

1   **A systematic revision of the Japanese species of the genus *Therion* Curtis, 1829**  
2   (Hymenoptera: Ichneumonidae: Anomaloninae)

3  
4   **So Shimizu<sup>a</sup>, \* , Andrew M.R. Bennett<sup>b</sup>, Masato Ito<sup>a, c</sup> and Kaoru Maeto<sup>a</sup>**

5  
6   <sup>a</sup>Laboratory of Insect Biodiversity and Ecosystem Science, Graduate School of  
7   Agricultural Science, Kobe University, Rokkodaicho 1–1, Nada, Kobe, Hyogo 657–8501,  
8   Japan

9   <sup>b</sup>Agriculture and Agri-Food Canada, Canadian National Collection of Insects, 960  
10   Carling Avenue, Ottawa, Ontario, Canada K1A 0C6

11   <sup>c</sup>Research Fellow (DC), Japan Society for the Promotion of Science, Tokyo, Japan

12   \*Corresponding author, e-mail: parasitoidwasp.sou@gmail.com

13  
14   **Abstract**

15   The Japanese species of the genus *Therion* Curtis, 1829 (Ichneumonidae: Anomaloninae)  
16   were revised based on examination of 447 Japanese specimens. Four species are  
17   recognized based on morphology and sequence data (mtCOI). Two of them are identified  
18   as previously known species: *T. circumflexum* (Linnaeus, 1758) and *T. giganteum*  
19   (Gravenhorst, 1829). The other two species are described as new: *T. carinatum* Shimizu  
20   & Bennett, sp. nov. and *T. nigrigasterum* Shimizu, Bennett & Ito, sp. nov. In addition, *T.*  
21   *rufomaculatum* (Uchida, 1928) stat. rev. is once again synonymized with *T. circumflexum*.  
22   The Japanese species of *Therion* are easily distinguished from each other by a newly  
23   provided key. The lasiocampid moth, *Dendrolimus spectabilis* (Butler, 1877), is newly  
24   recorded as a host of *T. giganteum*.

25  
26   **Keywords**

27   COI; koinobiont endoparasitoid; Lepidoptera; Palaearctic region; taxonomy

28   ZooBank: <http://zoobank.org/B187A3F3-5F7C-469B-B6EB-CE6992963D86>

29  
30   **Introduction**

31   The ichneumonid subfamily Anomaloninae Viereck, 1918 comprises two tribes, 46  
32   genera, and more than 700 valid species and is distributed in all biogeographical regions,  
33   except for the Arctic and Antarctic regions (Sheng et al. 2012; Yu et al. 2012; Broad 2014;

37 Ward 2015; Shimizu 2016a). In Japan, 10 genera and 67 valid species have been recorded  
38 (Yu et al. 2012; Shimizu 2016a, b).

39 The tribe Gravenhorstiini Enderlein, 1912 is known to comprise solitary koinobiont  
40 endoparasitoids of various Lepidoptera larvae (e.g., Lasiocampidae, Lycaenidae, and  
41 Saturniidae) (Matsumura 1926; Uchida 1928, 1954; Kusigemati 1972, 1981; Schnee  
42 2008). Most anomalonines are considered diurnal, but several species are likely to be  
43 crepuscular or nocturnal (Lee & Choi 2004; Shimizu 2016b).

44 The well-known genus *Therion* Curtis, 1829 of Gravenhorstiini comprises 25  
45 valid species occurring in the Australasian, Nearctic, Neotropical, Oriental, and  
46 Palaearctic regions (Yu et al. 2012; Schnee 2014). They are generally large (wing length  
47 6.6–17.8 mm) (Dasch 1984 for the Nearctic species) and relatively conspicuous, with  
48 dark head and mesosoma contrasting with yellow or orange on at least part of the  
49 metasoma (Figures 5–8). Six species have been reported in the Eastern Palaearctic region  
50 (Yu et al. 2012; Schnee 2014), and two species, *T. circumflexum* (Linnaeus, 1758) and *T.  
51 giganteum* (Gravenhorst, 1829), were previously recorded from Japan (e.g., Matsumura  
52 1926; Uchida 1928, 1958).

53 The Japanese *Therion* species have not been studied for the last six decades, so here  
54 we revise the Japanese species based on morphology and sequence data. Descriptions and  
55 a key to all the Japanese species of *Therion* are provided.

56

57

## 58 Materials and methods

59

### 60 Specimens examined

61 A total of 447 specimens from Japan and 58 specimens from other countries (Canada,  
62 China, England, France, Germany, India, Korea, Switzerland, Taiwan, and United States)  
63 were examined.

64

### 65 Photographic/ electron microscopy equipment and preparation of figures

66 Morphological characteristics were observed under a stereoscopic microscope (SMZ1500,  
67 Nikon, Tokyo, Japan).

68 Figures 5–8 and 23a-c were taken using a single lens reflex camera (D90, Nikon,  
69 Tokyo, Japan) with micro-lens (AF Micro-Nikkor 60mm f/2.8D, Nikon, Tokyo, Japan)  
70 and teleplus teleconvertor (N-AFD 2× Teleplus MC7, Kenoko, Tokyo, Japan). Figures  
71 11–22 and 24–35 were taken using a scanning electron microscope (SEM) (JSM-6010LV,  
72 JEOL, Tokyo, Japan). The specimens for SEM observation were not coated and were

73 observed under high vacuum and an accelerating voltage of 10kV.

74 Multi focus images were stacked by Combine ZP, and all figures were edited by  
75 Adobe Photoshop Creative Cloud and Illustrator Creative Cloud.

76

77 *Terms and abbreviations*

78 Morphological terms mainly follow Gauld (1991), and terms for surface microsculpture  
79 follow Eady (1968).

80 The following abbreviations are used for the collection depositories:

81 ANSP – Academy of Natural Science of Philadelphia of Drexel University, Philadelphia,  
82 Pennsylvania, USA

83 CNC – Canadian National Collection of Insects, Ontario, Canada

84 EUM – Ehime University Museum, Matsuyama, Japan

85 KPMNH – Kanagawa Prefectural Museum of Natural History, Odawara, Japan

86 LSL – The Linnean Society of London, London, England, United Kingdom

87 NIAES – National Institute for Agro-Environmental Sciences, Tsukuba, Japan

88 RBC – R. Bauer collection, Erlenstrasse 7, D-90530 Wendelstein, Germany

89 SEHU – The Laboratory of Systematic Entomology, Hokkaido University, Sapporo,  
90 Japan

91 TARI – Taiwan Agricultural Research Institute Council of Agriculture, Executive Yuan,  
92 Taichung, Taiwan

93 UL – Universite Laval, Departement de Biologie, Faculte des Sciences, Quebec, Canada

94 ZM – Zoological Museum, Helsinki, Finland

95 ZMB – Zoologisches Museum, Berlin, Germany

96

97 The abbreviations listed below are also used in this work.

98 CNN – collector is not noted (used in Specimens examined)

99 F – female (FF: females)

100 HT – holotype

101 IOD – inter-ocellar distance (shortest distance between inner margin of lateral ocelli)  
102 (Figure 2)

103 LOD – lateral-ocellar diameter (maximum diameter of lateral ocelli) (Figure 2)

104 LT – light trap

105 M – male (MM: males)

106 MsT – Malaise trap

107 OOD – orbito-ocellar distance (shortest distance between outer margin of lateral ocellus  
108 and orbit of eye) (Figure 2)

109     POD – post-ocellar distance (shortest distance between posterior margin of lateral  
110    ocellus and anterior margin of occipital carina) (Figure 2)

111     PT – paratype

112     S – metasomal sternite

113     T – metasomal tergite

114

115     *Measurements (Figures 3–4)*

116     The indices listed below follow Gauld (1976), Shimizu (2016a, b, 2017), and Shimizu et  
117    al. (2016).

118

119     *Fore wing indices (Figure 3)*

120     BI (Brachial index) = length of shortest distance between *CuI* and *IA* at distal end of first  
121    subdiscal cell [fh in Figure 3] / length of shortest distance between *CuI* and *IA* at  
122    proximal end of first subdiscal cell [ij in Figure 3]

123     CI (Cubital index) = length of *CuI* between *Im-cu* and *CuIa* [fg in Figure 3] / length of  
124    *CuIb* [gh in Figure 3]

125     DBI (Disco-brachial index) = length of *CuI* between *cu-a* and *Im-cu* [fi in Figure 3] /  
126    length of *Im-cu* between *CuI* and *2rs-m* [df in Figure 3]

127     ICI (Intercubital index) = length of *2rs-m* [bd in Figure 3] / length of *M* between *2m-cu*  
128    and *2rs-m* [de in Figure 3]

129     MI (Marginal index) = length of *Rs* [cd in Figure 3] / length of *Rs+2r* [ab in Figure 3]

130

131     *Hind wing indices (Figure 4)*

132     NI (Nervellar index) = length of *CuI* between *M* and *cu-a* [no in Figure 4] / length of *cu-*  
133    *a* [op in Figure 4]

134     RI (Radial index) = length of *Rs* between *RI* and *Ir-m* [kl in Figure 4] / length of *Ir-m*  
135    between *Rs* and *M* [lm in Figure 3]

136

137     *Metasomal indices*

138     DMI (Dorsal metasomal index) = length of dorsum of T2 / length of dorsum of T3

139     PI (Petiolar index) = distance between base of T1 and anterior margin of spiracle /  
140    distance between posterior margin of spiracle and apex of T1

141

142     *Molecular techniques and phylogenetic analysis*

143     Phylogenetic relationships were reconstructed using the “barcoding gene” of mtDNA of  
144    *Therion circumflexum* from Canada (n = 2), Japan (n = 6), and Taiwan (n = 1), *T.*

145 *nigrigasterum* Shimizu, Bennett & Ito, sp. nov. from Japan (n = 7), and *T. fuscipenne*  
146 (Norton, 1863) from Canada (n = 1) and United States (n = 1) (locality data of non-  
147 Japanese *Therion* specimens is shown in Supplementary material 1). *Heteropelma*  
148 *amictum* (Fabricius, 1775) was included as an outgroup for the *Therion* species (see  
149 Supplementary material 2). The samples for mtDNA analysis were preserved in 99.5%  
150 ethanol and stored at -30°C until dissection. Sample codes of the specimens used are  
151 indicated in brackets ([ ]) in “Specimens examined” and are summarized in Table 1.

152 A mid tarsus was removed from each individual and preserved in 99.5% ethanol.  
153 After drying, the tissue was ground in 20 µl of 50 mM NaOH and digested for 15 min at  
154 95°C. After that, the sample was neutralized by 20 µl of 200 mM Tris-HCl.

155 The “barcoding gene”, is widely used for the taxonomy of Hymenoptera (e.g.,  
156 Stigenberg et al. 2011). For most specimens, the mtCOI primers designed by Folmer et  
157 al. (1994) (LCO 5' GGT CAA CAA ATC ATA AAG ATA TTG G3'; HCO 5' TAA ACT  
158 TCA GGG TGA CCA AAA AAT CA3') (648 bp) were used for the polymerase chain  
159 reaction (PCR), which was conducted using KOD FX NEO kit (Toyobo, Osaka, Japan);  
160 cycling conditions were 94°C for 2 min, 35 cycles at 98°C for 10 s, 48°C for 30 s, and  
161 68°C for 15 s. PCR products were purified using Illustra GFX kit (GE Healthcare Life  
162 Sciences) and were amplified with the same primers using the BigDyeTM Terminator ver.  
163 3.1 Cycle Sequencing kit (Applied Biosystems, USA). Cycling conditions were 25 cycles  
164 at 96°C for 10 s, 50°C for 5 s, and 60°C for 4 min. Products were purified using the 3M  
165 sodium acetate, 95% ethanol, 70% ethanol, and Hi-Di formamide. Cycle sequencing  
166 reactions were run on an ABI Prism 3100 Genetic Analyzer (Applied Biosystems).  
167 Nearctic specimens were sequenced at the Canadian Centre for DNA Barcoding  
168 (University of Guelph, Canada) using the external primers LepF1 and LepR1 of Hebert  
169 et al. (2004) in conjunction with two internal primers C\_ANTMR1D and  
170 RonMWASPdeg\_t1 from Fisher & Smith (2008). These primers produced two  
171 overlapping fragments of 319 and 421 base pairs. Methods for DNA extraction, PCR  
172 reactions and DNA sequencing followed the protocols of Fisher & Smith (2008).

173 Sequence data were assembled using the DNA Dynamo Sequence Analyze  
174 Software (Blue Tractor Software) and were aligned using ClustalW  
175 (<http://www.genome.jp/tools/clustalw/>). Genetic distances were calculated on up to 650  
176 alignable base pairs according to the p-distance, implemented in MEGA6 (Tamura et al.  
177 2013). A maximum likelihood (ML) tree was constructed using MEGA6 with 1,000  
178 bootstrap replications (Tamura et al. 2013). The model selection for ML was performed  
179 according to the Akaike information criterion (AIC) in MEGA6. The best-fit substitution  
180 model was TN93, with rate heterogeneity among sites modeled using a proportion of

181 invariable sites (+I) and a gamma distribution (+G). All the DNA sequences obtained  
182 were deposited in the DDBJ/EMBL GenBank database.

183

184

185 **Results and discussion**

186

187 *Recognition of species based on morphology and molecular analysis*

188 Four morphospecies (Figures 5–8) were easily distinguished from each other by distinct  
189 morphological characteristics as shown in the key below. Among them, two  
190 morphospecies were also distinctive from each other by molecular evidence (i.e., the  
191 genetic distance of mtCOI was about 7–9% from each other) (Figure 9; Table 1); one of  
192 them was identified as *T. circumflexum*, but the other one could not be identified as any  
193 previously known species. Hence, we describe it as a new species, *T. nigrigasterum*  
194 Shimizu, Bennett & Ito, sp. nov., in Systematics Section.

195 We failed to collect fresh specimens of the other two morphospecies for the  
196 analysis of mtCOI. However, they can easily be distinguished from any other *Therion*  
197 species by morphological characteristics (see Table 2, key, and the diagnoses in the  
198 *Systematics* section). One of them was identified as *T. giganteum* and the other is  
199 described as a new species, *T. carinatum* Shimizu & Bennett, sp. nov.,

200

201

202 **Systematics**

203

204 **Family Ichneumonidae Latreille, 1802**

205 **Subfamily Anomaloninae Viereck, 1918**

206 **Tribe Gravenhorstiini Enderlein, 1912**

207 **Genus *Therion* Curtis, 1829**

208

209 *Therion* Curtis, 1829: 101. Type-species: *Ichneumon circumflexus* Linnaeus, 1758: 566,  
210 by original designation.

211 *Therium* Agassiz, 1846: 368. [Unjustified emendation]

212 *Exochilum* Wesmael, 1849: 119, 122. Type-species: *Ichneumon circumflexus* Linnaeus,  
213 1758: 566, by monotypy.

214

215 *Generic diagnosis.*

216 This genus can be distinguished from other genera of Anomaloninae by the following

combination of characteristics: eyes bare (Figures 10, 11, 16, 17, 24, 25, 30, 31); lower margin of clypeus without a median apical tooth (Figures 1, 10, 16, 24, 30); frons with a median longitudinal ridge or horn (Figures 1, 2, 10, 11, 16, 17, 24, 25, 30, 31); occipital carina complete (Figures 2, 11, 17, 25, 31); mandible with two distinct teeth; ventral tooth of mandible distinctly shorter than dorsal one; antero-ventral corner of pronotum with a tooth or not (Figures 12, 18, 26, 32); epicnemial carina present (Figures 12, 18, 26, 32); posterior transverse carina of mesosternum interrupted anterior to mid coxa; scutellum convex (Figures 18, 32); fore wing with CI = 1.0–1.4 and DBI = 0.9–1.1; hind wing with *Cu1*; fore coxa smooth, without a carina or its vestige; and mid tibia with two spurs.

*Therion* is most closely related to the genus *Heteropelma* Wesmael, 1849 (Gauld 1976; Dasch 1984), but can be distinguished from each other by the following combination of character states: posterior transverse carina of mesosternum interrupted anterior to the mid coxa in *Therion*, but complete in *Heteropelma*; face 0.8 times as long as wide in *Therion*, but face as long as wide in *Heteropelma*; and hind tarsal claw simply curved in *Therion*, but usually strongly geniculate in *Heteropelma*.

232

### 233 *Biology.*

234 The species of this genus are solitary koinobiont endoparasitoids of Lepidoptera larvae  
235 as mentioned above. They emerge from the pupa of their host (Wood et al. 1954). Adult  
236 specimens were collected in light traps, Malaise traps, yellow pan traps, and by sweeping  
237 (see *Specimens examined*), and some were observed on flowers (cf. Figure 37).

238

### 239 *Distribution.*

240 Australasian, Nearctic, Neotropical, Oriental, and Palaearctic regions (Yu et al. 2012).

241

### 242 *Remarks.*

243 A key to the Japanese genera of Anomaloninae, including *Therion*, was provided by  
244 Shimizu (2016a). Gauld (1976) provided a detailed description of the genus and a key to  
245 the world genera of Anomaloninae to that date.

246

### 247 *Diagnostic morphological characters for Japanese Therion species*

248 Anomalonine wasps often show a significantly wide range of variation within a species,  
249 and *Therion* species are no exception. Hence it has long been considered difficult to  
250 recognize the limits of species (e.g., *T. circumflexum* has many synonyms caused by its  
251 wide range of color variation). However, through the observation of many specimens, we  
252 have noticed some useful characters (i.e., stable enough within each species) for the

253 recognition of *Therion* species as follows.

254 *Head*. Surface sculpture on face and frons; the shape of the median longitudinal  
255 ridge or horn on the frons; proportion of IOD, LOD, OOD, and POD; and the number of  
256 flagellomeres.

257 *Mesosoma*. The shape of the antero-ventral corner and dorsal margin of the  
258 pronotum and scutellum; surface sculpture on the mesopleuron, scutellum, metapleuron,  
259 and propodeum; and the dorsal and lateral profile of the mesoscutum.

260 *Wing*. Fore wing length and NI.

261 *Leg*. The shape and pectination of the hind tarsal claw.

262 *Metasoma*. PI and the shape of T1.

263 *Color*. Body color can vary widely in some species, and may be at least partly  
264 correlated with latitude (see near end of Description of *T. circumflexum*). Previous  
265 researchers (e.g., Bauer 1967; Slobodchikoff 1977) of *Therion* usually used color for  
266 species diagnosis. However, color should not be solely relied on for delimiting species.  
267

268 *Key to the Japanese species of the genus Therion*

- 269 1. Frons with a longitudinal, gently convex ridge between lower margin of frons and  
270 lower margin of median ocellus (Figures 10, 11). Face with a distinct, long,  
271 longitudinal carina between dorsal margin of face and ventral margin (Figure 10).  
272 Antero-ventral corner of pronotum evenly curved (without a tooth) (Figure 12). Most  
273 of mesopleuron reticulate rugose (Figure 12).....  
274 ..... *T. carinatum* Shimizu & Bennett, sp. nov.
- 275 –. Frons with a strongly convex, trapezoidal horn-like ridge (Figures 16, 17, 24, 25, 30,  
276 31). Face usually without a distinct, long, longitudinal carina, if present, it is short or  
277 weak (Figures 16, 24, 30). Antero-ventral corner of pronotum abruptly curved with a  
278 distinguishable tooth (Figures 18, 26, 32). Most of mesopleuron punctate (Figures 18,  
279 26, 32)..... 2
- 280 2. Mesoscutum rounded in dorsal view and 1.3 times as long as its width in dorsal view  
281 (Figure 33). Dorsal margin of pronotum without a distinct, longitudinal impression  
282 (Figure 32). Proximal part of hind tarsal claw not pectinate (Figure 35). Scutellum  
283 densely rugosopunctate, distance between punctures much less than their diameter  
284 (Figures 33, 34)..... *T. nigrigasterum* Shimizu, Bennett & Ito, sp. nov.
- 285 –. Mesoscutum elongate in dorsal view and 1.4–1.5 times as long as its width in dorsal  
286 view (Figures 19, 27). Dorsal margin of pronotum with a distinct, shallow to deep,  
287 longitudinal impression (indicated by arrow in Figures 18, 26). Proximal part of hind  
288 tarsal claw pectinate (Figures 21, 29). Scutellum moderately punctate, distance

- 289        between punctures usually as long as their diameter (Figures 19, 20, 27).....3
- 290     3. T1 slender. Petiolar Index = 3.6–5.0. Yellowish part on outer orbit narrow and 0.1–  
291            0.2 times as wide as maximum breadth of gena in lateral profile. Scutellum  
292            moderately convex.....*T. circumflexum* (Linnaeus, 1758)
- 293     –. T1 stout. Petiolar Index = 3.1–3.3. Yellowish part on outer orbit wide and 0.3 times  
294            as wide as maximum breadth of gena in lateral profile. Scutellum strongly  
295            convex.....*T. giganteum* (Gravenhorst, 1829)
- 296
- 297

298        ***Therion carinatum* Shimizu & Bennett, sp. nov.**

299        [Japanese name: Kogata-matsuyadori-konbō-amebachī]

300        (Figures 5, 10–15, 38)

301        **ZooBank:** <http://zoobank.org/E4FE337C-E049-41E8-9BE6-B1F91C4D4B02>

303        *Diagnosis*

304        This species can easily be distinguished from other extant species of *Therion* by the  
305            following combination of characteristics: face with a distinct long, longitudinal carina  
306            between dorsal margin and ventral margin of face (Figure 10); antero-ventral corner of  
307            pronotum evenly curved without a tooth (Figure 12); most of mesopleuron reticulate  
308            rugose (Figure 12); and small body (i.e., fore wing 7.0 mm) (Figure 5).

