

TUBEROCEPHALUS (HEMIPTERA: APHIDIDAE) FROM CHINA WITH DESCRIPTION OF A NEW SPECIES

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ABSTRACT. The aphid genus *Tuberocephalus* Shinji from China reviewed with 11 species, including a new species, *T. tuberculus*, sp. nov., and a new record, *T. artemisiae* Shinji. *T. tianmushanensis* Zhang is re-described. Hitherto unknown fundatrix and autumn morph, gynopara and oviparous female of *T. momonis* (Matsumura) described, with salient biological notes. Keys to known species also provided. Voucher specimens including types deposited with the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

Key words: *Tuberocephalus*, Aphididae, new species, new record, key to species, China

Introduction

Shinji (1929) erected the genus *Tuberocephalus* with *Tuberocephalus artemisiae* Shinji as its type species. Shinji (1929) proposed *Trichosiphoniella* for *Aphis spinosula* Essig & Kuwana, 1918, which was regarded as synonymous with *T. sakurae* (Matsumura). Subsequently, Shinji (1929) defined *Trichosiphoniella* as a subgenus of *Tuberocephalus*. Thus, currently, there are two subgenera including *Tuberocephalus* s.str. Except for the review by Sorin and Remaudière (1998), studies on its taxonomy are limited.

This genus belongs to the subfamily Aphidinae, it has 12 species and a subspecies from South East Asia, namely, China, Japan, Korea, Malaysia, Pakistan, India and Eastern Russia (Remaudière & Remaudière, 1997; Sorin & Remaudière, 1998). But, from China, the study on the genus had been limited to descriptions of few new species (Chang & Zhong, 1976; Zhang & Zhong, 1983; Zhang, 1999). Recently surveys had been done in the south and southwest regions in China, and the genus reviewed. These findings along with a new species, *T. tuberculus*, sp. nov., a new record for China viz., *T. artemisiae* Shinji, and redescription of *T. tianmushanensis* Zhang are presented herein. Key to species from China also provided.

Material and Methods

Terminology followed is after Heie (1994) and Qiao (2004); units of measurements given in mm. The following abbreviations used: Ant. I, Ant. II, Ant. III, Ant. IV, V and VI, antennal segments I, II, III, IV, V and VI, respectively; Ant. Vb or VIb, base of the terminal segment V or VI; PT, processus terminalis; b.d.III, basal diameter of antennal segment III; URS, ultimate rostral segment; BW URS, basal width of ultimate rostral segment; MW hindtibia, middle diameter of hindtibia; H.t.II, second hindtarsal segment; SIPH, siphunculus; BW SIPH, basal width of siphunculus; DW SIPH, distal width of siphunculus; BW Cauda, basal width of cauda. Voucher specimens including types deposited with the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

Genus *Tuberocephalus* Shinji

Tuberocephalus Shinji, 1929: 39. Type species *Tuberocephalus artemisiae* Shinji, 1929, by original designation.

Akkaiopsis Zhang *et al.*, 1999: 345. Type-species *Akkaiopsis boschophaga* Zhang, 1999.

Heterogenaphis Ivanovskaja-Shubina, 1966: 18. Type-species *Heterogenaphis kunashyri* Ivanovskaja-Shubina, 1966

Trichosiphoniella Shinji, 1929: 46. Type-species *Aphis spinosula* Essig et Kuwana, 1918)= *Myzus sakurae* Matsumura, 1917.

Trichosiphoniella Shinji, 1930: 188. Type-species *Aphis spinosula* Essig et Kuwana, 1918)= *Myzus sakurae* Matsumura, 1917.

Diagnosis: Fundatrices with 4 or 5 segmented antennae, siphunculus present or absent, and with or without a small flange; apterae, dorsum of head with spinules either sparse or dense, antennal tubercles finger shaped or round, frontal tubercle indistinct or prominent, antennae 5 or 6 segmented, imbricated, shorter than body, without secondary rhinaria; alatae with secondary rhinaria on antennal segments III, IV or V. Rostrum short, at most reaching between middle and hindcoxae; apical rostral segment shorter or longer than second hindtarsal segment. Legs with indistinct or distinct imbrications. First tarsal chaetotaxy: 3, 3, 2 or 3. Siphunculus cylindrical, with its apex gradually tapering, imbricated, with or without setae. Cauda usually triangular with 4-6 setae. Alatae with antennal tubercles gibbous, not very high, and often with spino-pleural bands on abdominal tergites. Wings with veins normal.

Comments: Two subgenera of *Tuberocephalus* are distinct in the apterous alienicolae with *Phorodon*-like head in species inhabiting leaves of *Artemisia*, and with *Myzus*-like head in those inhabiting the subterranean young shoots or roots of *Artemisia* or *Chrysanthemum*; *Tuberocephalus* can be distinguished from *Phorodon* in the absence of tri-ommatidium, position of the projections on antennal segment I, and in the nature of siphuncular imbrications; it differs from *Myzus* by the ratio of the antennae to body length, and siphunculus with setae.

Diagnosis: Fundatrices with 4 or 5 segmented antennae, siphunculus present or absent, and with or without a small flange; apterae, dorsum of head with spinules either sparse or dense, antennal tubercles finger shaped or round, frontal tubercle indistinct or prominent, antennae 5 or 6 segmented, imbricated, shorter than body, without secondary rhinaria; alatae with secondary rhinaria on antennal segments III, IV or V. Rostrum short, at most reaching between middle and hindcoxae; apical rostral segment shorter or longer than second hindtarsal segment. Legs with indistinct or distinct imbrications. First tarsal chaetotaxy: 3, 3, 2 or 3. Siphunculus cylindrical, with its apex gradually tapering, imbricated, with or without setae. Cauda usually triangular with 4-6 setae. Alatae with antennal tubercles gibbous, not very high, and often with spino-pleural bands on abdominal tergites. Wings with veins normal.

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of siphuncular imbrications; it differs from *Myzus* by the ratio of the antennae to body length, and siphunculus with setae.

Key to subgenera of *Tuberocephalus* Shinji

1. Fundatrix with antennae 4 segmented; in Alienicolae, head *Phorodon* like (Figs.1a,2a); all forms with short rostrum (Figs. 1c,2c), apical rostral segment 1.19x (0.78-1.60x) as long as second hind tarsal segment; siphunculus with flange normal (Figs.1e,2e)..... *Tuberocephalus* Shinji
Fundatrix with antennae 5 segmented; in fundatrigeniae, head *Myzus* like (Figs.4a,7a,9a,10a); all forms with a apical rostral segment longer, 1.40x (1.20-1.60x) as long as second hind tarsal segment (Figs.4c,7c,9c,10c); siphunculus with a huge flange (Figs. 4e,7e, 9e,10e)..... *Trichosiphoniella* Shinji

Subgenus *Tuberocephalus* Shinji s.str.

Tuberocephalus Shinji, 1929: 39. Type species *Tuberocephalus artemisiae* Shinji, 1929.

Akkaiopsis Zhang, Chen, Zhong & Li, 1999: 345. Type species *Akkaiopsis boschophaga* Zhang, 1999.

Heterogenaphis Ivanovskaya-Shubina, 1966: 18. Type species *Heterogenaphis kunashyri* Ivanovskaja-Shubina, 1966.

This subgenus includes 4 species. One is a new record from China. Their primary hosts are members of the Rosaceae and secondary hosts species of *Artemisia* spp.

A. Key to species of the subgenus *Tuberocephalus* - Alienicola

1. Antennae 5 segmented, 0.30x as long as body; abdominal tergites strongly C-, O-shaped or irregularly wrinkled; finger like projections on antennal tubercles longer (Fig.1a), 3x or more as long as their diameter.....*T. artemisiae* Shinji
Antennae 5- or 6-segmented, 0.64x as long as body, abdominal tergites hardly wrinkled or sculptured; finger-like projections on antennal tubercles slightly shorter (Fig. 2a), less than 2x of their diameter.....*T. sasakii* (Matsumura)

B. Descriptions of species

1. *Tuberocephalus artemisiae* Shinji; new record from China (Fig. 1)

Tuberocephalus artemisiae Shinji, 1929:40; 1930:190.

