

## A Taxonomic Study of the Genus *Bactrothrips* KARNY (Thysanoptera, Phlaeothripidae) from Japan\*

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### Synopsis

The idolothripine genus *Bactrothrips* Karny from Japan is revisionally studied. Three species are redescribed, and four are newly described and illustrated. A key is provided to the seven species. *Gigantothrips harukawai* KUROSAWA and *Idolothrips kawamurai* ISHIDA are synonymized with *B. brevitubus* and *B. quadrituberculatus*, respectively.

Key words: Thysanoptera, Idolothripinae, *Bactrothrips*, description, new species.

### Introduction

Amongst elongate, dark-coloured Idolothripina in which males have a pair of tubercles on sixth (rarely fifth) abdominal segment the largest genus is *Bactrothrips* KARNY. MOUND and PALMER (1983) recently revised this genus and listed more than forty nominal species of the world in the genus including four from Japan after unifying several related genera into one genus. KUROSAWA (1968) recorded five species of this group from Japan under different four genera, they are BAGNALL's *honoris* (*Megathrips*) and *quadrituberculatus* (*Idolothrips-Megathrips*), ISHIDA's *kawamurai* (*Idolothrips*), KUROSAWA's *harukawai* (*Gigantothrips*) and TAKAHASHI's *brevitubus*. The three former species are transferred to *Bactrothrips* by MOUND and PALMER (1983), and two of them are at present synonymized, that is, *kawamurai* with *quadrituberculatus* and *harukawai* with *brevitubus*, therefore, three valid species are hitherto known in the genus from Japan. Based on careful studies of specimens we collected from many different sites in whole Japan, four species other than above-mentioned ones are here described as new species.

The insects of the genus *Bactrothrips* live on dead, dry leaves of broad-leaf trees, chiefly of

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Fagaceae in Japan. We can collect them by beating and jarring clusters of leaves turned brown, more or less rolled on hanging branches. They do not live on fallen leaves on the ground. They eat spores four-celled capsules. Numerous spore capsules are easily recognized in the gut of mounted specimens. Although those spores are similar in shape to each other among different species of *Bactrothrips*, it seems that there are certain relations between insect species and 'host' trees of which dead leaves are infested by those fungi. We collected those thrips specifically on about twelve of twenty Japanese species of Fagaceae species. It is noticeable that the majority of world species of this genus is known from the Afrotropical and Oriental Regions, however, one species newly described below seems to have acquainted an adaptability for the cool-temperate climate in the northern half of Japan differing all other Japanese species which live in the warm-temperate zone of southern half of Japan.

*Type-preservations.* All holotypes and most paratypes are preserved in the Laboratory of Entomology, Tokyo University of Agriculture.

*Abbreviations.* The following abbreviations are used for the five pairs of pronotal setae : *am*, anteromarginals; *aa*, anteroangulars; *ml*, midlaterals; *pa*, posteroangulars; *epim*, epimerals.

*Measurements.* The head length is measured from the anterior margin of eyes to base at middle including basal collar.

#### Genus *Bactrothrips* KARNY

*Bactrothrips* KARNY, 1912 : 131. Type-species: *Bactrothrips longiventris* KARNY, by monotypy.

*Eidothrips* BAGNALL, 1918 : 219. Type-species: *Eidothrips alluaudi* BAGNALL, by monotypy. [Synonymized by MOUND and PALMER, 1983 : 72.]

*Krinothrips* BAGNALL, 1918 : 220. Type-species: *Krinothrips divergens* BAGNALL, by monotypy. [Synonymized by BAGNALL, 1921.]

*Bactridothrips* KARNY, 1919 : 116. Type-species: *Bactridothrips idolomorphus* KARNY, by monotypy. [Synonymized by MOUND and PALMER, 1983 : 72.]

*Caudothrips* KARNY, 1921 : 230. Type-species: *Caudothrips buffai* KARNY, by monotypy. [Synonymized by MOUND and PALMER, 1983 : 72.]

*Bactrianothrips* BAGNALL, 1936 : 226-227. Type species: *Bactrianothrips alluaudi* BAGNALL, by monotypy. [Synonymized by BOURNIER, 1968 : 157.]

*Cervothrips* BAGNALL, 1936 : 229. Type-species: *Cervothrips berlandi* BAGNALL, by monotypy. [Synonymized by MOUND and PALMER, 1983 : 72.]

*Bactrothrips* BAGNALL ; MOUND and PALMER, 1983 : 72-73.

*Diagnosis.* Large, black, and slender Idolothripinae. Head much longer than wide, area

bearing antennae shortly prolonged in front of eyes, dorsal surface transversely striate ; eyes large, rarely with posterior prolongation on ventral surface ; posterior ocelli in contact with eyes ; cheeks merely constricted behind eyes, swollen posteriorly but slightly narrowed at base, with a pair of stout setae in postocular areas ; interocellar, postocellar and two pairs of postocular setae well developed, blunt or nearly pointed at apex. Antennae eight-segmented, very slender ; segments III to VI claviform, with parallel-sided stalk and club-head bearing weakly curved sense cones, segment III the longest ; segment III and IV with two and four sense cones respectively. Mouthcone short, broadly rounded ; maxillary stylets comparatively short, placed in a V-shape within low head. Pronotum small, surface weakly sculptured, median line weak ; usual major setae well developed, *aa* rather close to *ml* ; epimeral suture developed but incomplete ; praepectus present, but weak and narrow ; probasisternum well developed. All legs without any enlarged portions, warts or teeth in both sexes. Wings always developed (with an exception of African species, *pilhini* which has apterous form) ; forewings with numerous duplicated cilia. Pelta developed, consisting of a median lobe and a pair of lateral lobes connected narrowly, without micropores. Two pairs of sigmoid wing retaining setae present on abdominal tergites II to VII. Tergite VI of male usually with a pair of tubercles laterally, long and horn-like (an African species, *allnaudi* [*Eidothrips*, BAGNALL, 1918], with a larger pair on segment VI, and a smaller pair on segment V), but occasionally truncate or forked, sometimes also small tubercles on either or both of segments VII and VIII ; these tubercles completely absent in females of all species and an exceptional *pilhini*'s male. Male subgenital plate (semilunar plate) distinctly present, thin, sclerotized, suspended on the posterior margin of sternite IX, with an anterior end expanded in genital chamber, placed under the tube and slightly curved downwards at apical third (the plate can be easily studied in the whole mount decolored specimens). Tube longer than head, parallel-sided.

*Comments.* Species of the genus are very similar to one another, and a careful examination to compare with each other is necessary for identification. In the present paper, we pay special attention to the coloration of legs, the relative length of head and third antennal segment, and the shape of subgenital plate (semilunar plate) in male. Moreover, we have examined an internal structure of female vaginal wall which varies species-specifically (HAGA, 1975 ; UEDA and HAGA, 1987), and found that seven species of Japan listed hereinafter have quite different patterns of the structure with each other. These observations of the structure will be described and discussed elsewhere.

#### Key to the Japanese Species

1. Tibiae largely dark brown, cinditibiae dark brown with yellowish extreme bases and apices ..... 2.
- Tibiae bicolorous yellow and dark brown, at least distal third of hindtibiae yellowish ..... 3.
2. Eyes prolonged ventrally ..... *flectoventris* sp. nov.

- Eyes normal, not prolonged ventrally ..... *carbonarius* sp. nov.
- 3. Midtibiae bicolorous, yellowish at apical third or more ..... 4.
- Midtibiae largely dark brown, only with yellowish extreme base and apices ..... 6.
- 4. Epimeral accessory setae well developed, almost half the length of *epim*; club-heads of antennal segments III and IV pale, shaded with pale brown, distinctly paler than segment II ..... *pictipes* sp. nov.
- Epimeral accessory setae minute, at least shorter than one-third the length of *epim*; club-heads of antennal segments III and IV dark brown, almost concolorous with segment II ..... 5.
- 5. Head more than 2.1 times as long as the width across eyes; antennal segment III 0.70-0.74 times as (semilunar plate) long as head in male, 0.66-0.70 times in female; male abdominal tubercles on segment VI curved inwards; male subgenital plate long and slender, broadly lanceolate ..... *brevitubus* (TAKAHASHI)
- Head shorter than 2.0 times as long as the width across eyes; antennal segment III 0.65-0.67 times as long as head in male, 0.61-0.63 times in female; male abdominal tubercles on segment VI curved outwards; male subgenital plate (semilunar plate) tongue-like ..... *quadrituberculatus* (BAGNALL)
- 6. Head almost twice as long as the width across eyes; eyes a little shorter than one-third the length of head; sense cones on antennal segment III well developed, about half the length of the segment; epimeral accessory setae well developed, usually much longer than one-third the length of *epim*; male abdominal tubercles on segment VI almost straight or weakly curved outwards; mainly from the evergreen forest zone ..... *honoris* (BAGNALL)
- Head 1.67-1.88 times as long as the width across eyes; eyes somewhat longer than one-third the length of head; sense cones on antennal segment III short, shorter than one-third the length of the segment; epimeral accessory setae usually minute, at least shorter than one-third the length of *epim*; male abdominal tubercles on segment VI curved inwards; from the deciduous forest zone ..... *montanus* sp. nov.