310        *Description of holotype*

311        *Female.*

312        *Head* (Figures 10, 11). Face 0.8 times as long as wide, polished, entirely covered  
313            with dense punctures and setae, and with a distinct median, longitudinal carina between  
314            dorsal and ventral margins of face (Figure 10). Clypeus 0.4 times as long as wide, polished  
315            with sparse punctures and setae (Figure 10). Malar space 0.5 times as long as basal width  
316            of mandible. Frons polished and strigose with setae medially, with a median longitudinal,  
317            gently convex ridge between ventral margin of median ocellus and ventral margin of frons,  
318            and with two lateral longitudinal carinae (Figures 10, 11). Gena polished and entirely  
319            covered with punctures and setae (Figure 11). Interocellar area punctate with setae and  
320            with a deep, median, longitudinal, U-shaped concavity (Figure 11). Ventral end of  
321            occipital carina not reaching base of mandible and oral carina. OOD 2.1 times as long as  
322            LOD, IOD 1.6 times as long as LOD, POD 1.1 times as long as LOD (Figure 11).  
323            Antennae with 43 flagellomeres. First flagellomere 2.6 times as long as its width and 2.0

324 times as long as second flagellomere.

325     *Mesosoma* (Figures 12–14). Antero-ventral corner of pronotum evenly curved,  
326 without a tooth (Figure 12). Ventral part of pronotum strigose, dorsal part punctate  
327 reticulate, and posterior margin with a crenulate furrow (Figure 12). Dorsal margin of  
328 pronotum with a longitudinal, shallow impression. Anterior margin of mesoscutum  
329 abruptly rounded in profile. Notauli weak and vestigial (Figure 13). Mesoscutum 1.4  
330 times as long as its width in dorsal view and entirely densely punctate with setae (Figure  
331 13). Scutellum weakly convex in profile, its anterior part punctate with setae, and its  
332 posterior part reticulate rugose. Mesopleuron entirely reticulate rugose with setae, except  
333 dorsal part rugose and posterior margin with a crenulate furrow (Figure 12). Ventral  
334 margin of mesopleuron and mesosternum punctate with setae (Figure 12). Epicnemial  
335 carina with dorsal end reaching anterior margin of mesopleuron (Figure 12). Postscutellum  
336 as long as its width. Metapleuron and propodeum coarsely reticulate  
337 (Figures 12, 14). Propodeum rounded in dorsal view and almost flat in profile (Figures  
338 12, 14).

339     *Wings*. Fore wing 7.0 mm, with CI = 1.0; BI = 1.9; DBI = 1.0; MI = 1.4; ICI = 0.8.  
340 Hind wing with 11 uniform hamuli and RI = 2.4; NI = 0.9.

341     *Legs* (Figure 15). Hind coxa 2.0 times as long as its width. Trochanter 1.2 times as  
342 long as trochantellus in ventral view. Hind femur 5.7 times as long as its width and 0.7  
343 times as long as hind tibia. Hind basitarsus 0.6 times as long as tibia and 2.3 times as long  
344 as second tarsus. Hind second tarsus 1.4 times as long as third tarsus. Proximal part of  
345 hind outer tarsal claw pectinate with two teeth (Figure 15).

346     *Metasoma*. PI = 4.0; DMI = 1.8. Ovipositor sheath 0.6 times as long as hind tibia,  
347 tip of dorsal valve tapered and with a dorsal notch, and tip of ventral valve tapered.

348     *Color* (Figure 5). *Head* entirely black but middle of face with a yellow mark,  
349 anterior margin of gena with a transverse yellow line, and apex of mandibles amber, and  
350 flagellomeres yellow. *Mesosoma* entirely black but tegula yellow and posterior margin of  
351 mesopleuron brown to yellow. *Wing* venation brown and membrane brownish. *Legs*  
352 amber but coxae black, distal 0.3 of hind femur and distal 0.2 of hind tibia brownish, and  
353 hind tarsal segments yellow. *Metasoma* amber to dark amber but T2–5 with black marks,  
354 T6–8 entirely black, ovipositor sheath light brown, and upper valve of ovipositor yellow.

355     *Male*. Unknown.

356

357     *Etymology*

358     The specific name is from the characteristic median longitudinal carina on the face and  
359 frons.

360  
361     *Distribution*  
362     Eastern Palaearctic region (Japan: Hokkaido) (Figure 38).  
363  
364     *Biology*  
365     Unknown.  
366  
367     *Remarks*  
368     This species resembles *T. circumflexum*, and the unique specimen was previously  
369     identified by Uchida (1928, 1958) as *Exochilum* (= *Therion*) *circumflexum* var.  
370     *nigroscutellata* Hellén, 1926. This variety was defined based only on the black scutellum  
371     (Hellén 1926). This species is, however, easily distinguishable from all *Therion* species  
372     on account of a median longitudinal carina of the face combined with the lack of a tooth  
373     on the antero-ventral corner of the pronotum. The median longitudinal carina of the face  
374     is only known elsewhere in the Nearctic *T. nigripes* Dreisbach, 1947, but that species has  
375     a strong tooth on the antero-ventral corner of the pronotum and is predominantly black,  
376     including all of the mesosoma, metasoma and wing membranes.  
377  
378     *Specimen examined*  
379     HT: female, Japan: Otaru, Hokkaido, 11. VI. 1924, T. Uchida leg. (SEHU) (Figures 5, 10–  
380     15).  
381  
382  
383     ***Therion circumflexum* (Linnaeus, 1758)**  
384     [Japanese name: Matsuyadori-konbō-amebachi]  
385     (Figures 6, 16–23, 39)  
386  
387     *Ichneumon circumflexus* Linnaeus, 1758: 566. Type: F; Europe (LSL).  
388     *Ichneumon ramidulus* Christ, 1791: 341.  
389     *Anomalon unicolor* Ratzeburg, 1844: 87.  
390     *Exochilum occidentale* Cresson, 1879: 366. Type: F; Oregon, United States of America  
391       (ANSP)  
392     *Anomalon nigrum* Provancher, 1879: 142. Lectotype: F; Quebec, Canada (UL).  
393     *Anomalon japonicum* Cameron, 1906: 98. Type: F; Shirakawa, Japan.  
394     *Exochilum callosum* Shestakov, 1923: 44. Type: M; Mongolia.  
395     *Exochilum circumflexum* var. *rubropictum* Ulbricht, 1926: 15. Type: M; Germany

- 396     *Exochilum laricis* Matsumura, 1926: 25. Type: F; Hokkaido, Japan (SEHU).  
397     *Exochilum circumflexum* ab. *nigroscutellata* Hellen, 1926: 15. Type: F; Finland (ZM).  
398     *Exochilum circumflexum* var. *nipponicum* Uchida, 1928: 236. Lectotype: F; Osaka, Japan  
399         (SEHU).  
400     *Exochilum circumflexum* var. *rufomaculatum* Uchida, 1928: 237. Type: F and M; Taiwan  
401         (SEHU).  
402     *Therion rufomaculatum* Uchida, 1958: 93. Revised status  
403     *Exochilum curtocrine* Bauer, 1967: 96. Type: F; Germany (RBC).  
404

405     *Diagnosis*

406     This species can easily be distinguished from all species of *Therion* by the following  
407     combination of characteristics: wing cells brownish, not strongly infuscate; epicnemial  
408     carina with its dorsal end reaching anterior margin of mesopleuron; antero-ventral corner  
409     of pronotum with a sharp tooth (Figure 18); mesoscutum elongate and 1.4–1.5 times as  
410     long as wide in dorsal view (Figure 19); dorsal margin of pronotum with a more or less  
411     distinguishable longitudinal impression (Figure 18); scutellum moderately convex  
412     (Figure 18); notauli weak and vestigial; T1 slender and entirely amber to dark amber; and  
413     PI = 3.6–5.0.

414

415     *Re-description based on Japanese specimens*

416     *Female* (n = 263).

417         *Head* (Figures 16, 17). Face 0.7–0.8 times as long as wide, polished, entirely  
418         covered with dense punctures and setae, lacking a median, longitudinal carina (Figure 16).  
419         Clypeus 0.5–0.6 times as long as wide, polished with sparse punctures and setae (Figure  
420         16). Malar space 0.3–0.4 times as long as basal width of mandible. Frons polished with  
421         rugae, setae, and a median longitudinal horn-like ridge (Figures 16, 17). Gena polished  
422         and entirely covered with punctures and setae (Figure 17). Interocellar area punctate with  
423         setae and usually without a median, longitudinal concavity, but rarely with a shallow  
424         concavity (Figure 17). Ventral end of occipital carina not reaching base of mandible and  
425         oral carina. OOD 2.0–2.1 times as long as LOD, IOD 1.4–1.9 times as long as LOD, POD  
426         0.5–0.9 times as long as LOD (Figure 17). Antennae with 49–55 flagellomeres. First  
427         flagellomere 2.9–3.0 times as long as its width and 2.1–2.3 times as long as second  
428         flagellomere.

429         *Mesosoma* (Figures 18–20). Antero-ventral corner of pronotum with a tooth (Figure  
430         18). Ventral part of pronotum strigose, dorsal part punctate, posterior margin with a  
431         crenulate furrow, and dorsal margin with a longitudinal, shallow to deep impression

432 (Figure 18). Anterior margin of mesoscutum abruptly rounded in profile (Figures 18, 19).  
433 Notauli weak and vestigial (Figures 18, 19). Mesoscutum 1.4–1.5 times as long as its  
434 width in dorsal view (Figure 19) and entirely densely punctate with setae (Figures 18, 19).  
435 Scutellum moderately convex in profile and punctate with setae (Figure 18). Mesopleuron  
436 entirely punctate with setae, except for periphery of speculum strongly strigose, dorsal  
437 part rugose, and posterior margin with a crenulate furrow (Figure 18). Mesosternum  
438 punctate with setae (Figure 18). Epicnemial carina with its dorsal end reaching anterior  
439 margin of mesopleuron (Figure 18). Postscutellum as long as its width. Metapleuron and  
440 propodeum coarsely rugose (Figures 18, 20). Propodeum rounded in dorsal view and  
441 almost flat in profile (Figures 18, 20).

442 *Wings.* Fore wing 10.5–13.0 mm, with CI = 1.1–1.3; BI = 1.8–2.1; DBI = 1.0–1.1;  
443 MI = 1.5–1.7; ICI = 0.6–0.9. Hind wing with 10–14 uniform distal hamuli and RI = 2.3–  
444 2.5; NI = 0.7–1.0.

445 *Legs* (Figure 21). Hind coxa 1.9–2.0 times as long as its width. Trochanter 1.3–1.7  
446 times as long as trochantellus in ventral view. Hind femur 6.2–7.1 times as long as its  
447 width and 0.5–0.7 times as long as hind tibia. Hind basitarsus 0.5–0.6 times as long as  
448 tibia and 2.1–2.5 times as long as second tarsus. Hind second tarsus 1.5–1.7 times as long  
449 as third tarsus. Proximal part of hind outer tarsal claw pectinate (Figure 21).

450 *Metasoma.* PI = 3.6–5.0; DMI = 1.7–1.8. Ovipositor sheath 0.4–0.7 times as long  
451 as hind tibia, tip of upper valve tapered and with a dorsal notch, and tip of lower valve  
452 tapered.

453 *Color* (Figure 6). *Head* entirely black but following parts yellow or amber: three  
454 longitudinal lines on face; clypeus anterior margin of gena; median part of mandible and  
455 flagellomeres. *Mesosoma* entirely black but tegula yellow; posterior margin of  
456 mesopleuron amber to yellow (rarely black); part of mesopleuron and metapleuron rarely  
457 with an amber mark; and scutellum usually yellow (rarely black). *Wing* venation brown  
458 to yellow and cells brownish. *Legs* amber or yellow but coxae black, distal 0.2 of hind  
459 femur and distal 0.2 of hind tibia brownish. *Metasoma* amber to dark amber but following  
460 parts black: dorsum of T2; ventral part of T4–5; all of T6–8.

461 *Male* (n = 143). Fore wing length 9.0–12.0 mm. Antenna with 43–47 flagellomeres. Color  
462 similar to female, except as follows: usually face entirely yellow (rarely like the female),  
463 posterior margin of mesopleuron black, and hind coxa yellow medio-ventrally.

464

465 *Distribution*

466 Widespread in the Nearctic, Oriental, and Palaearctic regions (Yu et al. 2012).

467

468 *Distribution in Japan (Figure 39)*

469 [Hokkaido] (Matsumura 1926; Uchida 1928, 1958; Kusigemati 1972); [Honshu]  
470 Aomori (Watanabe & Ichida 2014), Gifu (Uchida 1928), Gunma\*, Hiroshima (Konishi  
471 & Nakamura 2000, 2005), Hyogo (Iwata 1960), Ishikawa (Togashi 1993), Kyoto (Uchida  
472 1928; Iwata 1958, 1960), Mie\*, Miyagi\*, Nagano\*, Nara\*, Niigata (Ohmori 1960;  
473 Shimizu 2014), Osaka (Uchida 1928, 1958), Saitama (Konishi & Nambu 1997), Shiga  
474 (Uchida 1958), Shizuoka (Uchida 1928; Watanabe & Makanai 2011), Tochigi (Katayama  
475 et al. 2010), Tokyo (Uchida 1928), Tottori\*, Toyama\*, Wakayama\*, Yamanashi\*;  
476 [Shikoku] Ehime (Uchida 1928; Konishi & Yamamoto 2000), Kochi\*; [Kyushu] Fukuoka  
477 (Uchida 1928), Kagoshima (Kusigemati 1981), Oita\*. \*New records from the prefectures.

478

479 *Biology*

480 Host records are mainly from noctuid moths including some important pests, and also  
481 from the families Lasiocampidae, Geometridae, Notodontidae, and Sphingidae (e.g.,  
482 Matsumura 1926; Kusigemati 1972; Gauld & Mitchell 1977; Slobodchikoff 1977;  
483 Kusigemati 1981; Dasch 1984; Chen et al. 2009). This species was collected mostly by  
484 Malaise traps and by sweeping. Only a few specimens were collected at light traps.

485

486 *Remarks*

487 Specimens were morphologically uniform, except for color.

488

489 *Latitudinal gradient of color in T. circumflexum*

490 We examined a total of 461 specimens of *T. circumflexum* from low latitude to moderately  
491 high latitude (India to Canada). As a result, considerable color variation was recognized,  
492 which seems to be correlated with latitude, similar to that found in the acaenitine  
493 ichneumonid *Spilopteron tosaensis* (Uchida, 1934) (Ito et al. 2015). In lower latitudes,  
494 the body tends to be more or less bright (e.g., hind coxae reddish in female; most of  
495 posterior metasomal segments amber) (Figure 22c); on the other hand, at higher latitudes,  
496 it is more or less dark (e.g., hind coxae black in female; most of posterior metasomal  
497 segments black) (Figure 22a, b). In the braconid wasp *Meteorus pulchricornis* (Wesmael,  
498 1835), Abe et al. (2013) suggested that adult color variation was caused by the difference  
499 of thermal conditions, i.e., the body color of adults is darkened when their cocoons are  
500 reared at low temperature. The color variation of *T. circumflexum* may be also caused by  
501 the difference of thermal conditions as in *M. pulchricornis* (Abe et al. 2013).

502 The color variations of *T. circumflexum* caused various authors to recognize several  
503 varieties including *Exochilum circumflexum* var. *rufomaculatum* Uchida, 1928 from

504 Japan and Taiwan (Uchida 1928). Uchida (1958) raised this variety to species status. In  
505 this study, no differentiation was recognized between dark and light morphs in molecular  
506 characters (Figure 9; Table 1), and color ranged continuously between the darkest and  
507 lightest specimens (Figure 22), therefore *T. rufomaculatum* (Uchida) is once again  
508 considered a synonym of *T. circumflexum*.

509

510 *Phenology of this species in Japan*

511 The phenology of the species in Japan is shown based on data from a total of 404  
512 specimens examined (Figure 23). In Hokkaido and Honshu, the specimens were  
513 frequently collected in summer (i.e., June to August), and in Shikoku and Kyushu, it was  
514 frequently collected in spring (i.e., April to June) and autumn (i.e., September to  
515 November) (Figure 23). The phenology possibly suggests that the species is univoltine in  
516 higher latitude regions (i.e., cold regions) and is plurivoltine in lower latitude regions (i.e.,  
517 warm regions).

518

519 *Specimens examined*

520       *Japanese specimens (263FF143MM)*: See Supplementary material 3 for detail.

521

522

523 ***Therion giganteum* (Gravenhorst, 1829)**

524 [Japanese name: Chishima-konbo-amebachi]

525 (Figures 7, 24–29, 40)

526

527 *Anomalon giganteum* Gravenhorst, 1829: 647. Lectotype: F, Germany, (ZMB),  
528 designated by Schnee, 1989: 246.

529 *Anomalon (Exochilum) pyramidatus* Thomson, 1894: 2118. Type: M, Sweden (Lund).  
530       Synonymized by Szépligeti (1905: 508).

531 *Exochilum dendrolimi* Matsumura, 1926: 36. Type: M, Kuriles (SEHU). Host:  
532       *Dendrolimus sibiricus*. Synonymized by Townes et al. (1965: 381).

533 *Exochilum dendrolimusi* Matsumura, 1926: 25. Type: M, Kuriles (same specimen of *E.*  
534       *dendrolimi* Matsumura, 1926) (SEHU). Host: *Dendrolimus albolineatus*.

535

536 *Diagnosis*

537 This species has been frequently confused with *T. circumflexum*, but it is easily  
538 distinguishable from it and the other species of *Therion* in Japan by the following  
539 combination of characteristics: antero-ventral corner of pronotum with a blunt tooth

540 (Figure 26); mesoscutum elongate and 1.4 times as long as its width in dorsal view (Figure  
541 27); dorsal margin of pronotum with a distinguishable longitudinal impression (Figure  
542 26); T1 stout; PI = 3.3; and large body (i.e., fore wing 15.0 mm) (Figure 7).

543

544 *Re-description based on Japanese specimens*

545 *Female* (n = 1).