Comments: *T. artemisiae* recognized as type species for the first time, on primary host *Cerasus* sp. and secondary hosts *Artemisia* spp..

Specimens examined: 1 apterous viviparous ♀, 19.viii.2004, No.15606-2-1, CHINA: Guizhou Province: Daozhen County, E107.55°, N29.17°, 1360m, on *Artemisia argyi*, J.Y. Yang; 4 alate viviparous ♀, 23.v.2007, CHINA: Hunan Province: Hengshan Mountain, No. Y8875 (2 slides), on *Cerasus* sp. F.M. Shi.

Distribution: China (Guizhou, Hunan); Japan and Eastern Russia.

Hosts: Primary hosts: *Cerasus* sp.; *Prunus donarium* var. *spontanea* subvar. *speciosa* and *P. yedoensis* (Sorin & Remaudière, 1998); secondary hosts: *Artemisia argyi*; *Artemisia montana* and *Artemisia Princeps* (Miyazaki, 1971); *Artemisia vulgaris* var. *indica* and *Artemisia* sp. (Sorin & Remaudière, 1998).

Biology: The aphid infests underside of leaves of *Artemisia* spp., sometimes makes them curl up. The heavy infested plants often become sooty as a result of the black mold (Miyazaki, 1971). The galls are bag- or horse bean-shaped, 27-30 mm long, and with single cell. Adult fundatrices appear in May. Fundatrigeniae all become alate viviparous female and move to secondary hosts. Heteroecious holocyclic, with sexual phase and galls on *Prunus* spp. and *Cerasus* sp..

2. *Tuberocephalus sasakii* (Matsumura) (Fig. 2)

Akkaiopsis boschophaga Zhang, Chen, Zhong & Li, 1999: 345.

Heterogenaphis kunashyri Ivanovskaja-Shubina, 1966: 18.

Myzus sasakii Matsumura, 1917: 404.

Myzus tsengi Tao, 1963: 173.

Specimens examined: 1 apterous viviparous ♀ and 2 apterous nymphs, 11.xi.1988, CHINA: Hunan Province: Dayong County, No. 8939-2-1, on *Artemisia argyi*, Coll. T.S. Zhong and W.Y. Zhang; 1 apterous viviparous ♀, 2 alate viviparous ♀ and 1 alatoid nymph, 30.x.1978, CHINA: Sichuan Province, No. Y1557-2-1, on *Artemisia argyi*, Coll. K.F. Zheng; 1 apterous viviparous ♀, 11.viii.1986, Qinghai Province: Datong County: Niangniang Mountain, No. 8649-1-1, host plant unknown, Coll. G.X. Zhang and T.S. Zhong.

Distribution: China (Hunan, Qinghai, Sichuan, Taiwan); India, Indonesia; Japan; Korea; Kuril islands and Russia.

Hosts: Primary hosts: *Prunus donarium* and *Prunus* spp. (Miyazaki, 1971); secondary hosts: *Artemisia argyi*; *Artemisia capillaris*, *Artemisia vulgaris* var. *indica*, and *Artemisia* spp. (Sorin & Remaudière, 1998); and *Artemisia princeps* (Miyazaki, 1971).

Biology: Apterous viviparous females infest under surface of leaves or young shoots of *Artemisia* spp.; fundatrix form bag-shaped galls on the upper surface of the leaves along the lateral veins in the primary hosts, and galls are very similar to those in *T. artemisiae* (Sorin & Remaudière, 1998). Heteroecious holocyclic (Blackman & Eastop, 2006).

Subgenus *Trichosiphoniella* Shinji

Trichosiphoniella Shinji, 1929:46. Type species *Aphis spinosula* Essig & Kuwana, 1918: 77.

Tuberocephalus (*Trichosiphoniella*) Shinji: Hille Ris Lambers, 1965:197; Miyazaki, 1971: 102.

The subgenus has 9 species, distributed in China, Eastern Russia, India, Japan, Korea and Malaysia from Rosaceae as primary hosts and *Artemisia* spp. and *Chrysanthemum* spp. as secondary hosts, including a new species from China (Sichuan) described herein.

T. higansakurae hainnevilleae Remaudière and Sorin should be a junior synonym of *T. tianmushanensis* Zhang.

A. Keys to species of the subgenus *Trichosiphoniella* Shinji –

i. Based on Fundatrix (unknown in *T. jinxiensis*, *T. lazikouensis* & *T. misakurae*)

1. Some spinal and pleural setae on abdominal tergites I-VI with conspicuous tuberculate bases (Fig. 15g)..... *T. tuberculus*, sp. nov.
Without characters mentioned above.....2
2. Abdominal tergites pale or faint brown, membranous and smooth; apical rostral segment 1.00-1.40x as long as second hind tarsal segment; siphunculus with 1-3 setae.....3
Abdominal tergites brown, with transverse spinulose stripes.....4
3. Abdominal tergites faint brown (Fig. 11E); apical rostral segment 1.08-1.24x as long as second hind tarsal segment; antennae 0.25-0.28x as long as body length*T. momonis*
Abdominal tergites pale, ultimate rostral segment 1.30-1.40 times as long as second hind tarsal segment; antennae 0.63x as long as body length.....*T. higansakurae*
4. Pronotum with brown transverse band and meso- and metanotum with a pair of pleural sclerites (Fig. 13A); antennae 0.27-0.32x as long as body, processus terminalis 0.91-1.29x as long as base of the terminal segment...*T. tianmushanensis*
Antennae at least 0.40x as long as body5
5. Antennae 0.67x as long as body; hind femora spinulose, imbricated.*T. sakurae*
Antennae 0.50x as long as body; hind femora smooth.....*T. liaoningensis*

ii. Based on apterous viviparous female (Fundatrigenia)

(unknown in *T. higansakurae*, *T. misakurae* & *T. tianmushanensis*)

1. Dorsum of abdomen pigmented; dorsal setae on head distinctly longer than basal diameter of antennal segment III.....2
Dorsum of abdomen pale; dorsal setae on head as long as or shorter than basal diameter of antennal segment III.....3
2. Antennae 0.60-0.73x as long as body; hind femora with spinules.....*T. sakurae*
Antennae 0.40-0.57x as long as body; hind femora smooth or with indistinct spinules.....*T. liaoningensis*
3. Tibiae of adults with some spinulose imbrications.....*T. momonis*
Tibiae of adults smooth or slightly wrinkled.....*T. jinxiensis*

iii. Alate viviparous female (Emigrant)

(*T. momonis* is spring morph; unknown in *T. jinxiensis*,
T. lazikouensis & *T. misakurae*)

1. Rostrum slightly long, apical rostral segment 1.40x (1.32-1.47x) as long as second hind tarsal segment; second hind tarsal segment longer than 0.10 mm; spinal patches on abdominal tergites III-V fused to a dorsal patch; antennal segments III

- and IV with 17-37 and 2-8 secondary rhinaria, respectively, V without secondary rhinaria*T. liaoningensis*
 Rostrum short, apical rostral segment 1.30x (1.20-1.40x) as long as second hind tarsal segment; second hind tarsal segment shorter than 0.10 mm; abdominal tergites pale, with brown bands, or large dorsal patch2
2. Dorsal setae on head 1.10-1.30x as long as basal diameter of antennal segment III; spinal and pleural patches on abdominal tergites III-V fused to a big patch; siphunculus with 0-3 setae*T. sakurae*
 Dorsal setae on head 0.80-0.90x as long as basal diameter of antennal segment III; siphunculus with 4-7 setae (rarely 0-2) abdominal tergites pale or tergites III-V each with a brown band3
3. Abdomen pale, without big dorsal patch, sometimes with narrow or indistinct spinal bands on tergites III-V; siphunculus with developed flange.....*T. momonis*
 Abdominal tergites III-V each with a brown band, sometimes fused to a big dorsal patch interrupted by spinal or pleural windows.....4
4. Antennal segments III and IV with 34-57 and 12-22 secondary rhinaria, and V with 0-5, respectively; apical rostral segment 1.40-1.60x as long as second hind tarsal segment; siphunculus 0.12x as long as body.....*T. higansakuræ*
 Antennal segments III and IV with 24-31 and 5-9 secondary rhinaria, and V with 0-3, respectively, ultimate rostral segment 1.14-1.46x as long as second hind tarsal segment, siphunculus 0.08-0.10x as long as body.....*T. tianmushanensis*

Comments: *T. lazikouensis* is only known by alienicola, and *T. misakuræ* only by alate gynopara on secondary host (Eastop & Blackman, 2005); both morphs of other species are unknown on secondary host in China, so, *T. lazikouensis* and *T. misakuræ* not included in the keys.

