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The Japanese Species of *Anaphothrips* and *Apterothrips* (Thysanoptera, Thripidae)

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Abstract Five species of the grass-living genus *Anaphothrips* are recognized in Japan. Two of them, *A. ponokikirmui* and *A. asahi*, are described for the first time. Besides, *Anaphothrips badius* and *Apterothrips secticornis* are recorded for the first time in Japan.

Anaphothrips in its traditional sense is a large genus of medium-sized and mainly grass-living thrips, forming a group of diverse species. It includes about 80 species, which are distributed in many parts of the world (JACOT-GUILLARMOD, 1974). BHATTI (1978) revised *Anaphothrips* and the related genera, and concluded that *Anaphothrips* includes only 19 species and that many species are transferred to other genera, although there remains a great amount to be explored. PITKIN (1978) recognized 16 species in *Anaphothrips* in its traditional broad sense from Australia. MOUND and WALKER (1982) also listed five species in a broad sense from New Zealand. More detailed analysis of the species of *Anaphothrips* and its relatives is required for the definition of the genus. All five Japanese species listed here belong to *Anaphothrips* in a strict sense (BHATTI, 1978). *Apterothrips*, represented by two species, is similar to *Anaphothrips*, and was occasionally treated as synonymous with the latter.

The two widely distributed species of *Anaphothrips* are already known in Japan, viz. *A. obscurus* from Hokkaido and Honshu, and *A. sudanensis* from the Nansei Islands. The present article adds four species to the thysanopterous fauna of Japan. The abbreviations used in the following lines are presented in my previous papers (KUDÔ, 1984, 1985). The type specimens are deposited in my collection.

Anaphothrips UZEL

Anaphothrips UZEL, 1895, Monogr. Ord. Thysanop., 142; BHATTI, 1978, Senckenb. biol., **59**: 87–90.

Head wider than long; with 2 pairs of AOS; setae small; ocelli present or absent; mouth cone moderately long; maxillary palpus 3-segmented. Antenna 8-segmented, often with a secondary suture on A_6; A_1 without middorsal pair of setae at anterior margin; A_2 with subbasal dorsal seta; A_3 and A_4 with forked sense cone; A_3–A_5 each with 5, 5, 6 setae; A_3–A_6 with microtrichia.

Pronotum without any prominent setae; furcasternum entire; probasisternum

without setae. Mesoscutum with anterior CPS and median setae far ahead of posterior margin; mesosternum alone with spinula; mesosternopleural suture present; metepimeron with 2 setae; metepisternum without setae. Macropterous or brachypterous; fore wing with weak setae; posterior FH wavy. Tarsi 2-segmented.

Abdomen without posteromarginal flanges; tergal B_1 widely spaced and shorter than half of their interdistance; T_8 with comb; T_{10} completely divided; median CPS placed far ahead of posterior margin or near the margin; setal formula being 2+1m+2+1m; lateroterga separated from terga. Sterna without accessory setae; S_2 with 2 pairs of posteromarginal setae; B_1 on S_7 in front of posterior margin. Male with 2 pairs of spine-like setae on T_9; sterna with glandular areas varying oval via crescentic to C-shaped.

Anaphothrips badius (WILLIAMS)

(Fig. 1)

Euthrips badius WILLIAMS, 1913, J. econ. Biol., **8**: 221.

♀ (Macropterous). Uniformly dark brown; tarsi and apex of tibiae paler; major body setae dark. Antenna dark brown, A_3–A_5 paler. Fore wing brown.

Head (Fig. 1.1) W/L 1.09–1.23; posterior third transversely striate; cheek weakly rounded; IOS placed on the lines joining outer margins of fore and hind ocelli; POS in a transverse row; IOD/HOW 3.86–4.83; OOD/IOD 2.00–2.22. Antenna (Fig. 1.2) 9-segmented; 1.9–2.0 times as long as head; A_3 L/W 2.05–2.43, shorter than A_6; A_4 L/W 1.83–2.14, as long as A_5; A_5 L/W 1.78–2.00; A_6 L/W 2.46–2.76, divided by apical suture; A_3 L/A_4L 1.07–1.21; A_6L/A_3L 1.08–1.36; A_7 L/W 1.00–1.14; A_3 L/W 2.20–2.60; A_3 with 4–5 microtrichia rows, A_4 and A_5 with 4 rows, A_6 with 3 rows.

Pronotum (Fig. 1.1) W/L 1.38–1.52; usually with faint, transversely anastomosing striae; with 39–50 setae in all. Mesoscutum (Fig. 1.1) with transversely anastomosing striae. Metascutum reticulate, with CPS at about middle and median setae on anterior fourth; metascutellum with some weak reticles. Mesosternum with 27–35 setae, metasternum with 17–19 setae. Fore wing L/W 13.67–15.18; with 17–24 anterior and 44–56 posterior FH; costa with 20–28 setae, fore vein with 9–11 setae, hind vein with 6–10; scale with 5–6 anal setae, without discal seta. Hind wing with 57–78 FH.

Tergum T_1 with transversely anastomosing striae; T_2–T_8 smooth between B_2; T_2–T_8 with serrations at lateral fifth of posterior margin; T_8 (Fig. 1.3) with fine comb of microtrichia separated from the others at base. T_9L/T_{10}L 0.97–1.14, B_1–B_3 on T_9 each 0.68–1.00, 0.79–1.11 and 0.81–1.00 times as long as T_9, B_2 usually longest; B_1–B_2 on T_{10} each 0.72–0.97 and 0.67–0.87 times as long as T_{10}. Ovipositor 2.00–2.22 times as long as pronotum.

Measurements (μm). Body L 1.3–1.5 mm. Head L 110–123, W 127–138;

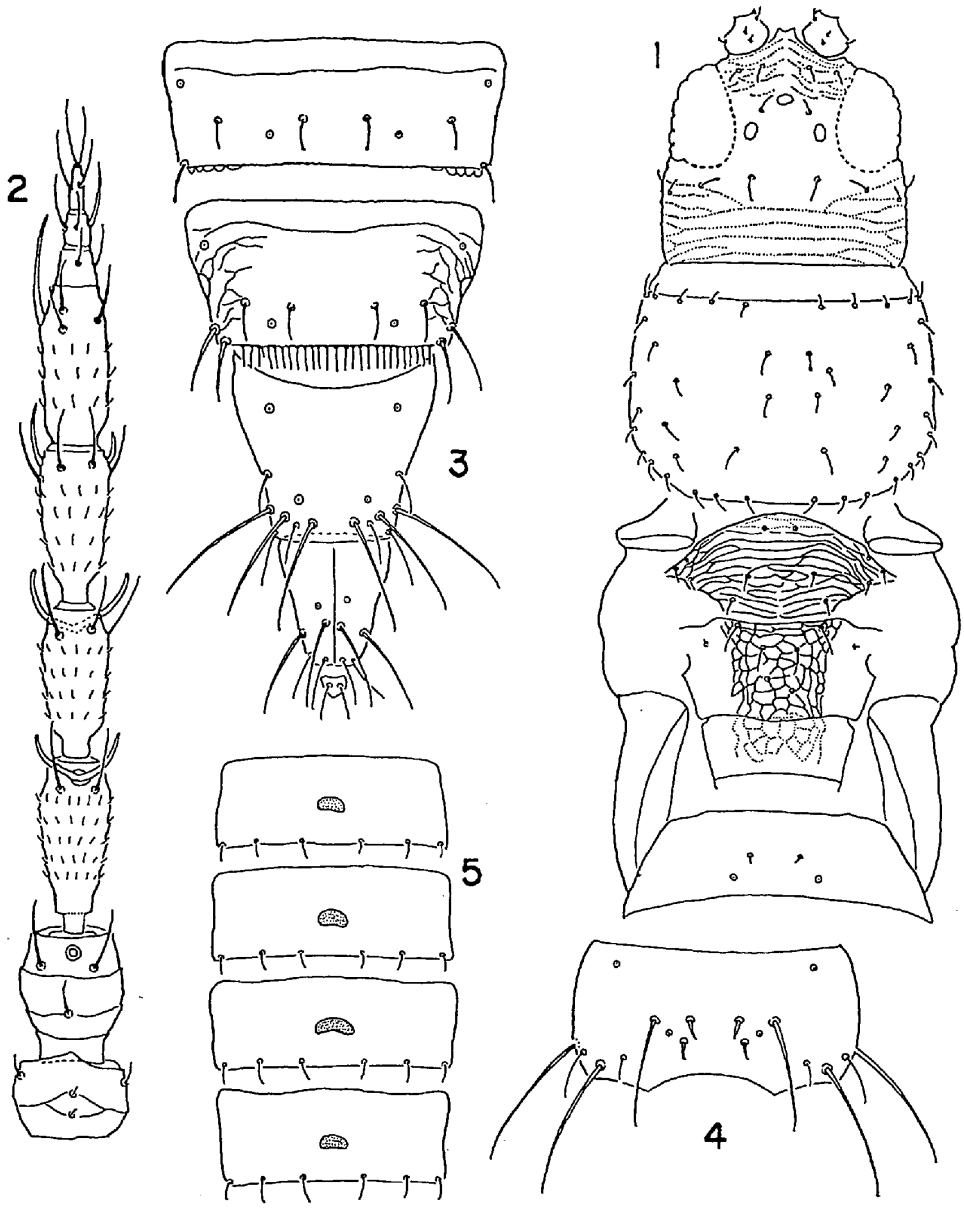

Fig. 1. *Anaphothrips badius* (WILLIAMS); 1, ♀, head, thorax and T_1; 2, ♀, antenna; 3, ♀, T_7–T_{10}; 4, ♂, T_9; 5, ♂, S_3–S_9.