*Bactrothrips brevitubus* TAKAHASHI

(Figs. 1, 2, 3, 22, 29)

*Bactrothrips* (*Bactridothrips*) *brevitubus* TAKAHASHI, 1935: 61-63. Holotype ♂, Japan (Department of Agricultural Research, Taipei) [not examined].

*Gigantothrips harukawai* KUROSAWA, 1957: 95-96. Holotype ♀, Japan (National Institute of Agro-Environmental Science, Ibaraki, Japan) [examined]. **Syn. nov.**

*Bactrothrips brevitubus* TAKAHASHI; KUROSAWA, 1968: 59.

*Bactrothrips brevitubus* TAKAHASHI; MOUND and PALMER, 1983: 73.

*Male* (macroptera). Colour uniformly dark to blackish brown; fore and midtibiae yellow at

bases and apices, hindtibiae yellow at bases and apical halves; antennal segments III to VI with yellow pedicels.

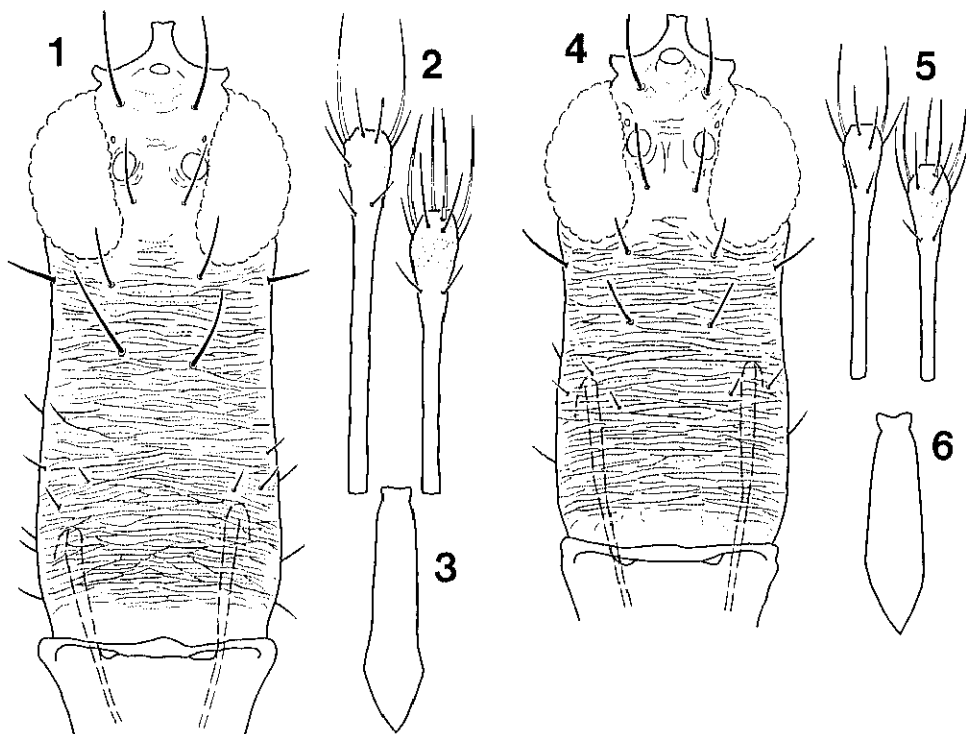
Head 2.15-2.28 times as long as the width across eyes; postocellar setae well developed, usually longer than postoculars pair I. Eyes 0.30-0.35 times as long as head. Antennae very slender, segment III 0.70-0.74 times as long as head.

Pronotum 0.42-0.45 times as long as head. Hindtibia 1.25-1.47 times as long as head.

Abdominal tubercles on segment VI well developed, long and curved inwards, but small male with short and straight ones (Fig. 29); segments VII and VIII each with a pair of small lateral tubercles, well developed in large male. Tube 1.64-1.75 times as long as head.

Subgenital plate (semilunar plate) long and slender, broadly lanceolate (Fig. 3).

*Measurements of small-large males in  $\mu\text{m}$ . Total body length 5600-7700 (distended). Head*



Figs. 1-3. *Bactrothrips brevitubus*, ♀.

1. head. 2. antennal segment III (left) and IV (right). 3. male subgenital plate (semilunar plate).

Figs. 4-6. *Bactrothrips carbonarius* sp. nov., ♀.

4. head. 5. antennal segment III (left) and IV (right). 6. male subgenital plate (semilunar plate).

length 572-732, width across eyes 270-324, minimum width across cheeks 222-256, maximum width across cheeks 245-297; eye length 189-222, width 97-118. Pronotum median length 243-329, width 372-530; hindtibia length 748-1081. Pelta median length 137-189, width 468-753. Tube length 998-1230, basal width 147-160, apical width 77-87. Antennal segments length (width): III 403-551 (52-62); IV 308-383 (52-58).

Length of setae: Intercellars 72-140, postocellars 73-104, postoculars I about 52-83, II 62-146. Pronotal *aa* 42-104, *am* 52-120, *ml* 62-158, *pa* 104-183, *epim* about 100-202. Metanotal medians 170-256. Subbasal wing setae  $B_1$  106-146,  $B_2$  110-171,  $B_3$  139-245.

*Female* (macroptera). Colour almost as in macropterous male. Head 2.12-2.25 times as long as width across eyes. Antennal segment III 0.66-0.70 times as long as head. Hindtibia 1.24-1.31 times as long as head. Tube 1.74-1.77 times as long as head.

*Measurements of small-large females in  $\mu\text{m}$ .* Total body length 5750-7850 (distended). Head length 551-738, width across eyes 261-329, minimum width across cheeks 233-275, maximum width across cheeks 265-302; eye length 169-233, width 100-118. Pronotum median length 244-308, width 403-510; hindtibia length 689-977. Pelta median length 117-170, width 498-742. Tube length 996-1294, basal width 138-168, apical width 74-85. Antennal segments length (width): III 371-510 (52-58); IV 296-370 (52-58).

Length of setae: Intercellars 74-127, postocellars about 70-80, postoculars I ?- about 80, II 130-180. Pronotal *aa* ?-about 90, *am* 53-105, *ml* 95-138, *pa* 138-190, *epim* 127-212. Metanotal medians 180-265. Subbasal wing setae  $B_1$  127-159,  $B_2$  117-170,  $B_3$  180-244.

*Material examined.* Many females and males (including holotype of *Gigantolhrips harukawai*: Japan, Kochi Pref., Kuroson, 11-VIII-1939, OBAYASHI leg.) from Japan (Honshu, Shikoku, Kyushu and the Ryukyus) and Taiwan.

*Comments.* This species is very similar to Oriental species *idolomorphus* (KARNY) from the Southeast Asia and India which could well be treated as a synonym. However, there are some variations between local populations in the colorations of tibiae and male abdominal tubercles, and in the relative length of head and antennal segments. HAN and ZHANG (1981: 298-299) described *zhamanus* as a subspecies of *brevitubus* from China. According to the original description of this subspecies, we could not distinguish it from variable series of our material in the most structures, and it seems to be the only distinctive feature is the sense cone formula of the fourth antennal segment. It has three sense cones on this segment, although all the other members of the genus, including *brevitubus* s. str., have four sense cones on the segment. There is a possibility that the sense cones formula of the unique holotype male of *zhamanus* is an aberration or merely lost one sense cone. The sense cones of them are easy to break down artificially during the mounting.

This species is very common in the evergreen forests of the southwestern Japan. It lives on the dead leaves of the evergreen broad-leaf trees such as *Castanopsis cuspidata*, *C. cuspidata* var. *sieboldii*, *Quercus salicina*, *Q. glauca*, *Cinnamomum camphora*, *C. japonicum*, *Machilus thunbergii*, *M. japonica*, *Neolitsea sericea* and etc.

*Bactrothrips carbonarius* sp. nov.

(Figs. 4, 5, 6, 23, 30)

*Male* (macroptera). Colour uniformly dark to blackish brown; all tibiae dark brown, with pale extreme bases and apices; antennal segments III to VI with yellow pedicels; abdominal tubercles dark.

Head 1.73-1.98 times as long as the width across eyes; postocular cheek setae well developed, usually longer than postocular pair I, interocular setae the longest. Eyes 0.32-0.34 times as long as head on dorsal surface. Ocelli 25-30  $\mu\text{m}$  in diameter; posterior pair about 50  $\mu\text{m}$  apart from each other, 90-94  $\mu\text{m}$  apart from anterior one in holotype. Antennae 2.28-2.48 times as long as head; segments III and IV 0.54-0.58 and 0.46-0.48 times as long as head respectively; sense cones on segment III about 100  $\mu\text{m}$  in holotype.