B. Descriptions of species

1. *Tuberocephalus (Trichosiphoniella) higansakuræ* (Monzen) (Fig. 3)

Myzus higansakuræ Monzen, 1927: 2.

Myzus higansakuræ Monzen: Monzen, 1929: 59;

Trichosiphoniella momonis: Hille Ris Lambers, 1965: 198.

Specimens examined: 4 fundatrices and 4 alate viviparous ♀, CHINA: Beijing City, 8.v.1976, No. 6220 (2 slides), on *Cerasus pseudocerasus*, Coll. G.X. Zhang and T.S. Zhong; 1 fundatrix and 5 alatoid nymphs, 14.vi.1997, CHINA: Qinghai Province: Tongren County, No. 11425-1(-1-2), on *Amygdalus triloba*, Coll. X.L. Chen; 3 fundatrices, 20.iv.2005, CHINA: Sichuan Province: Miyi County, No. 17180-1-1, on a kind of plant of Rosaceae, Coll. X.L. Huang; 1 fundatrix and 2 alate viviparous ♀, 2.vi.2005, CHINA: Guizhou Province: Leigongshan Mountain, No. 16239-1-1, on *Cerasus pseudocerasus*, Coll. Y. Fang; 4 fundatrices, 1.iv.2005, CHINA: Sichuan Province: Yanbian County, No. 17059-1-1, host plant unknown, Coll. X.L. Huang; 2 nymphs, 3.v.2005, CHINA: Sichuan Province: Meigu County, No. 17250-1-1, on a kind of plant of Rosaceae, Coll. X.L. Huang,

Distribution: China (Anhui, Beijing, Hebei, Henan, Guizhou, Qinghai, Shaanxi, Shandong, Sichuan) and Japan.

Hosts: Primary hosts: *Amygdalus triloba*, *Cerasus pseudocerasus*; *Prunus itosakura* and *Prunus* sp. (Sorin & Remaudière, 1998); secondary hosts: *Artemisia vulgaris* var. *indica* (Sorin & Remaudière, 1998).

Biology: The fundatrix forms a bag shaped pseudo-gall on the under surface of the leaves of the primary hosts along the lateral vein, about 20-40 mm long and 5-7 mm wide, green and gradually turn red between April and May. In the middle of May, alatae emigrate to secondary hosts. Alienicolae infest subterranean young shoots of secondary hosts. Alate gynoparae appear on the under surface of cherry in late October and give birth to oviparous females, females mate with alate males, and lay eggs by late October (Chang & Zhong, 1976).

2. *Tuberocephalus (Trichosiphoniella) jinxiensis* Chang & Zhong (Fig. 4)

Tuberocephalus jinxiensis Chang & Zhong, 1976: 75

Specimens examined: Holotype: apterous fundatrigenia, 20.vi.1957, CHINA: Liaoning Province: Jinxi City, No. 783-1-1, on *Prunus humilis*, Coll. G.X. Meng; *paratypes:* 5 apterous fundatrigeniae, with same data as holotype; 22.v.2007, CHINA: Liaoning Province: Huanren County, No. 20143 (2 slides), on a kind of plant of Rosaceae, Coll. X.L. Huang; 13 apterous fundatrigeniae, 29.v.1973, CHINA: Beijing, No. 5198 (2 slides), on *Prunus humilis*, coll. Y.F. Han; 5 apterous fundatrigeniae, 27.vi.1985, CHINA: Hebei Province: Chicheng County, No. Y5895-2, on *Prunus humilis*, Coll. S.B. Tian; 1 apterous fundatrigenia and 3 alatoid nymphs, 9.vii.1986, CHINA: Gansu Province: Min County, No. 8446 (2 slides), on *Prunus humilis*, Coll. G.X. Zhang.

Distribution: China: Beijing, Hebei, Gansu, Liaoning, and Yunnan.

Hosts: Primary host: *Prunus humilis*; secondary hosts unknown.

Biology: Apterous fundatrigeniae and alate viviparous females infest the barrel shaped pseudo-galls on the under surface of leaves of primary hosts along the lateral veins (Chang & Zhong, 1976).

3. *Tuberocephalus (Trichosiphoniella) lazikouensis* Zhang (Figs. 5, 6)

Tuberocephalus lazikouensis Zhang, 1999: 491.

Specimens examined: Holotype: apterous viviparous ♀ (alienicola), 15.vii.1986, CHINA: Gansu Province: Min County, No. 8472-1-1, on *Artemisia argyi*, Coll. G.X. Zhang; *paratypes:* 7 apterous alienicolae and 2 apterous nymphs, with same data as holotype; 4 apterous alienicolae, 23.vi.1999, CHINA: Shaanxi Province: Zhouzhi County, No. 12313 (2 slides), on *Artemisia argyi*, Coll. T.L. He; 5 apterous viviparous ♀, 3.v.2006, CHINA: Yunnan Province: Diqing Tibetan Autonomous Prefecture, No.18660 (2 slides), on *Artemisia* sp., Coll. X.L. Huang.

Distribution: China: Gansu, Shaanxi, Yunnan.

Hosts: Primary hosts unknown; secondary host: *Artemisia argyi*.

Biology: Individuals of the species colonize under surface of leaves.

4. *Tuberocephalus (Trichosiphoniella) liaoningensis* Chang & Zhong (Fig. 7)

Tuberocephalus liaoningensis Chang & Zhong, 1976:75.