pronotum L 111–129, W 162–183; Fore wing L 595–715, W 42–50; T_9 L 79–95; B_1–B_3 on T_9 each 57–83, 70–92, 70–85; T_{10} L 75–86; B_1–B_2 on T_{10} each 58–73, 56–65; ovipositor L 240–270. Antenna 216–235 in total L; antennal segments as follows:

Segment	1	2	3	4	5	6	7	8
L	20	30–31	38–43	32–38	33–38	42–48	8	11–13
W	29	24–26	17–19	17–18	18–20	16–18	7–8	5

♂ (Macropterous). Colored as in female. T_9 (Fig. 1.4) with 2 pairs of small

spine-like setae (B_1 and SB_1), B_2 and B_3 1.1–1.2 times as long as T_8, MD about as long as T_8 S_3–S_6 (Fig. 1.5) each with small oval glandular area. Body L 1.0 mm.

Specimens examined. Hokkaido: 8 ♀ 1 ♂ (grass), Okoppe, VIII 9, 1976; 4 ♀ (?*Scirpus wichurae*), Otoineppu, Kamiotoineppu, VIII 10, 1976.

Host plants. Cyperaceae: probably *Scirpus wichurae* BOCKLR. Gramineae: unidentified species.

Distribution. New to Japan. Hokkaido: Abashiri, Kamikawa. Palearctic: England, Denmark, Germany, Austria, Switzerland, Poland, USSR (Estonia, Ukraina, Siberia).

Remarks. This Palearctic species is similar to *A. obscurus* in general structure, but differs from the latter in its dark color, in the abdominal terga unsculptured medially, and in the fact that both the sexes are known with only the macropterous form. Moreover, of the 28 quantitative characters of comparison between *A. badius* and *A. obscurus* (Table 1), 10 (Nos. 2, 3, 6–9, 16, 17, 27, 28) are highly significantly different between the two species by *t*-test ($p<0.01$), although the ranges of those 9 characters except for No. 28 overlap interspecifically.

Anaphothrips obscurus (MÜLLER)

(Fig. 2)

Thrips obscura MÜLLER, 1776, Zool. Danicae Prod. Anim., 96.

♀ (Macro- and brachypterous). Yellow, macropterous form with some brown blotches; B_1 and B_2 on T_8 brown, B_3 yellow. Fore wing grayish yellow. A_1 yellowish white; A_2–A_5 brownish yellow, A_5 darker; A_6–A_8 brown.

Head (Fig. 2.1) W/L 1.16–1.30; with transversely anastomosing striae on posterior half; IOS usually just outside ocellar triangle in front of hind ocelli; POS B_1 anterior to the rest; IOD/HOW 3.00–4.33; OOD/IOD 2.15–2.61. Antenna (Fig. 2.2) 9-segmented, 2.2–2.4 times as long as head; A_3 L/W 2.30–2.67; A_4 L/W 1.95–2.33, mostly shorter than A_5; A_5 L/W 1.97–2.41; A_6 longest, L/W 2.67–3.11, with 9 setae, with complete or incomplete suture; A_3L/A_4L 1.10–1.28; A_6L/A_3L 1.07–1.23; A_7 L/W 1.38–1.83; A_8 L/W 2.60–3.20; A_3 with 4–5 microtrichia rows, A_4–A_5 with 4 rows, A_6 with 3 rows.

Pronotum (Fig. 2.1) W/L 1.24–1.46, nearly unsculptured; with 35–52 setae in all. Mesoscutum (Fig. 2.3) transversely anastomosing-striate, partly reticulate; interdistance of inner pair of median setae about 0.65 times as long as interdistance of outer pair. Metascutum reticulate, with CPS at middle and median setae on anterior fourth to third. Mesosternum with 30–36 setae, metasternum with 14–18 setae. Fore wing (Fig. 2.5) L/W 12.89–15.24; with 19–26 anterior and 46–62 posterior FH; costa with 18–24 setae, these at middle of wing about 0.25 times as long as wing W; fore vein with 7–10 setae, hind vein with 4–8; scale with 4–5 anal setae, without discal seta. Hind wing with 69–84 FH.

Table 1. Mean and S.D. of quantitative characters in females of three *Anaphothrips* species.

Character	*A. badius*		*A. obscurus*		*A. ponokikirmui*	
	Mean±S.D.	n	Mean±S.D.	n	Mean±S.D.	n
1. Head W/L	1.15±0.05	10	1.23±0.04	12	1.10±0.05	13
2. IOD/HOW	4.50±0.28	9	3.38±0.39	14	3.75±0.27	11
3. OOD/IOD	2.10±0.08	9	2.40±0.17	13	2.53±0.13	9
4. A_3L/W	2.26±0.11	11	2.48±0.13	12	2.40±0.12	13
5. A_4L/W	1.97±0.11	11	2.18±0.12	12	2.49±0.13	13
6. A_5L/W	1.88±0.07	11	2.20±0.14	12	2.18±0.06	13
7. A_6L/W	2.59±0.11	11	2.93±0.12	12	2.94±0.12	13
8. A_7L/W	1.10±0.07	11	1.51±0.16	12	1.24±0.08	13
9. A_8L/W	2.37±0.16	11	3.00±0.19	12	2.80±0.20	13
10. A_3L/A_4L	1.15±0.04	11	1.16±0.05	12	1.06±0.03	13
11. A_6L/A_3L	1.14±0.08	11	1.16±0.05	12	1.14±0.05	13
12. Pronotum W/L	1.43±0.05	11	1.37±0.05	13	1.28±0.04	13
13. No. of pronotal setae	45.2±3.3	10	42.3 ±5.0	13	45.6 ±5.5	9
14. Fore wing L/W	14.29±0.51	11	13.77±0.71	12	13.80±0.95	5
15. No. of costal setae on fore wing	22.7 ±2.0	16	21.1 ±1.7	20	22.8 ±2.3	8
16. No. of fore veinal setae on fore wing	10.4 ±0.6	15	7.9 ±0.7	20	8.3 ±1.0	6
17. No. of hind veinal setae on fore wing	8.3 ±1.0	16	6.7 ±1.0	20	7.8 ±1.3	6
18. No. of anterior FH on fore wing	21.1 ±2.0	15	23.2 ±2.0	18	20.4 ±1.5	8
19. No. of posterior FH on fore wing	52.7 ±3.9	13	56.5 ±4.2	18	52.7 ±2.1	3
20. No. of FH on hind wing	71.5 ±6.4	13	77.4 ±4.3	23	68.7 ±2.5	6
21. $T_9L/T_{10}L$	1.07±0.06	10	1.02±0.06	11	1.05±0.03	13
22. T_9B_1/T_9L	0.81±0.10	10	0.93±0.06	16	1.12±0.07	14
23. T_9B_2/T_9L	0.95±0.11	11	1.00±0.06	15	1.17±0.09	15
24. T_9B_3/T_9L	0.93±0.08	10	0.98±0.07	16	1.05±0.09	14
25. T_9B_1/pronotal L	0.57±0.07	10	0.53±0.03	18	0.72±0.06	13
26. $T_{10}B_1/T_{10}L$	0.82±0.08	12	0.95±0.08	14	0.92±0.06	14
27. $T_{10}B_2/T_{10}L$	0.76±0.06	10	0.90±0.07	14	0.86±0.06	13
28. Ovipositor L/pronotal L	2.12±0.06	11	1.59±0.04	13	1.88±0.06	13

Abdominal terga (Fig. 2.6) with transversely anastomosing striae almost throughout; with indistinct, minute serrations laterad of B_3; T_8 with complete comb of microtrichia separated with others at base, occasionally some microtrichia shorter; $T_9L/T_{10}L$ 0.91–1.10; B_1–B_3 on T_9 each 0.83–1.00 times, 0.88–1.09 times and 0.79–1.10 times as long as T_9; B_1 on T_9 0.48–0.59 times as long as pronotum; B_1–B_2 on T_{10} each 0.80–1.06 times and 0.80–1.03 times as long as T_{10}. Ovipositor 1.50–1.65 times as long as pronotum.