Pronotum 0.42-0.47 times as long as head; *am* setae well developed, almost as long as *aa*, epimeral accessory setae long, usually much longer than half the length of *epim*. Forewings each with 46-47 duplicated cilia in holotype, 31-32 in minimum sized paratype, 47-49 in maximum sized paratype. Hindtibiae 1.14-1.24 times as long as head.

Abdominal tubercles on segment VI almost straight, or very weakly curved inwards; segment VII without tubercles, segment VIII with a pair of distinct small tubercles, but indistinct in small male. Tube 1.43-1.55 times as long as head, 5.98-6.32 times as long as the width across base.

Subgenital plate (semilunar plate) tongue-like, widest near apical third, nearly pointed at apex, 3.5-3.9 times as long as wide (Fig. 6).

*Measurements of holotype (smallest-largest paratypes) males in  $\mu\text{m}$ .* Total body length 5470 (4175-5830) (distended). Head length 574 (445-601), width across eyes 297 (255-305), minimum width across cheeks 244 (217-245), maximum width across cheeks 265 (233-267); eye length 190 (144-194), width 106 (88-108). Pronotum median length 263 (191-277), width 424 (339-456); hindtibia length 688 (508-742). Pelta median length 148 (114-149), width 542 (382-604); tubercles on segment VI 530 (130-660). Tube length 826 (689-903), basal width 138 (109-146), apical width 74 (64-75). Antennal segments length: III 318 (244-340); IV 265 (212-280); V 244 (207-254); VI 160 (133-161); total 1314 (1102-1399).

Length of setae: Interocellars 125-138 (110-150), postocellars 74 (63-75), postoculars pair I 35 (32-63), pair II 74-85 (74-85). Prothoracic *aa* 65 (63-96), *am* 74 (60-86), *ml* 100-106 (96-115), *pa* 106-116 (100-122), *epim* 138-148 (100-160). Metathoracic medians 127-138 (108-138). Forewing subbasals B<sub>1</sub> 106-111 (98-117), B<sub>2</sub> 88-108 (106-127), B<sub>3</sub> 159-170 (117-160). B<sub>1</sub> on tergite IX 212-232 (180-?), B<sub>2</sub> on IX 96-102 (88-105). Anals 270-280 (215-286).

*Female* (macroptera). Colour almost as in macropterous male. Head 1.66-1.87 times as long as the width across eyes. Eyes 0.33-0.34 times as long as head. Antenna 2.2-2.4 times as long as head; segment III 0.51-0.54 times as long as head, segment IV 0.44-0.47 times as long as head. Pronotum 0.44-0.47 times as long as head; hindtibia 1.02-1.11 times as long as head; forewings each with 35-48 duplicated chlia. Tube 1.61-1.70 times as long as head, 5.

85-6.05 times as long as the width across base.

*Measurements of medium sized (smallest-largest) female paratypes* in  $\mu\text{m}$ . Total body length 5639 (4738-6250) (distended). Head length 551 (477-593), width across eyes 305 (286-318), minimum width across cheeks 254 (244-274), maximum width across cheeks 272 (265-297); eye length 186.5 (159-201), width 100-102 (96-115). Pronotum median length 244 (212-275), width 445 (392-477); hindtibia length 594 (487-657). Pelta median length 159 (127-159), width 578 (477-689). Tube length 890 (774-1007), basal width 149 (128-172), apical width 76 (69-82). Antennal segments length: III 286 (254-318); IV 244 (223-276); V 223 (212-254); IV 138 (128-159); total 1220 (1145-1367).

Length of setae: Interocellars 127-135 (115-?140), postocellars 64-125 (63-75), postoculars pair I 50-53 (37-52), pair II 67-72 (74-75). Prothoracic *aa* 67-77 (52-85), *am* 75 (65-85), *ml* about 100 (85-?110), *pa* 110-125 (108-143), *epim* 145-149 (116-185). Metathoracic medians 162 (120-170). Forewing subbasals B<sub>1</sub> 117-127 (90-138), B<sub>2</sub> 138-158 (126-160), B<sub>3</sub> 150-160 (158-180). B<sub>1</sub> on tergite IX 284-286 (244-307), B<sub>2</sub> on IX 265 (254-302). Anals 265-275 (260-288).

*Holotype* ♂. Japan: Nara Pref., Nara-shi, Takabatakecho, nr. Yagyu-Kaido, on dead leaves of *Quercus glauca*, 30-XI-1983, S. OKAJIMA leg.

*Paratypes* (114 ♀♀ and 80 ♂♂ in total). Japan: 86 ♀♀ 62 ♂♂, collected with holotype; 4 ♀♀ 15 ♂♂, same locality as holotype, 11-VIII-1980, S. OKAJIMA leg.; Nagasaki Pref., Tsushima Is., Kami-Tsushima, Mt. Ohboshiyama, 24 ♀♀ 3 ♂♂ on dead leaves and branches, 6-VII-1983, A. and S. SAITO leg.

*Comments.* This species is most similar to another new species described below under the name of *flectoventris* in the coloration and the general appearance, but the latter species has the eyes exceptionally prolonged on ventral surface. Both of them were collected together on the dead leaves of *Quercus glauca* in Nara Prefecture.

*Bactrothrips flectoventris* sp. nov.

(Figs. 7, 8, 9, 24, 31)

*Male* (macroptera). Colour uniformly dark to blackish brown; all tibiae dark brown with yellowish extreme bases and apices; antennal segments III to VI with yellow pedicels; abdominal tubercles dark.

Head 1.47-1.70 times as long as the width across eyes; the distance between postocular setae pair I usually farther than the distance between pair II, interocellar setae the longest. Eyes well developed, strongly prolonged posteriorly on ventral surface, 0.32-0.34 times as long as head on dorsal surface, 0.50-0.52 times as long as head on ventral surface (Fig. 7). Ocelli 24-26  $\mu\text{m}$  in diameter, posterior pair 52  $\mu\text{m}$  apart from each other, 82-86  $\mu\text{m}$  apart from anterior one in holotype. Antennae 2.45-2.71 times as long as head, segments III and IV 0.56-0.60 and 0.49-0.53 times as long as head respectively; sense cones on segment III 96  $\mu\text{m}$  in holotype.

Pronotum 0.47-0.50 times as long as head; *am* setae well developed, almost as long as or

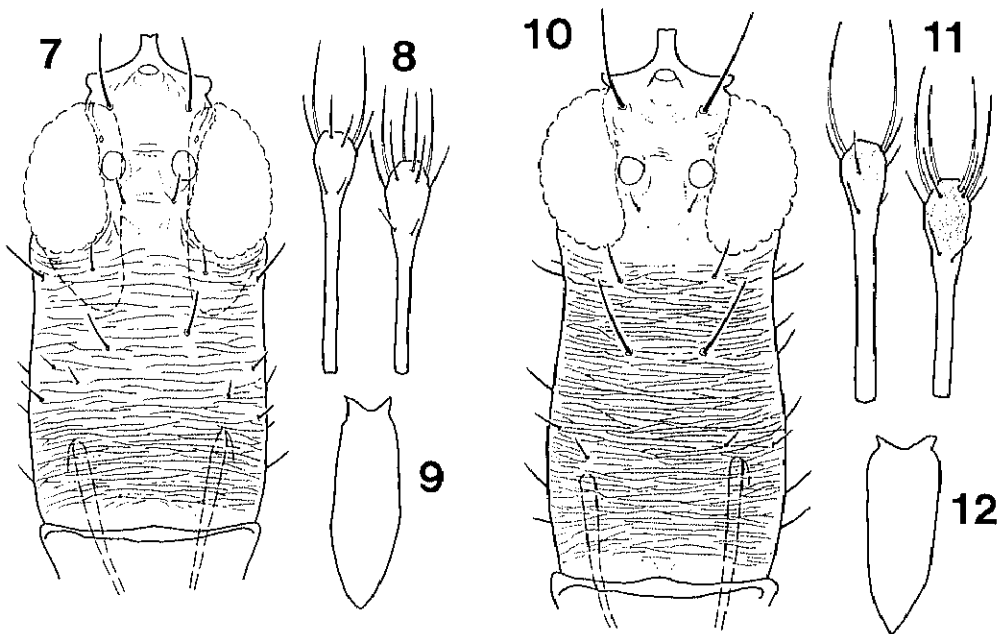


somewhat shorter than *aa*; epimeral accessory setae usually more or less longer than half the length of *epim*. Hindtibia 1.11-1.33 times as long as head. Forewings each with 35-36 duplicated cilia in holotype, 20-21 in minimum sized paratype, 41-43 in maximum sized paratype.

Median lobe of pelta nearly triangular rather than hemicircular (Fig. 24). Abdominal tubercles on segment VI almost straight, segment VII without prominent tubercles, segment VIII with a pair of small lateral tubercles, but absent in small male. Tube 1.66-1.77 times as long as head, 5.87-6.35 times as long as the width across base.

Subgenital plate (semilunar plate) almost tongue-like, 2.7-3.3 times as long as wide, rounded or nearly pointed at apex (Fig. 9).