Specimens examined: 29 apterous fundatrigeniae and 1 alate viviparous ♀ (syntypes), 22.vi.1957, CHINA: Jilin Province: Gongzhuling City, No. 725 (3 slides), on *Cerasus pseudocerasus*, Coll. G.X. Zhang and X.Z. Bao; 8 fundatrices, 25.iii.1982; Beijing City, No. 7380 (2 slides), on *Amygdalus triloba*, Coll. G.X. Zhang; 1 apterous fundatrigenia and 1 apterous nymph, 21.iv.2004; No. 13455-1-1, on *Prunus persica*, Coll. J.Y. Yang and L.Y. Jiang; 9 apterous fundatrigeniae, 29.iv.1978; No. 6684 (2 slides), on *Amygdalus triloba*, Coll. T.S. Zhong; 1 alate viviparous ♀, 13.v.1948; No. 638-1-1, on *Cerasus pseudocerasus*, host plants unknown; 1 alate viviparous ♀, 20.v.1983; Liaoning Province: Shenyang City, No. Y4708-1-1, host plant unknown, Coll. B.L. Zhang; 5 apterous fundatrigeniae and 20 alate viviparous ♀, 24.v.1972, CHINA: Beijing City, No. 5254 (5 slides), on *Amygdalus triloba*, Coll. C.L. Fang and B.L. Zhang; 7 apterous fundatrigeniae, 13.v.1973; Beijing City, No. 6306 (2 slides), on *Cerasus pseudocerasus*, Coll. G.X. Zhang; 1 apterous fundatrigenia, 6 alate viviparous ♀ and 2 alatioid nymphs, 28.v.1977; Jilin Province: Gongzhuling City, No. Y1358 (2 slides), on *Cerasus pseudocerasus*, Coll. X.Z. Bao; 2 apterous fundatrigeniae and 2 alate viviparous ♀, 30.v.1982, Liaoning Province: Shenyang City, No. Y3150-1-1, on *Cerasus pseudocerasus*, Coll. unknown; 2 apterous fundatrigeniae, 22.v.1983, Liaoning Province: Shenyang City, No. Y4646-1-1, on *Cerasus pseudocerasus*, Coll. F.G. He; 3 apterous nymphs, 15.v.1983, Liaoning Province: Dalian City, No. Y4706-1-1, on *Cerasus pseudocerasus*, Coll. L.J. Liu; 3 apterous fundatrigeniae, 16.v.1983, Liaoning Province: Xiongyue County, No. Y4739-1-1, on *Cerasus pseudocerasus*, Coll. L.J. Liu; 5 apterous fundatrigeniae, 16.v.1983, Liaoning Province: Xiongyue City, No. Y4739-1(-1-3), on *Cerasus pseudocerasus*, Coll. L.J. Liu; 8 apterous fundatrigeniae, 10.v.1983, Liaoning Province: Shenyang City, No. Y4692 (2 slides), on *Cerasus pseudocerasus*, Coll. F.G. He; 6 apterous nymphs, 4.v.2005, Sichuan Province: Meigu County, No. 17260 (2 slides), host plants unknown, Coll. X.L. Huang; 12 alate viviparous ♀ and 4 apterous fundatrigeniae, 12.vi.1977, Beijing City, No. 6559 (6 slides), on *Cerasus pseudocerasus*, Coll. T.S. Zhong; 25 apterous fundatrigeniae, 3.vi.1957, Jilin Province: Gongzhuling City, No. Y463 (2 slides), on *Cerasus pseudocerasus*, Coll. G.X. Zhang and X.Z. Bao; 1 apterous fundatrigenia, 22.vi.1958, Liaoning Province: Xingcheng City, No. 825-1-1, on *Cerasus pseudocerasus*, Coll. G.X. Meng; 3 apterous fundatrigeniae, 4.vi.1982, Liaoning Province: Shenyang City, No. Y3499-1(-1-1), on *Cerasus pseudocerasus*, Coll. B.L. Zhang; 1 alate viviparous ♀, 29.vi.1983, Liaoning Province: Shenyang City, No. Y4515-1-1, host plants unknown, Coll. F.G. He; 1 alate viviparous ♀, 29.vi.1983, Liaoning Province: Qianshan Mountain, No. Y4544-1-1, host plants unknown, Coll. F.G. He; 2 alate viviparous ♀, 30.vi.1983, Liaoning Province: Shenyang City, No. Y4502-1-1, host plants unknown, Coll. F.G. He; 2 apterous fundatrigeniae, 26.vi.1984, Liaoning Province: Benxi City, No. Y4928-1-1, on *Cerasus pseudocerasus*, Coll. G.X. Zhang and L.J. Liu.

Distribution: China (Beijing, Gansu, Jilin, Liaoning, Shandong, Sichuan) and Japan.

Hosts: Primary hosts: *Amygdalus triloba*, *Prunus pseudocerasus*; and *P. tomentosa* (Sorin & Remaudière, 1998); secondary hosts: *Artemisia vulgaris* var. *indica* (Sorin & Remaudière, 1998).

Biology: Fundatrices emerge in late March, or early April; aphids infest under surface sides of young leaves of cherry, heavy infestations lead to curling, and cause withering or death (Chang & Zhong, 1976). The emigrants appear in the middle of May and migrate to the secondary hosts. Alienicolae infest the subterranean young shoots of the secondary host (Sorin & Remaudière, 1998). Heteroecious holocyclic, with sexual phase and galls on *Prunus* spp. (Blackman & Eastop, 2006).

5. *Tuberocephalus (Trichosiphoniella) misakurae* Moritsu & Hamasaki (Fig. 8)

Tuberocephalus misakurae Moritsu & Hamasaki, 1983: 221.
Surcaudaphis supericauda Zhang, 1999: 487.

Specimens examined: 7 alate viviparous ♀ (gynoparae) and 2 alatoid nymphs, 4.ix.1986, CHINA: Gansu Province: Yuzhong County, No. 8671 (2 slides), on *Solanum tuberosum* (?), Coll. Y.Z. Zhang.

Distribution: China (Gansu) and Japan.

Hosts: Primary hosts: *Prunus pauciflora*, *P. takenakar*, and *Prunus* sp. (Moritsu & Hamasaki, 1983), *P. pseudocerasua* (Sorin & Remaudière, 1998); secondary hosts: *Chrysanthemum morifolium* var. *sinense*, *Chrysanthemum* sp. (Sorin & Remaudière, 1998) and *Solanum tuberosum* (?) (Zhang, 1999).

Biology: The eggs hibernate near the buds of *Prunus pauciflora* and *P. takenakae*, especially on *P. pauciflora*. Fundatrices hatch in late March and form a bag shape gall on the leaves. In the gall, the fundatrix produces fundatrigenia, but extremely rare. In the middle of May, alate fundatrigeniae migrate to secondary host plants (Moritsu & Hamasaki, 1983). Alienicolae feed on the thin lateral roots of host plants (*Chrysanthemum* spp.) (Sorin and Remaudière, 1998). Alate gynoparae infest the under surface of leaves *Solanum tuberosum* (?) (Zhang, 1999). In China and Japan, the alternation host plants is between *Prunus* and *Dendranthema* (Eastop & Blackman, 2006), and *Solanum tuberosum* may not be its true host.

6. *Tuberocephalus (Trichosiphoniella) momonis* (Matsumura) (Figs. 9, 11)

Myzus momonis Matsumura, 1917: 402.
Trichosiphoniella formosana Hille Ris Lambers, 1965: 198. .
Tuberocephalus longxishanensis Zhang, 1999: 651.

Only apterous fundatrigeniae and alate emigrants are known (Sorin & Remaudière, 1998); the description of the fundatrix, apterous viviparous female (autumn morph), gynopara, oviparous female and alate male given now.

Fundatrix: Body broadly oval, dark green when alive. Mounted specimens: Body pale brown (Fig. 11E). Body 2.11-2.17 mm long, 1.56 mm wide. Head dark brown, having spinules dorsally and ventrally, antennal tubercles low, diverging, frontal tubercle slightly prominent, frons conspicuous shallow W-shaped (Fig. 9g); with 1 pair of

cephalic setae, 1 pair of antennal tubercles' setae, and 4 pairs of dorsal setae. Eyes with distinct ocular tubercles. Antennae 5-segmented (Fig. 9h), segments I and II dark brown, with sparse imbrications, segments III-V pale brown, with imbrications, 0.25-0.28x as long as body, processus terminalis 0.97-1.05x as long as basal part of the segment VI. Primary rhinaria not ciliated, secondary rhinaria absent. Rostrum short, reaching between fore and middle coxae; apical rostral segment wedge-shaped, apex dark brown (Fig. 9i), 2.16-2.22x as long as its basal width, 1.08-1.24x as long as hind second tarsal segment, with 6 primary setae and 2 secondary setae.

Thorax smooth dorsally and ventrally. Spiracles small nephroid, spiracular plates dark brown and slightly prominent with dense spinules. Mesosternal furca with stems widely separated (Fig. 9j). Legs short, coxae, femora and the distal parts of tibiae with spinules. Hind femora 0.66-0.70x as long as antennae. Hind tibiae 0.24-0.25x as long as body. First tarsal chaetotaxy: 3, 3, 3.