546 *Head* (Figures 2–4). Face 0.6 times as long as wide, polished, entirely covered with  
547 dense punctures and setae, lacking a median, longitudinal carina (Figure 24). Clypeus 0.5  
548 times as long as wide, polished with sparse punctures and setae (Figure 24). Malar space  
549 0.4 times as long as basal width of mandible. Frons polished with setae, with a median,  
550 strongly convex swelling, and with irregular rugae (Figures 24, 25). Gena polished and  
551 entirely covered with dense punctures and setae (Figure 25). Interocellar area with a  
552 median, longitudinal, shallow concavity (Figure 25). Occipital carina with ventral end not  
553 reaching base of mandible and oral carina. OOD 1.8 times as long as LOD, IOD 1.3 times  
554 as long as LOD, POD 0.7 times as long as LOD (Figure 25). Antennae with 60  
555 flagellomeres. First flagellomere 2.4 times as long as its width and 2.3 times as long as  
556 second flagellomere.

557 *Mesosoma* (Figures 26–28). Antero-ventral corner of pronotum evenly rounded  
558 with a dull tooth (Figure 26). Ventral part of pronotum strigose, dorsal part punctate,  
559 posterior margin with crenulate furrow, and dorsal margin with longitudinal impression  
560 (Figure 26). Anterior margin of mesoscutum evenly curved in profile (Figure 26). Notauli  
561 weak (Figure 27). Mesoscutum 1.4 times as long as its width in dorsal view (Figure 27),  
562 polished, and entirely, densely punctate with setae (Figures 26, 27). Scutellum strongly  
563 convex in profile and finely punctate with setae (Figures 26, 27). Ventral part of  
564 mesopleuron punctate with setae, periphery of speculum strongly strigose, dorsal part  
565 rugose, and posterior margin with crenulate furrow (Figure 26). Mesosternum punctate  
566 with setae (Figure 26). Epicnemial carina laterally incomplete, its dorsal end not reaching  
567 anterior margin of mesopleuron (Figure 26). Postscutellum as long as its width.  
568 Metapleuron and propodeum coarsely rugose (Figures 26, 28). Propodeum rounded in  
569 dorsal view and weakly rounded in profile (Figures 26, 28).

570 *Wings*. Fore wing 15.0 mm, with CI = 1.1; BI = 2.2; DBI = 1.0; MI = 1.5; ICI = 0.8.  
571 Hind wing with 15 uniform hamuli and RI = 2.1; NI = 0.9.

572 *Legs* (Figure 29). Hind coxa 1.7 times as long as its width. Trochanter 1.7 times as  
573 long as trochantellus in ventral view. Hind femur 6.8 times as long as its width and 0.7  
574 times as long as hind tibia. Hind basitarsus 0.6 times as long as tibia and 2.5 times as long  
575 as second tarsus. Hind second tarsus 1.5 times as long as third tarsus. Hind outer tarsal

576 claw simple (Figure 29).

577 *Metasoma*. PI = 3.3; DMI = 1.9. Ovipositor sheath 0.6 times as long as hind tibia,  
578 tip of upper valve tapered and with a dorsal notch, and tip of lower valve tapered.

579 *Color* (Figure 7). *Head*. Following parts amber to dark amber: most of face and  
580 clypeus, middle- and distal-part of mandible, edge of eyes, and flagellomeres. The  
581 following parts black: mediolateral, longitudinal stripes of face, margin of clypeus,  
582 posterior part of gena, frons, proximal part of mandible. *Mesosoma* entirely black but the  
583 following parts amber to dark amber: tegula, subtegular ridge, dorsal and posterior margin  
584 of mesopleuron, medioventral mark of metapleuron, and scutellum. *Wing* venation brown  
585 and cells brownish. *Legs* amber but the following parts dark amber to black: mid- and  
586 hind coxae, distal 0.3 of hind femur, and distal 0.2 of hind tibia. *Metasoma* amber to dark  
587 amber but the following parts black: anterior half of dorsal part of T2, dorsal half of T5,  
588 ventral half of T4–5, and all of T6–8.

589 *Male* (n = 1). Fore wing length 16.5 mm. Antenna broken in examined specimen.  
590 Structure otherwise similar to female, except as follows: periphery of speculum punctate;  
591 epicnemial carina with dorsal margin adjacent to anterior margin of mesopleuron; and  
592 hind outer tarsal claw proximally pectinate. Color mostly as in female except the face  
593 entirely yellow in male.

594

#### 595 *Distribution*

596 Palaearctic region (Yu et al. 2012) including France (Aubert 1957) and Algeria (Morley  
597 1913) in the west, to Japan in the east (Matsumura 1926).

598

#### 599 *Distribution in Japan (Figure 40)*

600 [*Hokkaido*] (Matsumura 1926) and [*Honshu*] Fukui\* (Haneda et al. 1998). \*This record  
601 may be a misidentification of *T. circumflexum* with *T. giganteum* (see *Remarks*)

602

#### 603 *Biology*

604 This species has been reared from Lasiocampidae and Noctuidae (e.g., Uchida 1928;  
605 Matsumura 1926; Uchida 1930; Schnee 2008). Species of the genus *Dendrolimus* Germar  
606 have been known previously as hosts, but *D. spectabilis* (Butler, 1877) is a new host  
607 record. According to the label data of the specimen examined in this study, the collector  
608 (KM) collected a wintering larva of *Dendrolimus spectabilis*, and a wasp subsequently  
609 emerged from its pupa.

610

#### 611 *Remarks*

612 This species has been reported only in Hokkaido and Fukui Pref. (Honshu). We examined  
613 specimens from Hokkaido, but we did not collect any specimens from Fukui Pref. In  
614 Fukui Pref., more or less stout and large individuals of *T. circumflexum* were collected,  
615 so the record from Fukui Pref. may be due to the misidentification of *T. circumflexum* as  
616 this species.

617

618 *Specimens examined.*

619 *Japanese specimens.* 1M, Kuril, Hokkaido, Uchida leg. (SEHU) (Holotype of *Exochilum*  
620 *dendrolimi* Matsumura, 1926); 1F, Ebetsu, Sapporo, 16. VIII. 1986, K. Maeto leg.  
621 (emerged from *Dendrolimus spectabilis*) (NIAES) (Figures 7, 24–29).

622

623

624 ***Therion nigrigasterum* Shimizu, Bennett & Ito, sp. nov.**

625 [Japanese name: Asama-konbo-amebachi]

626 (Figures 8, 30–36, 41)

627

628 ZooBank: <http://zoobank.org/5D9BC82A-BAC9-4F88-8E66-CADBBDED4A90>

629

630 *Diagnosis*

631 This species can easily be distinguished from the other extant species of *Therion* by the  
632 following combination of characteristics: face without a median, longitudinal carina  
633 (Figure 30); antero-ventral corner of pronotum rounded with only a weak tooth (Figure  
634 32); T1 black in anterior 0.8 and amber in posterior 0.2 (Figure 8); hind tarsal claw simple  
635 (Figure 35); dorsal margin of pronotum without a distinguishable impression (Figure 32);  
636 mesoscutum rounded and 1.3 times as long as its width in dorsal view (Figure 33). This  
637 species resembles the Nearctic *Therion* species, *T. fuscipenne* (Norton, 1863), but can be  
638 distinguished from it by the following combination of characteristics: clypeus sparsely  
639 punctate (Figure 30) (clypeus closely punctate in *T. fuscipenne*); frons coarsely irregularly  
640 rugose (Figures 30, 31) (frons finely reticulate in *T. fuscipenne*); anterior part of T1 black  
641 (Figure 8) (T1 entirely amber in *T. fuscipenne*).  
642

643

643 *Description of type specimens*

644 *Female* (n = 8).

645 *Head* (Figures 30, 31). Face 0.7 (HT: 0.7) times as long as wide, polished and  
646 entirely covered with dense punctures and setae, lacking a median, longitudinal carina  
647 (Figure 30). Clypeus 0.5 (HT: 0.5) times as long as wide, polished and sparsely punctate

with setae (Figure 30). Malar space 0.3–0.4 (HT: 0.3) times as long as basal width of mandible. Proximal half of mandible punctate with setae. Frons polished and coarsely rugose with setae, with a median, longitudinal, strongly convex, and tubercular horn on ventral part (Figures 30, 31). Gena polished and punctate with setae (Figure 31). Interocellar area polished and punctate with setae, without a median, longitudinal concavity (Figure 31). Occipital carina with its ventral end not reaching to base of mandible and oral carina. OOD 1.7–1.9 (HT: 1.7) times as long as LOD, IOD 1.5–1.7 (HT: 1.6) times as long as LOD, POD 0.6–0.9 (HT: 0.8) times as long as LOD (Figure 31). Antennae with 54–56 (HT: 54) flagellomeres. First flagellomere 3.2–3.7 (HT: 3.2) times as long as its width and 2.1–2.5 (HT: 2.2) times as long as second flagellomere.

*Mesosoma* (Figures 32–34). Antero-ventral corner of pronotum rounded with only a weak tooth (Figure 32). Ventral part of pronotum rugose, median part reticulate rugose, dorsal part punctate, dorsal margin without a longitudinal impression, and posterior margin with crenulate furrow (Figure 32). Anterior margin of mesoscutum in profile abruptly curved (Figure 32). Notauli vestigial (Figures 32, 33). Mesoscutum nearly perfectly circular and 1.3 (HT: 1.3) times as long as its width in dorsal view (Figure 33), and entirely, densely punctate with setae (Figures 32, 33). Scutellum moderately convex in profile and densely rugosopunctate with setae (Figures 32, 33). Ventral part of mesopleuron rugosopunctate with setae, median part more punctate than rugose, dorsal part entirely rugose, and posterior margin with a crenulate furrow (Figure 32). Mesosternum punctate with setae (Figure 32). Epicnemial carina with its dorsal end reaching anterior margin of mesopleuron (Figure 32). Postscutellum as long as its width. Most of propodeum and metapleuron coarsely reticulate except median part of metapleuron rugosopunctate, and posterior part of propodeum transversely strigose (Figures 32, 34). Propodeum moderately rounded in dorsal view and weakly rounded in profile (Figures 32, 34).

*Wings.* Fore wing 11.5–12.5 (HT: 12.5) mm, with CI = 1.1–1.3 (HT: 1.1); BI = 2.0–2.2 (HT: 2.2); DBI = 1.0–1.1 (HT: 1.0); MI = 1.5–1.7 (HT: 1.6); ICI = 0.6–0.8 (HT: 0.8). Hind wing with 13–15 (HT: 15) uniform hamuli and RI = 2.3–2.8 (HT: 2.5); NI = 0.4–0.6 (HT: 0.6).

*Legs* (Figure 35). Hind coxa 1.9–2.2 (HT: 2.0) times as long as its width. Trochanter 1.2–1.5 (HT: 1.3) times as long as trochantellus in ventral view. Hind femur 6.3–7.1 (HT: 6.3) times as long as its width and 0.7 (HT: 0.7) times as long as hind tibia. Hind basitarsus 0.6 (HT: 0.6) times as long as tibia and 2.2–2.4 (HT: 2.2) times as long as second tarsus. Hind second tarsus 1.4–1.5 (HT: 1.4) times as long as third tarsus. Hind tarsal claw simple without pectination (Figure 35).

684        *Metasoma*. PI = 3.8–4.9 (HT: 4.9); DMI = 1.7–1.8 (HT: 1.8). Ovipositor sheath 0.5–  
685        0.6 (HT: 0.6) times as long as hind tibia, tip of upper valve tapered and with a dorsal notch,  
686        and tip of lower valve tapered with tooth.

687        *Color* (Figure 8). *Head* entirely black but the following parts yellow or amber: three  
688        longitudinal lines on face; mediadorsal part of clypeus; upper margin of mandible;  
689        anterior margin of gena; and flagellomeres. *Mesosoma* entirely black but tegula amber.  
690        *Wing* venation brown and cells brownish. *Legs* amber but the following parts dark amber  
691        to black: coxae, distal 0.4 of hind femur, and distal 0.2 of hind tibia. *Metasoma*. The  
692        following parts black: T1 except apical 0.2, anterior 0.7 of dorsal part of T2, T4–8, S5–8  
693        All other parts amber to dark amber.

694        *Male* (n = 30). Fore wing length 11.0–12.5 mm. Antenna with 49–52 flagellomeres.  
695        Similar to female, but face entirely yellow in male.

696

697        *Etymology*

698        The specific name is from the characteristic metasomal color.

699

700        *Distribution*

701        Eastern Palaearctic region (Japan: Gunma Pref.) (Figure 41).

702

703        *Biology*

704        Almost unknown, but the specimens were collected in a grass-land plateau at Gunma Pref.,  
705        Japan, in autumn by SS and MI (Figure 36). They were visiting *Aralia cordata* Thunberg  
706        (Araliaceae) (Figure 37).

707

708        *Remarks*

709        This species can easily be distinguished from any other Japanese species of *Therion* on  
710        account of its blackish color, rather stout body, shape of mesoscutum in dorsal view, etc.  
711        (see key and *Diagnosis* for details).

712        The fore wing length of male is usually shorter than female, and the number of  
713        flagellomeres of male is also smaller than female, as *T. circumflexum*.

714

715        *Specimens examined.*

716        HT: [JAPAN] F, Japan: Takamine kogen, Kanbara, Tsumagoi Vil., Agatsuma County,  
717        Gunma Pref. [36° 24' N, 138° 27' E; ca. 1900 m alt.], 3. IX. 2015, S. Shimizu leg.  
718        (NIAES) (Figure 8). PT: 2FF, same data as holotype (1F, KPMNH; 1F, SEHU) [Tn1,  
719        LC199012 (SEHU); Tn2, LC199013 (KPMNH)]; 1F, same data as holotype except for K.

720 Watanabe leg. (KPMNH) [Tn3, LC199014]; 1F, same data as holotype except for M. Ito  
721 leg. (SEHU) [Tn4, LC199015]; 1F7MM, same data with holotype except for 23. VIII.  
722 2016 (1F3MM, NIAES; 1M, OMNH; 1M, KPMNH, 1M, SEHU, 1M, CNC); 2F23MM,  
723 same data as holotype except for 23. VIII. 2016, M. Ito leg. (5MM, NIAES; 5MM,  
724 OMNH; 5MM, KPMNH; 5MM, SEHU; 1F, CNC; 1F3MM, EUM) [Tn5, LC199016  
725 (NIAES); Tn6, LC199017 (SEHU); Tn7, LC199018 (SEHU)]  
726  
727

## 728 Acknowledgements

729  
730 The authors would like to express sincere thanks to Dr. Gavin Broad (the Natural History  
731 Museum) and one anonymous reviewer for their insightful comments and suggestions on  
732 our manuscript; Dr. Masahiro Ôhara (Hokkaido University Museum) and Mr. Namiki  
733 Kikuchi (Hokkaido University) for their kind support during the investigation of  
734 ichneumonoid collection at SEHU; to Dr. Kazuhiko Konishi (Ehime University) for his  
735 kind support during the investigation of ichneumonoid collection at EUM; to Dr. Shin-  
736 ichi Yoshimatsu (NIAES) and Dr. Hiraku Yoshitake (NIAES) for their kind support during  
737 the investigation of ichneumonid collection at NIAES; to Dr. Kyohei Watanabe  
738 (KPMNH) for his kind support during the investigation of ichneumonoid collection at  
739 KPMNH; Dr. Chi-Feng Lee (TARI) for his kind support during the investigation of  
740 ichneumonoid collection at TARI; to Dr. Kenichi Ikeda (Kobe University) for his kind  
741 support during the observation of specimens by using SEM in Kobe University, Kobe,  
742 Japan; and to Mrs. Takuto Hirooka, Shunpei Fujie (Osaka), and Yuya Kitayama (Kinki  
743 University) for providing the valuable specimens. Sequencing of Canadian specimens  
744 was made possible by operating grants to the Canadian Centre for DNA Barcoding,  
745 University of Guelph, Canada. This study was in part supported by JSPS KAKENHI  
746 Grant Number 2529034 to KM.

747

748

## 749 References

750

- 751 Abe, Y., Nishimura, T. & Maeto, K. (2013) Causes of polymorphic melanism and its  
752 thermoregulatory function in a parasitoid wasp *Meteorus pulchricornis*  
753 (Hymenoptera: Braconidae). *European Journal of Entomology* **110**: 627–632.  
754 Agassiz, L.J.R. (1846) *Nomenclator zoologicus, Index universalis. Recognoverunt*, Guil.  
755 F. Erichson et L. Imhoff. 360 pp.

- 756 Aubert, J.F. (1957) Révision des travaux concernant les Ichneumonides de France et  
757 premier supplément au catalogue de Gaulle. *Entomophaga* **2**: 213-243
- 758 Bauer, R. (1967) Zwei neue Arten der Gattung *Therion* Curtis (Hymenoptera,  
759 Ichneumonidae). *Nachrichtenblatt der Bayerischen Entomologen* **16**: 95–98.
- 760 Broad, G.R. (2014) A new, endemic genus of Anomaloninae (Hymenoptera,  
761 Ichneumonidae) from St Helena. *Journal of Hymenoptera Research* **41**: 31–45. doi:  
762 10.3897/JHR.41.8099
- 763 Cameron, P. (1906) Descriptions of two new species of Ichneumonidae from Japan.  
764 *Entomologist* **39**: 98–99.
- 765 Chen, S.P., Wang, C.L. & Chen, C.N. (2009) A list of natural enemies of insect pests in  
766 Taiwan. Taiwan Agricultural Research Institute Special Publication No.137.  
767 Taiwan. 466pp.
- 768 Christ, J.L. (1791) Naturgeschichte, Klassification und Nomenklatur der Insekten von  
769 Bienen, Wespen und Ameisengeschlect. Frankfurt am Main. 535 pp.
- 770 Cresson, E.T. (1879) Description of Ichneumonidae, chiefly from the Pacific slope of the  
771 United States and British North America. *Proceedings of the Academy of Natural  
772 Sciences of Philadelphia* **30**: 348–381.
- 773 Curtis, J. (1829) Guide to an arrangement of British insects. London. 256 pp.
- 774 Dasch, C.E. (1984) Ichneumon-flies of America north of Mexico: 9. Subfamilies  
775 Theriinae and Anomaloninae. *Memoirs of the American Entomological Institute* **36**:  
776 1–610.
- 777 Eady, R.D. (1968) Some illustrations of microsculpture in the Hymenoptera. *Proceedings  
778 of the Royal Entomological Society of London Series A* **43**: 66–72. doi:  
779 10.1111/j.1365-3032.1968.tb01029.x
- 780 Fisher, B.L. & Smith, M.A. (2008) A Revision of Malagasy Species of *Anochetus* Mayr  
781 and *Odontomachus* Latreille (Hymenoptera: Formicidae) *PLoS One* **3**: e1787.  
782 doi:10.1371/journal.pone.0001787
- 783 Folmer, O., Black, M., Hoeh, W., Lutz, R. & Vrijenhoek, R. (1994) DNA primers for  
784 amplification of mitochondrial cytochrome c oxidase subunit I from diverse  
785 metazoan invertebrates. *Molecular Marine Biology and Biotechnology* **3**: 294–297.
- 786 Gauld, I.D. (1976) The classification of the Anomaloninae (Hymenoptera:  
787 Ichneumonidae). *Bulletin of the British Museum (Natural History) Entomology* **33**:  
788 1–135.
- 789 Gauld, I.D. (1991) The Ichneumonidae of Costa Rica, 1. *Memoirs of the American  
790 Entomological Institute* **47**: 1–589.
- 791 Gauld, I.D. & Mitchell, P.A. (1977) Hymenoptera, family Ichneumonidae, subfamilies

- 792 Orthopelmatinae and Anomaloninae. *Handbooks for the Identification of British*  
793 *Insects* 7 (2b): 1–32.
- 794 Gravenhorst, J.L.C. (1829) *Ichneumonologia Europaea*. Pars III. 1097 pp. Vratislaviae.
- 795 Haneda, Y., Tano, T., Okuno, H., Nozaka, C., Murota, T., Kurokawa, H. & Inoue, S.  
796 (1998) Hymenoptera. In “Catalogue of Insect in Fukui Pref. II” 314–404 pp. [In  
797 Japanese]
- 798 Hebert, P.D.N., Penton, E.H., Burns, J.M., Janzen, D.H. & Hallwachs, W. (2004) Ten  
799 Species in One: DNA Barcoding Reveals Cryptic Species in the Neotropical  
800 Skipper Butterfly *Astraptes fulgerator*. *Proceedings of the National Academy of*  
801 *Sciences USA* 101: 14812–14817.
- 802 Hellén, W. (1926) Beiträge zur Kenntnis der Ichneumoniden Finlands II. Subfam.  
803 Ophioninae und Anomaloninae. *Acta Societatis pro Fauna et Flora Fennica* 56 (6):  
804 1–27.
- 805 Ito, M., Watanabe, K. & Maeto, K. (2015) Molecular evidence resolving the confusion of  
806 two ichneumonid species of *Spilopteron* (Hymenoptera) caused by marked  
807 geographical colour variation. *European Journal of Entomology* 112: 543–556. doi:  
808 10.14411/eje.2015.068
- 809 Iwata, K. (1958) Ovarian eggs of 233 species of the Japanese Ichneumonidae  
810 (Hymenoptera). *Acta Hymenopterologia* 1: 63–74.
- 811 Iwata, K. (1960) The comparative anatomy of the ovary in Hymenoptera, Part V.  
812 Ichneumonidae. *Acta Hymenopterologia* 1: 115–169.
- 813 Katayama, E., Matsumura, T. & Watanabe, K. (2010) Ichneumonidae of Ōtawara City  
814 and Nasushiobara City, Tochigi Prefecture, Japan. *Insect* 60: 149–160. [In  
815 Japanese]
- 816 Konishi, K. & Yamamoto, E. (2000) A list of the Ichneumonidae from Odamiyama and  
817 its adjacent area. *Nature of Odamiyama* II: 735–754. [In Japanese]
- 818 Konishi, K. & Nakamura, S. (2000) Distributional notes on the Ichneumonidae  
819 (Hymenoptera) from Hiroshima prefecture. *Miscellaneous Reports of the Hiwa*  
820 *Museum for Natural History* (39): 107–115. [In Japanese]
- 821 Konishi, K. & Nakamura, S. (2005) Distributional notes on the Ichneumonidae  
822 (Hymenoptera) from Hiroshima prefecture III. *Miscellaneous Reports of the Hiwa*  
823 *Museum for Natural History* (44): 229–239. [In Japanese]
- 824 Konishi, K. & Nambu, T. (1997) Ichneumonidae from Saitama Prefecture. *Saitama-*  
825 *doubutsukan-tsūshin* (25): 1–12. [In Japanese]
- 826 Kusigemati, K. (1972) New host records of Ichneumonidae from Japan. *Kontyū* 40: 85–  
827 87.