Measurements (μm). Body L 1.2–1.5 mm. Head L 108–125, W 137–146; pronotum L 120–138, W 167–192; fore wing L 676–838, W 52–65; T_9L 70–80; B_1–B_3 on T_9 each 63–75, 63–82, 63–77; T_{10} L 68–85; B_1–B_2 on T_{10} each 60–80, 60–75;

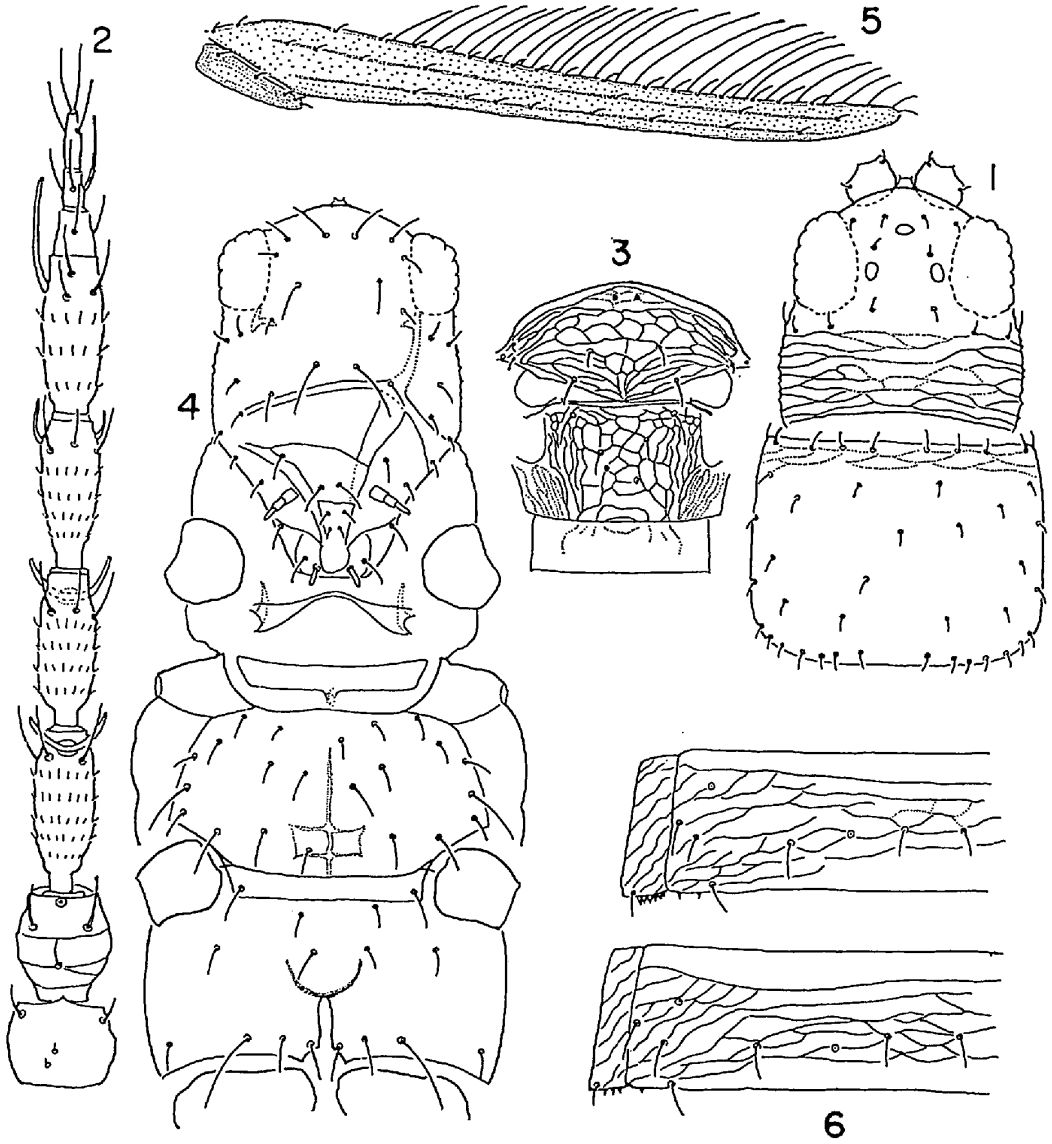

Fig. 2. *Anaphothrips obscurus* (MÜLLER), ♀; 1, head and pronotum; 2, antenna; 3, meso- and metanotum; 4, head and thorax, ventral; 5, fore wing; 6, part of T_3 and T_4.

ovipositor L 192–223. Antenna 239–269 in total L; antennal segments as follows:

Segment	1	2	3	4	5	6	7	8
L	20–23	30–35	42–48	37–42	37–45	48–56	10–11	13–17
W	27–30	25–28	18–20	17–19	17–20	18–19	7–8	5

♂. Unknown.

Specimens examined. Hokkaido: 5 ♀ (grass), Toyotomi, Wakasakanai, VIII 11, 1976; 2 ♀ (grass), Okoppe, VIII 9, 1976; 10 ♀ (grass), Shari, VIII 8, 1976; 1 ♀ (*Cirsium* sp.), Nemuro, Makinouchi, VIII 7, 1976; 2 ♀ (*Fraxinus* sp.), Akkeshi,

Aikappu, VIII 5, 1976; 10 ♀ (*Phleum pratense*), Kamikawa, Sôunkyô (1,000 m), VIII 13, 1976; 2 ♀ (*Scirpus wichurae*), Kamishihoro, Nukabira, VIII 4, 1976; 1 ♀ (*Plantago lanceolata*), Ishikari, Bannaguro, VI 16, 1969; 3 ♀ (*Glycine max*), Sapporo, Hokkaido Univ. Campus, VIII 4, 1975; 11 ♀ (grass), Eniwa, Shimamatsu, VIII 14, 1976; 8 ♀ (*Ph. pratense*), Makkari, VIII 9, 1975; 5 ♀ (*Ph. pratense*), Tomakomai, Hokkaido Univ. Exp. Forest, VIII 17, 1978; 7 ♀ (*Asparagus officinalis*), Mori, Himekawa, VIII 21, 1977. Aomori-ken: 10 ♀ (*S. wichurae*), Ôhata, Yagen, VIII 12, 1975; 8 ♀ (*Descampsia flexuosa*), Mt. Iwaki (1,600 m), VIII 29, 1976. Iwate-ken: 2 ♀ (*Miscanthus sinensis*), Rikuzentakada, Hirota, IX 2, 1976. Fukushima-ken: 8 ♀ (grass), Inawashiro, Ottate (1,000 m), VIII 25, 1975. Ibaraki-ken: 4 ♀ (grass), Ôarai, X 2, 1976. Yamanashi-ken: 2 ♀ (*Ph. pratense*), Sutama, Masutomi (1,400 m), VII 26, 1976. Nagano-ken: 10 ♀ (grass), Togakushi, Okusha (1,300 m), VIII 25, 1978; 7 ♀ (grass), Suwa, Kirigamine (1,400 m), IX 14, 1975; 2 ♀ (*Betula ermanii*), Mt. Kisokomagatake (2,700 m, alpine zone). Shizuoka-ken: 3 ♀ (grass), Shizuoka, Umegashima, X 1, 1977. Ehime-ken: 2 ♀ (grass), Mt. Ishizuchi (1,800 m), VIII 30, 1978. Kôchi-ken: 13 ♀ (*Lolium multiflorum*), Kôchi, VI 5, 1982. Fukuoka-ken: 10 ♀ (grass), Nôgata, Inunakitôge, V 8, 1976. Saga-ken: 5 ♀ (grass), Yamato, Kawakami, X 20, 1977. Nagasaki-ken: 3 ♀ (grass), Nomozaki, Wakisaki, X 22, 1977.

Host plants. Cyperaceae: *Scirpus wichurae* BÖLR. Gramineae: *Descanpsia flexuosa* (L.) TRIN., *Lolium multiflorum* LAM., *Phleum pratense* L., unidentified species. Occasionally found on herbs and tree leaves, *e.g.*, Betulaceae: *Betula ermanii* CHAM., Liliaceae: *Asparagus officinalis* L., Moraceae: *Morus bombycis* L.

Distribution. Hokkaido: Sôya, Abashiri, Kushiro, Tokachi, Kamikawa, Hidaka, Iburi, Ishikari, Shiribeshi, Oshima. Honshu: Aomori, Akita, Iwate, Miyagi (KUROSAWA, 1968), Fukushima, Ibaraki, Tokyo (KUROSAWA, 1968), Saitama (KUROSAWA, 1968), Tochigi (KUROSAWA, 1968), Yamanashi, Nagano, Shizuoka. Shikoku: Ehime, Kôchi. Kyushu: Fukuoka, Saga, Nagasaki. Palearctic: England, Sweden, Finland, Denmark, Germany, the Netherlands, France, Italy, Austria, Poland, Czechoslovakia, Hungary, Rumania, Yugoslavia, Albania, USSR, China, Korea, Azores. Nearctic: Canada, the United States. Oriental: India (Jammu & Kashmir, Himachal Pradesh). Australia: Australia, New Zealand, Hawaii. Ethiopian: Egypt, South Morocco.