Abdomen membranous, without reticulations. Dorsal setae of body fine and moderately long with acute apices. Ventral setae similar to dorsal. Siphunculus wholly dark brown, short cylindrical, with dense spinulose imbrications and distinct flange (Fig. 9k), with 1-2 setae, 0.07-0.08x as long as body, 1.71-1.81x as long as cauda. Cauda triangular (Fig. 9l), 0.84-0.97x as long as basal width, with 4 setae. Anal plate with 5 setae. Genital plate with 10-12 posterior and 2 anterior setae.

Apterous viviparous female (autumn morph): Body oval, dark green when alive. Mounted specimens: Body brown (Fig. 11D), smaller than those of spring colonies, 1.45-1.80 mm long, 0.96-1.07 mm wide. Head dark brown, with dense spinules dorsally and ventrally except the central area with sparse or no spinules, antennal tubercles low, diverging, frontal tubercle slightly prominent. Head with normal chaetotaxy. Antennae 6-segmented (Fig. 9o), segments I-II and V-VI dark brown, segments I-VI with imbrications, longer than those of spring colonies, 0.41-0.50x as long as body, segment IV as long as the basal part of the segment VI, processus terminalis 2.13-2.43x as long as the basal part of the segment VI. Rostrum just reaching middle coxae; apical rostral segment 1.48-2.32x as long as its basal width, 1.16-1.26x as long as hind second tarsal segment, with 6 primary setae and 2 secondary setae.

Thorax. Thorax notum brown, with spinulose reticulations. Legs moderately long, coxae, femora with spinules, and distal parts of tibiae with indistinct spinules. Hind femora 0.54-0.65x as long as antennae. Hind tibiae 0.34-0.39x as long as body. First tarsal chaetotaxy: 3, 3, 3.

Abdomen brown, with spinulose reticulations. Dorsal setae short, with acute apices. Ventral setae similar to dorsal. Siphunculus wholly dark brown, cylindrical (Fig. 9p), longer than that of fundatrices and fundatrigeniae, with dense spinulose imbrications and developed flange, with 5 or 6 setae, 0.14-0.19x as long as body, 2.35-3.03x as long as cauda. Cauda triangular, 0.95-1.18x as long as basal width, with 6 setae. Anal plate with 6-8 setae. Genital plate with 12-14 posterior and 2 anterior setae.

Apterous oviparous female: Differs from apterous viviparous females (spring morph) in the following: General measurements see table 4. Body smaller (Fig. 11F), about 0.93 mm long, 0.50 mm wide. Antennae shorter (Fig. 9u), 5-segmented, 0.44x as long as body; apical rostral segment 1.14x as long as hind second tarsal segment; hind femora 0.16 mm long, 1.30x as long as antennal segment III; hind tibiae 0.29 mm long, 0.31x as long as body with 15-24 scent plaques; abdomen membranous on dorsum; siphunculus shorter, with 6 or 7 setae; cauda triangular, with 6 setae; genital plate with 14 posterior and 8 anterior setae. Nymphs with spinules on hind tibiae.

Gynopara: Differs from alate viviparous female (spring morph) in the following: Antennae longer (Figs. 9q, r), 0.87x as long as body; antennal segment III 2.04x as long as segment IV, with slightly more rhinaria (segment III 27-32, IV 5-8, V 0 or 1), processus terminalis longer, 2.72-2.80x as long as the basal part of segment VI; siphunculus with 4 or 5 setae;

Alate male. Differs from gynopara in the following: Antennae longer (Figs. 9s, t), 0.91x as long as body, processus terminalis 3.23x as long as the basal part of segment VI; with more secondary rhinaria (83-98 on segment III, 47-52 on IV, 9-11 on V, 2-6 on VIb); abdominal tergites III-V with dorsal patch interrupted by irregular small windows; siphunculus with fewer (3) setae.

Specimens examined: 2 fundatrices and 2 apterous fundatrigeniae, 7.v.2009, CHINA: Beijing, Badaling Great Wall, No. 22846 (2 slides), on *Prunus persica*, Coll. X.M. Su and L. L.; 10 apterous viviparous ♀, 8.iv.1982-IV-8, Fujian Province: Fuzhou City, No. 7469 (3 slides), on *Prunus persica*, Coll. T.S. Zhong; 3 apterous nymphs, 20.iv.1982, Fujian Province: Wuyi Mountain, No. 7496-1-1, on *Prunus persica*, Coll. T.S. Zhong; 6 apterous viviparous ♀ and 2 apterous nymphs, 6.v.1975, Zhejiang Province: Hangzhou City, No. 5611-1-1, on *Prunus persica*, Coll. G.X. Zhang and T.S. Zhong; 6 apterous viviparous ♀, 2 alatoid nymphs and 8 alate viviparous ♀, 23.v.1975, Zhejiang Province: Hangzhou City, No. 5821 (3 slides), on *Prunus persica*, Coll. G.X. Zhang; 5 apterous viviparous ♀, 8.v.2006, Yunnan Province: Yulong County, No. 18173 (2 slides), on *Prunus persica*, Coll. X.L. Huang; 11 apterous viviparous ♀ and 6 alate viviparous ♀, 25.v.1980, Yunan Province: Lijiang City, No. 7163 (4 slides), on *Prunus persica*, Coll. T.S. Zhong and L.Y. Wang; 6 apterous nymphs, 19.v.1985, Hebei Province: Yi County, No. Y5856 (2 slides), on *Prunus persica*, Coll. S.B. Tian; 6 apterous viviparous ♀, 16.v.1977, Beijing City, No. 6563 (3 slides), on *Prunus persica*, Coll. T.S. Zhong; 11 apterous viviparous ♀, 13.v.1976, Beijing City, No. 6224 (2 slides), on *Prunus persica*, Coll. G.X. Zhang and T.S. Zhong; 5 apterous viviparous ♀, 13.v.2009, Sichuan Province: Ya'an City, No. 22534-1-1, on *Prunus persica*, Coll. X.M. Su; 3 apterous viviparous ♀, 29.v.2009, Gansu Province: Longnan County, No. 23006-1(-1-1), on *Prunus persica*, Coll. X.Y. Li and J.J. Yu; 14 apterous viviparous ♀ and 20 alate viviparous ♀, 12.vi.1977, Beijing City, No. 6563 (6 slides), on *Prunus persica*, Coll. T.S. Zhong; 12 alate viviparous ♀, 21.vi.1956, Henan Province, Anyang City, No. 387-1-4, on *Prunus persica*, Coll. T.S. Zhong; 14 apterous viviparous ♀, 9 alate viviparous ♀ and 8 alatoid nymphs, 21.vi.1956, Henan Province: Anyang City, No. 418 (5 slides), on *Prunus persica*, Coll. T.S. Zhong; 4 apterous viviparous ♀, 26.vi.1979, Beijing City, No. 6926-1-1, on *Prunus persica*, Coll. B.Z. Li and G.X. Zhang; 2 apterous viviparous ♀, 15.vi.2003, Beijing City, No. 14250-1-1, on *Prunus persica*, Coll. G.X. Qiao; 3 apterous viviparous ♀ and 3 alatoid nymphs, 24.vi.1977, Liaoning Province: Shenyang City, No. Y1183 (2 slides), on *Prunus persica*, Coll. C.B. Zhao; 1 alate viviparous ♀, 19.vi.1962, Beijing City, No. 3646-1(-1-), on *Prunus persica*, Coll. Y.F. Han; 1 apterous viviparous ♀, 28.vi.1962, Beijing City, No. 3660-1-1, on *Prunus persica*, Coll. T.S. Zhong; 4 apterous viviparous ♀, 16.vi.1953, Beijing City, No. 1887 (2 slides), on *Prunus persica*, Coll. L.Y. Wang; 6 alate viviparous ♀ and 4 apterous viviparous ♀, 2.vii.1990, Gansu Province: Dingxi County, No. 9784 (4 slides), on *Prunus persica*, Coll. T.S. Zhong; 2 apterous viviparous ♀, 5.vii.2008, Ningxia Autonomous Region: Liupan Mountain, No. 21606-1-1, on *Prunus persica*, Coll. J. Chen; 4 apterous viviparous ♀, 11.vii.1986, Gansu Province: Min County, No. 8486 (2 slides), on *Prunus persica*, Coll. G.X. Zhang and T.S. Zhong; 3 apterous