*Measurements of holotype (smallest-largest paratypes) males in  $\mu\text{m}$ .* Total body length 4700 (3795-5420) (distended). Head length 466 (360-504), width across eyes 276 (244-297), minimum width across cheeks 244 (222-263), maximum width across cheeks 255 (242-275); eye dorsal length 156 (116-170), ventral length 234 (186-255), width 92-95 (75-97). Pronotum median



Figs. 7-9. *Bactrothrips flectoventris* sp. nov., ♀.

7. head. 8. antennal segment III (left) and IV (right). 9. male subgenital plate (semilunar plate). Figs. 10-12. *Bactrothrips honoris*, ♀. 10. head. 11. antennal segment III (left) and IV (right). 12. male subgenital plate (semilunar plate).

length 220 (170-254), width 386 (328-424); hindtibia length 572 (402-668). Pelta median length 143 (116-148), width 487 (371-530); tubercles on segment VI 350 (43-490). Tube length 776 (636-869), basal width 132 (108-137), apical width 73 (61-74). Antennal segments length: III 265 (212-302); IV 228 (190-265); V 212 (178-244); VI 138 (122-157); total 1155 (975-1293).

Length of setae: Interocellars 95-98 (65-125), postocellars 40-63 (30-50), postoculars pair I 27-32 (20-40), pair II 50-56 (55-75). Prothoracic *aa* 60-70 (35-85), *am* 60-72 (52-76), *ml* 74-76 (65-88), *pa* 106-110 (77-105), *epim* 105-116 (74-138). Metathoracic medians 128-133 (96-118). Forewing subbasals B<sub>1</sub> 95-97 (75-110), B<sub>2</sub> 85-100 (75-127), B<sub>3</sub> 128-130 (108-117). B<sub>1</sub> on tergite IX 203-212 (186-230), B<sub>2</sub> on IX 76-80 (72-82). Anals 240-245 (220-265).

*Female* (macroptera). Colour almost as in macropterous male. Head 1.56-1.73 times as long as the width across eyes. Eyes 0.31-0.34 times as long as head on dorsal surface, 0.48-0.51 times as long as head on ventral surface. Antenna 2.49-2.56 times as long as head; segment III 0.55-0.58 times as long as head, segment IV 0.47-0.50 times as long as head. Pronotum 0.45-0.48 times as long as head; hindtibia 1.02-1.22 times as long as head; forewings each with 26-36 duplicated cilia. Tube 1.65-1.80 times as long as head, 5.60-6.36 times as long as the width across base.

*Measurements of medium sized (smallest-largest) female paratypes* in  $\mu\text{m}$ . Total body length 5522 (4144-6010) (distended). Head length 493 (398-530), width across eyes 296 (255-307), minimum width across cheeks 265 (234-276), maximum width across cheeks 275 (243-287); eye dorsal length 165 (127-180), ventral length 244 (201-255), width 97-99 (85-104). Pronotum median length 231 (180-254), width 414 (339-445); hindtibia length 562 (408-647). Pelta median length 159 (127-167), width 519 (382-593). Tube length 890 (657-944), basal width 140 (117-152), apical width 74 (62-83). Antennal segments length: III 276 (221-307); IV 243 (191-265); V 222 (180-244); VI 151 (129-167); total 1230 (1017-1346).

Length of setae: Interocellars about 100 (85-?110), postocellars 21-32 (about 30-35), postoculars pair I 25-30 (20-about 30), pair II 62-64 (50-75). Prothoracic *aa* 65-70 (shorter than 30-75), *am* 75-82 (54-85), *ml* 100-106 (63-110), *pa* 110-124 (86-127), *epim* 128-138 (82-138). Metathoracic medians 128-138 (96-128). Forewing subbasals B<sub>1</sub> 96-102 (85-122), B<sub>2</sub> 106-108 (75-138), B<sub>3</sub> 138-140 (105-170). B<sub>1</sub> on tergite IX 255-276 (222-276), B<sub>2</sub> on IX 244-256 (212-270). Anals 285-289 (230-297).

*Holotype* ♀. Japan: Nara Pref., Nara-shi, Takabatakecho, nr. Yagyū-kaido, on dead leaves of *Quercus glauca*, 30-III-1983, S. OKAJIMA leg.

*Paratypes* (101 ♀♀ 70 ♂♂ in total). Japan: 85 ♀♀ 61 ♂♂ collected with holotype; 12 ♀♀ 9 ♂♂, same locality as holotype, 11-VIII-1980, S. OKAJIMA leg. Taiwan: Nantou Hsien, Nanshanchi, 4 ♀♀ on dead leaves, 24-III-1984, S. OKAJIMA leg.

*Non-paratypic material*. Japan: Hyogo Pref., Akashi, Ozaki, 2 ♀♀ 2 ♂♂ on dead leaves of *Q. glauca*, 7-V-1972, K. HAGA leg.; Hyogo Pref., Awaji-Shima Is., Mt. Mikuma-yama, 1 ♀ on dead leaves of *Q. glauca*, 2-I-1971, K. HAGA leg.; Osaka Pref., Takatsuki-shi, Settsukyo, 2 ♀♀ 1 ♂ on dead leaves of *Q. glauca*, 6-IV-1970, K. HAGA leg.

*Comments*. Most of the generic features of this species is common with all the other

members of the genus *Bactrothrips*. However, it has posteriorly prolonged ventral portions of the compound eyes which cannot be observed in the other species of the genus.

This species lives on the dead leaves of *Quercus glauca* which is one of the evergreen common oak in the warm-temperate forest zone of the southwestern Japan, and represents an interesting posture in its habitat where many adults and immature insects aggregate. The adult insects of both sexes, flex their posterior abdomen strongly to the left or right horizontally, and form a shape like as a fish-hook or an Arabic numeral "6" in the resting phase.

*Bactrothrips honoris* (BAGNALL)

(Figs. 10, 11, 12, 25, 34)

*Megathrips honoris* BAGNALL, 1921 : 359. Holotype ♂, Japan (BMNH) [examined].

*Megathrips hornis* [sic!] BAGNALL ; KUROSAWA, 1968 : 59.

*Bactrothrips honoris* BAGNALL ; MOUND and PALMER, 1983 : 73.

*Male* (macroptera). Colour uniformly dark brown ; fore- and midtibiae shaded with dark brown, with yellow bases and apices, hindtibiae dark brown with bases and apical fourth yellow ; antennal segments III to VI with yellow pedicels ; abdominal tubercles on segment VI usually pale towards apex.

Head about twice as long as the width across eyes ; interocular setae and postocular pair II well developed, the latter almost as long as or shorter than the former, postocellar setae the shortest. Eyes 0.31-0.32 times as long as head. Antennae 2.37-2.44 times as long as head ; segments III and IV 0.53-0.59 and 0.46-0.48 times as long as head respectively ; sense cones on segment III long, nearly half the length of the segment.

Pronotum 0.47-0.49 times as long as head ; *am* setae almost as long as, or a little shorter than *aa*, *pa* usually shorter than *epim*, epimeral accessory setae well developed, about half the length of *epim*. Hindtibia 1.30-1.44 times as long as head. Forewings each with 40-55 duplicated cilia.

Abdominal tubercles on segment VI slender, weakly curved outwards ; segment VII without distinct tubercles ; segment VIII with a pair of distinct small lateral tubercles. Tube 1.35-1.41 times as long as head, 5.07-5.35 times as long as the width across base.

Subgenital plate (semilunar plate) 2.5-3.0 times as long as wide, widest near base, gradually narrowed towards apex.

*Measurements of small-large males in μm.* Total body length 5300-6230 (distended). Head length 551-628, width across eyes 275-311, minimum width across cheeks 217-245, maximum width across cheeks 240-270 ; eye length 172-202, width 95-116. Pronotum median length 244-307, width 382-466 ; hindtibia length 720-900. Pelta median length 127-159, width 488-646 ; tubercles on segment VI 340-580. Tube length 775-848, basal width 145-167, apical width 72

-83. Antennal segments length : III 297-370 ; IV 254-299 ; V 248-281 ; VI 160-201 ; total 1314-1526.

Length of setae : Interocellars 116-150, postocellars less than 20-40, postoculars pair I 50-60, pair II 75-143. Prothoracic *aa* 50-75, *am* 50-75, *ml* 80-106, *pa* 105-120, *epim* 110-170. Metathoracic medians 160-223. Forewing subbasals B<sub>1</sub> 100-121, B<sub>2</sub> 108-148, B<sub>3</sub> 175-206. B<sub>1</sub> on tergite IX 265-295, B<sub>2</sub> on IX 118-130. Anals 233-265.

*Female* (macroptera). Colour almost as in macropterous male. Head 1.97-2.04 times as long as the width across eyes. Eyes 0.31-0.32 times as long as head ; postocular setae pair II usually shorter than interocellars. Antennae 2.37-2.48 times as long as head ; segments III and IV 0.52-0.57 and 0.46-0.49 times as long as head respectively. Pronotum 0.43-0.48 times as long as head ; hindtibia 1.2-1.4 times as long as head ; forewings each with 36-53 duplicated cilia. Tube 1.56-1.62 times as long as head, 5.97-6.03 times as long as the width across base.