- 828 Kusigemati, K. (1981) New host records of Ichneumonidae from Japan (IV). *Memoirs of*  
829 *the Faculty of Agriculture, Kagoshima University* **17**: 135–138.
- 830 Lee, J.W. & Choi, J.K. (2004) Revision of Korean *Aphanistes* Förster, 1869  
831 (Ichneumonidae: Anomaloninae) with description of a new species. *Entomological*  
832 *Research* **34**: 187–193.
- 833 Linnaeus, C. (1758) *Systema naturae per regna tria naturae, secundum classes, ordines,*  
834 *genera, species cum characteribus, differentiis, synonymis locis. Tomus I. Editio*  
835 *decima, reformata. Laurnetii Salvii, Holmiae.* 824 pp.
- 836 Matsumura, S. (1926) On the five species of *Dendrolimus injurious* to conifers in Japan,  
837 with their parasitic and predaceous insects. *Journal of the College of Agriculture,*  
838 *Hokkaido Imperial University* **18**: 1–42.
- 839 Morley, C. (1913) A revision of the Ichneumonidae based on the collection in the British  
840 Museum (Natural History) with descriptions of new genera and species. Part II.  
841 Tribes Rhyssides, Echthromorphides, Anomalides and Paniscides. London,  
842 British Museum. 140 pp.
- 843 Ohmori, Y. (1960) Catalogue of Hymenoptera from Kamo City. *Transactions of Essa*  
844 *Entomological Society* (33–34): 16–19. [In Japanese]
- 845 Provancher, L. (1879) Faune canadienne. Les insectes - Hyménoptères. *Naturaliste*  
846 *Canadien* **11**: 141–150.
- 847 Ratzeburg, J.T.C. (1844) Die Ichneumonen der Forstinsecten in forstlicher und  
848 entomologischer Beziehung. Berlin. 224 pp.
- 849 Schnee, H. (1989) Revision der von Gravenhorst beschriebenen und redeskribierten  
850 Anomaloninae mit Beschreibung zweier neuer Arten (Hymenoptera,  
851 Ichneumonidae). *Deutsche Entomologische Zeitschrift* **36**: 241–266.
- 852 Schnee, H. (2008) Die Anomaloninae der Sammlung Arnold Forster - Typenrevision und  
853 faunistische Anmerkungen (Hymenoptera, Ichneumonidae). *Beitraege zur*  
854 *Entomologie* **58**: 249–266.
- 855 Schnee, H. (2014) Anomaloninae aus Israel und Palästina mit Beschreibung einer neuen  
856 Anomalon-Art (Hymenoptera: Ichneumonidae). *Entomologische Zeitschrift* **124**:  
857 97–107.
- 858 Sheng, M.-L., Schönitzer, K. & Sun, S.-P. (2012) A new genus and species of  
859 Anomaloninae (Hymenoptera, Ichneumonidae) from China. *Journal of*  
860 *Hymenoptera Research* **27**: 37–45. doi: 10.3897/JHR.27.2574
- 861 Shestakov, A. (1923) Ad cognitum specierum tribus Anomalonini (Hym.,  
862 Ichneumonidae). *Ezhegodnik Zoologicheskago Muzeya* **24**: 44–51.
- 863 Shimizu, S. (2014) Catalogue of Ichneumonidae (Hymenoptera) from Niigata Prefecture,

- 864 Japan. *Transactions of Essa Entomological Society* (111): 1–25. [In Japanese]
- 865 Shimizu, S. (2016a) Recognition of the genus *Habrocampulum* Gauld, 1976  
866 (Hymenoptera: Ichneumonidae: Anomaloninae) from Japan, with a new  
867 combination and a key to the species. *Zootaxa* **4103**: 283–288. doi:  
868 10.11646/zootaxa.4103.3.7
- 869 Shimizu, S. (2016b) *Aphanistes nocturnus* Lee & Choi, 2004 (Hymenoptera:  
870 Ichneumonidae), new to Japan. *Japanese Journal of Systematic Entomology* **22**:  
871 51–54.
- 872 Shimizu, S. (2017) Description of a new species and revised key to species of the  
873 *Enicospilus antefurcalis* species-group from Japan (Hymenoptera: Ichneumonidae:  
874 Ophioninae). *Acta Entomologica Musei Nationalis Pragae* **57**: 183–194.
- 875 Shimizu, S., Watanabe, K. & Maeto, K. (2016) Revision of the Taiwanese species of the  
876 genus *Leptophion* Cameron, 1901 (Hymenoptera: Ichneumonidae: Ophioninae),  
877 with a discussion of their phenology and distribution. *Zootaxa* **4144**: 71–88. doi:  
878 10.11646/zootaxa.4144.1.3
- 879 Slobodchikoff, C.N. (1977) Patterns of variation of wasps of the genus *Therion*  
880 (Hymenoptera: Ichneumonidae). *University of California Publications in*  
881 *Entomology* **82**: 1–65.
- 882 Stigenberg, J., Vikberg, V. & Belokobylskij, S.A. (2011) *Meteorus acerbivorus* sp. nov.  
883 (Hymenoptera, Braconidae), a gregarious parasitoid of *Acerbia alpine* (Quensel)  
884 (Lepidoptera, Arctiidae) in North Finland. *Journal of Natural History* **45**: 1275–  
885 1294.
- 886 Szépligeti, G. (1905) Übersicht der paläarktischen Ichneumoniden. I. Theil. *Annales*  
887 *Musei Nationalis Hungarici* **3**: 508–540.
- 888 Tamura, K., Stecher, G., Peterson, D., Filipski, A. & Kumar, S. (2013) MEGA6:  
889 Molecular evolutionary genetics analysis version 6.0. *Molecular Biology and*  
890 *Evolution* **30**: 2725–2729. doi: 10.1093/molbev/msr121
- 891 Thomson, C.G. (1894) LI. Anmärkningar öfver Ichneumoner särskildt med hänsyn till  
892 några af A.E. Holmgrens typer. *Opuscula Entomologica. Lund.* XIX: 2080–2137.
- 893 Togashi, I. (1993) Ichneumonid fauna of the foot of Mt. Hakusan and Mt. Hakusan,  
894 Ishikawa Prefecture, Japan (2). *Entomological Journal of Fukui* **13**: 45–50. [In  
895 Japanese]
- 896 Townes, H.K., Momoi, S. & Townes, M. (1965) A catalogue and reclassification of the  
897 eastern Palearctic Ichneumonidae. *Memoirs of the American Entomological*  
898 *Institute* **5**: 1–661.
- 899 Uchida, T. (1928) Zweiter Beitrag zur Ichneumoniden-Fauna Japans. *Journal of the*

- 900                  Faculty of Agriculture, Hokkaido University **21**: 177–297.  
901 Uchida, T. (1930) Beitrag zur Ichneumoniden-Fauna Japans. *Journal of the Faculty of  
902 Agriculture, Hokkaido University* **25**: 349–376.  
903 Uchida, T. (1954) Vier neue Schlufwespen als Schmarotzer der Tagfalter (Hym.  
904 Ichneumonidae). *Insecta matsumurana* **18**: 67–72.  
905 Uchida, T. (1958) Anomalinen und Therionen in der Sammlung des entomologischen  
906 Instituts der Hokkaido Universitaet I. *Insecta matsumurana* **21**: 85–108.  
907 Ulbricht, A. (1926) Niederrheinische Ichneumoniden. 4. Nachtrag. *Mitteilungen Naturw.  
908 Mus. Crefeld* **1926**: 1–30.  
909 Watanabe, K. & Makanai, H. (2011) A catalogue of the Ichneumonidae from Shizuoka  
910 prefecture. *Suruga no konchu* **236**: 6495–6508. [In Japanese]  
911 Watanabe, K. & Ichida, T. (2014) A catalogue of the Ichneumonidae from Aomori  
912 prefecture. *Celastrina* **49**: 25–40. [In Japanese]  
913 Ward, D.F. (2015) Review of the Anomaloninae (Hymenoptera: Ichneumonidae) from  
914 New Zealand with a description of a new genus and two new species. *New Zealand  
915 Entomologist* **38**: 58–66. doi: 10.1080/00779962.2014.985418  
916 Wesmael, C. (1849) Revue des Anomalons de Belgique. *Bulletin de l'Academie Royale  
917 des Sciences, des Lettres et des Beaux-Arts de Belgique* **16**: 115–139.  
918 Wood, G.W., Nielson, W.T.A., Maxwell, C.W. & McKiel, J.A. (1954) Life-history studies  
919 of *Spaelotis clandestina* (Harr.) and *Polia purpurissata* (Grt.) (Lepidoptera:  
920 Phalaenidae), in low-bush blueberry in New Brunswick. *The Canadian  
921 Entomologist* **86**: 169–173.  
922 Yu, D.S., van Achterberg, K. & Horstmann, K. (2012) Taxapad 2012, Ichneumonoidea  
923 2011. Database on flash-drive., Ottawa, Ontario, Canada. Available from:  
924 <http://www.taxapad.com/> (Accessed 4. Sept. 2016)  
925  
926

927 **Supplementary material 1. Label data for non-Japanese sequenced *Therion*  
928 specimens.**

929 ***Therion fuscipenne* (Norton, 1863)**

930 *Specimens examined.* CANADA: 1M, South Branch, Newfoundland and Labrador, 31. VII.  
931 1974, Heinrich leg. (MsT) (CNC: CNCHYM 013006) [Tf1, KY754480]; United States:  
932 1F, Rabun Bald, Georgia, 9. VIII. 1957, W.R. Richards leg. (CNC: CNCHYM 013007)  
933 [Tf2, KY754479].

934

935

936      **Supplementary material 2. Label data for sequenced outgroup specimen.**

937      ***Heteropelma amictum* (Fabricius, 1775)**

938      *Specimens examined.* JAPAN: 1M, Mt. Heko-san, Mizuumi, Ikeda Town, Imadate County  
939      [35° 53' N, 136° 26' E; 1400–1460 m alt.], 11. VI. 2016, S. Shimizu leg. (SW) (NIAES).

940

941

942      **Supplementary material 3. Label data for *Therion circumflexum*.**

943      [Hokkaido] 7FF, Butomakabetsu-rindo, Uryu-enshurin, Hokkaido Univ., Uryu, Moshiri  
944      [44° 23' N, 142° 13' E; 280–320 m alt.], 17. VII. 2012, K. Watanabe leg. (KPMNH); 2FF,  
945      Uryu-enshurin, Hokkaido Univ., Uryu, Moshiri, 14. VII. 2012, K. Watanabe leg.  
946      (KPMNH); 1F, Kasumidai, Mori Town, 3. VIII. 2000, T. Nambu leg. (KPMNH); 2FF,  
947      Butokamabetsu Path, Uryu-kenkyurin, Hokkaido Univ. [44° 24' 26" N, 142° 13' 28" E;  
948      317 m alt.], 11–17. VII. 2012, K. Watanabe et al. leg. (MsT) (KPMNH); 5FF2MM, Uryu-  
949      kenkyurin, Hokkaido Univ. [44° 24' N, 142° 13' E; 300 m alt.], 17. VII. 2012, M. Ito leg.  
950      (KPMNH); 5FF, Uryu-kenkyurin, Hokkaido Univ. [44° 24' N, 142° 13' E; 300 m alt.], 16.  
951      VII. 2012, M. Ito leg. (KPMNH); 3FF1M, Otaru, 18. VII. 1927, T. Uchida leg. (SEHU);  
952      2FF, Helvetia, 27. VII. 1928, T. Uchida leg. (SEHU); 3FF2MM, Moshiri, Uryu County,  
953      17. VIII. 1944, T. Uchida leg. (SEHU); 1F, Shiretoko, 19. VII. 1952, M. Konishi leg.  
954      (SEHU); 1F, Garugawa Riv., 23. VI. 1924, T. Uchida leg. (SEHU); 1F, Huyushima, Erimo,  
955      6. VII. 1942, T. Uchida leg. (SEHU); 1M, Maruyama, 27. VI. 1923, T. Uchida leg.  
956      (SEHU); 1F, Jyozankei, 7. VIII. 1923, T. Uchida leg. (SEHU); 1F, Jyozankei, Sapporo, 7.  
957      VIII. 1926, S. Matsumura leg. (SEHU); 1F, Mikuni-toge, Kamishihoro, 15. VII. 2012, M.  
958      Sakakibara leg. (EUM); 1F, Shibetsu-gawa, Shibetsu Town, 9. IX. 2015, H. Yoshitomi  
959      leg. (EUM); 1F, Maruyama, 28. VII. 1928, T. Uchida leg. (SEHU); 1F, Mt. Hakodate, 26.  
960      VIII. 1955, K. Honma leg. (SEHU); 1F, Hitsujigaoka, Sapporo City [43° 00' 23" N, 141°  
961      24' 52" E], 27. VI–4. VII. 2012, K. Konishi leg. (MsT) (EUM); 1F, Mt. Apoi-dake,  
962      Hidaka [811 m alt.], 5. X. 1968, M. Miyatake leg. (EUM); 1F, Horoshika-toge to Nukabira,  
963      3. X. 1968, M. Miyatake leg. (EUM); 1F, Naganuma, 28–31. VIII. 2003, A. Iwasaki leg.  
964      (MsT or beetling) (EUM); 1F, Mt. Daisetsu, 22. VII. 1956, S. Ueda leg. (EUM); 1F,  
965      Sapporo, 4. VII. 1926, T. Uchida leg. (SEHU); 1F, Dry riverbed of Mukawa R., Mukawa  
966      [42° 41' 38" N, 142° 6' 44" E], 13. VII. 2012, K. Konishi leg. (EUM); 1F, Sapporo, 7.  
967      VII. 1929, T. Uchida leg. (SEHU); 1F, Jyozankei, 27. VIII. 1931, T. Uchida leg. (SEHU);  
968      1F, Gensirin, Sapporo, 3. VI. 1951, S. Momoi leg. (SEHU); 1F, Teine-highland, Mt. Teine,  
969      Teine Ward, Sapporo City [43° 05' 06" N, 141° 12' 03" E; 400–700 m alt.], 7. VI. 2015,  
970      N. Kikuchi leg. (SEHU); 2FF, Mitsumata, Kamishihoro Town [43° 30' 25" N, 143° 08'  
971      23" E; ca. 650 m alt.], 20. VII. 2014, N. Kikuchi leg. (SEHU); 1F7MM, Akan Lake Trail,

- 972 Akan Town, Kusiro City [43° 26' N, 144° 1–4' E; 420–530 m alt.], 10. IX. 2014, S.  
973 Shimizu & Y. Saito leg. (SW) (SEHU); 1F, Nopporo Forest Park, Nishinopporo, Ebetsu  
974 City [43° 03' 25" N, 143° 30' 35" E], 6. VI. 2014, N. Kikuchi leg. (SEHU); 1M, Teine-  
975 highland, Mt. Teine, Teine Ward, Sapporo City [43° 5' N, 141° 12' E; 500–600 m alt.],  
976 22. VI. 2014, N. Kikuchi leg. (SEHU); 1F1M, Teine-highland, Mt. Teine, Teine Ward,  
977 Sapporo City [43° 05' 06" N, 141° 12' 03" E; 400–700 m alt.], 15. VII. 2014, N. Kikuchi  
978 leg. (KPMNH); 1F, Teine-highland, Mt. Teine, Teine Ward, Sapporo City [43° 05' 06" N,  
979 141° 12' 03" E; 400–700 m alt.], 7. VI. 2015, N. Kikuchi leg. (SEHU); 1M, Otarugawa-  
980 rindo, Jozankei, Minami Ward, Sapporo City, 11. VIII. 2012, S. Fujie leg. (OMNH); 1M,  
981 Maruyama, 13. VII. 1929, T. Uchida leg. (SEHU); 1M, Jyozankei, 7. X. 1930, T. Uchida  
982 leg. (SEHU); 1M, Tesio, 1–4. VII. 1930, T. Uchida leg. (SEHU); 1F, Maruyama, 14. VII.  
983 1927, T. Uchida leg. (SEHU); 1F, Otaru, 11. VI. 1924, T. Uchida leg. (SEHU); 1M,  
984 Sapporo, 20. VIII. 1924, T. Uchida leg. (SEHU); 1F, Mt. Rishiri, Rishiri Is., 11. VII. 1958,  
985 M. Miyatake leg. (EUM); 1F, Maruyama, 27. VII. 1923, T. Uchida leg. (SEHU); 1F,  
986 Rausu-onsen, Nemuro, 9. VII. 1986, M. Rut leg. (NIAES); 2MM, Mt. Hakodate-yama,  
987 29. VIII. 1965, T. Matsumura leg. (NIAES); 1M, Minamishimonuma, Horonobe, 28. VII.  
988 1990, N. Kuhara leg. (NIAES); 1F, Iwafuchi-zawa, Kenichi-gawa R., Kumaishi, 21–29.  
989 IX. 1995, Y. Ito & T. Ito leg. (MsT) (NIAES); 1F, Mt. Tarumae-san, 21. VII. 1998, K.  
990 Konishi leg. (NIAES); 1F, Akankohan, Akan Town, 3. VII. 1986, M. Rut leg. (NIAES);  
991 1F, Akan-kohan, Akan Town, 28–29. VI. 1980, K. Maeto leg. (NIAES); 2MM, Nukabira,  
992 5. VII. 1989, K. Maeto leg. (NIAES); 1F, Kamishohoku-rindo, Kamishihoro, 16. VII.  
993 2012, M. Sakakibara leg. (EUM); 1F1M, Nukabira, Kamishihoro Town [600 m alt.], 30.  
994 VI. 1980, K. Maeto leg. (NIAES); 1M, Nukabira, Kamishihoro Town [600 m alt.], 1. VII.  
995 1980, K. Maeto leg. (NIAES); 1F, Torinoshita, Furano-shi, 29. IX–3. X. 1993, K. Suzuki  
996 et al. leg. (NIAES); 1F, Sapporo, 1. VII. 1989, K. Maeto leg. (NIAES); 2FF1M, Mt.  
997 Moiwa, Sapporo, 20. VII. 1993, K. Konishi leg. (NIAES); 5FF, Jozankei 350 m, Sapporo,  
998 20–31. VII. 1989, M. Sharkey & K. Maeto leg. (MsT) (NIAES); 1F2MM, Kyushu Univ.  
999 Exp. Forest, Ashoro Town, 24–26. VI. 1980, K. Maeto leg. (NIAES); 2FF. Bibai  
1000 Kochunai, 29. VIII. 1977, collector unknown (NIAES); 1F, Misono, Kitami, 22. VII. 1969,  
1001 Y. Dhe leg. (NIAES); 2FF1M, Nukabira, Tokachi, 29. VI. 1986, M. Rut leg. (NIAES); 1F,  
1002 Ashoro, Tokachi, 2. VII. 1986, M. Rut leg. (NIAES); 1M, Park Kamikawa, 5. VII. 1971,  
1003 S. Yamaguchi leg. (S. Katsuya collection) (NIAES); 1F, Chubetsu, Biei Town, 7. VII.  
1004 1980, K. Maeto leg. (NIAES); 1F, Hokkaido Univ. Exp. Forest, Tomakomai City, 18–20.  
1005 VI. 1980, K. Maeto leg. (NIAES); 1F, Moiwa, Sapporo, 11. VII. 1956, T. Nambu leg. (T.  
1006 Nambu collection) (NIAES); 1M, Iwananosawa, Kamitoikan, Horonobe, 27. IX–12. X.  
1007 1993, M. Inoue leg. (MsT) (NIAES); [Honshu] Aichi Pref.: 1F, Mt. Sanageyama, 14. V.