Remarks. *Anaphothrips obscurus* is similar to *A. ponokikirmui* to be described below, but separable by the characters discussed under the latter species. It is widespread and abundant on grasses in the northern temperate areas, but no males have been known.

Anaphothrips ponokikirmui n. sp.

(Fig. 3)

♀ (Macro- and brachypterous). Uniformly yellow; tip of mouth cone and

tip of abdominal segment X brown; major body setae hyaline or yellow; fore wing pale brown. A_1 yellowish white; A_2–A_4 brownish yellow; A_5–A_8 brown but A_5 yellowish at base.

Head (Fig. 3.1) W/L 1.04–1.17; with transversely anastomosing striae on posterior half; IOS just outside ocellar triangle in front of hind ocelli; POS B_1 anterior to the rest; IOD/HOW 3.25–4.33; OOD/IOD 2.29–2.69. Antenna (Fig. 3.2) 9-segmented, about twice as long as head; A_3 L/W 2.15–2.63; A_4 L/W 2.22–2.64, longer than A_5; A_5 L/W 2.10–2.27; A_6 longest, L/W 2.70–3.17, with 8 setae, mostly with complete but rarely with partial suture; A_3L/A_4L 1.00–1.12; A_6L/A_3L 1.06–1.24; A_7 L/W 1.13–1.38; A_8 L/W 2.40–3.00; A_3 with 5 microtrichia rows, A_4 and A_5 with 4 rows, A_6 with 3 rows.

Pronotum (Fig. 3.1) L/W 1.21–1.34, slightly longer than head; with faint and transversely anastomosing striae on anterior and posterior parts; with 33–52 setae in all. Mesoscutum (Fig. 3.3) with transversely anastomosing striae; with 2 pairs of median setae nearly in longitudinal row, interdistance of inner (anterior) pair more than 0.8 times as long as interdistance of outer (posterior) pair. Metascutum reticulate; without CPS; with median setae on anterior third; metascutellum with some longitudinal striae. Mesosternum with 23–27 setae, metasternum with 12–15. Fore wing L/W 13.1–15.1; with 18–23 anterior and 51–55 posterior FH; costa with 20–26 setae, these at middle of wing about 0.5 times as long as wing W; fore vein with 7–9 setae, hind vein with 6–8; scale with 4–5 anal setae and no discal seta. Hind wing with 66–68 FH.

Abdominal terga with faint and transversely anastomosing striae throughout; T_2–T_7 (Fig. 3.4) with minute but distinct serrations laterad of B_2 at posterior margin; T_8 (Fig. 3.5) with complete comb of microtrichia basally separated with others; $T_9L/T_{10}L$ 1.00–1.08; B_1–B_3 on T_9 each 0.98–1.27 times, 1.02–1.22 times and 0.91–1.20 times as long as T_9; B_1 on T_9 0.62–0.84 times as long as pronotum; B_1–B_2 on T_{10} each 0.83–1.04 times and 0.76–0.98 times as long as T_{10}. Ovipositor 1.77–1.97 times as long as pronotum.

Measurements (μm). Body L 1.4–1.6 mm. Head L 120–142, W 140–150; pronotum L 135–145, W 170–190; fore wing L 670–800, W 48–57; T_9 83–95, B_1–B_3 each 91–113, 95–117, 85–102; $T_{10}L$ 80–93, B_1–B_2 each 75–83, 67–80; ovipositior L 252–283. Antenna 246–282 in total L; antennal segments as follows:

Segment	1	2	3	4	5	6	7	8
L	22–25	30–34	42–50	40–48	40–44	50–56	8–10	13–15
W	28–31	28–30	19–20	18–19	19–20	18–19	7–8	5

♂ (Macro- and brachypterous). Colored as in female; fore wing grayish brown, paler apically. T_8 with complete comb of microtrichia, usually separated at base but occasionally connected with others, with more emphasized bases than in female. T_9 (Fig. 3.6) with 2 pairs of spine-like setae (B_1 and SB_1); B_2, B_3 and MD subequal and 1.0–1.2 times as long as T_9. S_3–S_7 (Fig. 3.7) with small oval glandular

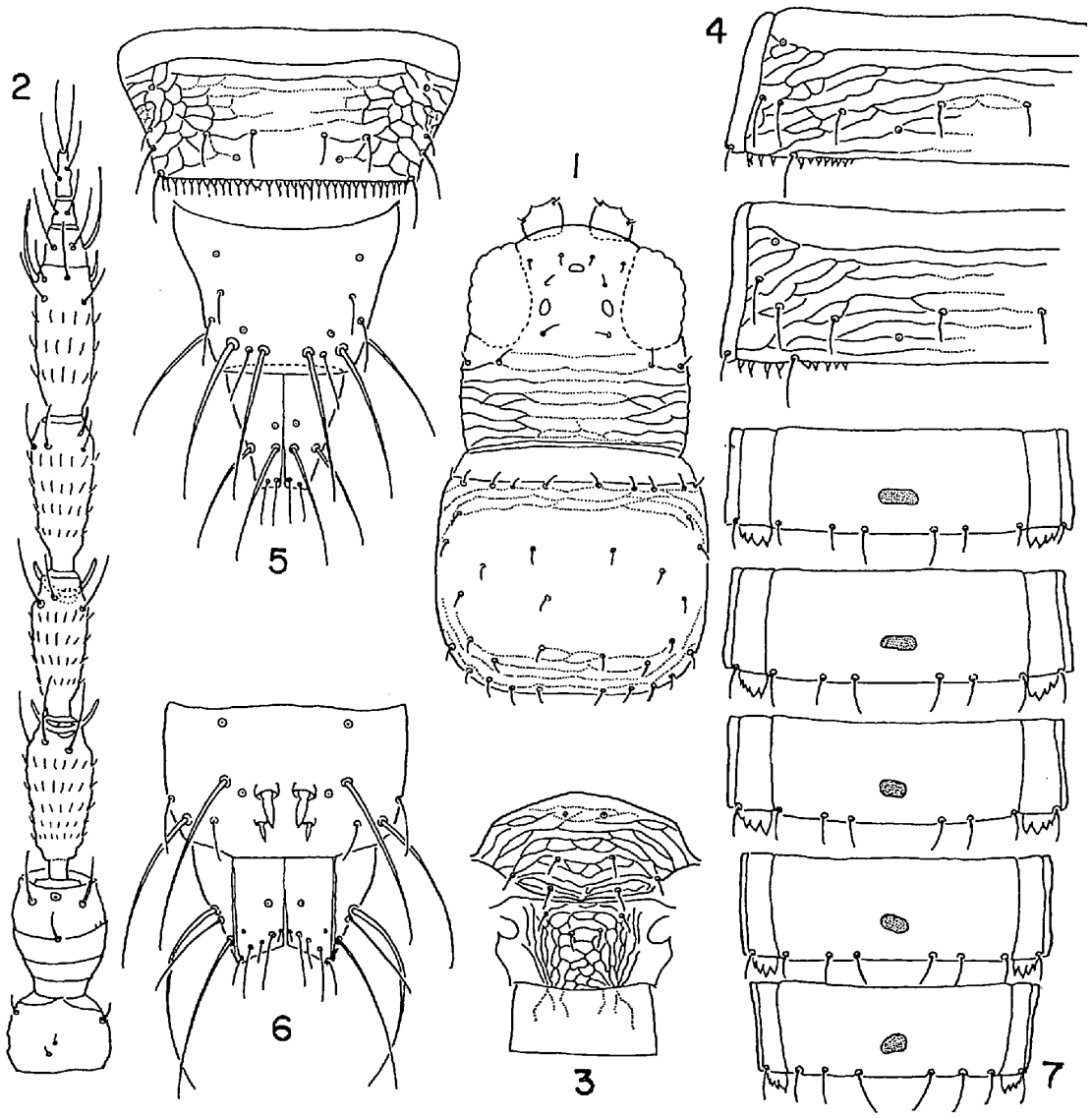

Fig. 3. *Anaphothrips ponokikirmui* n. sp.; 1, ♀, head and pronotum; 2, ♀, antenna; 3, ♀, meso- and metanotum; 4, ♀, part of T_3 and T_4; 5, ♀, T_8–T_{10}; 6, ♂, T_9 and T_{10}; 7, ♂, S_3–S_7.

area. Body L 1.1–1.2 mm.