viviparous ♀, 2.vii.1984, Chongqing City, No. Y6421-1-1, on *Prunus persica*, Coll. W.C Zhang; 4 alate viviparous ♀ and 4 apterous viviparous ♀, 5.vii.1981, Hebei Province: Chengde City, No. Y7261 (2 slides), on *Prunus persica*, Coll. W.B. Yang; 22 alate viviparous ♀, 22.vii.1953-VII-22, Liaoning Province: Xingchen City, No. 665 (3 slides), on *Prunus persica*, Coll. G.X. Zhang; 6 apterous viviparous ♀ and 2 alate viviparous ♀, 17.vii.1985, Gansu Province: Wudu County, No. 8058 (2 slides), on *Prunus persica*, Coll. G.X. Zhang and T.S. Zhong; 15 alate viviparous ♀ and 1 apterous viviparous ♀, 1.viii.1982, Beijing City, No. 1051 (2 slides), on *Prunus persica*, Coll. T.S. Zhong; 8 apterous viviparous ♀ and 8 alate viviparous ♀, 10.ix.1965, Beijing City, No. 5062 (4 slides), on *Prunus persica*, Coll. T.S. Zhong; 27 alate viviparous ♀ and 16 apterous viviparous ♀, 13.xi.1957, Henan Province: Anyang City, No. 4662 (4 slides), on *Prunus persica*, Coll. T.S. Zhong; 2 gynoparae, 2 alate ♂, 2 apterous oviparous ♀ and 2 apterous oviparous nymphs, 12.x.1982, Liaoning Province: Shenyang City, No. Y2820 (3 slides), on *Prunus persica*, host plants unknown; 3 apterous viviparous ♀ and 1 alate viviparous ♀, 13.vii.2009, MONGOLIA: Dariganga, No. 22804 (2 slides), on *Prunus persica*, Coll. X.L. Huang.

Distribution: China (Anhui, Beijing, Fujian, Gansu, Guangxi, Guizhou, Hebei, Henan, Inner Mongolia, Jiangsu, Liaoning, Ningxia, Shandong, Yunnan, Zhejiang, Taiwan); Mongolia, Japan and Korea.

Hosts: Primary host: *Prunus persica*, secondary hosts: unknown (Blackman & Eastop, 1994; Sorin & Remaudière, 1998).

Biology: Fundatrices appear in mid-April and early May, and give birth to many nymphs in the pseudo-galls. These infest sprouts, and roll edges of young leaves of *Prunus persica*, and turn them into red pseudo-galls. Alatae are produced in late May and June, these persist into summer on peach, and life cycle is still unknown (Blackman & Eastop, 1994). The secondary host is still unknown (Sorin & Remaudière, 1998). The specimens collected from April to October indicate that apterous viviparous females and alate viviparous females are observed on peach in September (Fig.11D). Gynoparae, oviparous females (Fig. 11F) and alate males emerge on peach in October. Therefore, the species may be monoecious holocyclic.

7. *Tuberocephalus (Trichosiphoniella) sakurae* (Matsumura) (Fig. 10)

Myzus sakurae Matsumura, 1917: 403.

Aphis spinosula Essig & Kuwana, 1918: 77.

Myzus higansakurae Monzen, 1929: 59.

Myzus rarus Monzen, 1927: 4; 1929: 62.

Myzus sakurae Hori, 1929: 105; Takahashi, 1965: 70.

Myzus sasaki Takahashi, 1924: 3.

Phorodon momonis Shinji, 1941: 1002.

Trichosiphoniella spinosula: Shinji, 1929: 47; Shinji 1930: 188.

Trichosiphoniella formosana Hille Ris Lambers, 1965: 198.

Trichosiphoniella spinulosa Hille Ris Lambers, 1965: 199.

Sorbaphis kurilensis Ivanovskaja-Shubina, 1966: 14.

Specimens examined: 5 apterous fundatrices, 2 alate viviparous ♀, 1 alatioid nymph and 7 apterous nymphs, 12.v.1975, CHINA: Zhejiang Province: Tianmushan Mountain, No. 5679 (2 slides), on *Armeniaca mume*, Coll. G.X. Zhang and T.S.

Zhong; 9 alate viviparous ♀ and 3 alatoid nymphs, 2.v.1975, Zhejiang Province: Hangzhou City, No. 5564 (3 slides), on *Prunus cerasus*, Coll. G.X. Zhang and T.S. Zhong; 3 apterous fundatrigeniae, 2 alate viviparous ♀ and 2 alatoid nymphs, 15.v.1975, Zhejiang Province: Tianmushan Mountain, No. 5726 (2 slides), on *Prunus cerasus*, Coll. G.X. Zhang and T.S. Zhong; 6 apterous fundatrigeniae, 12.v.1975, Zhejiang Province: Tianmushan Mountain, No. 5681-1-2, on *Prunus cerasus*, Coll. G.X. Zhang and T.S. Zhong; 21 alatoid nymphs, 22.vi.1962, Liaoning Province: Xingchen County, No. 825 (2 slides), on *Prunus cerasus*, Coll. T.S. Zhong; 2 alate viviparous ♀ (gynoparae), 3 oviparous ♀, 7 alate ♂ and 4 alatoid nymphs, 28.x.1951, Beijing City, No. 641 (2 slides), on *Prunus cerasus*, Coll. G.X. Meng; 5 apterous oviparous ♀, 8 alate viviparous ♀ (gynoparae) and 10 alate ♂, 30.x.1962, Beijing City, No. 1218 (4 slides), on *Prunus cerasus*, Coll. G.X. Zhang; 29 alate male and 30 apterous oviparous ♀, 7.xi.1963, Beijing City, No. 1356 (4 slides), on *Prunus cerasus*, Coll. S.Y. Fang.

Distribution: China (Beijing, Zhejiang, Hebei, Gansu, Jiangsu, Liaoning, Shandong, Sichuan, Yunnan, Taiwan); Eastern Russia, Japan and Korea.

Hosts: Primary hosts: *Armeniaca mume*, *Prunus cerasus*; *P. donarium*, *P. pauciflora*, *P. yedoensis* and *Prunus* spp. (Sorin & Remaudière, 1998); *P. jamasakura*, *P. lannesiana*, *P. maximowiczii*, *P. sachalinensis*, *P. triloba* (Blackman & Eastop, 2006); secondary hosts: *Artemisia montana*, *A. vulgaris* var. *indica* and *Artemisia* sp. (Sorin & Remaudière, 1998).

Biology: Fundatrices occur early in April to middle of May, give birth to many apterous or alate nymphs in the galls. Alate emigrants appear between beginning of May and late July, and move to secondary host plants, and apterous fundatrigeniae form new galls and give birth to nymphs. Alienicolae infest subterranean young shoots of *Artemisia* spp. (Sorin & Remaudière, 1998). Gynoparae emerge in the middle of October to early November, and produce oviparous ♀ on the primary hosts.

8. *Tuberocephalus (Trichosiphoniella) tianmushanensis* Zhang (Figs. 12,13)

Tuberocephalus tianmushanensis Zhang, 1980: 58.

Comments: Sorin and Remaudière (1998) pointed out that *Tuberocephalus (Trichosiphoniella) higansakurae hainnevilleae* Remaudière and Sorin described on *Prunus subhirtella* var. *pendula* from Orne, France, is very similar to *T. (Trichosiphoniella) tianmushanensis*, and possibly a synonym. We examined the holotype and paratypes of *T. (Trichosiphoniella) tianmushanensis*, and checked the original description of *T. (Trichosiphoniella) higansakurae hainnevilleae*. These support Remaudière and Sorin's views, and thus *T. (Trichosiphoniella) higansakurae hainnevilleae* should be a junior synonym of *T. tianmushanensis*. Zhang (1980) firstly described the fundatrices and alate viviparous females (emigrant) of *T. tianmushanensis* in Chinese. We redescribe this species here.

