the mesoscutum delicately alutaceous or punctate, without distinct short irregular transverse striae. In *S. shirakashii* the pedicel 2.2’ longer than broad; F1 in the female antenna 1.2’ longer than F2; F11 1.9’ longer than F10; notauli are distinctly impressed, complete, reach the pronotum, while in *S. shirokashicola* the pedicel 1.6’ longer than broad; F1 in the female antenna 1.7’ longer than F2; F11 2.3’ longer than F10; notauli are short, indistinctly impressed, visible only in the posterior 1/3–1/2 of the mesoscutum.
FIGURES 69–73. Saphonecrus shirokashicola (Shinji), comb. nov., female: 69–71, head: 69, anterior view, 70, dorsal view, 71, posterior view. 72, antenna, 73, mesosoma, part, lateral view.

Genetic distances

All specimens from Ufo cerroneuroteri and U. nipponicus share the same haplotype for 28S D2 and it is more similar to Saphonecrus irani than to either Saphonecrus shirakashii or Saphonecrus shirokashicola (Table 2). CoxI sequences show larger variation, all Ufo cerroneuroteri and U. nipponicus specimens have unique haplotypes. Within species, distances are one-scale smaller (0.16–0.31%) than between the two Ufo species (1.2–1.7%) (Table 2). Distances from all other species exceeds 10%, including Saphonecrus shirakashii and Saphonecrus shirokashicola. Distances of Ufo species from the latters are comparable to minimal distances from Saphonecrus and Synergus species. Furthermore, Saphonecrus sp. TWT112 is more similar to Ufo than to Saphonecrus shirakashii and Saphonecrus shirokashicola (11%). These results suggest that the two herein described Ufo species form a unique distinct unit.
Also the sequences obtained for *S. shirakashii* and *S. shirokashicola* suggest that these are distinct units, differ considerably from each other and from *Ufo*. For 28S D2, both have unique haplotypes, distances from some Palearctic *Synergus* and *Synophrus* species are even smaller than distance from each other. *Cox1* shows similar pattern, minimal distances from Palearctic *Synergus* and *Saphonecrus* are comparable with the distance to *Ufo* (all within 12–15%) and *Saphonecrus* sp. JP03 (11–15%) while the distance from each other is nearly equal to 15–16% (Table 2).

**FIGURES 74–78.** *Saphonecrus shirokashicola* (Shinji), **comb. nov.**, female: 74, pronotum and propleuron, anterior view, 75, mesoscutum, dorsal view, 76, mesoscutellum, dorsal view, 77, metascutellum and propodeum, posterodorsal view, 78, metasoma, female, lateral view.

**Key to Ufo species**

1. Frons smooth, shiny; height of eye 1.1 longer than length of malar space (Fig. 30) ................................. *abei*
2. Frons alutaceous; height of eye 1.5–2.0' longer than length of malar space (Figs 1, 5, 18) ................................. 2
2. Notauli complete, median mesoscutal line present in a form of short triangle posteriorly (Figs 12); 2nd metasomal tergite strongly incised posterodorsally (Figs 16) ................................. cerroneuroteri  
- Notauli incomplete, extending most to half length of mesoscutum, median mesoscutal line absent (Figs 26, 44); 2nd metasomal tergite straight, not incised posterodorsally (Figs 29, 47) ............................................. niponicus

3. Lower face with dense white setae; height of eye 1.8–2.0’ longer than length of malar space (Fig. 18); F1 of female antenna 2.0’ longer than pedicel (Fig. 22) ............................................................... koreanus

- Lower face with only scattered setae; height of eye 1.6’ longer than length of malar space (Fig. 40); F1 of female antenna 1.4’ longer than pedicel (Fig. 42) ............................................................... Saphonecrus

Discussion

Inquiline cynipid gallwasps (Cynipidae: Synergini), associated with cynipid host galls on oaks, currently are distributed between 6 genera (Ceroptrs, Saphonecrus, Synergus, Synophrus, Ufo and Agastoroxenia Nieves-Aldrey & Medianero). Previous analyses, into which Agastoroxenia and Ufo were not involved, supported monophyly for the Synergus complex (Saphonecrus, Synergus, Synophrus), distinct from Ceroptrs (Pénzes et al. 2009, Ács et al. 2010). Saphonecrus appeared to be a paraphyletic group with respect to Synophrus, the two lineages of which can be easily distinguished: (i) for the first lineage, which includes Saphonecrus connatus (Hartig), S. lusitanicus (Tavares), S. barbotini Pujade-Villar & Nieves-Aldrey, all the Synophrus species and a number of undescribed Eastern Palearctic species, the lateral pronotal carina is absent and the pronotum is rounded in dorsal view; (ii) for the second lineage, which includes three other Western Palearctic Saphonecrus species (S. undulatus (Mayr), S. haimi (Mayr), and S. irani Melika & Pujade-Villar) and a number of undescribed Eastern Palearctic species, the lateral pronotal carina present and the pronotum with sharp angles in dorsal view (Pénzes et al. 2009, Ács et al. 2010). We expect that S. shirakashii, S. shirokashicola, Saphonecrus sp. JP03 and Saphonecrus sp. TWT112, belong to the second Saphonecrus clade.

Based on the morphological characters Ufo belong to the Synergus complex (Melika et al. 2005), which is supported by the genetic distances. Within the Synergus complex, Ufo possesses with a few synapomorphies: the head is trapezoid in anterior view and very narrow in dorsal view, rectangular aspect of the pronotum has distinct rectangular aspect in dorsal view, the tarsal claw with a very acute basal lobe, host cynipid galls associated with cynipid host galls on oaks, currently are distributed between 6 genera (Ceroptrs, Saphonecrus, Synergus, Synophrus, Ufo and Agastoroxenia Nieves-Aldrey & Medianero). Previous analyses, into which Agastoroxenia and Ufo were not involved, supported monophyly for the Synergus complex (Saphonecrus, Synergus, Synophrus), distinct from Ceroptrs (Pénzes et al. 2009, Ács et al. 2010). Saphonecrus appeared to be a paraphyletic group with respect to Synophrus, the two lineages of which can be easily distinguished: (i) for the first lineage, which includes Saphonecrus connatus (Hartig), S. lusitanicus (Tavares), S. barbotini Pujade-Villar & Nieves-Aldrey, all the Synophrus species and a number of undescribed Eastern Palearctic species, the lateral pronotal carina is absent and the pronotum is rounded in dorsal view; (ii) for the second lineage, which includes three other Western Palearctic Saphonecrus species (S. undulatus (Mayr), S. haimi (Mayr), and S. irani Melika & Pujade-Villar) and a number of undescribed Eastern Palearctic species, the lateral pronotal carina present and the pronotum with sharp angles in dorsal view (Pénzes et al. 2009, Ács et al. 2010). We expect that S. shirakashii, S. shirokashicola, Saphonecrus sp. JP03 and Saphonecrus sp. TWT112, belong to the second Saphonecrus clade.

No doubts, that the current two lineages within Saphonecrus do not reflect the diversity of known and undescribed species within the Eastern Palearctic and for some of them new genera must be established what will be discussed elsewhere.

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