Specimens examined. Holotype: ♀ macroptera (grass), Hokkaido, Nemuro, Makinouchi, VIII 7, 1976. Paratypes: Hokkaido: 6 ♀ macropterae, 3 ♀ hemimacropterae, 9 ♀ brachypterae, collected with holotype. Nagano-ken: 10 ♀ brachypterae, 1 ♂ macroptera, 1 ♂ hemimacroptera and 1 ♂ brachyptera (grass), Suwa, Kirigamine (1,400 m), IX 14, 1975.

Host plants. Gramineae: Unidentified species.

Distribution. Hokkaido: Nemuro. Honshu: Nagano.

Remarks. Anaphothrips ponokikirmui is very similar to *A. obscurus*, but differs in the metascutum without CPS (vs. with CPS in *obscurus*), and the abdominal

terga with distinct serrations laterad of B_2 at posterior margin (vs. almost absent). Moreover, in *A. ponokikirmui* both the macro- and brachypterous forms occur in both sexes, and the body is always uniformly yellow, never having brown blotches. Of the 28 quantitative characters (Table 1), 9 (Nos. 1, 5, 8, 10, 12, 22, 23, 25, 28) are highly significantly different between the two species by *t*-test ($p<0.01$), although the ranges of those 7 characters except for Nos. 25 and 28 overlap interspecifically.

Anaphothrips sudanensis TRYBOM

(Fig. 4)

Anaphothrips sudanensis TRYBOM, 1911, Res. Swed. zool. Exped. Egypt 1901, (19): 60–63.

♀ (Macropterous). Bicolored; head, thorax, abdominal segments I, II, most of VI and entire VII–X dark brown; abdominal segments III–V, anterior margin of VI and legs yellow, but femora often shaded at base or at outer margin; rarely most of these segments tending to be dark; major setae on abdominal segments VIII–X dark. Fore wing with second fourth dark, gradually becoming paler distally; basal fourth hyaline, distal half slightly shaded. A_1, A_2, most of A_5 and entire A_6–A_8 dark brown; A_3, A_4 and base of A_5 yellow.

Head (Fig. 4.1) W/L 1.13–1.30; with transversely anastomosing striae on posterior half; 3 pairs of POS in a transverse row; IOD/HOW 2.75–3.67; OOD/IOD 2.18–2.38. Antenna (Fig. 4.2) 8-segmented, 2.1–2.2 times as long as head; A_3 L/W 2.17–2.50; A_4 L/W 1.94–2.35, subequal to A_5 in length; A_5 L/W 1.86–2.31; A_6 longest, L/W 2.65–3.23, undivided by secondary suture, distinctly pedicellate, with 8 setae; A_3L/A_4L 1.04–1.14; A_6L/A_3L 1.11–1.25; A_7 L/W 1.14–1.67; A_8 L/W 2.44–3.50; A_3–A_5 with 4 microtrichia rows, A_6 with 3 rows.

Pronotum (Fig. 4.1) W/L 1.20–1.39; with faint and transversely anastomosing striae; with 40–53 setae in all. Mesoscutum with transversely anastomosing striae. Metascutum (Fig. 4.1) irregularly striate; usually with but occasionally without CPS; with median setae on anterior third; metascutellum smooth. Mesosternum with 23–32 setae, metasternum with 14–22 setae. Fore wing L/W 13.84–16.13; with 17–22 anterior and 45–51 posterior FH; costa with 17–21 setae, these at middle of wing about 0.33 times as long as wing W; fore vein with 10–12 setae, hind vein with 8–10; scale with 3–5 anal setae. Hind wing with 55–67 FH.

Tergum T_1 transversely striate throughout; T_2–T_8 (Fig. 4.3) with transversely anastomosing striae on lateral fourth only; T_2–T_7 with small serrations laterad of B_2 at posterior margin; T_8 with fine comb of microtrichia separated basally with others; $T_9L/T_{10}L$ 0.91–1.14; B_1–B_3 on T_9 each 1.22–1.41 1.26–1.50, and 1.16–1.41 times as long as T_9; B_1 on T_9 0.69–0.84 times as long as pronotum; B_1–B_2 on T_{10} each 1.06–1.27 and 0.79–1.24 times as long as T_{10}. Ovipositor 1.65–1.83 times as long as pronotum.

Measurements (μm). Body L 1.3–1.5 mm. Head L 100–120, W 118–140;

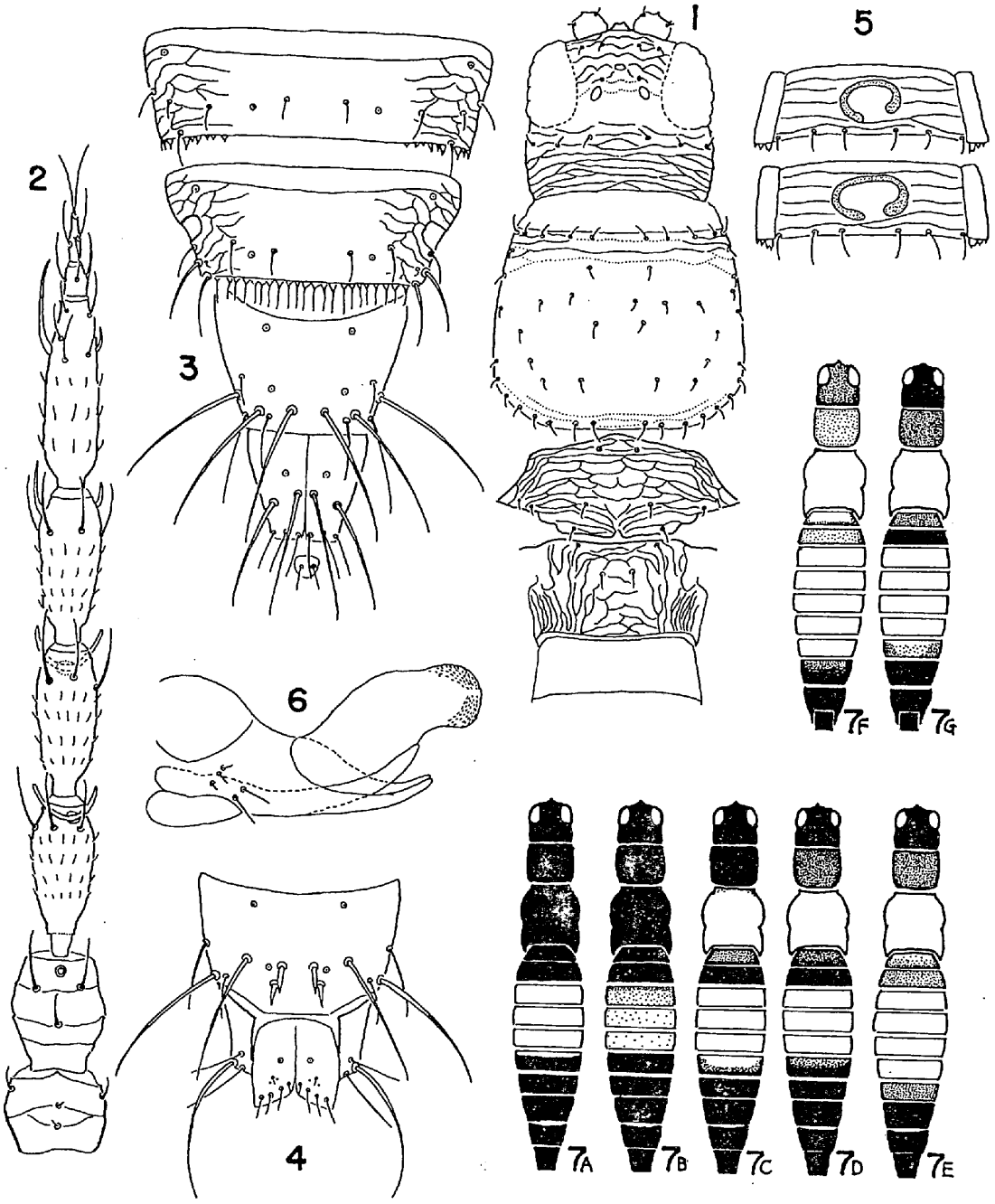

Fig. 4. *Anaphothrips sudanensis* TRYBOM; 1, ♀, haed and thorax, dorsal; 2, ♀, antenna; 3, ♀, T_7–T_{10}; 4, ♂, T_9 and T_{10}; 5, ♂, S_5 and S_6; 6, ♂, genitalia, lateral; 7, color variation: A–B, macropterous ♀; C–E, brachypterous ♀; F–G, brachypterous ♂.

pronotum L 110–138, W 150–177; fore wing L 610–670, W 38–46; T_9L 70–83; B_1–B_3 on T_9 each 90–106, 93–113, 85–100; T_{10}L 63–87; B_1–B_2 on T_{10} each 70–95, 55–83; ovipositor L 198–245. Antenna 218–252 in total L; antennal segments as follows:

Segment	1	2	3	4	5	6	7	8
L	18–20	28–34	38–45	33–40	33–40	45–50	8–10	11–14
W	26–28	24–26	16–18	16–18	16–18	16–18	6–7	4–5

♀ (Brachypterous). Head, prothorax, abdominal segments II and VII–X dark brown; abdominal segments I and VI brown posteriorly and yellow anteriorly; pterothorax and abdominal segments III–V yellow; legs and antenna as in macroptera. Structure as in macroptera except ocelli absent and metanotum undivided.