*Measurements of small-large females in μm.* Total body length 5787-6858 (distended). Head length 562-628, width across eyes 276-318, minimum width across cheeks 231-254, maximum width across cheeks 254-286 ; eye length 180-197, width 96-108. Pronotum median length 244-297, width 403-477 ; hindtibia length 678-880. Pelta median length 138-160, width 546-699. Tube length 880-1017, basal width 146-170, apical width 74-88. Antennal segments length : III 297-358 ; IV 261-307 ; V 244-295 ; VI 170-199 ; total 1335-1558.

Length of setae : Interocellars 110-180, postocellars less than 20-52, postoculars pair I 40-53, pair II 80-110. Prothoracic *aa* ?-?, *am* 60-72, *ml* 96-106, *pa* 128-148, *epim* 154-191. Metathoracic medians 210-254. Forewing subbasals B<sub>1</sub> 110-138, B<sub>2</sub> 115-128, B<sub>3</sub> 222-243. B<sub>1</sub> on tergite IX 297-350, B<sub>2</sub> on IX 286-339. Anals 265-318.

*Material examined.* Japan : Ryukyus, Ishigaki-jima Is., Mt. Omoto-dake, 1 ♀ 1 ♂ on dry twigs, 14-VI-1972, S. OKAJIMA leg. ; Ryukyus, Okinawa-jima Is., Izumi, 3 ♀ ♀ 2 ♂ ♂ on dead *Quercus* leaves, 9-V-1972, S. OKAJIMA leg. ; Kagoshima Pref., Shimo-koshiki-jima Is., Teuchi, 10 ♀ ♀, 25-V-1975, Odake, 1 ♀ 1 ♂, 27-V-1975, Y. WATANABE leg. ; Kagoshima Pref., Yakushima Is., Onoaida, 8 ♀ ♀ 2 ♂ ♂ on dead leaves of *Myrica rubra*, 18-V-1983, N. SUZUKI leg. ; Nagasaki Pref., Tsushima Is., Mt. Ariake, 1 ♀ 1 ♂ on dead leaves, 23-III-1976, S. OKAJIMA leg. ; Hyogo Pref., Mt. Futatabisan, 1 ♀ 2 ♂ ♂ on dead leaves, 15-VIII-1980, S. OKAJIMA leg. ; Osaka Pref., foot of Mt. Ikoma-san, Hiraoka Park, 2 ♂ ♂ on dead leaves of evergreen tree, 29-XII-1983, S. OKAJIMA leg. ; Osaka Pref., Mino-o, Katsuoji, 1 ♂ on dead *Salix* leaves, 1-XI-1970, K. HAGA leg. ; Nara Pref., Mt. Kasuga-yama, Uguisu-no-taki, 1 ♂ on dead leaves, 29-VIII-1970, K. HAGA leg. ; Kanagawa Pref., Miura-hanto, Jinmuji, 36 ♀ ♀ 32 ♂ ♂ on dead leaves of *Quercus acuta*, 27-XII-1988, S. OKAJIMA leg. .

*Comments.* This species is commonly found in the southwestern Japan living on the dead leaves of the evergreen broad-leaf trees, mainly Fagaceae. They are *Castanopsis cuspidata*, *Castanopsis cuspidata* var. *Sieboldii*, *Quercus salicina*, *Quercus acuta* and other evergreen *Quercus*, but it is rarely found on those of *Camellia*, *Myrica* and *Salix*.

*Bactrothrips montanus* sp. nov.

(Figs. 13, 14, 15, 26, 33)

*Male* (macroptera). Colour uniformly dark brown; fore- and midtibiae dark brown, a little paler than femora, with yellow bases and apices, hindtibia dark brown at basal half, with yellow base, yellow at apical half; antennal segments III to VI with yellow pedicels, their heads somewhat paler than segments I and II; abdominal tubercles on segment VI gradually paled towards apex.

Head 1.75-1.88 times as long as the width across eyes; interocellar setae the longest, a little longer than postocular II, but sometimes subequal in length. Eyes well developed, 0.34-0.35 times as long as head. Ocelli well developed, 30-32  $\mu\text{m}$  in diameter; posterior pair about 56  $\mu\text{m}$  apart from each other, 96-98  $\mu\text{m}$  apart from anterior one in holotype. Antennae 2.45-2.50 times as long as head; segments III and IV 0.61-0.69 and 0.47-0.52 times as long as head respectively; sense cones on segment III shorter than one-third the length of the segment, about 100  $\mu\text{m}$  in holotype.

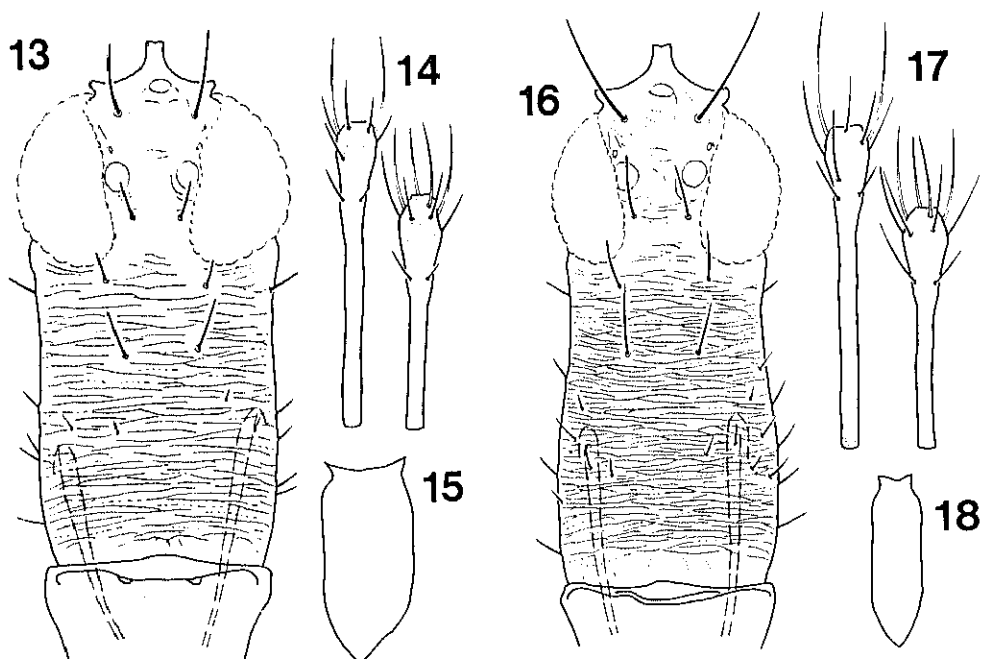
Pronotum 0.46-0.50 times as long as head; *am* setae almost as long as or somewhat shorter than *aa*; *epim* the longest; epimeral accessory setae minute, much shorter than one-third the length of *epim*. Hindtibiae 1.29-1.56 times as long as head. Forewings each with 52 duplicated cilia in holotype, 32-34 in minimum sized paratype, 57-61 in maximum sized paratype.

Pelta distinctly reticulated, anterior portion of median lobe reticulated longitudinally, contrasting with posterior portion and lateral lobes which are reticulated transversely (Fig. 26). Abdominal tubercles on segment VI well developed, slightly curved inwards; segments VII and VIII each with a pair of distinct small tubercles, those of segment VIII much stouter (Fig. 33). Tube 1.54-1.62 times as long as head, 5.27-5.84 times as long as the width across base.

Subgenital plate (semilunar plate) comparatively wide, sometimes less than twice as long as wide, with an asymmetrical tip.

*Measurements of holotype (smallest-largest paratypes) males in  $\mu\text{m}$ .* Total body length 6060 (4420-6780) (distended). Head length 580 (466-636), width across eyes 320 (265-339), minimum width across cheeks 244 (222-271), maximum width across cheeks 262 (240-286); eye length 198 (162-223), width 116 (95-127). Pronotum median length 287 (217-315), width 445 (339-488); hindtibia length 860 (604-990). Pelta median length 159 (113-163), width 604 (435-690); tubercles on segment VI 650 (190-800). Tube length 940 (755-980), basal width 161 (143-175), apical width 86 (75-93). Antennal segments length: III 382 (287-435); IV 286 (222-329); V 244 (191-270); VI 161 (128-176); total 1442 (1145-1590).

Length of setae: Interocellars 100-110 (80-115), postocellars 30-40 (20-33), postoculars pair I 50-60 (30-60), pair II ?130 (80-110). Prothoracic *aa* 50-55 (45-80), *am* 40-45 (30-45), *ml* about 100 (85-100), *pa* 137-140 (110-115), *epim* 160-180 (100-190). Metathoracic medians 160-170 (138-170). Forewing subbasals  $B_1$  116-128 (70-125),  $B_2$  96-118 (72-137),  $B_3$  244-255 (160-244).  $B_1$  on tergite IX ?210 (170-215),  $B_2$  on IX about 90 (105-105). Anals 296-315 (265-297).