- 1008 1978, CNN (EUM); Akita Pref.: 1F, Mt. Chokai-san, Yashima Town, 8–9. VI. 1991, K.  
1009 Konishi leg. (NIAES); Aomori Pref.: 1M, Okoppegawa, Oma Town, 23. VIII. 1992, T.  
1010 Ichita leg. (NIAES); 1F1M, Nakadomari Town, Kitatsugaru County, 21. VII. 2007, H.  
1011 Kawai leg. (KPMNH); 1F, Akanezawa, Ohwani Town, 11. VI. 1994, T. Ichita leg.  
1012 (NIAES); 1F, Takinosawa-toge, Hiraka Town, 12. VI. 1994, T. Ichita leg. (NIAES); 1F,  
1013 Hibakozawa-rindo, Aomori City, 27. VI. 1992. T. Ichita leg. (NIAES); 1F, Hibakozawa-  
1014 rindo, Aomori City, 24. VII. 1993, T. Ichita leg. (NIAES); 1M, Tashirotai, Aomori City,  
1015 30. VIII. 1997, T. Ichita leg. (NIAES); 1F, Tashirotai, Aomori City, 14. IX. 1997, T. Ichita  
1016 leg. (NIAES); 1F, Yokouchi-Yaegiku, Aomori City, 5. VI. 1994, T. Ichita leg. (NIAES);  
1017 1F, Mt. Hakkoda, 13. VII. 1954, T. Uchida leg. (SEHU); 1F, Tsuta-Onsen, 14. VII. 1954,  
1018 T. Kumata leg. (SEHU); 1F, Sukayu (=maybe Sugayu of Aomori Pref.), 13. VII. 1954,  
1019 CNN (SEHU); 1F, Mt. Hakkoda, 13. VII. 1954, T. Kumata leg. (SEHU); Chiba Pref.: 1M,  
1020 Mt. Kanouzan to Mother-bokujyo, 16. V. 1968, H. Suda leg. (KPMNH); 1F, Okugome,  
1021 Karatsu City, 23. X. 2011, Y. Saito leg. (KPMNH); Fukui Pref.: 1M, Mt. Washikuradake,  
1022 Izumi Vil., 4. VII. 1982, H. Kurokawa leg. (KPMNH); 1M, Mt. Heko-san, Mizuumi,  
1023 Ikeda Town, Imadate County [35° 53' N, 136° 26' E; 1400–1460 m alt.], 10. VI. 2016, S.  
1024 Shimizu leg. (SW) (KPMNH); 2MM, Suwara, Ohno, 24. VI. 1997, Y. Haneda leg.  
1025 (NIAES); 1F1M, Suwara, Ohno, 8. VI. 1998, Y. Haneda leg. (NIAES); Fukushima Pref.:  
1026 1M, Oze, 6. IX. 1952, H. Hasegawa leg. (NIAES); 1F, Mt. Adataa, 27. VIII. 1984, T.  
1027 Nambu leg. (T. Nambu collection) (NIAES); 1F, Mts. Azuma-yama, Nakatsugawa, 10.  
1028 VII. 1985, K. Konishi leg. (NIAES); 1F, Goshikinuma, Urabandai, 9. VII. 1985, K.  
1029 Konishi leg. (NIAES); 1F, Kwairi (near Mts. Iide), 27–28. VI. 1987, K. Konishi leg.  
1030 (NIAES); 1F, Hinoemata, 28–29. VII. 1990, K. Konishi leg. (NIAES); 1M, Nanairi,  
1031 Hinoemata, 29. VI. 1991, K. Konishi leg. (NIAES); Gifu Pref.: 2MM, Hiwada highland,  
1032 Takayama City [35° 58' 36" N, 137° 31' 38" E; 1330 m alt.], 31. VII. 2012, M. Ito leg.  
1033 (EUM); 1F, Hirayu, Mt. Norikura, 28. VII. 1956, J. Minamikawa & Y. Kubota leg. (J.  
1034 Minamikawa collection) (NIAES); 1F, Hirayu-otaki park, Takayama City, 4. VIII. 2012,  
1035 S. Fujie leg. (OMNH) (Figure 6); Gunma Pref.: 1M, Mikuni-san, Minakami Town, Tone  
1036 County, 11. VIII. 2008, H. Katahira leg. (KPMNH); 1M, Yuzawa, Marunuma, Katashina  
1037 Vil. [36° 53' 13" N, 139° 20' 59" E; 1440–1560 m alt.], 2. VII. 2008, K. Watanabe leg.  
1038 (KPMNH); 1M, Mt. Akagi [1300 m alt.], 21. VIII. 1998, M. Uchida leg. (EUM); 1F,  
1039 Kirimizu [920–1040 m alt.], 17. VIII. 1980, M. Hayashi et al. leg. (NIAES); 1F, Hoshi-  
1040 onsen, 11. VI. 1955, I. Hattori leg. (NIAES); 1M, Fujioka, 7. V. 1972, H. Hasegawa leg.  
1041 (NIAES); 1F, Yuzawa, Marunuma, Katashina Vil. [36° 50' 13" N, 139° 20' 59" E; 1440–  
1042 1560 m alt.], 2. VII. 2008, K. Watanabe leg. (KPMNH); Hyogo Pref.: 1F, Ichinotani,  
1043 Suma-Setsu (=Hyogo Pref.), 2?, VIII. 1929 (SEHU); 1F, Mt. Okinosen, 28. V. 1954, S.

- 1044 Momoi leg. (SEHU); 1F, Niiya, Ojiro Ward, Kami Town, 20. VI. 2014, S. Fujie leg.  
1045 (OMNH); 1M, Mt. Takamaru-yama, Kami Town [35° 23' 32" N, 134° 30' 59" E; 950 m  
1046 alt.], 18. VII. 2011, M. Ito leg. (KPMNH); 1F, Mt. Hyonosen, Yabu City [35° 19' 29" N,  
1047 134° 33' 58" E; ca. 500 m alt.], 13. VII. 2013, M. Ito leg. (LT) (NIAES); 3MM, Mt.  
1048 Hyonosen, Sekinomiya Town, [670–1510 m alt.], 1. VI. 1983, K. Konishi leg. (NIAES);  
1049 Ishikawa Pref.: 1M, Hakusan, Kaga, 3. VIII. 1957, F. Takechi leg. (EUM); 1F, Sekido-  
1050 san, 18. V. 1960, E. Kawase leg. (NIAES); 1F, Nabetani, Tatsukuchi Town, 28. X. 1989,  
1051 Y. Sugie leg. (NIAES); 1M, Nabetani, Tatsukuchi Town, 1. XI. 1989, Y. Sugie leg.  
1052 (NIAES); Iwate Pref.: 1F, Shimokuriyagawa, Morioka City, 13. IX. 2008, M. Sakakibara  
1053 leg. (EUM); 1M, Mt. Hayachine [400 m alt.], 20–27. VI. 1989, M. Sharkey & H.  
1054 Makihara leg. (MsT) (NIAES); 1M, NARCT, 15. V. 2003, Sakakibara leg. (EUM); 1F,  
1055 Yamada, 21–24. VIII. 1989, Y. Katayama leg. (NIAES); 1F, Ozuchi, 22. VIII. 1989, Y.  
1056 Katayama leg. (NIAES); 1F, Shimokuriyagawa, Morioka City, 26. IX. 2011, Sakakibara  
1057 leg. (EUM); Kanagawa Pref.: 1F, Mt. Jinba-yama, Fujino Town [35° 39' 9" N, 139° 9'  
1058 55" E; 700–830 m alt.], 13. IX. 2009, K. Watanabe leg. (KPMNH); 1F, Kozu (Sagami),  
1059 29. X. 1950, N. Fukuhara leg. (NIAES); Kyoto: 1F, Kyoto, 25. X. 1923, T. Uchida leg.  
1060 (SEHU); 1F, Kyoto Pref., 27. IV. 1930, N. Takeuchi leg. (SEHU); 1M, Hanase-toge,  
1061 Sakyo Ward [35° 09' 38" N, 135° 47' 18" E; 800 m alt.], 23. VI. 2012, M. Ito leg.  
1062 (NIAES); Mie Pref.: 1F, Toba (maybe Mie Pref.), 29. X. 1922, M. Yanagisawa leg.  
1063 (SEHU); 1F, Toba (maybe Mie Pref.), 20. X. 1922, M. Yanagisawa leg. (SEHU); 1M, Mie,  
1064 28. VII. 1952, O. Sato leg. (SEHU); Miyagi Pref.: 2MM, Mts. Zao, 22–25. VIII. 1978, M.  
1065 Sato leg. (EUM); 1M, Kamoshika spa, Mt. Zao, 25. VI. 1979, T. Nambu leg. (T. Nambu  
1066 collection) (NIAES); 1F, Sendai City, 25. IX. 1926, M. Yamanaka leg. (SEHU); Nagano  
1067 Pref.: 1F2MM, Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [35° 51' 47" N, 137°  
1068 31' 37" E; 1660–1700 m alt.], 7. VIII. 2010, K. Watanabe leg. (KPMNH); 1F, Shiga, 8.  
1069 VIII. 1972, S. Katsuya leg. (S. Katsuya collection) (NIAES); 1F, Kamikochi, 31. VII.  
1070 1967, K. Ogura leg. (NIAES); 1F, Hiraya, Norikura, 28. VII. 1956, J. Minami & Y. Kubota  
1071 leg. (J. Minamikawa collection) (NIAES); 1F1M, Hirayu, Norikura, 27. VII. 1956, J.  
1072 Minamikawa & Y. Kubota leg. (J. Minamikawa collection) (NIAES); 1M, Mt. Azusa-  
1073 yama, Kawakami Vil., 17. VII. 1999, Y. Nakatani leg. (NIAES); 2FF, Mt. Azusa-yama,  
1074 Kawakami Vil. [35° 34' 12" N, 138° 24' 35" E; 1355–1455 m alt.], 5. IX. 2015, K.  
1075 Watanabe leg. (KPMNH); 1M, Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [35°  
1076 30' 35" N, 137° 36' 36" E; ca. 1677 m alt.], 13. VI. 2015, K. Watanabe leg. (KPMNH);  
1077 1M, Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [ca. 1550 m alt.], 16. VII. 2007,  
1078 K. Watanabe leg. (KPMNH); 1F, Karei-kogen, Hase, Ina City [35° 47' N, 138° 7' E; 1160–  
1079 1800 m alt.], 30. VII. 2013, K. Watanabe leg. (KPMNH); 1F, Hakkaisan, Mt. Ontake-san,

1080 Otaki Vil., Kiso County [ $35^{\circ} 52' 0''$  N,  $137^{\circ} 31' 28''$  E; 1720–1820 m alt.], 22. IX. 2011,  
1081 K. Watanabe leg. (KPMNH); 1F, Mt. Kamanashiyama, Ina City, 20. VII. 2008, T. Ban leg.  
1082 (KPMNH); 1F, Nagamine-toge, Kaida Vil., 14. VIII. 2007, H. Kawai leg. (KPMNH); 1M,  
1083 Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [ $35^{\circ} 52' 0''$  N,  $137^{\circ} 31' 28''$  E; 1720–  
1084 1820 m alt.], 8. VIII. 2010, K. Watanabe leg. (KPMNH); 1M, Hakkaisan, Mt. Ontake-san,  
1085 Otaki Vil., Kiso County [ $35^{\circ} 52' 0''$  N,  $137^{\circ} 31' 28''$  E; 1720–1820 m alt.], 5. VIII. 2010,  
1086 K. Watanabe leg. (KPMNH); 1F, Nagaike, Yamanouchi Town, Shimotakai County, 22.  
1087 VIII. 2007, K. Watanabe leg. (KPMNH); 1F, Tateshina-kogen, 10. X. 1982, K. Konishi  
1088 leg. (NIAES); 1M, Mt. Nyugasa, 9. VII. 1964, collector unknown (S. Katsuya collection)  
1089 (NIAES); 2FF, Nanakurasawa, Yumata, Omachi City, 4. VII. 1982, S. Yoshimatsu leg.  
1090 (NIAES); 1M, Shiga-kogen, 26–27. VII. 1961, J. Minamikawa leg. (J. Minamikawa  
1091 collection) (NIAES); 1M, Sugadaira, Ueda City, 14. VIII. 1965, S. Katsuya leg. (S.  
1092 Katsuya collection) (NIAES); 1M, Oiwake, 29. VI. 1952, E. Kawase leg. (Eiji Kawase  
1093 collection) (NIAES); 1F, Mt. Ontake-san, Otaki Vil., Kiso County [ $35^{\circ} 52' N$ ,  $137^{\circ} 31' E$ ;  
1094 1790–1870 m alt.], 13. VI. 2015, S. Shimizu leg. (SW) (NIAES); 1F, Kagami-ike,  
1095 Togakushi, Nagano City [ $36^{\circ} 45' N$ ,  $138^{\circ} 04' E$ ; ca. 1200 m alt.], 27. VII. 2014, S. Fujie  
1096 leg. (OMNH); 1F, Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County, 31. VII. 2013, S.  
1097 Fujie leg. (OMNH); 1M, Mt. Ontake-san, Otaki Vil., Kiso County, 31. VII. 2014, S. Fujie  
1098 leg. (OMNH); 1F, University of Tsukuba, Sugadaira-kogen (=Sugadaira Montane  
1099 Research Center of University of Tsukuba), Ueda City [ $36^{\circ} 31' 23'' N$ ,  $138^{\circ} 20' 54'' E$ ;  
1100 ca. 1320 m alt.], 25. VI–13. VII. 2015, S. Shimizu leg. (MsT) (NIAES); 2FF, University  
1101 of Tsukuba, Sugadaira-kogen (=Sugadaira Montane Research Center of University of  
1102 Tsukuba), Ueda City [ $36^{\circ} 31' 23'' N$ ,  $138^{\circ} 20' 54'' E$ ; ca. 1320 m alt.], 1–23. VIII. 2015,  
1103 S. Shimizu leg. (MsT) (NIAES) (Figure 22b); 2FF2MM, Azusayama, Kawakami Vil.,  
1104 Minamisaku County [ $35^{\circ} 57' N$ ,  $138^{\circ} 41' E$ ; 1360–1460 m alt.], 14. VI. 2015, S. Shimizu  
1105 leg. (SW) (NIAES); 5FF, Mt. Ontake-san, Otaki Vil., Kiso County [ $35^{\circ} 51' 46'' N$ ,  $137^{\circ} 31' 44'' E$ ;  
1106 ca. 1680 m alt.], 8–9. VIII. 2014, S. Shimizu leg. (MsT) (NIAES); 2FF,  
1107 Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [ $35^{\circ} 51' N$ ,  $137^{\circ} 31' E$ ; 1670–2090  
1108 m alt.], 28. VII. 2013, S. Shimizu leg. (MsT) (NIAES); 4FF, Mt. Ontake-san, Otaki Vil.,  
1109 Kiso County [ $35^{\circ} 51' 43.8'' N$ ,  $137^{\circ} 31' 44.1'' E$ ; 1680 m alt.], 26. VII. 2015, Y. Kitayama  
1110 leg. (KPMNH); 1F, Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [ $35^{\circ} 52' 00'' N$ ,  
1111  $137^{\circ} 31' 28'' E$ ; 1720–1820 m alt.], 5–9. VIII. 2010, K. Watanabe leg. (KPMNH); 2FF,  
1112 Ontake-kyukamura, Otaki Vil., Kiso County [ $35^{\circ} 51' 22'' N$ ,  $137^{\circ} 32' 30'' E$ ; 1460 m alt.],  
1113 9. VII. 2011, M. Ito leg. (NIAES); 1F, Kyuukamura Campsite, Otaki Vil., Kiso County  
1114 [ $35^{\circ} 51' 34'' N$ ,  $137^{\circ} 33' 03'' E$ ; 1360 m alt.], 10. VII. 2011, M. Ito leg. (KPMNH); 1F,  
1115 Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [ $35^{\circ} 51' 47'' N$ ,  $137^{\circ} 31' 49'' E$ ; 1670