♂ (Brachypterous). Head, prothorax, abdominal segments II and VII–X brown; abdominal segment I brown posteriorly, yellow anteriorly; pterothorax, abdominal segments III–VI and legs yellow. Occasionally prothorax yellowish brown, and abdominal segment VII yellow. A_1–A_4 and base of A_5 yellow, the rest brown to dark brown.

Tergum T_9 (Fig. 4.4) with 2 pairs of spine-like setae (B_1 and SB_1), B_2 1.2–1.3 times, B_3 1.0–1.2 times and MD 1.0–1.2 times as long as T_9. S_3–S_8 (Fig. 4.5) with a large C-shaped glandular area. Genitalia (Fig. 4.6): aedeagus thick, gradually tapering apically but not sharply pointed, as long as paramere; paramere with 3 short and 2 long setae at base. Body L 0.9–1.0 mm.

Specimens examined. Nagasaki-ken: 25 ♀10 ♂ (grass), Nomozaki, Wakisaki, X 22, 1977. Miyazaki-ken: 6 ♀ 2 ♂ (grass), 2 ♀ (*Piper kadzura*), Nichinan, Ôdôtsu, IV 2, 1975. Kagoshima-ken: 27 ♀ 2 ♂ (grass), Mt. Kaimondake, X 7, 1978. Okinawa-ken: 2 ♀ (*Ipomoea batatas*), Itoman, Mabuni, XII 24, 1976; 4 ♀ (*Miscanthus sinensis*), Hirara, XII 28, 1976. Taiwan: 2 ♀ (grass), Puli, V 15, 1973. Hongkong: 6 ♀ 2 ♂ (grass), Sheung Shui, V 20, 1973. Thailand: 30 ♀ 7 ♂ (grass), Bangkok, V 25, 1973.

Host plants. Gramineae: *Miscanthus sinensis* ANDERSS., unidentified species.

Distribution. Kyushu: Nagasaki, Miyazaki, Kagoshima. Okinawa: Okinawa-jima, Miyako-jima. Palearctic: Cyprus, Morocco, Usbekistan, Central Asia. Oriental: Taiwan, Hongkong (new record), the Philippines, Thailand (new record), Java, Sumatra, India, Sri Lanka. Australian: Australia, New Britain, New Caledonia. Ethiopian: Egypt, Sudan, Somalia, Nigeria, Senegal, Mozambique, South Africa. Neotropical: West Indies.

Remarks. This species is easily distinguished from the congeners by the distinctly bicolored body. Because of considerable color variation, many scientific names have been given to it in earlier times. At the present all those are regarded as a single species, but PITKIN (1978) has suggested the possibility of existence of more than one species under the name *sudanensis*, because the variations in color and sex ratio tend to show a constant in respective regions.

The examined Japanese specimens vary poorly, but some color patterns are shown in Fig. 4.7. The macropterous form is always darker than the brachypterous form, and the male tends to become more yellow than the female. In the macropterous form the pterothorax is always brownish, never becoming clear yellow,

Table 2. Mean and S. D. of quantitative characters in females of two *Anaphothrips* species and *Apterothrips secticornis*.

Character	*A. sudanensis**		*A. asahi*		*A. secticornis*	
	Mean±S.D.	n	Mean±S.D.	n	Mean±S.D.	n
1. Head W/L	1.21±0.05	13	1.16±0.03	17	1.21±0.05	8
2. IOD/HOW	3.34±0.34	7	—		—	
3. OOD/IOD	2.28±0.06	6	—		—	
4. A_3L/W	2.35±0.11	15	2.17±0.09	19	1.80±0.06	8
5. A_4L/W	2.18±0.10	15	2.03±0.08	19	1.67±0.06	8
6. A_5L/W	2.15±0.12	15	2.06±0.10	19	1.54±0.05	8
7. A_6L/W	2.87±0.15	15	2.84±0.16	19	2.19±0.07	8
8. A_7L/W	1.37±0.12	15	1.31±0.13	19	0.96±0.07	8
9. A_8L/W	2.70±0.24	15	2.80±0.15	19	2.99±0.19	8
10. A_3L/A_4L	1.10±0.04	15	1.09±0.05	19	1.05±0.03	8
11. A_6L/A_3L	1.18±0.04	15	1.26±0.05	19	1.25±0.04	8
12. Pronotum W/L	1.30±0.06	14	1.27±0.05	17	1.39±0.06	9
13. No. of pronotal setae	46.5 ±3.1	13	42.8 ±3.7	15	32.6 ±2.3	8
14. Fore wing L/W	14.97±0.92	6	—		—	
15. No. of costal setae on fore wing	19.7 ±1.7	8	—		—	
16. No. of fore veinal setae on fore wing	11.2 ±0.8	9	—		—	
17. No. of hind veinal setae on fore wing	9.0 ±0.8	7	—		—	
18. No. of anterior FH on fore wing	19.9 ±1.5	9	—		—	
19. No. of posterior FH on fore wing	47.9 ±2.2	8	—		—	
20. No. of FH on hind wing	62.0 ±3.8	7	—		—	
21. $T_9L/T_{10}L$	1.03±0.08	11	0.92±0.06	15	0.90±0.03	8
22. T_9B_1/T_9L	1.31±0.06	12	1.29±0.08	18	0.79±0.05	7
23. T_9B_2/T_9L	1.40±0.07	13	1.40±0.06	16	0.94±0.06	7
24. T_9B_3/T_9L	1.27±0.07	11	1.27±0.07	15	0.91±0.05	7
25. T_9B_1/pronotal L	0.78±0.04	14	0.75±0.03	16	0.43±0.03	6
26. $T_{10}B_1/T_{10}L$	1.15±0.07	11	1.07±0.08	15	0.60±0.01	6
27. $T_{10}B_2/T_{10}L$	1.06±0.13	12	0.97±0.08	15	0.73±0.07	8
28. Ovipositor L/pronotal L	1.73±0.06	14	1.72±0.06	17	1.52±0.07	8

* Macro- and brachypterous forms combined.

while in the brachypterous form it is never dark brown, becoming at most brownish on the strongly chitinized portions.

Anaphothrips asahi n. sp.

(Fig. 5)

♀ (Bachypterous). Uniformly yellow including legs; major body setae hyaline to yellow. A_1 and A_2 yellow; A_3 and A_4 brownish yellow; A_5 brown but paler

basally; A_0–A_8 dark brown.

Head (Fig. 5.1) W/L 1.11–1.24; with some transverse striae postward of POS; ocelli absent, occasionally hind ocelli weakly present; POS B_1 slightly anterior to the rest. Antenna (Fig. 5.2) 8-segmented, twice as long as head; A_3 L/W 2.00–