Figs. 13-15. *Bactrothrips montanus* sp. nov., ♀.

13. head. 14. antennal segment III (left) and IV (right). 15. male subgenital plate (semilunar plate).

Figs. 16-18. *Bactrothrips pictipes* sp. nov., ♀.

16. head. 17. antennal segment III (left) and IV (right). 18. male subgenital plate (semilunar plate).

*Female* (macroptera). Colour almost as in macropterous male. Head 1.67-1.82 times as long as the width across eyes. Eyes 0.36-0.39 times as long as head. Antennae 2.30-2.49 times as long as head; segments III and IV 0.60-0.62 and 0.45-0.50 times as long as head respectively. Pronotum 0.47-0.50 times as long as head; hindtibia 1.31-1.38 times as long as head; forewings each with 47 duplicated cilia in maximum paratype, 33-39 in minimum paratype. Tube 1.75-1.81 times as long as head, 6.12-6.17 times as long as the width across base.

*Measurements of medium sized (smallest-largest) female paratypes* in  $\mu\text{m}$ . Total body length 6310 (5440-7200) (distended). Head length 551 (498-636), width across eyes 312 (297-351), minimum width across cheeks 266 (254-287), maximum width across cheeks 281 (256-302); eye length 197 (180-243), width 108 (100-134). Pronotum median length 275 (238-309), width 424 (371-466); hindtibia length 742 (657-870). Pelta median length 138 (116-166), width 625 (488-720). Tube length 996 (900-1115), basal width 162 (146-182), apical width 88 (78-95). Antennal segments length: III 339 (300-383); IV 258 (249-289); V 222 (201-236); IV 158 (148

-170); total 1336 (1240-1465).

Length of setae: Intercellars about 80-90 (80-112), postocellars 21-30 (about 30-55), postoculars pair I 20-30 (20-about 50), pair II about 80 (55-110). Prothoracic *aa* 55-65 (50-70), *am* about 50 (40-45), *ml* 90-95 (75-100), *pa* 135-145 (74-150), *epim* 160-168 (135-175). Metathoracic medians 150-160 (164-190). Forewing subbasals B<sub>1</sub> 103-107 (95-116), B<sub>2</sub> 75-85 (82-127), B<sub>3</sub> 225-235 (223-265). B<sub>1</sub> on tergite IX 244-275 (276-316), B<sub>2</sub> on IX 286-318 (297-334). Anals 315-330 (290-320).

*Holotype* ♂. Japan: Yamanashi Pref., Masutomi-Kanayama, on dead leaves of *Quercus mongolica* var. *grosseserrata*, 16-V-1987, S. OKAJIMA leg.

*Paratypes* (24 ♀♀ 37 ♂♂). Japan: 19 ♀♀ 29 ♂♂, collected with holotype; Yamanashi Pref., Mt. Mitsutoge, 1 ♀ on dead leaves of *Q. mongolica* var. *grosseserrata*, 28-VII-1981, S. OKAJIMA leg.; Yamanashi Pref., Daibosatsu, Hikawa-rindo, 1 ♀, 23-VI-1985, T. NIISATO leg. Yamanashi Pref., Kanayama, Yazawa-rindo, 2 ♀♀ 4 ♂♂ on dead leaves of *Q. mongolica* var. *grosserrata*, 23-VIII-1988, W. SUZUKI leg.; Nagano Pref., Sugadaira, on *Q. mongolica* var. *grosseserrat*, 1 ♂, 29-V-1973, 1 ♀ 3 ♂♂, 16-X-1974, K. HAGA leg.

*Comments.* This species is somewhat similar to *quadrituberculatus* in the body size, well developed abdominal tubercles and the habit, but has the different colouration of the tibiae, shape of the male tubercles on the sixth abdominal segment. The eyes which occupies more than one-third of the head length are larger than those of the other species of the genus.

This species lives on the dead curled leaves of the deciduous *Quercus* trees, *Q. mongolica* var. *grosseserrata* and *Q. dentata* which are common in the cool-temperate zone. In the midland of Honshu it can be found in mountainous areas ca. 1000-2000 m altitude. This species overwinters occasionally under deep snow on their habitat.

#### *Bactrothrips pictipes* sp. nov.

(Figs. 16, 17, 18, 27, 32)

*Male* (macroptera). Colour uniformly dark brown; all femora yellowish apically, all tibiae dark brown with yellow bases, foretibia gradually paled towards apex, midtibia with apical fourth yellow, hindtibia with apical half yellow; antennal segments III to IV with yellow pedicels which are weakly shaded with grey medially, the heads of segments III and IV much paler than segment I and II, only with pale brown shadings; abdominal tubercles on segment VI yellow with bases dark brown.

Head slender, 2.07-2.20 times as long as the width across eyes; intercellar setae the longest, much longer than postoculars pair II, sharply pointed at apex. Eyes 0.30-0.33 times as long as head. Ocelli about 30  $\mu$ m in diameter; posterior pair 51  $\mu$ m apart from each other, 82-87  $\mu$ m apart from anterior one in holotype. Antennae 2.42-2.51 times as long as head; segments III and IV 0.62-0.68 and 0.49-0.51 times as long as head respectively; sense cones on segment III about one-third the length of the segment, about 12  $\mu$ m in holotype.

Pronotum 0.42-0.47 times as long as head; *am* setae almost as long as *aa*, slender, sharply

pointed at apex, other major setae blunt at apex, *epim* the longest, epimeral accessory setae well developed, almost half the length of *epim*. Hindtibia 1.12-1.29 times as long as head.

Forewings each with 40-42 duplicated cilia in holotype, 29-30 in minimum sized paratype, 43-47 in maximum sized paratype.

Abdominal tubercles on segment VI almost straight or very weakly curved outwards apically; segment VII with a pair of small tubercles in medium to large sized individuals, but its absent in small sized ones. Tube 1.52-1.62 times as long as head, 5.21-5.99 times as long as the width across base.

Subgenital plate (semilunar plate) tongue-like, about thrice as long as wide, almost parallel-sided.

*Measurements of holotype (smallest-largest paratypes) males in  $\mu\text{m}$ .* Total body length 5450 (4130-5755) (distended). Head length 551 (472-604), width across eyes 266 (228-285), minimum width across cheeks 223 (191-229), maximum width across cheeks 250 (214-254); eye length 170 (155-191), width 85-95 (77-96). Pronotum median length 254 (201-258), width 397 (328-408); hindtibia length 710 (530-774). Pelta median length 148 (116-159), width 567 (403-583); tubercles on segment VI 500 (100-530). Tube length 892 (722-964), basal width 156 (138-161), apical width 74 (63-74). Antennal segments length: III 371 (297-392); IV 279 (233-297); V 236 (191-265); VI 159 (128-160); total 1383 (1145-1463).

Length of setae: Interocellars 95-100 (94-140), postocellars 49-55 (42-53), postoculars pair I 53-64 (38-54), pair II 67-69 (72-59). Prothoracic *aa* 62-66 (?40-70), *am* 52-65 (50-68), *ml* 94-96 (70-68), *pa* 96-98 (72-96), *epim* 120-143 (105-125). Metathoracic medians 153-155 (122-168). Forewing subbasals B<sub>1</sub> 106-108 (80-108), B<sub>2</sub> 133-138 (108-128), B<sub>3</sub> 175-185 (135-153). B<sub>1</sub> on tergite IX 183-208 (167-194), B<sub>2</sub> on IX 97-103 (80-108). Anals 280-290 (215-245).

*Female (macroptera).* Colour as in macropterous male. Head 2.0-2.1 times as long as the width across eyes. Eyes 0.31-0.33 times as long as head. Antennae 2.44-2.50 times as long as head; segments III and IV 0.62-0.64 and 0.48-0.52 times as long as head respectively. Pronotum 0.44-0.48 times as long as head; hindtibia 1.16-1.24 times as long as head; forewings each with 41-42 duplicated cilia in maximum paratype, 33-34 in minimum paratype. Tube 1.64-1.67 times as long as head, 5.85-6.30 times as long as the width across base.

*Measurements of medium sized (smallest-largest) female paratypes in  $\mu\text{m}$ .* Total body length 5520 (4810-5980) (distended). Head length 567 (510-574), width across eyes 271 (254-287), minimum width across cheeks 228 (220-246), maximum width across cheeks 264 (248-284); eye length 179 (167-189), width 90-95 (90-98). Pronotum median length 254 (232-273), width 411 (371-438); hindtibia length 700 (593-710). Pelta median length 156 (127-148), width 572 (498-636). Tube length 933 (848-954), basal width 148 (138-163), apical width 78 (74-84). Antennal segments length: III 361 (318-360); IV 275 (254-297); V 244 (222-244); VI 150 (138-159); total 1388 (1272-1420).