Fundatrix: Measurements (in mm): Body 1.68-1.83 long, 1.17-1.20 wide. Mounted specimens: Body yellow brown and round (Fig.13A). Head and prothorax segmented distinctly, head dark brown, with dense spinules dorsally and ventrally, (Fig. 12a). Median frons slightly prominent, antennal tubercles low, roundly and distinctly diverging at inner margins, front shallow W-shaped. Head with a pair of cephalic and

a pair of antennal tubercles' setae, dorsal setae on head fine and acute, 2 pairs of dorsal setae between antennae, arranged longitudinally, and 2 pairs of dorsal setae between compound eyes, arranged transversely. Length of cephalic setae 0.01-0.02 mm, dorsal setae 0.017-0.022 mm long, 0.71-1.33x and 1.00-1.29x as long as basal diameter of antennal segment III, respectively. Eyes small and red, with small ocular tubercles. Antennae 5-segmented, dark brown, antennal segments I and II with rough imbrications, segments III-V with distinct imbrications (Fig. 12b). Antennae 0.27-0.32x as long as body length, length in proportion of segments I-V: 26-33, 22-25, 100, 32-36, 41-58+40-59, processus terminalis 0.91-1.29x as long as base of the segment. Antennal setae short and acute, segments I-V each with 3, 3 or 4, 1 or 2, 3, 2+ 3 setae, respectively; apex of processus terminalis with 3 setae, setae on segment III 0.010-0.012 mm long, 0.57-0.71x as long as basal diameter of the segment. Primary rhinaria small and round, without cilia, secondary rhinaria absent. Rostrum short, just reaching middle coxae; ultimate rostral segment wedge-shaped, dark brown (Fig. 12c), 1.96-2.45x as long as basal diameter of the segment, 1.58-1.96x as long as second hind tarsal segment, with 6 primary and 5 or 6 accessory setae.

Thorax indistinctly segmented, metathorax and abdominal tergite I indistinctly segmented. Spinal and pleural patches on pronotum fused to a dark brown band, meso- and metanotum brown, each with a pair of pleural patches, and with conspicuously transverse spinulous stripes which are more distinct laterad. Venter with spinulous stripes. Intersegmental sclerites dark brown. Thoracic spiracles round, opened, spiracles plates slightly prominent and densely spinulose. Mesosternal furca with stems widely separated (Fig. 12d). Pro, meso and metanotum each with 2, 6, 4 spinal setae, 2, 2, 4 pleural setae and 0, 2, 4 or 5 marginal setae, respectively. Legs short, coxae, femora and distal part of tibiae dark brown, the rest brown, coxae and distal 2/3 of femora with sparse spinulous imbrications, femora a little curved, tibiae smooth, second hind tarsal segments smooth. Hind femora 1.54-2.00x as long as antennal segment III. Hind tibiae 0.27-0.28x as long as body. Setae on legs short, stout with slightly acute apices, length of setae on hind tibiae 0.012-0.019 mm, 0.50-0.73x as long as middle diameter of the segment. First tarsal chaetotaxy: 3, 3, 2.

Abdomen brown, with transverse spinulous stripes dorsally and ventrally. Spiracles nephroid, closed, spiracles plates dark brown, slightly prominent, and densely spinulose. Intersegmental sclerites dark brown. Dorsal setae of body short with acuminate apices. Tergites I-V each with 4, 4, 4, 6, 4 or 5 spinal setae, 2, 6, 10, 8, 4 marginal setae, tergite VI with 4 setae between siphunculus, tergite VII with 4 setae, tergite VIII with 2 or 3 setae. Length of marginal setae on tergite I 0.007-0.015 mm, dorsal setae on tergite VIII 0.02-0.03 mm long, 0.50-1.00x and 1.29-1.71x as long as basal diameter of antennal segment III, respectively. Siphunculus short and cylindrical, with developed flange and strong spinulose imbrications, with 2 or 3 short setae (Fig. 12e), 1.88-2.28x as long as basal width, 0.080-0.085x as long as body length, 0.66-0.95x as long as antennal segment III, 1.07-1.40x as long as cauda. Cauda triangle with acute apex, with transverse spinulous stripes, slightly constricted at base (Fig. 12f), about 0.75-1.33x as long as its basal width, with 5 setae. Anal plate transverse oval (Fig. 12g), with transverse spinulous stripes and 6 or 7 setae. Genital plate broad round (Fig. 12h), posterior part with transverse spinulous stripes, with 11 or 12 short or long posterior setae and 2 anterior setae. Larvae with spinules on hind tibiae.

Alate viviparous female (emigrant): Measurements (in mm): Body 1.87-1.93 long, 0.81-0.86 wide. Mounted specimens. Body elongate oval (Fig. 13B), brown. Head and prothorax segmented distinctly. Head brown, smooth with sparse wrinkle. Median

frons slightly prominent, antennal tubercles low, roundly and slightly diverging at inner margins. Head with apical setae fine and acute, with a pair cephalic setae and 2 pairs of antennal tubercles' setae, 2 pairs of dorsal setae between antennae, arranged longitudinally, and 2 pairs of dorsal between compound eyes, arranged transversely, apical and dorsal setae 0.012-0.020 mm and 0.012-0.015 mm long, respectively, 0.67-0.83x and 0.56-1.00x as long as basal diameter of antennal segment III. Eyes red, big, with distinct ocular tubercles. Antennae 6-segmented, dark brown, segments I and II brown, with sparse, small imbrications, segment III-VI imbricated, the ones on segment III weak (Figs. 12i, j), 0.54-0.61x as long as body, length in proportion of segments I-VI: 14-20 , 15 , 100 , 46-58 , 32-49 , 27-34+77-85, processus terminalis 2.39-3.22x as long as base of the segment. Antennal setae moderately long and acute, segments I-VI each with 2 or 3 , 3 , 3-5 , 5 , 2 or 3 , 2+3 setae, respectively, apex of processus terminalis with 3 setae. Setae on antennal segment III 0.010-0.012 mm, 0.44-0.83x as long as basal diameter of the segment. Primary rhinaria round and ciliated, antennal segment III with 24-33 secondary rhinaria arranged irregularly over the whole length, segments IV and V with 5-9, 1 or 2 secondary rhinarium, respectively. Rostrum slightly long, not or just reaching middle coxae, apical rostral segment wedge-shaped, 2.13-2.27x as long as its basal width, 1.14-1.46x as long as hind second tarsal segment.

Thorax. Pro, meso and metathorax distinctly segmented. Legs long, variably pigmented, brown, coxae, distal 2/3 of femora, 1/4 of tibiae, and tarsus dark brown. Coxae and distal 2/3 of femora with sparse spinules, tibiae smooth. Hind second tarsal segment smooth. Hind femora 1.15-1.25x as long as antennal segment III. Hind tibiae 0.39-0.41x as long as body. Setae on legs moderately long and acute, setae on hind tibiae 0.017-0.022 mm long, 0.70-0.90x as long as middle diameter of the segment. First tarsal chaetotaxy: 3, 3, 2.