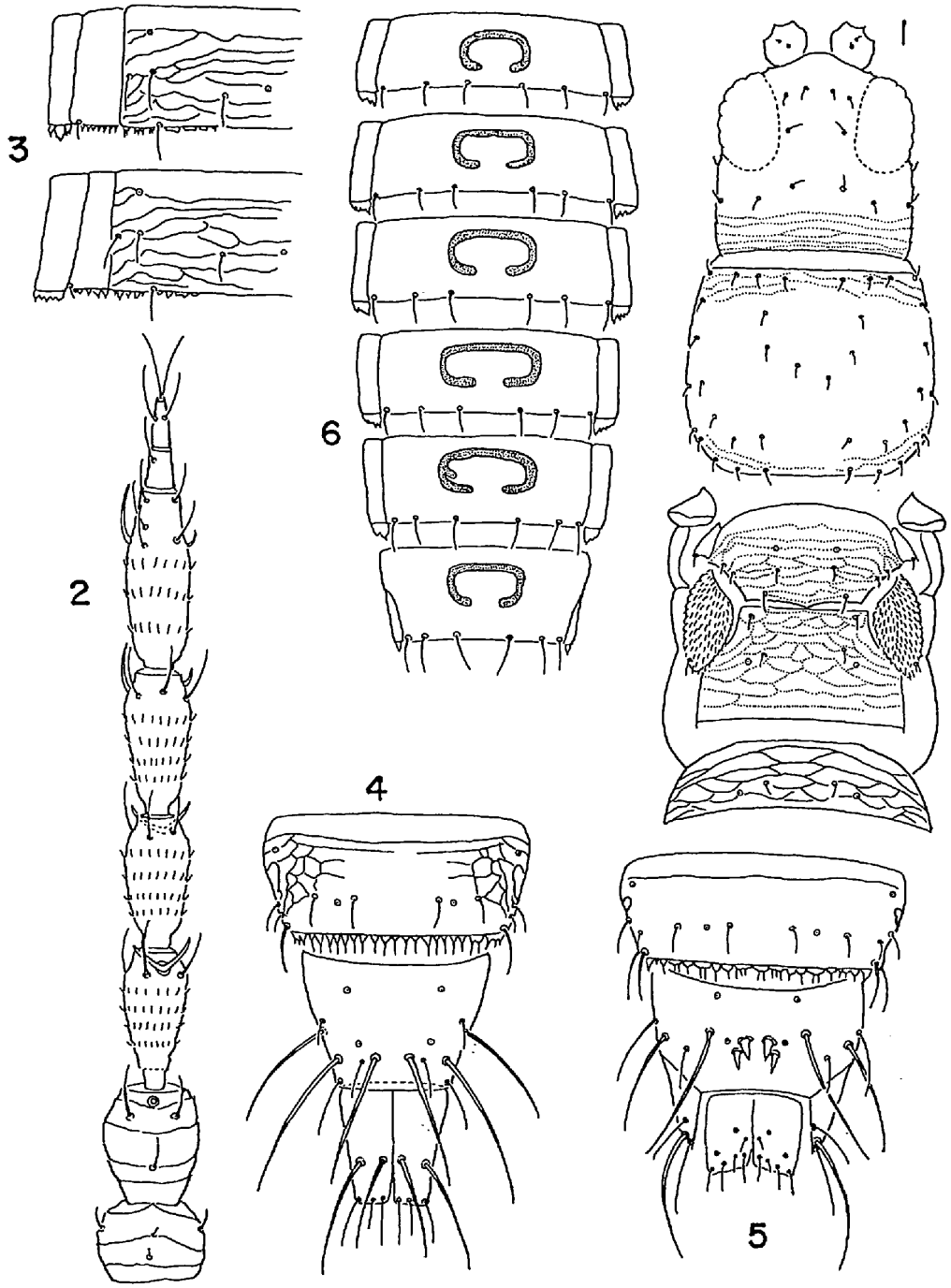

Fig. 5. *Anaphothrips asahi* n. sp., 1, ♀, head, thorax and T_1; 2, ♀, antenna; 3, ♀, part of T_3 and T_4; 4, ♀, T_8–T_{10}; 5, ♂, T_8–T_{10}; 6, ♂, S_3–S_8.

2.36; A_4 L/W 1.94–2.17, subequal to A_5 in length; A_5 L/W 1.89–2.24; A_6 longest, L/W 2.50–3.19, without secondary suture, with 8–9 setae, short but distinctly pedicellate; A_3L/A_4L 1.00–1.17; A_6L/A_3L 1.15–1.33; A_7 L/W 1.00–1.47; A_8 L/W 2.60–3.00; A_3–A_5 with 4 microtrichia rows, A_6 with 3 rows.

Pronotum (Fig. 5.1) W/L 1.20–1.35; almost unsculptured; with 36–48 setae in all. Mesoscutum with weak, transverse striae. Metanotum (Fig. 5.1) with transversely anastomosing striae; with CPS and median setae at about middle; mesosternum with 26–33 setae, metasternum with 14–18.

Abdominal terga with weak and transversely anastomosing striae, occasionally very weak but never smooth; T_2–T_7 (Fig. 5.3) with serrations at lateral fifth of posterior margin; T_8 (Fig. 5.4) with complete comb of microtrichia, mostly separated from others at base but occasionally fused; $T_9L/T_{10}L$ 0.79–1.03; B_1–B_3 on T_9 each 1.14–1.45 times, 1.29–1.52 times and 1.16–1.39 times as long as T_9; B_1 on T_9 0.68–0.80 times as long as pronotum; B_1–B_2 on T_{10} each 0.94–1.22 times and 0.83–1.10 times as long as T_{10}. Ovipositor 1.64–1.84 times as long as pronotum.

Measurements (μm). Body L 1.2–1.45 mm. Head L 105–115, W 123–133; pronotum L 121–138, W 153–178; T_9 L 71–82; B_1–B_3 on T_9 each 90–108, 100–116, 85–100; T_{10} L 74–90; B_1–B_2 on T_{10} each 80–93, 75–90; ovipositor L 205–235. Antenna 223–243 in total L; antennal segments as follows:

Segment	1	2	3	4	5	6	7	8
L	18–20	29–31	37–42	34–38	35–39	47–51	8–10	12–15
W	25–29	24–26	17–20	17–18	17–18	16–19	7–8	5–6

♀ (Macropterous): Colored as in brachypterous form. Fore wing L/W 13.0; costa with 16–17 setae, these at middle of wing about 0.47 times as long as wing W; fore vein with 3–4 basal and 2 apical setae, hind wing with 4–5; scale with 5 anal setae.

♂ (Brachypterous). Colored as in female. A_6 with 8 setae; T_9 (Fig. 5.5) with 2 pairs of spine-like setae, B_2 1.2–1.3 times and MD 1.0–1.1 times as long as T_9; S_3–S_8 (Fig. 5.6) with C-shaped glandular area. Body L 1.0–1.1 mm.

Specimens examined. Holotype: ♀ brachyptera (grass), Shizuoka-ken, Shizuoka, Nihondaira, V 23, 1979. Paratypes: Saitama-ken: 3 ♀ (grass), Arakawa, Shiroku, VIII 29, 1977. Shizuoka-ken: 11 ♀ 2 ♂ (grass), XI 5, 1970, 1 ♂ (*Phragmites* sp.), VII 28, 1975, 1 ♀ (grass), V 23, 1979, Shizuoka, Nihondaira. Kagawa-ken: 21 ♀ 2 ♂ (grass), Takamatsu, Goshikidai, XI 6, 1977. Kôchi-ken: 1 ♀ (*Lophatherum gracile*), Kôchi, Godaisan, IX 25, 1975. Tokushima-ken: 11 ♀ 4 ♂ (*Arthraxon hispidus*), Itchiu, IX 24, 1975. Saga-ken: 11 ♀ 2 ♂ (grass), Yamato, Kawakami, X 20, 1977. Kumamoto-ken: 4 ♀ 3 ♂ (grass), Kumamoto, Tatsutayama, X 23, 1977. Ôita-ken: 3 ♀ (*Miscanthus sinensis*), Ôta, Futagoji, IV 30, 1976. All specimens brachypterous except 1 ♀.

Host plants. Gramineae: *Arthraxon hispidus* (THUNB.) MAKINO, *Lophatherum gracile* BRONGN., *Miscanthus sinensis* ANDERSS., *Phragmites* sp., unidentified species.

Distribution. Honshu: Saitama, Shizuoka. Shikoku: Kagawa, Tokushima, Kôchi. Kyushu: Saga, Ôita, Kumamoto.

Remarks. *Anaphothrips asahi* may be closest to *A. floralis* KARNY from Vietnam, but differs from the latter in A_6 with 8–9 setae (vs. 12 setae), the metanotum with CPS (vs. without them), longer major setae on T_9 of the female, and both sexes being mostly brachypterous (vs. macropterous).

Key to Japanese Species

1. Antenna (Fig. 1.2) 9-segmented, A_6 with complete or incomplete secondary suture. Male, if known, with small circular glandular areas (Fig. 3.7).... 2
— Antenna (Fig. 4.2) 8-segmented, A_6 not divided. Male with C-shaped glandular areas (Fig. 4.5)..... 4
2. Uniformly dark brown, A_3, A_4 and tarsi paler. Abdominal terga unsculptured medially. Ovipositor more than twice as long as pronotum. Always macropterous. .....*A. badius* (WILLIAMS)
— Yellow, occasionally with brown blotches but never uniformly brown. Abdominal terga with transversely anastomosing striae nearly throughout. Ovipositor less than twice as long as pronotum. Macro- or brachypterous. 3
3. Metascutum with a pair of CPS. Serrations almost absent at posterior margin of abdominal terga (Fig. 2.6). Male unknown. ....*A. obscurus* (MÜLLER)
— Metascutum without CPS. Serrations distinct laterad of B_2 at posterior margin of abdominal terga (Fig. 3.4). Both sexes known. ..*A. ponokikirmui* n. sp.
4. Distinctly bicolored with brown and yellow; abdominal segments III–V yellow in macropterous form, pterothorax also yellow in brachypterous form. Major setae on abdominal segments VIII–X brown. Abdominal terga unsculptured medially. .....*A. sudanensis* TRYBOM
— Uniformly yellow including major body setae. Abdominal terga with transversely anastomosing striae throughout, never smooth medially. .... *A. asahi* n. sp.

Apterothrips BAGNALL

Apterothrips BAGNALL, 1908, Trans. nat. Hist. Soc. Northunb. Newcatsle-on-Tyne, (N.S.), **3**: 185.