1116 m alt.], 30. VII. 2012, M. Ito leg. (EUM); 1M, Karei highland, Hase, Ina City [35° 47' N,  
1117 138° 07' E; 1300–1800 m alt.], 30. VII. 2013, M. Ito leg. (EUM); 1F, Ogawa, Otaki Vil.,  
1118 Kiso County, 31. VII. 2012, S. Fujie leg. (OMNH); 1M, Hakkaisan, Mt. Ontake-san,  
1119 Otaki Vil., Kiso County [35° 52' 01" N, 137° 31' 01" E; 1650–1850 m alt.], 30. VII. 2012,  
1120 S. Fujie leg. (OMNH); 1F, near Amidado, Mizuho, Iiyama City, 18. VII. 2010, S. Fujie  
1121 leg. (OMNH); 3MM, Mt. Mikasayama, Otaki Vil., Kiso County [35° 51' 47" N, 137° 31'  
1122 49" E; 1670 m alt.], 10. VII. 2011, M. Ito leg. (KPMNH); 1F, Mt. Mikasayama, Otaki  
1123 Vil., Kiso County [35° 51' 47" N, 137° 31' 49" E; 1670 m alt.], 9. VII. 2011, M. Ito leg.  
1124 (KPMNH); 2FF1M, Hakkaisan, Mt. Ontake-san, Otaki Vil., Kiso County [35° 51' 46" N,  
1125 137° 31' 44" E; 1680 m alt.], 18–20. VIII. 2014, S. Shimizu leg. (MsT) (KPMNH); 6FF,  
1126 Azusayama, Kawakami Vil., Minamisaku County [35° 57' N, 138° 41' E; ca. 1400 m alt.],  
1127 5. IX. 2015, M. Ito leg. (NIAES) [Tc1, LC199005; Tc2, LC199006; Tc3, LC199007; Tc4,  
1128 LC199008; Tc5, LC199009; Tc6, LC199010]; 1F, Mt. Ontake-san, Otaki Vil., Kiso  
1129 County [35° 52' 15" N, 137° 31' 22" E; ca. 1840 m alt.], 25. VI–15. VII. 2015, S. Shimizu  
1130 leg. (MsT) (NIAES); Nara Pref.: 1F, Tenri, 16. VIII. 1957, I. Miyagi leg. (EUM); 2MM,  
1131 Odaigahara, 12. VIII. 1980, R. Noda leg. (NIAES); 1F, Mt. Shakaga-take, Totsukawa Vil.,  
1132 26. VII–24. VIII. 2014, T. Hirooka & S. Fujie leg. (MsT) (OMNH); 1F, Mt. Odaigahara,  
1133 Kamikitayama [ca. 1570 m alt.], 5. VI. 2004, A. Kawazoe leg. (MsT) (NIAES); 1M, Mt.  
1134 Shakagatake, Totsukawa Vil., 28. VI. 2015, S. Fujie leg. (OMNH); Niigata Pref.: 1F,  
1135 Sawada Town, Sado Is., 12. VII. 1987, A. Saito leg. (NIAES); 1F, Mt. Kinpoku, Sado Is.,  
1136 22. V. 1936, K. Baba leg. (SEHU); 1F, Mt. Kinpoku, Sado Is., 7–8. VII. 1936, K. Baba et  
1137 al. leg. (SEHU); 1F, Otomi-toge, Suginosawa, Myoko City [36° 51' 58" N, 138° 01' 27"  
1138 E; ca. 1500 m alt.], 10. VIII. 2013, S. Shimizu leg. (SW) (NIAES); 1F, Sasagamine,  
1139 Suginosawa, Myoko City [36° 52' N, 138° 04' E; 1300 m alt.], 7. VIII. 2013, S. Shimizu  
1140 leg. (SW) (NIAES); 2FF, Sasagamine, Suginosawa, Myoko City [36° 51' N, 138° 05' E;  
1141 1335 m alt.], 11. VIII. 2013, S. Shimizu leg. (SW) (NIAES) (Figure 22a); 1M,  
1142 Sasagamine, Suginosawa, Myoko City [ca. 1300 m alt.], 15. VII. 2013, S. Shimizu leg.  
1143 (SW) (NIAES); 2MM, Sasagamine, Suginosawa, Myoko City [ca. 1300 m alt.], 16. VII.  
1144 2013, S. Shimizu leg. (SW) (NIAES); 2FF, Sasagamine, Suginosawa, Myoko City [36°  
1145 52' N, 138° 05' E; 1330 m alt.], 8. VIII. 2013, S. Shimizu leg. (SW) (NIAES); 1F, Ginzan-  
1146 daira, Okutadami, Utsuno, Uonuma City [ca. 1100 m alt.], 31. VIII. 2006, S. Shimizu leg.  
1147 (NIAES); 1M, Sasagamine, Suginosawa, Myoko City [36° 52' N, 138° 04' E; 1200–1335  
1148 m alt.], 17. IX. 2013, S. Shimizu leg. (SW) (KPMNH); 1F, Suginosawa, Myoko City [36°  
1149 52' 07" N, 138° 05' 03" E; 1300 m alt.], 3. VIII. 2012, M. Ito leg. (NIAES); Saitama  
1150 Pref.: 1F, Ohirayama, Ranzan, 22. V. 2000, T. Nambu leg. (EUM); 1F, Nagawaka, Ogano,  
1151 15. X. 1994, Y. Yamaguchi leg. (T. Nambu collection) (NIAES); 2MM, Yorii, 21. V. 1978,

- 1152 T. Nambu leg. (T. Nambu collection) (NIAES); 1M, Kamiaguhara, Kamiizumi, 29. IV.  
1153 1994, T. Nambu leg. (T. Nambu collection) (NIAES); 1F, Mitsumine, 23. VII. 1974, K.  
1154 Hara leg. (T. Nambu collection) (NIAES); 1F, Otaki, 11. VI. 1984, T. Nambu leg. (T.  
1155 Nambu collection) (NIAES); 1F, Asuwa, Moroyama, 16. X. 1993, M. Uchida leg. (T.  
1156 Nambu collection) (NIAES); 1M, Irikawa, Otaki, 25. VIII. 1985, T. Nambu leg. (T.  
1157 Nambu collection) (NIAES); 1M, Jyumonji pass, 3. VIII. 1984, T. Nambu leg. (T. Nambu  
1158 collection) (NIAES); Shiga Pref.: 1M, Biwako-Valley, Otsu City [35° 13' 00" N, 135° 53'  
1159 36" E; 990 m alt.], 31. V. 2010, M. Ito leg. (KPMNH); Shizuoka Pref.: 1F, Inatori,  
1160 Higashiizu Town [34° 46' 43" N, 139° 2' 16" E; 60–140 m alt.], 20. V. 2009, T. Muraki  
1161 leg. (KPMNH); 1M, Mt. Amagi-san, Izu, 30. VII. 1939, S. Katsuya leg. (S. Kastuya  
1162 collection) (NIAES); 1F, Dainiti-toge, Abegun, 5. VIII. 1959, J. Minamikawa leg.  
1163 (NIAES); 1M, Ogasayama, 19. X. 1958, J. Minamikawa leg. (J. Minamikawa collection)  
1164 (NIAES); 2MM, Abetoge, 8. VIII. 1960, J. Minamikawa leg. (NIAES); 1M, Umegashima,  
1165 2. VIII. 1965, S. Katsuya leg. (S. Katsuya collection) (NIAES); Tochigi Pref.: 1F, Onuma,  
1166 Shiobara, Nasushiobara, 6–15. VI. 2008, Y. Matsunura leg. (KPMNH); 1M, Yumoto,  
1167 Nikko City, 19. VIII. 2012, T. Nakayama leg. (KPMNH); 1M, Yumoto, Nikko City, 22.  
1168 IX. 2015, J. Okayasu leg. (EUM); 1F, Nasu, 29. VII. 1956, S. Hisamatsu leg. (EUM); 1M,  
1169 Sanno-rindo, 21. VII. 1986, H. Makihara leg. (NIAES); 1F, Jigokusawa, Niikko, 16. VI.  
1170 1972, N. Fukuhara leg. (NIAES); 1M, Inarigawa, Nikko, 7. VIII. 1997, M. Matsumura &  
1171 T. Matsumura leg. (NIAES); 1M, Kawamata Lake, Kuriyama Town, 13–14. VII. 1996, T.  
1172 Matsumura leg. (NIAES); 3FF, Chuzenji, Nikko, 28. VI. 1982, S. Naomi leg. (NIAES);  
1173 1F, Senjyogahara, Nikko, 21. VII. 1937, collector unknown (S. Katsuya collection)  
1174 (NIAES); 1F, Yaita, 22. VIII–8. IX. 1989, K. Konishi leg. (MsT) (NIAES); 1M, Yumoto,  
1175 Nikko City, 19. VIII. 2012, T. Nakayama leg. (KPMNH); 1M, Spa. Meotobuchi-Spa.  
1176 Nikkozawa, Nikko City, 23–24. VI. 2011, T. Nakayama leg. (KPMNH); Tokyo: 1F, Tokyo,  
1177 10. VIII. 1961, R. Takahashi leg. (NIAES); 1F, Fuchu, 26. X. 1937, CNN (Tel Ishii  
1178 collection) (NIAES); 1F, Fuchu, 12. XI. 1937, CNN (Tel Ishii collection) (NIAES); 2MM,  
1179 Mt. Takao, 17. V. 1964, J. Minamikawa leg. (J. Minamikawa collection) (NIAES); 1F,  
1180 Takao, 1. X. 1933, CNN (N. Kumazawa collection) (NIAES); 1F, Nagabuchi, Oume City,  
1181 23. X. 1994, H. Takahashi leg. (NIAES); Tottori Pref.: 1F, Odanganaru, Mt. Hyonosen,  
1182 Wakasa Town [35° 20' N, 134° 31' E], 24. VIII. 2011, K. Abe leg. (LT) (KPMNH);  
1183 Toyama Pref.: 8FF, Inonedani, Arimine, Toyama City [1120 m alt.], 7–14 (1F), 14–21  
1184 (1F), 21–28 (1F). VII, 4–11 (1F), 11–16 (1F), 16–25 (2FF). VIII, 8–15 (1F). IX. 2009, M.  
1185 Watanabe et al. leg. (MsT) (KPMNH); 1F, Kamegai, Toyama City [330 m alt.], 8–15. IX.  
1186 2009, M. Watanabe et al. leg. (MsT) (KPMNH); 1F1M, Jurodani, Arimine, Toyama City  
1187 [1120 m alt.], 21–28 (1F). VII, 11–16 (1M). VIII. 2009, M. Watanabe et al. (MsT)

1188 (KPMNH); 2FF, Kamimomose, Toga Vil., Nanto City [664 m alt.], 11–18. VIII. 2009, M  
1189 Watanabe et al. leg. (MsT) (KPMNH); Wakayama Pref.: 2MM, Mt. Gomadanzan, Ryujin,  
1190 Ryujin Vil., Tanabe City [ $34^{\circ} 03' 32''$  N,  $135^{\circ} 33' 57''$  E; 1280–1370 m alt.], 23. VI. 2012,  
1191 S. Fujie leg. (OMNH); Yamagata Pref.: 1F, Mt. Funagata, 27. VII. 1960, S. Katsuya leg.  
1192 (NIAES); 2FF1M, Mt. Akakuzure-yama, 24. VII. 1993, K. Konishi leg. (NIAES); 1F,  
1193 Yachidaira, Mts. Iide, 19. VI. 1988, K. Konishi leg. (NIAES); Yamanashi Pref.: 1M,  
1194 Kaminikkawa-toge, Koushu City, 16. VI. 2007, K. Watanabe leg. (KPMNH); 1F,  
1195 Daibosatsu-toge [1400 m alt.], 3. VIII. 2010, T. Maeda leg. (KPMNH); 1F, Biwakubo-  
1196 sawa, Masutomi, Hokuto City [ $35^{\circ} 51' 18''$  N,  $138^{\circ} 34' 54''$  E; 1360–1560 m alt.], 24. VI.  
1197 2010, K. Watanabe leg. (KPMNH); 1M, Biwakubo-sawa, Masutomi, Hokuto City [ $35^{\circ}$   
1198  $51' 18''$  N,  $138^{\circ} 34' 54''$  E; 1360–1560 m alt.], 28. VI. 2008, C. Satoh leg. (KPMNH); 1F,  
1199 Yanagisawa-toge, Koshu City [ $35^{\circ} 46' 44''$  N,  $138^{\circ} 48' 10''$  E; 1480–1580 m alt.], 5. VIII.  
1200 2008, S. Yoshizawa leg. (KPMNH); 2MM, Kaminikkawa-toge, Koushu City [ $35^{\circ} 43' 44''$   
1201 N,  $138^{\circ} 49' 51''$  E; 1560–1600 m alt.], 8. VI. 2009, T. Kidokoro leg. (KPMNH); 1F,  
1202 Hikawa-rindo, Sagashio, Koshu City [ $35^{\circ} 40' 48''$  N,  $138^{\circ} 48' 42''$  E; 1180–1260 m alt.],  
1203 5. VIII. 2008, M. Irie leg. (KPMNH); 2MM, Kaminikkawa-toge, Koushu City [ $35^{\circ} 43'$   
1204  $44''$  N,  $138^{\circ} 49' 51''$  E; 1560–1600 m alt.], 6. VIII. 2008, T. Kidokoro leg. (KPMNH);  
1205 1M, Yanagisawa-toge, Koshu City [ $35^{\circ} 46' 44''$  N,  $138^{\circ} 48' 10''$  E; 1480–1580 m alt.], 5.  
1206 VIII. 2008, K. Watanabe leg. (KPMNH); 1M, Mt. Syakushi, Fujiyoshida City, 30. VI.  
1207 2012, Y. Suzuki leg. (KPMNH: KPM-NK5002033); 1M, Mt. Kusigata, 24. VII. 1938,  
1208 Nagasawa leg. (Tei Ishii collection) (NIAES); 1F, Mitsu-toge, 31. V. 1971, S. Yamaguchi  
1209 leg. (S. Katsuya collection) (NIAES); 1F, Kaminikkawa pass, Mt. Daibosatsu, 15–18. VII.  
1210 1982, S. Naomi leg. (NIAES); 1F, Minobu, Yamanashi Pref., 12. VI. 1928, K. Sato leg.  
1211 (SEHU); 2MM, Kaminikkawa-toge, Koshu City [ $35^{\circ} 43' 44''$  N,  $138^{\circ} 49' 51''$  E; 1560–  
1212 1600 m alt.], 6. VIII. 2008, K. Watanabe leg. (KPMNH); 1F, near Suzuran-sou, Koshu  
1213 City [ $35^{\circ} 42' 33''$  N,  $138^{\circ} 49' 42''$  E; ca. 1400 m alt.], 17. VI. 2008, T. Kidokoro leg.  
1214 (KPMNH); 1F1M, Narusawa\_fuji-path, Narusawa Vil. [ $35^{\circ} 23' 47''$  N,  $138^{\circ} 41' 13''$  E;  
1215 1800 m alt.], 24. IX. 2011, M. Ito leg. (EUM); [Shikoku] 1F, Mt. Irazu-yama, Shikoku, 8.  
1216 XI. 1916, T. Uchida leg. (SEHU); 1F1M, Mt. Sara, 11. V. 1952, M. Miyatake leg. (EUM);  
1217 1M, Mt. Sara, 15. V. 1955, T. Yano leg. (NIAES); Ehime Pref.: 1M, Marutaki,  
1218 Kumakogen Town [1500–1600 m alt.], 18. VI. 2005, K. Takasuka leg. (EUM); 1F,  
1219 Mominoki, Misaka, 19. X. 1952, T. Yano leg. (EUM); 2FF2MM, Mt. Ishizuchi, 18. VI.  
1220 1978, N. Takaki leg. (EUM); 1F, Komenono, 14. V. 1972, T. Ishihara leg. (EUM); 1M,  
1221 Komenono, Matsuyama City, 5. XI. 1977, N. Takaki leg. (EUM); 1F, Komenono, 3. V.  
1222 1978, N. Takaki leg. (EUM); 1F, Mt. Saragamine, Touon City [900–1100 m alt.], 5. VII.  
1223 2008, Y. Yamauchi leg. (EUM); 2FF, Mt. Saragamine, 18. VI. 1978, M. Kotani leg.

1224 (EUM); 1F, Oda Town, 7. VII. 1995, E. Yamamoto leg. (NIAES); Kochi Pref.: 1F1M,  
1225 Nagano, Yusuhara, 6–8. V. 1994, Utsunomiya, Kawanabe & Fujimori leg. (EUM); 1M,  
1226 Tengu-kogen, 4. VI. 1989, I. Yamashita leg. (NIAES); 1F, Kuroson, 29. IV. 1956, Y. Wake  
1227 leg. (EUM); 1F, Mt. Kagigamori, 14. V. 1989, I. Yamashita leg. (NIAES); 1F, Hirooka,  
1228 Tosa (=Kochi Pref.), 2. IV. 1933, H. Okamoto leg. (SEHU); 1F, Engyoji, 3. V. 1931, Y.  
1229 Sugihara leg. (SEHU); 1F, Kodakasaka, 7. XI, 1929, Y. Sugihara leg. (SEHU); Tokushima  
1230 Pref.: 3MM, Mt. Koutsusan [1100 m alt.], 12. V. 1985, K. Ohara leg. (NIAES); [Kyushu]  
1231 Fukuoka Pref.: 1F, Mt. Hikosan, 26. IV. 1981, R. Noda leg. (NIAES); 1F, Mt. Hiko-san,  
1232 2–3. V. 1983, K. Konishi leg. (NIAES); 1F, Fukuoka, 28. IV. 1954, S. Takagi leg. (SEHU);  
1233 Kagoshima Pref.: 1F, Mt. Inaodake, Ohsumi Pen., 12. V. 2007, T. Maeda leg. (KPMNH);  
1234 1M, Okawa-rindo, Yakushima Is., 21. IV. 1981, S. Yoshimatsu leg. (NIAES); 1M, Kojima,  
1235 Yakushima Is., 25. IV. 1981, S. Yoshimatsu leg. (NIAES); 1F, Isa City [32° 07' 30.8" N,  
1236 130° 29' 55.3" E], 7. IX. 2012, Y. Matsubara & K. Fukuda leg. (MsT) (KPMNH);  
1237 Kumamoto Pref.: 1F1M, Shiratori-yama, Yatsushiro City, 23. V. 2011, T. Kawano leg.  
1238 (KPMNH); 1F, Mt. Ichifusa, 29. V. 1981, R. Noda leg. (NIAES); Nagasaki Pref.: 2MM,  
1239 Nagasaki, 1925, CNN (Tel Ishii collection) (NIAES); Oita Pref.: 1F, Mt. Kuju, 2. VI.  
1240 1955, T. Miyake leg. (SEHU); 1F, Mt. Kuju, 12. VII. 1968, S. Kinoshita leg. (EUM); 1F,  
1241 Ohuneyama 24. VII. 1979, K. Konishi leg. (NIAES)  
1242 *Non-Japanese specimens:* CANADA (4FF1M): 1F1M, Gatineau Park, Quebec, 23. VIII.  
1243 1991, K. Yamagishi leg. (YPT) (NIAES); 1F, 2 m. N. Metcalfe, Ontario, 28. VI. 1982,  
1244 B.E. Cooper leg. (NIAES); 1F, BC, Cowichan, 18. VIII. 1964, J.A. Chapman leg.  
1245 (identified by Clement Dasch) (CNC: CNCHYM012996) [Tc7, KY754478]; 1F, ON,  
1246 Stittsville, 30. V. 1963, W.R.M. Mason leg. (identified by Clement Dasch) (CNC:  
1247 CNCHYM012998) [Tc8, KY754477]; CHINA (8FF1M): Fukien (new record): 6FF,  
1248 Chungan, Bohea, Hills, 10 (1F), 19 (1F), 25 (2FF), 31 (2FF). X. 1939, T.C. Maa leg.  
1249 (TARI); 1F, Yungan, Syingpan, 3. VII. 1941, T.C. Maa leg. (TARI); 1M, Yungan,  
1250 Syingpan, 24. XI. 1941, T.C. Maa leg. (TARI); 1F, Shaown, Shuipeikieh, 22. X. 1941,  
1251 T.C. Maa leg. (TARI) (Figure 22c); ENGLAND (1F): 1F, Mallard Wood, New Forest,  
1252 Hampshire, 27. VII. 1977, G.R. Else leg. (determined as *Therion circumflexum* by I.D.  
1253 Gauld, who was one of the greatest ichneumonologist in the world and energetically  
1254 researched anomalonine wasps) (TARI); FRANCE (1M): 1M, Alpilles, 7. V. 2015, S.  
1255 Klopfstein leg. (NIAES); GERMANY (1F): 1F, Schleissheim, 6.36? (SEHU); INDIA  
1256 (3FF5MM): 2FF5MM, Simla H.P., 25. IX. 1971, K. Sadanaga leg. (NIAES); 1F, Simala  
1257 H.P., 24. IX. 1971, I. Hattori leg. (NIAES); KOREA (1F): 1F, Kankyeryong, Soraksan  
1258 Nat. Park [900–1100 m], 10. VI. 1994, T. Matsumura leg. (NIAES); SWITZERLAND  
1259 (2FF): 1F, Zollikofen, 15. VI. 2003, S. Klopfstein leg. (NIAES); 1F, Halenbrücke [520 m