Length of setae: Interocellars 135-140 (104-130), postocellars 52-65 (53-45), postoculars pair I 50-60 (40-65), pair II 67-72 (63-78). Prothoracic *aa* 60-63 (47-65), *am* 58-62 (66-76),



*ml* 92-94 (72-98), *pa* 86-90 (86-102), *epim* 140-145 (123-155). Metathoracic medians 142-158 (133-160). Forewing subbasals B<sub>1</sub> 108-113 (92-122), B<sub>2</sub> 127-132 (118-142), B<sub>3</sub> 178-182 (148-188). B<sub>1</sub> on tergite IX 260-265 (236-260), B<sub>2</sub> on IX 296 (255-295). Anals 280-282 (260-290).

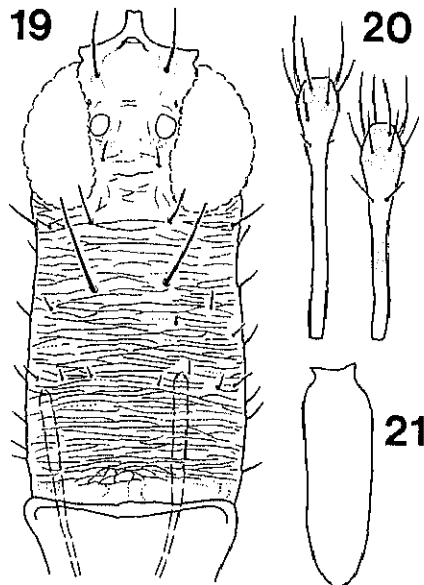
*Holotype* ♂. Japan: Kanagawa Pref., Miura-hantou, Jinmuji Forest, on dead leaves, 6-III-1983, S. OKAJIMA leg.

*Paratypes* (88 ♀♀ 34 ♂♂ in total). Japan: 3 ♀♀ 1 ♂, collected with holotype; 3 ♀♀ 3 ♂♂, data very similar to holotype, but 23-XII-1982; 73 ♀♀ 23 ♂♂, data very similar to holotype but 27-XII-1988; Izu Isls., Miyake-jima Is., nr. Tairo-ike, 6 ♂♂ on dead leaves, 27-X-1985, S. OKAJIMA leg.; Nara Pref., Nara-shi, Takabatake-cho, nr. Yagyu-kaido, 1 ♀, 30-XII-1983, 6 ♀♀ 1 ♂, 11-VIII-1980, on dead leaves, S. OKAJIMA leg.; Nagasaki Pref., Tsushima Is., Mt. Ariake, 1 ♀ on dead leaves, 22-III-1976, S. OKAJIMA leg.; Nagasaki Pref., Tsushima Is., Kami-tsushima, Mt. Ohboshiyama, 1 ♀ on dead leaves and branches, 6-VII-1983, A. & S. SAITO leg.

Non-paratypic material. Japan: Ryukyus, Okinawa-jima Is., Kunigami-son, Okuni-rindo, 11 ♀♀ 7 ♂♂ on dead leaves, 28-VIII-1988, S. OKAJIMA leg.

*Comments.* In general appearance, this species is very similar to *honoris*, but it can be distinguished by the coloration of the midtibiae and relative length of third and fourth antennal segments. Moreover, male subgenital plates are quite distinct.

This species lives in the warm-temperate forest zone of the southwestern Japan, and it



Figs. 19-21. *Bactrothrips quadriluberculatus*, ♀.  
19. head. 20. antennal segment III (left) and IV (right). 21. male subgenital plate (semilunar plate).

occurs on the dead leaves of evergreen trees such as *Quercus acuta*, *Q. glauca*, *Castanopsis cuspidata* var. *Sieboldii* and etc.

*Bactrothrips quadrituberculatus* (BAGNALL)

(Figs. 19, 20, 21, 28, 35)

*Idolothrips quadrituberculatus* BAGNALL, 1908 : 210-211. Holotype, Japan (BMNH) [examined].

*Megathrips quadrituberculatus* (BAGNALL); BAGNALL, 1916 : 406.

*Idolothrips kawamurai* ISHIDA, 1932 : 2-3. Holotype ♂, Japan (Hokkaido University) [examined]. Syn. nov.

*Bactrothrips quadrituberculatus* (BAGNALL); MOUND and PALMER, 1983 : 74.

**Male** (macroptera). Colour uniformly dark to blackish brown; foretibia yellow to brownish yellow, tinged with brown basally, mid- and hindtibiae banded dark brown on basal halves, extreme bases and apical halves yellow; antennal segments III to VI with yellow pedicels, segment IV with median portion of pedicel shaded with pale brown; abdominal tubercles on segment VI gradually paled towards apex, dark brown to yellow.

Head 1.84-1.94 times as long as the width across eyes; interocellar setae and postoculars pair II well developed, the former usually shorter than the latter, postocellar setae the shortest. Eyes 0.31-0.32 times as long as head. Antennae 2.59-2.64 times as long as head; segments III and IV 0.65-0.67 and 0.51-0.55 times as long as head respectively; sense cones on segment III short, 0.20-0.25 times as long as the segment.

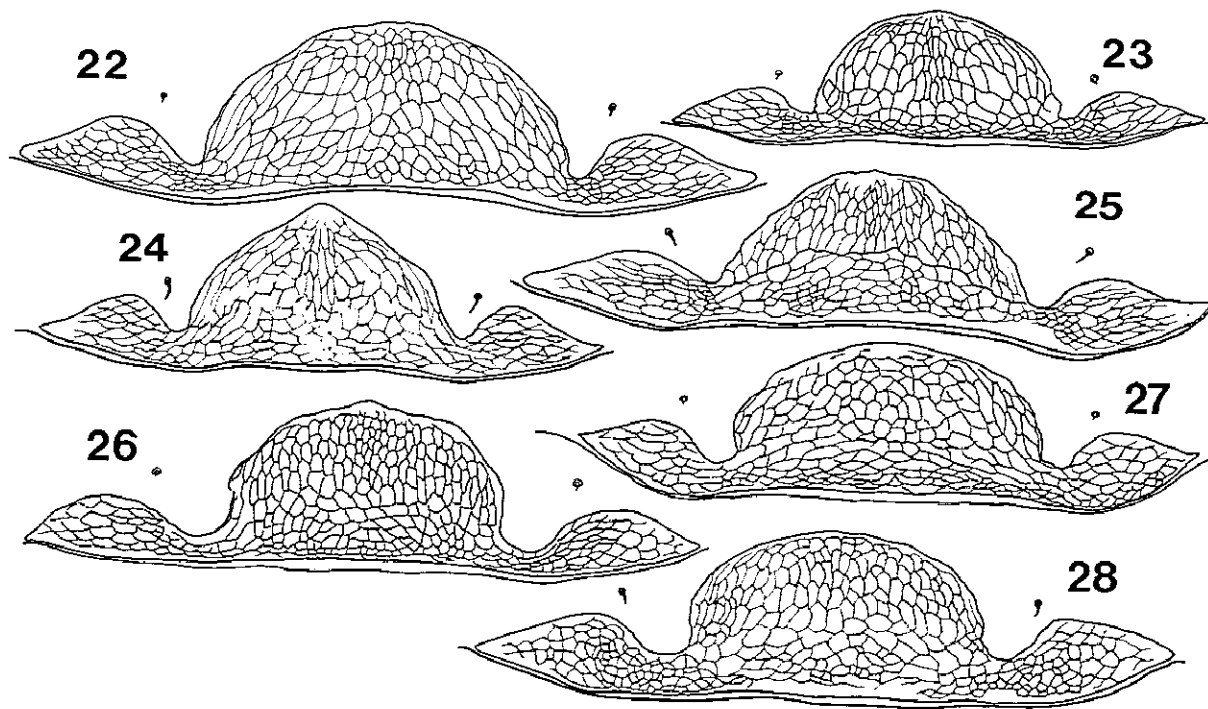
Pronotum 0.45-0.49 times as long as head; *am* setae shorter than *aa*, epimeral accessory setae minute, at least shorter than 0.4 times as long as *epim*. Hindtibia 1.26-1.33 times as long as head. Forewings each with 29-31 duplicated cilia in small sized individual, 45-47 in large sized one.

Abdominal tubercles on segment VI stout, usually curved outwards; segments VII and VIII each with a pair of small lateral tubercles, but those on segment VII absent in small individual. Tube 1.51-1.58 times as long as head, 5.17-5.57 times as long as the width across base.

Subgenital (semilunar plate) plate rectangular with dull tip, 3.2-3.3 times as long as wide (Fig. 21).

*Measurements of small-large males* in  $\mu\text{m}$ . Total body length 4230-5770 (distended). Head length 435-555, width across eyes 236-287, minimum width across cheeks 204-252, maximum width across cheeks 223-270; eye length 138-178, width 79-95. Pronotum median length 196-268, width 339-435; hindtibia length 551-735. Pelta median length 117-159, width 424-570; tubercles on segment VI 210-570. Tube length 657-875, basal width 127-157, apical width 63-76. Antennal segments length: III 284-369; IV 224-300; V 192-253; VI 138-170; total 1145-1441.

Length of setae: Interocellars 76-110, postocellars about 30-36, postoculars pair I 46-?,



Figs. 22-28. Pelta of *Bactrothrips* species.