Head wider than long; with 2 pairs of AOS; ocelli absent; mouth cone moderately long, broadly rounded apically; maxillary palpus 3-segmented. Antenna 9-segmented, A_6 with complete or incomplete secondary suture; A_3–A_6 distinctly pedicellate; A_3 and A_4 with simple sense cone at outer side; A_3–A_5 respectively with 5, 4, 6 setae.

Pronotum without major setae; furcasternum entire. Mesonotum without

anterior CPS; metanotum without CPS; meso- and metasternum without spinula; mesosternum undivided. Wings absent. Tarsi 2-segmented.

Abdominal segments with flanges at posterior margins; T_8 without comb of microtrichia; T_{10} completely divided by a longitudinal suture; setal formula being 4+1m+1+1m, the last one on pleurite; lateroterga separated from terga; sterna without accessory setae. Male with 2 pairs of spine-like setae on T_9.

Apterothrips has been occasionally regarded as being synonymous with *Anaphothrips*. It is, however, separable from the latter by the presence of postero-marginal flanges on the abdomen (vs. absence) and the intermediate terga of the abdomen with 7 pairs of setae (vs. 6 pairs).

Apterothrips secticornis (TRYBOM)

(Fig. 6)

Thrips secticornis TRYBOM, 1896, Öfv. k. vetensk.-Akad. Förh., **53**: 620.

♀ (Apterous). Uniformly dark brown including legs and antenna; A_3 occasionally slightly paler with yellowish pedicel; tarsi and apical third of tibiae usually brown to yellowish brown; major setae dark brown.

Head (Fig. 6.1) W/L 1.15–1.28; with transversely anastomosing striae, partly reticles; anteriorly rounded between eyes; cheeks weakly serrated; IOS 0.45–0.50 times as long as eye; 3 pairs of POS in a transverse row. Antenna (Fig. 6.2) 2.0–2.1 times as long as head; A_3 L/W 1.73–1.90; A_4 L/W 1.61–1.78, longer than A_5; A_5 L/W 1.47–1.60; A_6 longest, L/W 2.13–2.27; A_3L/A_4L 1.00–1.11; A_6L/A_3L 1.20–1.31; A_7 L/W 0.91–1.09; A_8 L/W 2.71–3.33; A_3 and A_5 with 2 microtrichia rows, A_4 with 3 rows, A_6 with 3–4 rows.

Pronotum (Fig. 6.1) W/L 1.32–1.50, nearly unsculptured; with 30–36 setae in all; PMS B_1 and B_4 slightly longer than the rest. Pterothorax (Fig. 6.1) broad; meso- and metanotum with transversely anastomosing striae; mesonotum with 7 pairs of setae, metanotum with 10 pairs; mesosternum with 12–15 setae, metasternum with 8.

Abdomen very broad about 1.5 times as wide as metathorax; each tergum (Fig. 6.4) with deep flange at posterior margin; sterna (Fig. 6.6) also each with deeply separated flange between marginal setae; B_1 and B_2 on T_1–T_8 developed, 0.4–0.5 times as long as respective tergum; median CPS placed at posterior margin; $T_9L/T_{10}L$ 0.84–0.94; B_1–B_3 on T_9 each 0.71–0.86 times, 0.84–1.08 times and 0.84–0.97 times as long as T_9; B_1 on T_9 0.40–0.47 times as long as pronotum; B_1–B_2 on T_{10} each 0.58–0.62 times and 0.62–0.82 times as long as T_{10}. Sterna with all primary setae at posterior margin; ovipositor 1.41–1.63 times as long as pronotum.

Measurements (μm). Body L 1.2–1.4 mm. Head L 113–125, W 143–1,50; pronotum L 137–145, W 189–205; T_9L 70–82; B_1–B_3 on T_9 each 55–61, 65–77, 65–73; T_{10} L 80–93; B_1–B_2 on T_{10} each 48–55, 51–65; ovipositor L 205–217. Antenna 246–

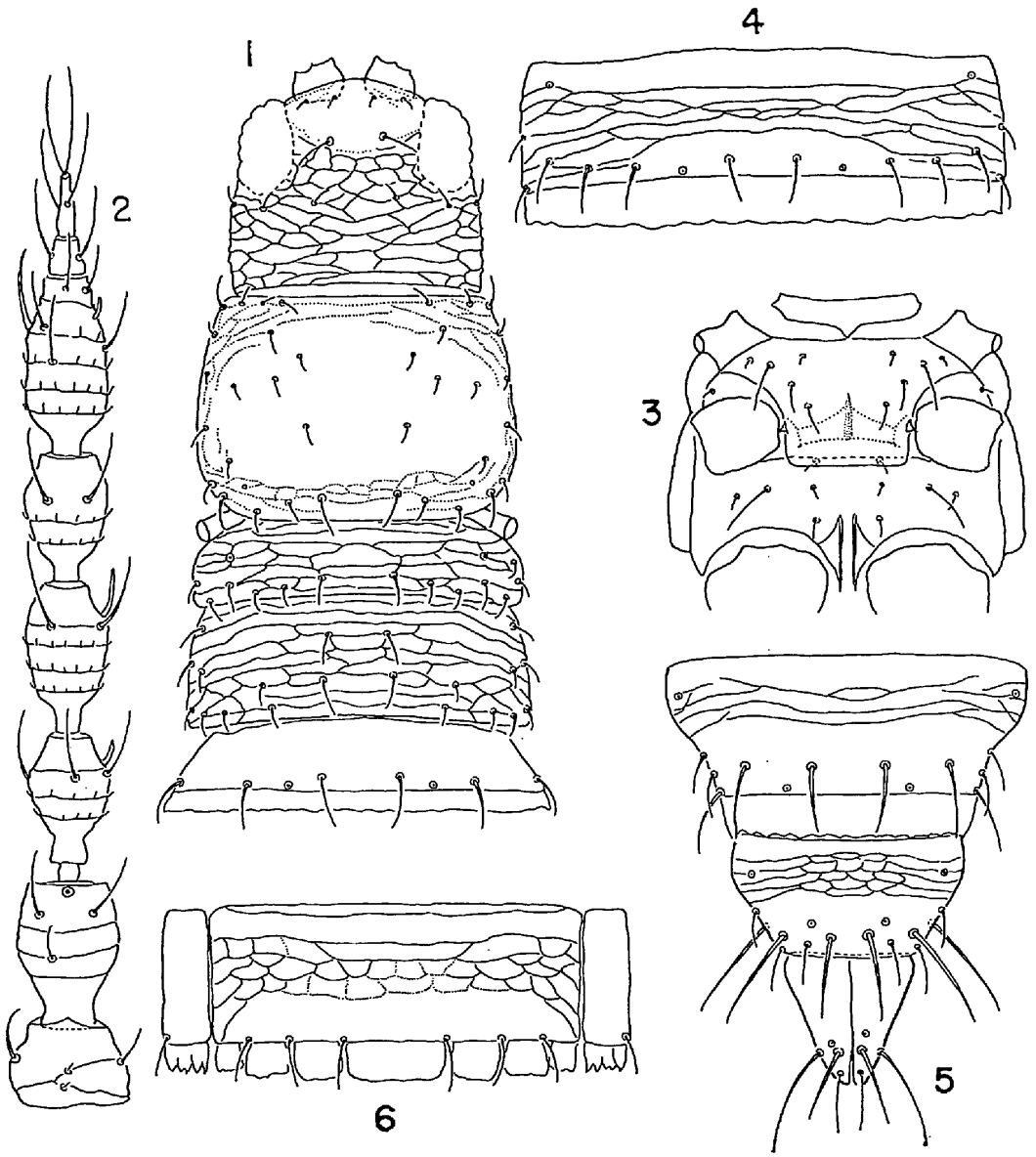

Fig. 6. *Apterothrips secticornis* (TRYBOM), ♀, 1, Head, thorax and T_1; 2, antenna; 3, meso- and metanotum; 4, T_5; 5, T_8–T_{10}; 6, S_5.

260 in total L; antennal segments as follows:

Segment	1	2	3	4	5	6	7	8
L	22–23	38–40	38–40	37–40	33–37	48–51	10–11	18–20
W	30–33	29–30	21–23	22–23	22–23	22–23	11–12	6–7

♂ (Apterous). Still undiscovered from Japan.

Specimens examined. Nagano-ken: 10 ♀ (grass), Mt. Kisokomagatake (2,900 m, alpine zone), VII 27, 1977.

Host plant. Gramineae: unidentified species.

Distribution. Honshu: Nagano. Palearctic: Iceland, England, Sweden, Finland, Italy, Austria, Switzerland, Rumania, USSR (Russia, Ukraina, Gruzia, Siberia). Nearctic: Greenland, Canada, the United States. Australia: Hawaii, New Zealand. Neotropical: Chile, Argentina, Falkland Is., Easter Is., Juan Fernandez Is., South Georgia Is.

Remarks. *Apterothrips secticornis* is widely but rather patchwise distributed in the Holarctic, Australian and Neotropical Regions including islands and high mountains.

Acknowledgments

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