1260 alt.], 23. V. 2003, S. Klopfstein leg. (NIAES); TAIWAN (14FF15MM): 1F, Tayuling,  
1261 Hualien [2560 m alt.], 10–16. VI. 1980, K.S. Lin & B.H. Chen leg. (MsT) (TARI); 10MM,  
1262 Saukan, Taiheizam, 16–18. VII. 1938, J. Sonan leg. (TARI); 1F1M, Wuling, 21. IV. 1966,  
1263 H.H. Tseng & S.H. Lin leg. (TARI); 3FF, Kuandouchi, 21–31. I. 1973, CNN (MsT)  
1264 (TARI); 1F, Anmashan, Taichung [2275 m alt.], 6–9. VII. 1979, L.Y. Chou leg. (TARI);  
1265 1M, Peitungyuanhan, 1–15. VII. 1972, CNN (MsT) (TARI); 1F, Wushe, Nantou [1150 m  
1266 alt.], 6. XI. 1981, S.C. Lin & W.S. Tang leg. (TARI); 2FF, Peitungyuanhan, 1–15. IV.  
1267 1973, CNN (MsT) (TARI); 2FF, Peitungyuanhan, 16–31. VII. 1972, CNN (MsT) (TARI);  
1268 1F, Peitungyuanhan, 29. IX–6. X. 1971, CNN (MsT) (TARI); 1F, Peitungyuanhan, 1–31.  
1269 V. 1973, CNN (MsT) (TARI); 1M, Meifeng, Nantou [2150 m alt.], 26. VIII. 1980, K.S.  
1270 Lin & C.H. Wang leg. (TARI); 1M, Alishan, Chiayi [2400 m alt.], 17–20. VIII. 1982, K.C.  
1271 Chou & C.C. Pan leg. (TARI); 1M, Meifeng, Nantou [2250 m alt.], 31. VII–2. IX. 1982,  
1272 L.Y. Chou & K.C. Chou leg. (TARI); 1F, Ren`ai Township, Wufeng [24° 00' 25" N, 121°  
1273 07' 31" E; ca. 1600 m alt.], 2. X. 2015, M. Ito leg. (NIAES) [Tr, LC199011].  
1274  
1275  
1276  
1277  
1278  
1279  
1280  
1281  
1282  
1283  
1284  
1285  
1286  
1287  
1288  
1289  
1290  
1291  
1292  
1293  
1294  
1295

1296 **Table 1.** Sample codes, sample localities, accession numbers, and genetic distance of  
 1297 *Therion* species.

| Taxon                  | Locality               | Sample code | Tc1   | Tc2   | Tc3   | Tc4   | Tc5   | Tc6   | Tc7   | Tc8   | Tr    | Tn1   | Tn2   | Tn3   | Tn4   | Tn5   | Tn6   | Tn7   | Tn8   | Tn9   | Tn10  | Tn11  | Tn12     | Accession number |          |
|------------------------|------------------------|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|------------------|----------|
| <i>T. circumflexum</i> | Nagano                 | Tc1         |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |          | LC199005         |          |
|                        | Nagano                 | Tc2         | 0.000 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |          | LC199006         |          |
|                        | Nara                   | Tc3         | 0.018 | 0.018 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |          | LC199007         |          |
|                        | Fukui                  | Tc4         | 0.022 | 0.022 | 0.011 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |          | LC199008         |          |
|                        | Fukui                  | Tc5         | 0.018 | 0.018 | 0.007 | 0.004 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |          | LC199009         |          |
|                        | Fukui                  | Tc6         | 0.018 | 0.018 | 0.007 | 0.004 | 0.000 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |          | LC199010         |          |
|                        | Canada                 | Tc7         | 0.036 | 0.036 | 0.040 | 0.040 | 0.040 | 0.040 |       |       |       |       |       |       |       |       |       |       |       |       |       |       |          | KY754478         |          |
|                        | Canada                 | Tc8         | 0.040 | 0.040 | 0.043 | 0.043 | 0.043 | 0.043 | 0.043 |       |       |       |       |       |       |       |       |       |       |       |       |       |          | KY754477         |          |
|                        | <i>T. rufomaculata</i> | Taiwan      | Tr    | 0.014 | 0.014 | 0.011 | 0.007 | 0.011 | 0.011 | 0.032 | 0.036 |       |       |       |       |       |       |       |       |       |       |       |          |                  | LC199011 |
|                        |                        | Gunma       | Tn1   | 0.076 | 0.076 | 0.087 | 0.083 | 0.087 | 0.087 | 0.087 | 0.090 | 0.083 |       |       |       |       |       |       |       |       |       |       |          |                  | LC199012 |
|                        |                        | Gunma       | Tn2   | 0.076 | 0.076 | 0.087 | 0.083 | 0.087 | 0.087 | 0.087 | 0.090 | 0.083 | 0.000 |       |       |       |       |       |       |       |       |       |          |                  | LC199013 |
|                        |                        | Gunma       | Tn3   | 0.076 | 0.076 | 0.087 | 0.083 | 0.087 | 0.087 | 0.087 | 0.090 | 0.083 | 0.000 |       |       |       |       |       |       |       |       |       |          |                  | LC199014 |
|                        |                        | Gunma       | Tn4   | 0.076 | 0.076 | 0.087 | 0.083 | 0.087 | 0.087 | 0.087 | 0.090 | 0.083 | 0.000 |       |       |       |       |       |       |       |       |       |          |                  | LC199015 |
|                        |                        | Gunma       | Tn5   | 0.076 | 0.076 | 0.087 | 0.083 | 0.087 | 0.087 | 0.087 | 0.090 | 0.083 | 0.000 |       |       |       |       |       |       |       |       |       |          |                  | LC199016 |
|                        |                        | Gunma       | Tn6   | 0.076 | 0.076 | 0.087 | 0.083 | 0.087 | 0.087 | 0.087 | 0.090 | 0.083 | 0.000 |       |       |       |       |       |       |       |       |       |          |                  | LC199017 |
|                        |                        | Gunma       | Tn7   | 0.076 | 0.076 | 0.087 | 0.083 | 0.087 | 0.087 | 0.087 | 0.090 | 0.083 | 0.000 |       |       |       |       |       |       |       |       |       |          |                  | LC199018 |
|                        |                        | Canada      | Tn1   | 0.083 | 0.083 | 0.079 | 0.076 | 0.076 | 0.069 | 0.076 | 0.079 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087 | 0.087    | KY754480         |          |
|                        |                        | Canada      | Tn2   | 0.087 | 0.087 | 0.083 | 0.079 | 0.079 | 0.079 | 0.072 | 0.079 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.083 | 0.084    | KY754479         |          |
|                        | <i>H. amictum</i>      | Fukui       | OGHa  | 0.105 | 0.105 | 0.119 | 0.108 | 0.112 | 0.112 | 0.116 | 0.112 | 0.105 | 0.105 | 0.105 | 0.105 | 0.105 | 0.105 | 0.105 | 0.105 | 0.105 | 0.130 | 0.134 | LC199019 |                  |          |

1299 **Table 2.** Comparison of the diagnostic characters among Japanese *Therion* species in  
1300 females.

| Character                                       | <i>T. carinatum</i> sp. nov. | <i>T. circumflexum</i> | <i>T. giganteum</i>  | <i>T. nigrigasterum</i> sp.<br>nov. |
|---|------------------------------|------------------------|----------------------|-------------------------------------|
| OOD/ LOD  | 2.1                          | 2.0–2.1                | 1.8                  | 1.7–1.9                             |
| IOD/ LOD  | 1.6                          | 1.4–1.9                | 1.3                  | 1.5–1.7                             |
| POD/ LOD  | 1.1                          | 0.5–0.9                | 0.7                  | 0.6–0.9                             |
| Flagellomeres                                   | 43                           | 49–55                  | 60                   | 54–56                               |
| Tooth of antero-ventral corner of pronotum      | absent                       | present                | absent               | present                             |
| Shallow impression on dorsal margin of pronotum | present                      | present                | present              | absent                              |
| Scutellum                                       | weakly convex                | moderately convex      | strongly convex      | moderately convex                   |
| Epicnemial carina                               | complete                     | complete               | laterally incomplete | complete                            |
| Length of fore wing (mm)                        | 7.0                          | 10.5–13.0              | 15.0                 | 11.5–12.5                           |
| NI  | 0.9                          | 0.7–1.0                | 0.9                  | 0.4–0.6                             |
| Hind outer tarsal claw                          | basally pectinate            | basally pectinate      | simple               | simple                              |
| PI  | 4.0                          | 3.6–5.0                | 3.3                  | 3.8–4.9                             |
| T1  | slender                      | slender                | stout                | slender                             |

1301  
1302

1303

1304

1305

1306

1307

1308

1309

1310

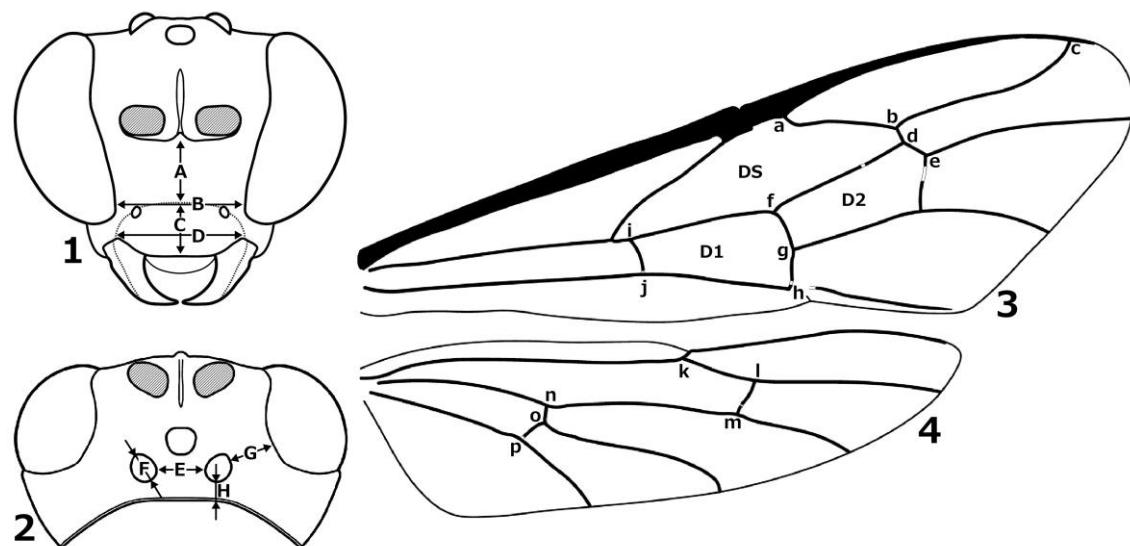
1311

1312

1313

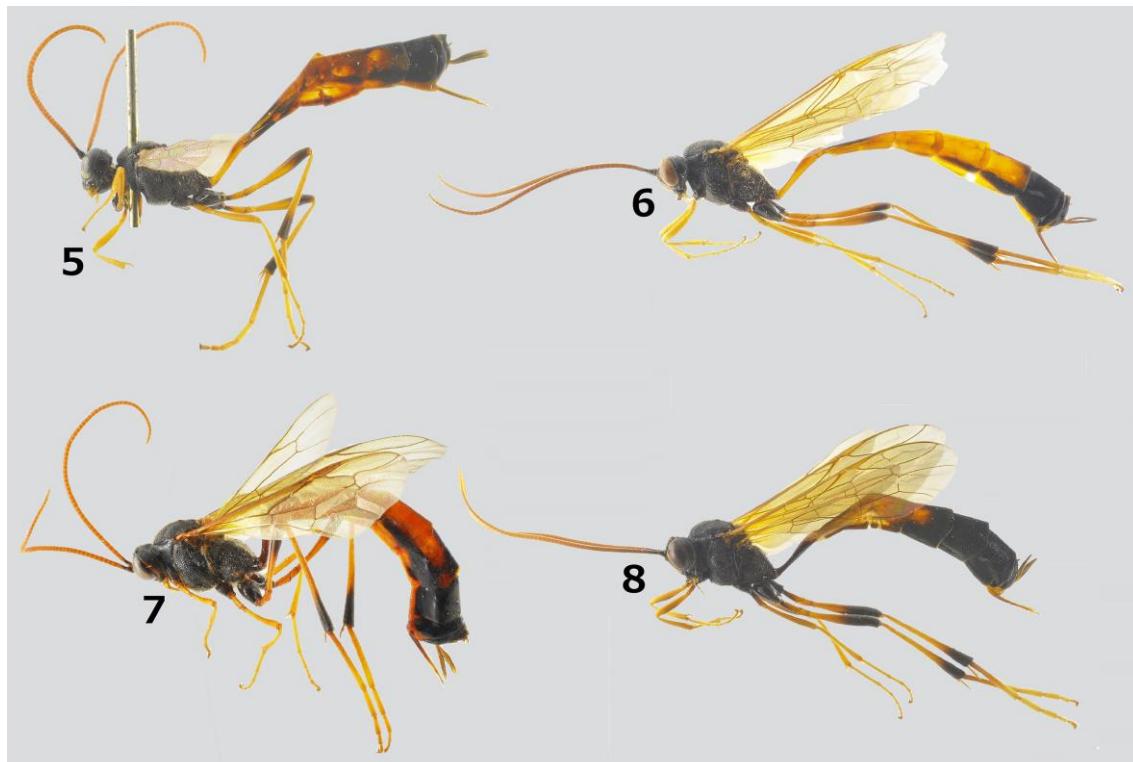
1314

1315 **Figure legends**



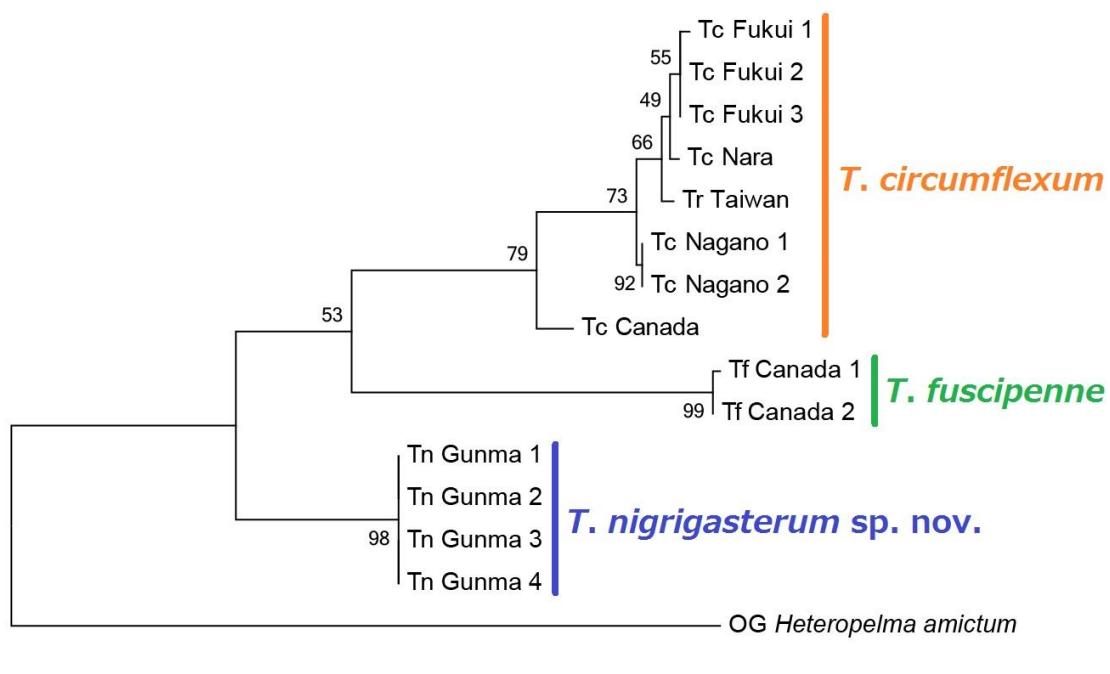
1316

1317 **Figures 1–4.** Measurement characters of *Therion*. (1) head in frontal view: A-facial height,  
1318 B-facial width, C-clypeal height, D-clypeal width; (2) head in dorsal view: E-IOD,  
1319 F-LOD, G-OOD, H-POD; (3) fore wing: BI=fh/ij, CI=fg/gh, DBI=fi/df, MI=ab/bc,  
1320 ICI=bd/de, discosubmarginal cell (DS), first subdiscal cell (D1), second discal cell (D2);  
1321 (4) hind wing: RI=kl/lm, NI=no/op.

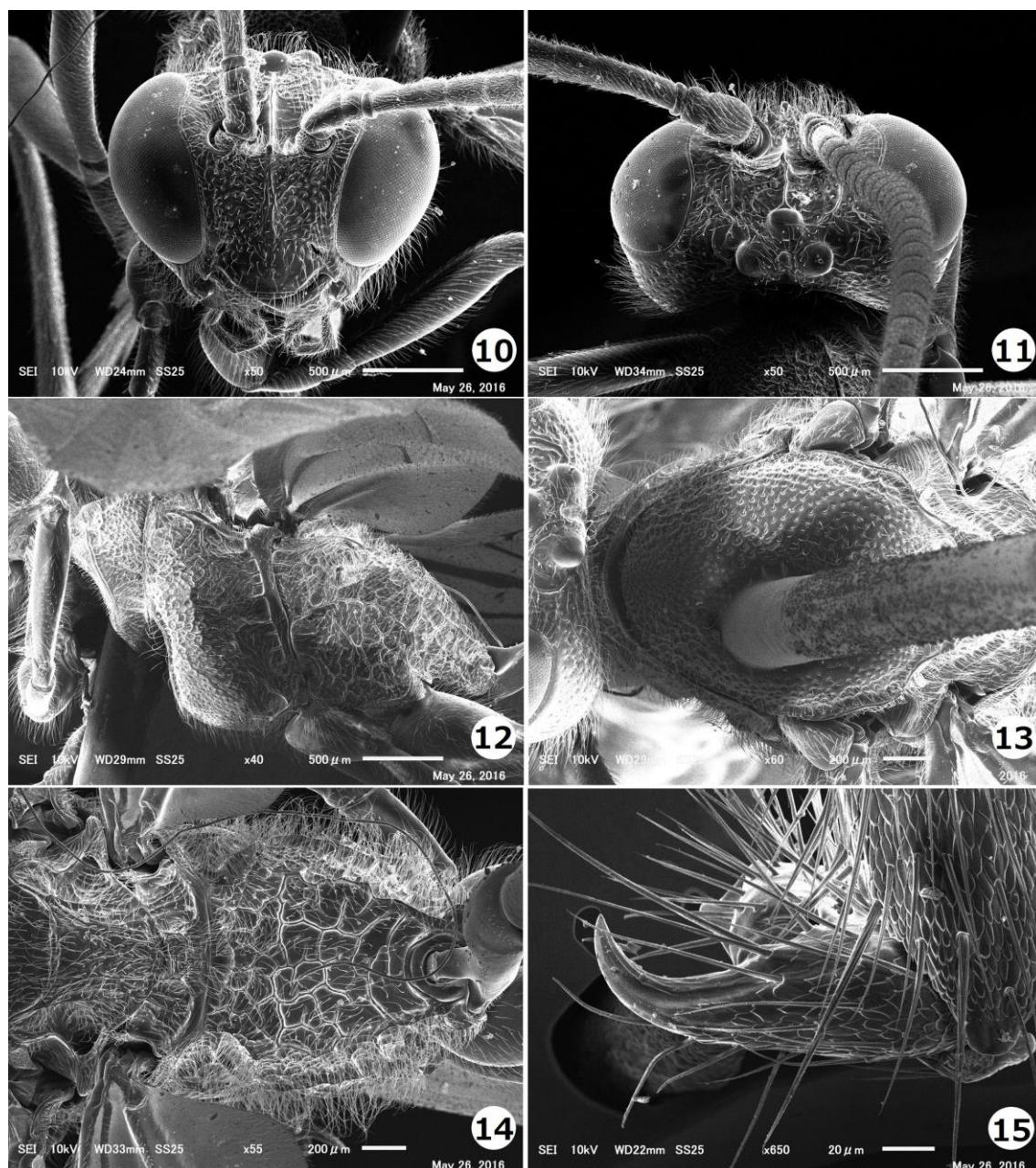


1322

1323 **Figures 5–8.** Lateral habitus of Japanese *Therion*. (5) *T. carinatum* sp. nov. (HT).  
1324 (6) *T. circumflexum*; (7) *T. giganteum*; (8) *T. nigrigasterum* sp. nov. (HT).