22. *B. brevitubus*.

24. *B. flectoventris* sp. nov.

26. *B. montanus* sp. nov.

28. *B. quadriluberculatus*.

23. *B. carbonarius* sp. nov..

25. *B. honoris*.

27. *B. pictipes* sp. nov.

pair II 70-112. Prothoracic *aa* 48-82, *am* 47-62, *ml* 96-118, *pa* 105-122, *epim* 113-138. Metathoracic medians 124-142. Forewing subbasals B<sub>1</sub> 82-108, B<sub>2</sub> 97-108, B<sub>3</sub> 158-174. B<sub>1</sub> on tergite IX 163-160, B<sub>2</sub> on IX 90-108. Anals 224-265.

*Female* (macroptera). Colour almost as in macropterous male. Head 1.78-1.91 times as long as head. Eyes 0.32-0.34 times as long as head. Antennae 2.42-2.52 times as long as head; segments III and IV 0.61-0.63 and 0.48-0.50 times as long as head respectively. Pronotum 0.44-0.47 times as long as head; hindtibia 1.23-1.24 times as long as head; forewings each with 29-31 duplicated cilia in small sized individual, 40-44 in large sized one. Tube 1.67-1.74 times as long as head, 5.42-5.68 times as long as the width across base.

*Measurements of small-large females in μm.* Total body length 4640-6190 (distended). Head length 450-556, width across eyes 252-292, minimum width across cheeks 232-251, maximum width across cheeks 254-265; eye length 148-186, width 82-102. Pronotum median length 201-262, width 360-427; hindtibia length 556-690. Pelta median length 116-159, width 424-615. Tube length 754-965, basal width 139-170, apical width 76-83. Antennal segments length: III 275-346; IV 217-276; V 190-224; VI 133-167; total 1134-1346.

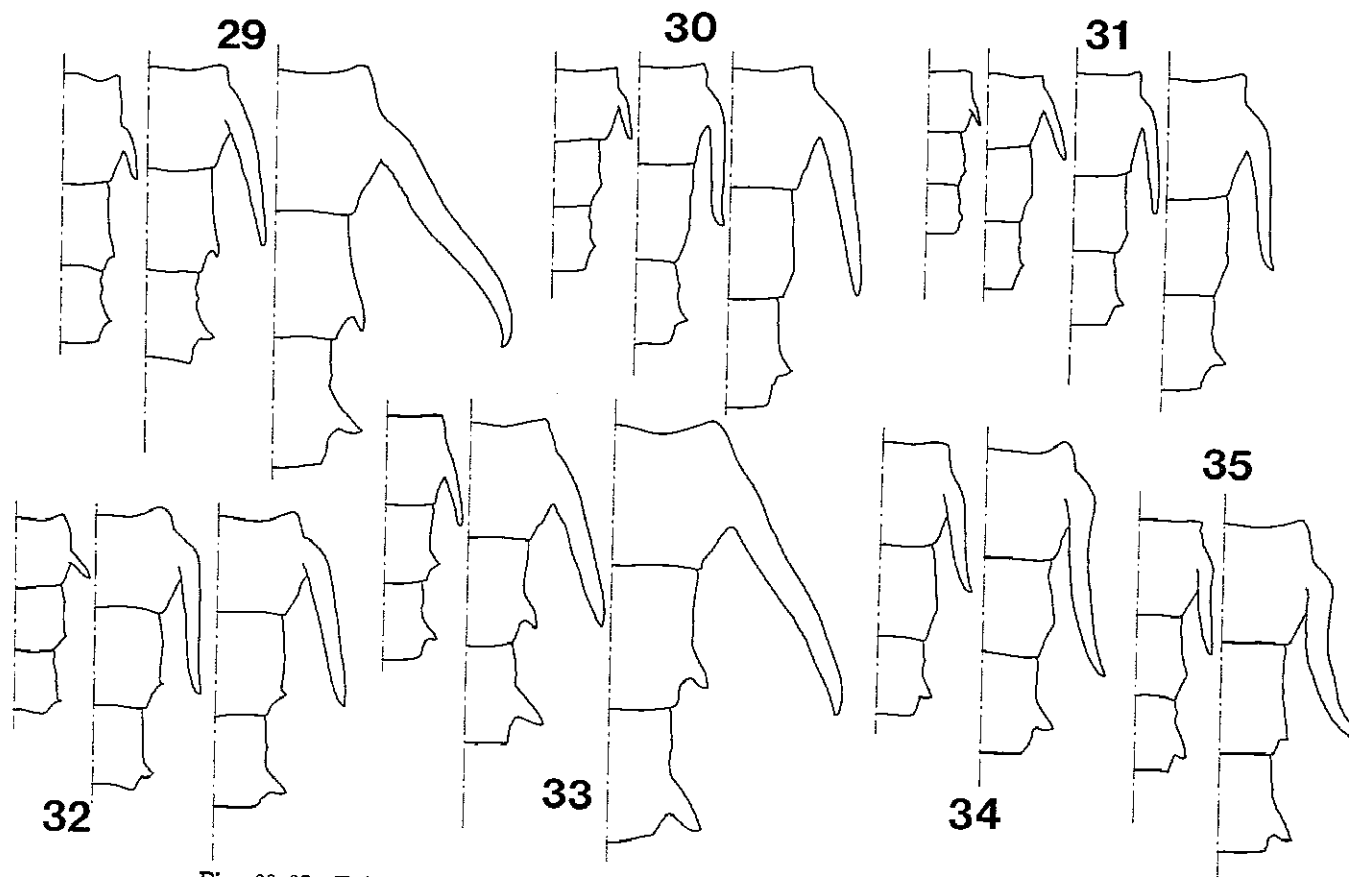
Length of setae: Interocellars 66-95, postocellars 49-38, postoculars pair I 50-745, pair II 97-122. Prothoracic *aa* 66-62, *am* 51-62, *ml* 96-104, *pa* 112-138, *epim* 118-153. Metathoracic medians 122-150. Forewing subbasals B<sub>1</sub> 96-103, B<sub>2</sub> 102-128, B<sub>3</sub> 145-173. B<sub>1</sub> on tergite IX 248-286, B<sub>2</sub> on IX 260-286. Anals 240-306.

*Material examined.* Japan: Hyogo Pref., Kobe, holotype ♂, 30-VI-1919, J. E. A. LEWIS (BMNH); Hyogo Pref., nr. Kobe, Mt. Futatabi-san, 1 ♂ on dead branches of *Quercus* tree, 29-III-1970, K. HAGA leg.; Hyogo Pref., Ako, Ozaki, 1 ♂ on dead coppice, 7-V-1972, K. HAGA leg.; Nagasaki Pref., Tsushima Is., Kami-Tsushima, Mt. Ohboshiyama, 1 ♂ on dead leaves and branches, 6-VII-1983, A. and S. SAITO leg.; Osaka Pref., Mino-o, Saigahara-dani, 1 ♂ on coppice, 5-VII-1969, K. HAGA leg.; Osaka Pref., Mt. Ikoma, Hiraoka Park, 12 ♀♀ 20 ♂♂ on dead leaves of *Quercus acutissima*, 13-VIII-1980, S. OKAJIMA leg.; Wakayama Pref., Hidaka, Oura, 1 ♀ on dead *Quercus phillyraeoides*, 3-VIII-1970, K. HAGA.; Nara Pref., Nara-shi, Takabatake-cho nr. Yagyu-kaido, 1 ♀ 2 ♂♂ on dead leaves of *Quercus glauca*, 30-XII-1983, S. OKAJIMA leg.; Okayama Pref., Hayashima, 3 ♀♀ 4 ♂♂ on dead leaves, 12-VII-1984, T. Matsumoto leg.; Yamanashi Pref., nr. Nirasaki, Anayama, 3 ♀♀ 4 ♂♂ on dead leaves of *Q. acutissima*, 15-VII-1983, S. OKAJIMA leg.; Ibaraki Pref., nr. Tsuchiura, Yatabe-cho, 13 ♀♀ 10 ♂♂ on dead leaves of *Castanea crenata*, 9-VII-1985.

*Comments.* This species lives on the dead leaves of the deciduous *Quercus* and allied trees, such as *Q. acutissima*, *Q. serrata* and *Castanea crenata*, rarely on those of evergreen *Quercus*. Although the deciduous ones distribute in the cool-temperate zone as well as upper zone of the warmtemperate zone, we could find *quadrituberculatus* only in the latter forests.

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Figs. 29-35. Tubercles on abdominal segment VI, VII and VIII of *Bactrothrips* species, showing variation according as body size varies.

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| 29. <i>B. brevitubus</i> .           | 30. <i>B. carbonarius</i> sp. nov. |
| 31. <i>B. flectoventris</i> sp. nov. | 32. <i>B. pictipes</i> sp. nov.    |
| 33. <i>B. montanus</i> sp. nov.      | 34. <i>B. honoris</i> .            |
| 35. <i>B. quadrituberculatus</i> .   |                                    |

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