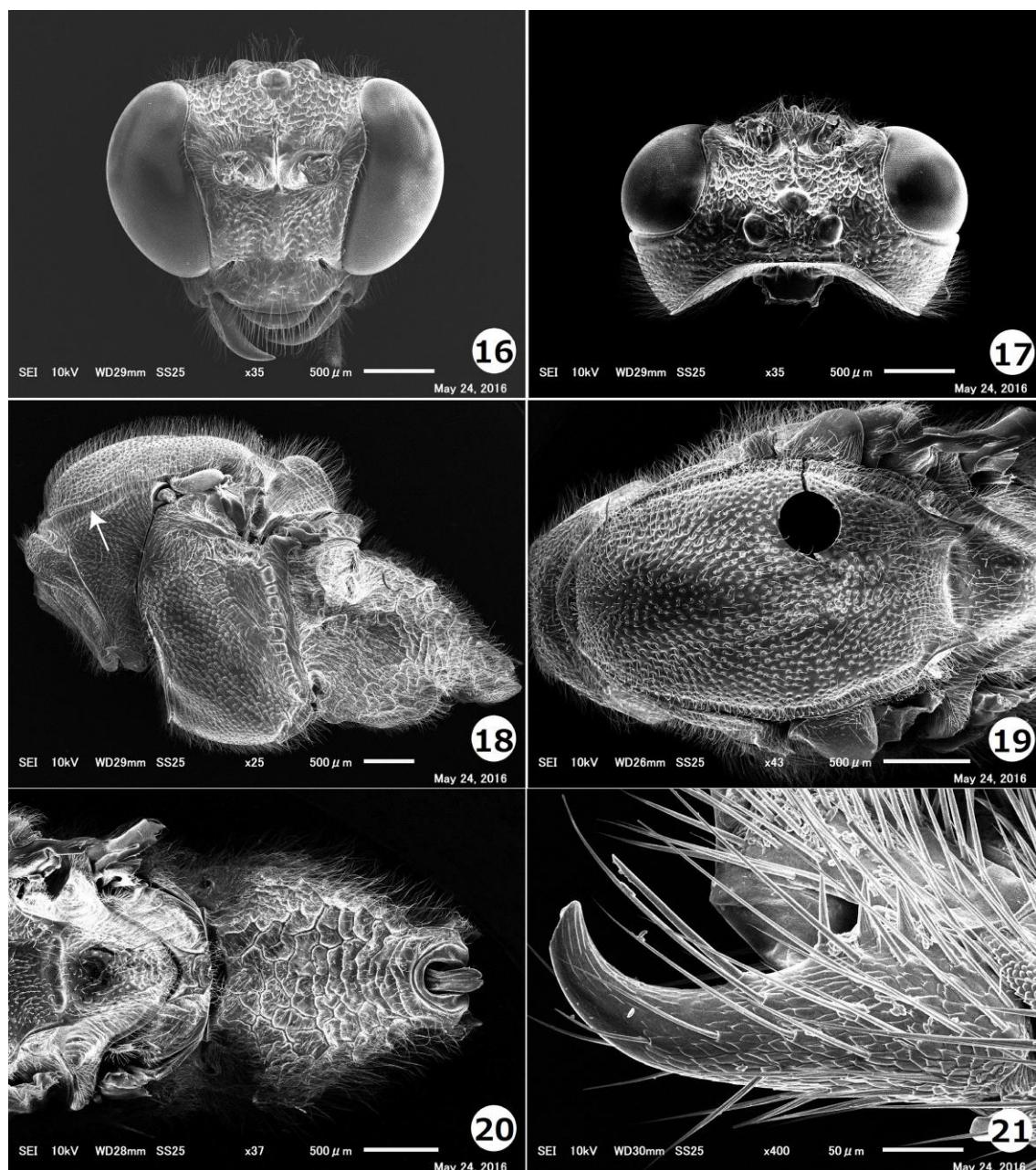


1325 **Figure 9.** Maximum likelihood (ML) tree based on mtCOI sequences of *Therion* species.  
1326 Bootstrap values (> 50%) are indicated at the nodes. See Table 1 for specimen codes.  
1327



1328

1329 **Figures 10–15.** SEM images of *Therion carinatum* sp. nov. (HT). (10) head in frontal  
1330 view; (11) head in dorsal view; (12) mesosoma in lateral view; (13) mesoscutum in dorsal  
1331 view; (14) scutellum and propodeum in dorsal view; (15) hind outer tarsal claw in lateral  
1332 view.



1333

1334 **Figures 16–21.** SEM images of *Therion circumflexum* (a female from Honshu). (16) head  
1335 in frontal view; (17) head in dorsal view; (18) mesosoma in lateral view (white allows  
1336 shows a longitudinal impression of upper margin of pronotum); (19) mesoscutum in  
1337 dorsal view; (20) scutellum and propodeum in dorsal view; (21) hind outer tarsal claw in  
1338 lateral view.



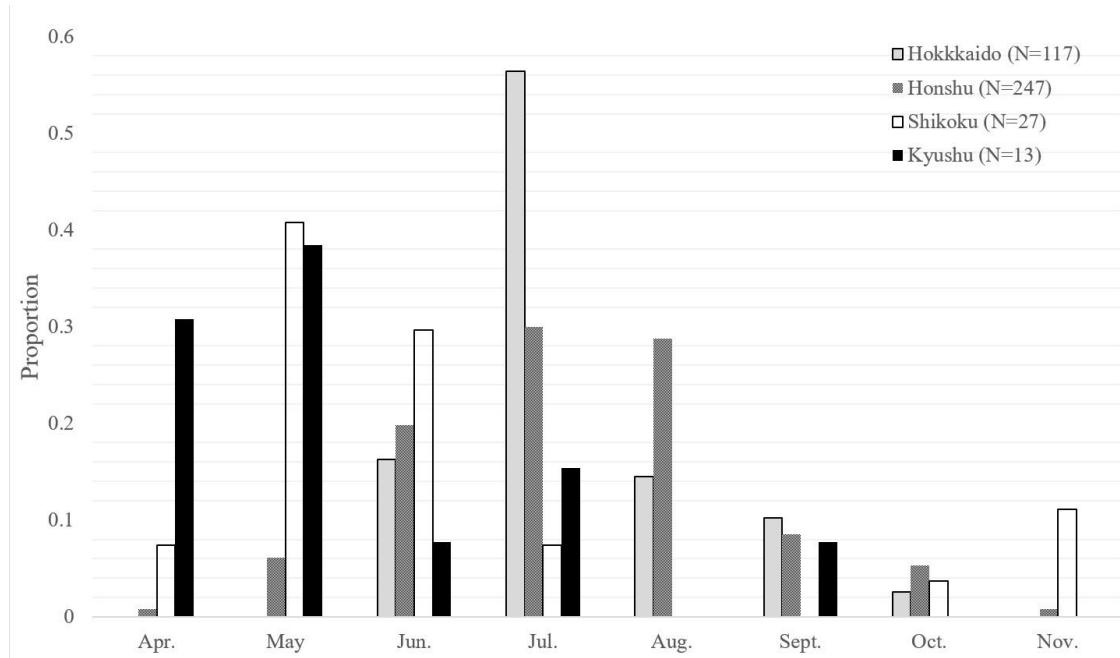
22

1339

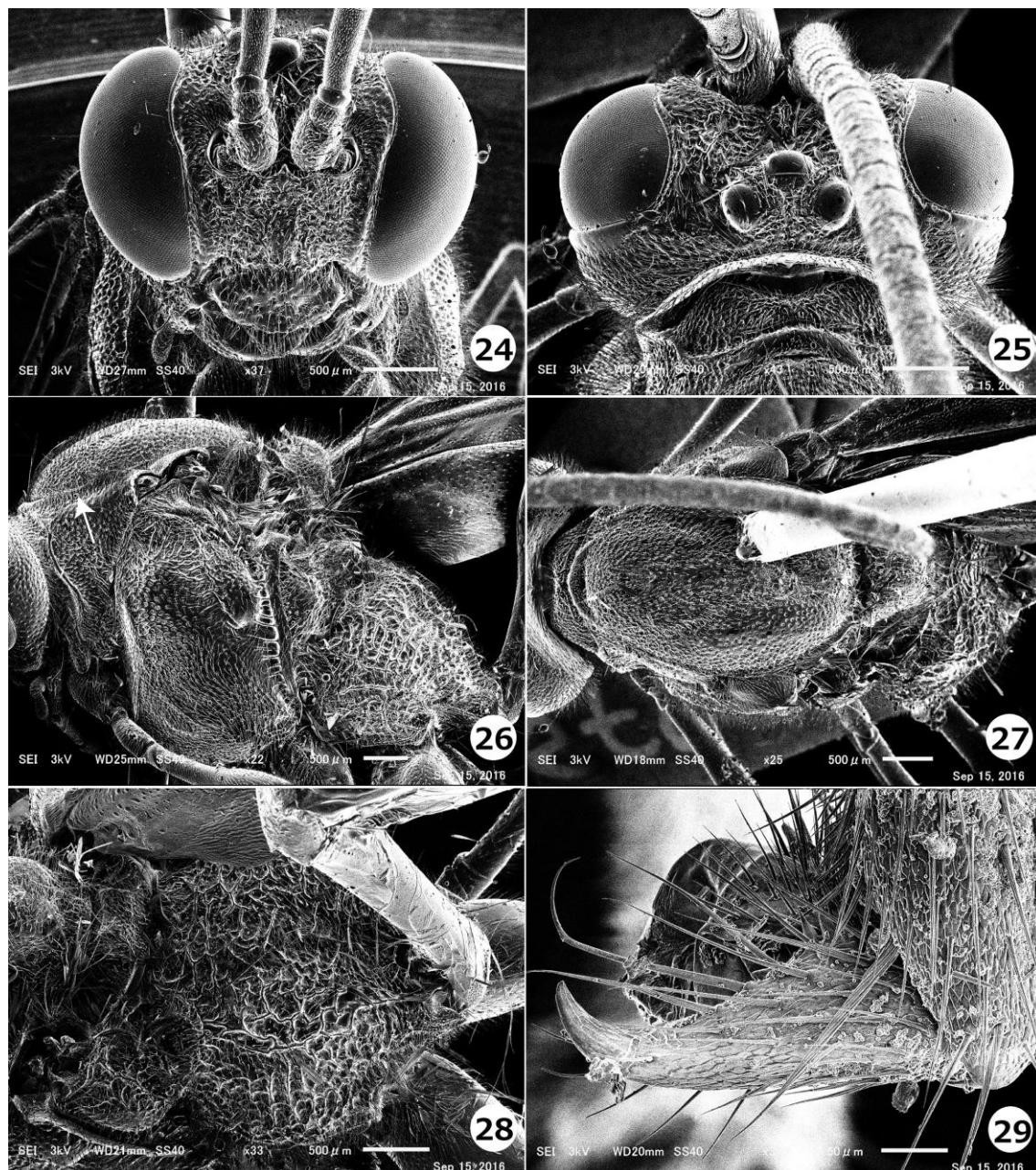
1340 **Figure 22.** Color variations of female of *Therion circumflexum* in Japan. (a, b) Japanese  
1341 specimens (a, Niigata Pref.; b, Nagano Pref.), which were previously belonging to *T.*  
1342 *circumflexum*; (c) Chinese specimen, which was previously belonging to *T.*  
1343 *rufomaculatum* (synonymized with *T. circumflexum* in this paper)

1344

1345

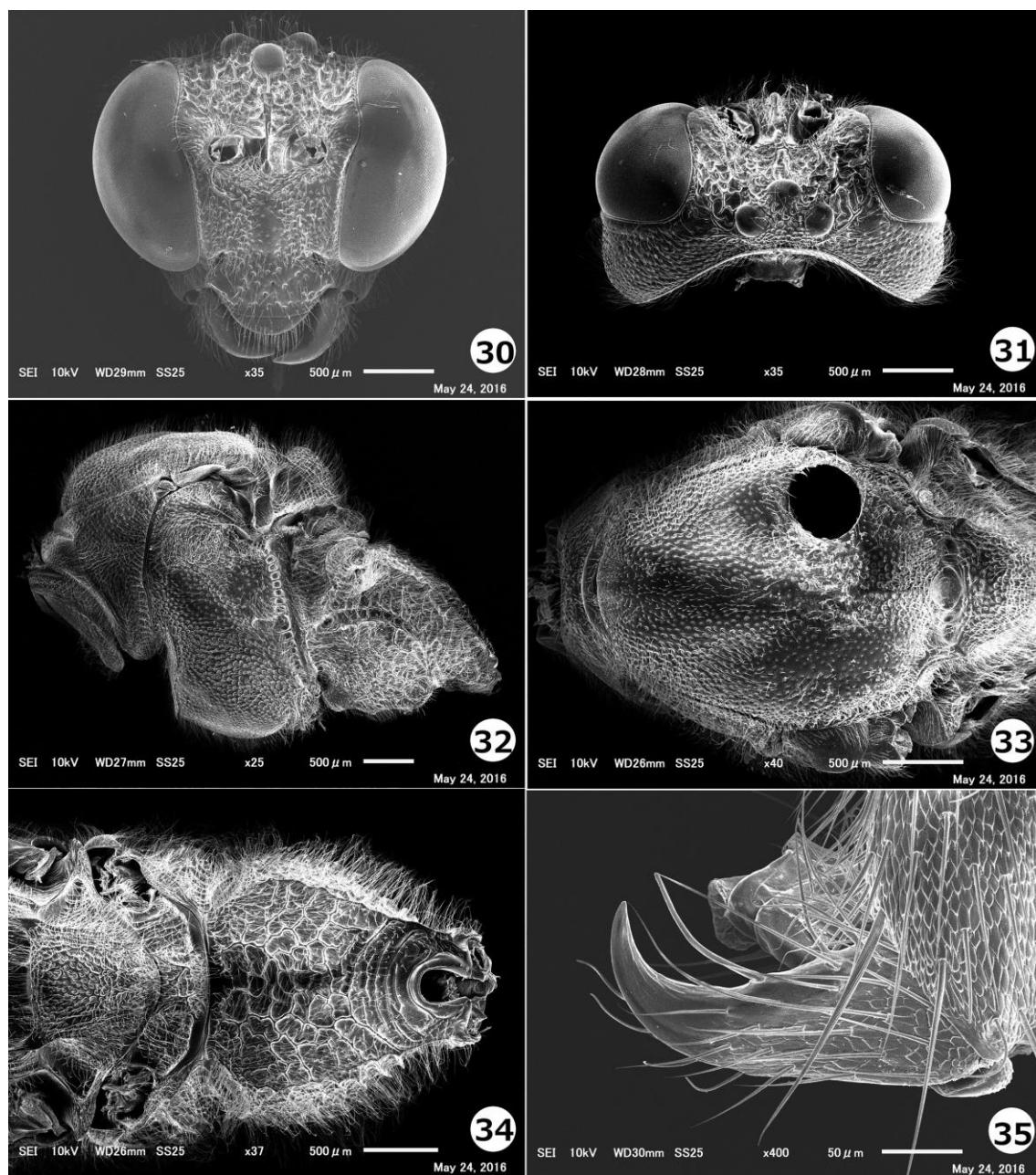


**Figure 23.** Phenology of *Therion circumflexum* in Japan.



1346

1347 **Figures 24–29.** SEM images of *Therion giganteum* (a female from Hokkaido). (24) head  
1348 in frontal view; (25) head in dorsal view; (26) mesosoma in lateral view (white allows  
1349 shows a longitudinal impression of upper margin of pronotum); (27) mesoscutum in  
1350 dorsal view; (28) scutellum and propodeum in dorsal view; (29) hind outer tarsal claw in  
1351 lateral view.



1352

1353 **Figures 30–35.** SEM images of *Therion nigrigasterum* sp. nov. (a female PT). (30) head  
1354 in frontal view; (31) head in dorsal view; (32) mesosoma in lateral view; (33)  
1355 mesoscutum in dorsal view; (34) scutellum and propodeum in dorsal view; (35) hind  
1356 outer tarsal claw in lateral view.



36

1357

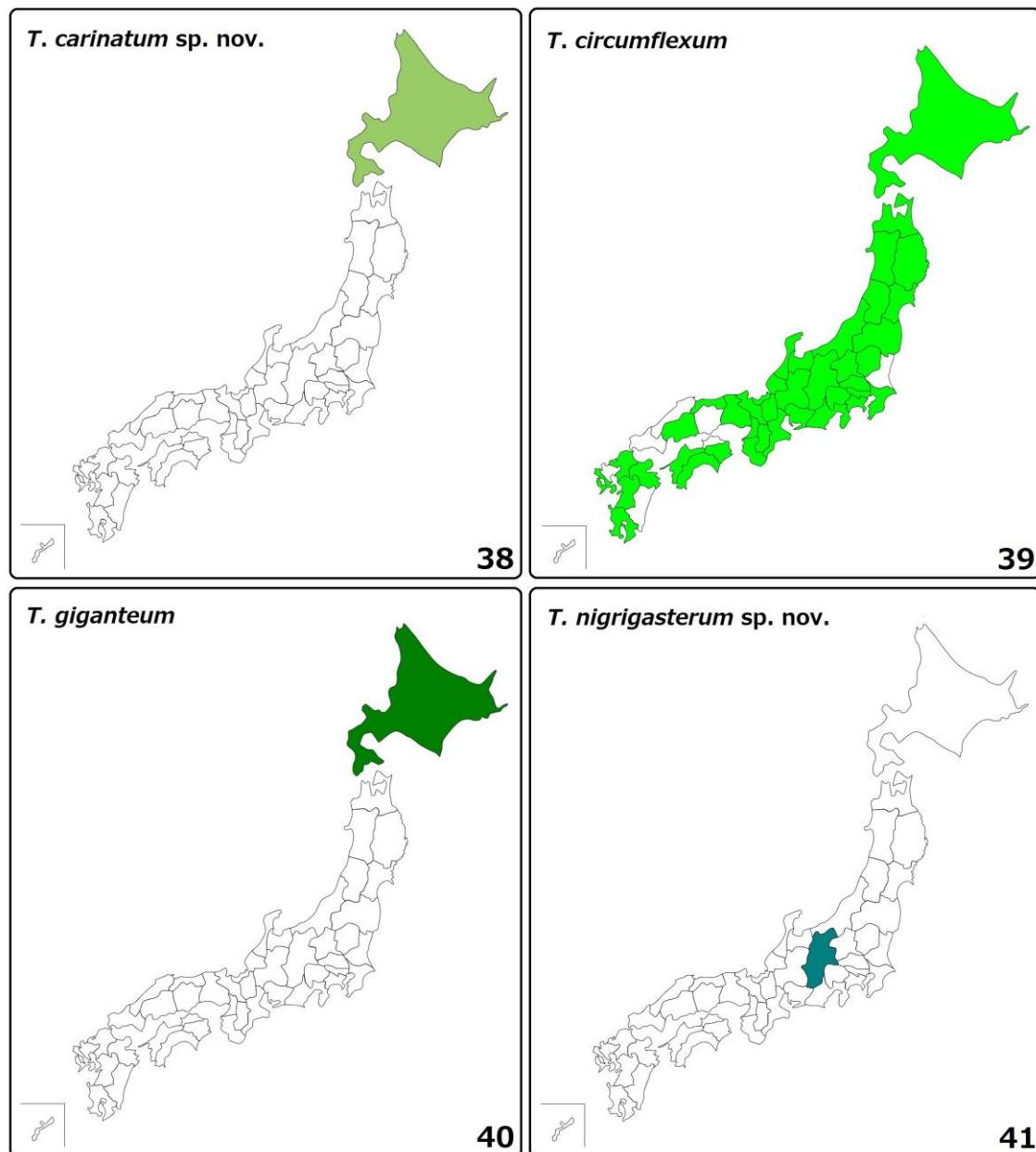
1358 **Figure 36.** Type locality of *Therion nigrigasterum* sp. nov.



37

1359

1360 **Figure 37.** Female of *Therion nigrigasterum* sp. nov. visiting *Aralia cordata* Thunberg  
1361 at the type locality.



1362

1363 **Figures 38–41.** Distribution of Japanese *Therion*. (37) *T. carinatum* sp. nov.; (38) *T.*  
1364 *circumflexum*; (39) *T. giganteum*; (40) *T. nigrigasterum* sp. nov.  
1365