Abdomen brown, tergites smooth, and ventrally with transverse, spinulose stripes, and aired marginal patches, ornamented, spinulose and with setae on tergites I-VI, setae on tergites I-IV bigger than those of V and VI. Tergite I with a brown spinal patch, tergite II with a pair of pleural patches, sometimes indistinct, tergites III-VI each with spinal and pleural patches fused to form a brown band, tergites VII and VIII each with a brown band. Intersegmental sclerites brown. Spiracles nephroid, closed, spiracular plates brown, and slightly prominent. Dorsal setae on body moderately long and acute. Length of marginal setae on tergite I 0.012-0.017 mm, and dorsal setae on tergite VIII 0.022-0.025 mm long, 0.56-1.17x and 1.00-1.67x as long as basal diameter of antennal segment III, respectively. Siphunculus dark brown, densely imbricated, cylindrical, with a well developed flange and 5-7 setae (Fig. 12k), 0.08-0.09x as long as body, 2.58-3.09x as long as its basal width, 1.75-2.22x as long as cauda. Cauda triangle, slightly blunt apex, with 5 setae (Fig. 12l), 0.73-0.86x as long as its basal width. Anal plate transversely oval, with 7-9 setae. Genital plate broadly rounded, with 10 or 11 posterior and 2 anterior setae.

Specimens examined: Holotype: Fundatrix 1975-V-12, CHINA: Zhejiang Province: Tianmushan Mountain, No. 5681-1-3, on *Prunus pseudocerasus*, Coll. G.X Zhang and T.S. Zhong; *paratypes:* 4 fundatrices and 4 alate viviparous ♀ No. 5681-1-1, with same data as holotype.

Distribution: China: Beijing, Zhejiang.

Hosts: Primary host: *Prunus pseudocerasus* (cherry); secondary hosts unknown.

Biology: Fundatrices form barrel-shaped pseudo-galls on the undersides along the lateral veins of the leaves of the primary hosts, about 12-15 mm long. The adult fundatrices appear in May and give birth to many nymphs. Fundatrigeniae become alate viviparous females emigrate to unknown secondary hosts (Zhang & Zhong, 1980).

9. *Tuberocephalus (Trichosiphoniella) tuberculus*, sp. nov. (Table 1,2; Figs. 14,15)

Description: Fundatrix: Measurements (in mm): Body 1.96-2.20 long, 1.06-1.27 wide. General measurements see Table 1. Mounted specimens. Body pale and elongate oval (Fig. 15a). Setae with conspicuous tuberculate bases on thoracic nota and abdominal tergites. Head and prothorax segmented distinctly. Anterior part of head faint brown. Head with densely spinules ventrally and dorsally except for central posterior area (Figs. 14a,15b). Median frons prominence, almost as high as antennal tubercles. Antennal tubercles low, diverging at inner margins, frons conspicuously W-shaped. Head with a pair of cephalic and a pair of antennal tubercles' setae, setae on head fine and acute, 2 pairs of dorsal setae between antennae, arranged longitudinally, and 2 pairs of dorsal setae between compound eyes, arranged transversely. Length of cephalic setae 0.011-0.014 mm, dorsal setae about 0.016 mm long, 0.43-0.49x and 0.55-0.66x as long as basal diameter of antennal segment III, respectively. Eyes small, with ocular tubercles. Antennae 5-segmented, segment I with sparse spinules, segment II smooth, segments III-V imbricated, ones on segment III weak (Figs. 14b, 15c). Antennae 0.26-0.28x as long as body, length in proportion of segments I-V: 18-21, 14-18, 100, 41-46, 44-51+41-44, processus terminalis 0.90-0.95x as long as basal part of the segment. Antennal setae short and acute, segments I-VI each with 3, 3, 1 or 2, 2, 1+3 setae, respectively; apex of processus terminalis with 3 setae, setae on segment III 0.008-0.010 mm long, 0.38-0.59x as long as basal diameter of the segment. Primary rhinaria small and round, without cilia, secondary rhinaria absent. Rostrum short, reaching between fore and middle coxae. Apical rostral segment wedge-shaped, apical part brown (Figs. 14c, 15d), 1.65-1.76x as long as basal diameter of the segment, 1.37-1.42x as long as second hind tarsal segment, with 4 primary and 2 accessory setae.

Thorax distinctly segmented, metathorax and abdominal tergite I indistinctly segmented. Thorax pale, with dense transverse spinulose stripes dorsally and ventrally. Mesosternal furca with stems widely separated (Figs. 14d, 15e), length of each stem 0.07-0.09 mm, 0.37-0.40x as long as antennal segment III. Pro, meso and metanotum each with 1, 3-4, 4-5 pairs of spinal setae, 1, 5-6, 5-6 pairs of pleural setae and 1, 4-5, 6-7 pairs of marginal setae, respectively, some pleural and marginal setae on mesonotum and some marginal setae on metanotum with pale sclerotizations at bases, marginal setae on pronotum, some spinal and marginal setae on mesonotum and some spinal setae on metanotum with conspicuous and scabrous tuberculate bases (Fig. 14f). Legs short, femora a little curved, coxae and distal part of femora with transverse spinulose stripes, tibiae and second hind tarsal segments smooth. Hind femora 1.67-2.06x as long as antennal segment III. Hind tibiae 0.25-0.29x as long as body. Setae on legs short, stout with acute apices, length of setae on hind tibiae 0.017-0.022 mm, 0.59-0.63x as long as middle diameter of the segment. First tarsal chaetotaxy: 2, 2, 2.

Abdomen pale, with transverse spinulose stripes dorsally and ventrally. Spiracles nephroid, spiracular plates pale and slightly prominent. Some spinal and pleural setae on abdominal tergites I-VI with conspicuous tuberculate bases (Fig. 14g), the longest setae with conspicuous tuberculate bases on tergites I-VI: 0.022, 0.032, 0.017, 0.032,

0.029, 0.029 mm long, 1.00, 1.44, 0.78, 1.44, 1.38, and 1.38x as long as basal diameter of antennal segment III, respectively. Tergites I-VII each with 2-3, 3-4, 2-3, 5-6, 3-4, 4-5, 2 pairs of spinal setae and 4-5, 5-6, 3-4, 6-7, 5-6, 4-5, 4 pairs of marginal setae, respectively, tergite VIII with 4 setae, length of marginal setae on tergite I 0.015-0.023 mm, dorsal setae on tergite VIII 0.03-0.04 mm, 0.78-1.16x and 1.27-1.64x as long as basal diameter of antennal segment III, respectively. Siphunculus short and cylindrical, slightly constricted at base, with distinct flange and spinulose imbrications, without setae, and not constricted at apex (Figs. 14e, 15f), 2.92-3.63x as long as basal width, 0.041-0.043x as long as body, 0.43-0.47x as long as antennal segment III, and 0.78-0.83x as long as cauda. Cauda pentagonal with blunt apex, with transverse spinulose stripes, not constricted at base (Figs. 14f, 15i), about 1.19x as long as its basal width, with 4 setae. Anal plate transversely oval (Fig. 14g), with transverse spinulose stripes and 11 setae. Genital plate broadly round (Fig. 14h), with 8 or 9 short posterior and 2 anterior setae.

Fundatrix nymph (the fourth instar nymph): Measurements (in mm): Body 1.90 long, 0.96 wide. General measurements see Table 1. Mounted specimens: Body roundly oval, pale with apex of siphunculus faint brown (Fig. 15g). Head and prothorax segmented indistinctly. Anterior part of head faint brown. Head densely spinulose ventrally and dorsally except for posterior central area. Median frons prominent, almost as high as antennal tubercles. Antennal tubercles low, diverging at inner margins, front conspicuously W-shaped. Head with a pair each of cephalic and antennal tubercles' setae, apical setae fine and acute, 2 pairs of dorsal setae between antennae, arranged longitudinally, and 2 pairs of dorsal setae between compound eyes, arranged transversely. Length of cephalic setae 0.01 mm, dorsal setae 0.02 mm, 0.56x and 1.13x as long as basal diameter of antennal segment III, respectively. Eyes small, with ocular tubercles. Antennae 5-segmented, short, segment I with spinules, segment II smooth, segments III-V imbricated, ones on segment III weak. Antennae 0.23x as long as body, length in proportion of segments I-V: 39, 29, 100, 54, 62+54, respectively, process terminalis 0.87x as long as basal part of the terminal segment. Antennal setae short and acute, segments I-V each with 3, 3, 0, 1, 2+3 setae, respectively, apex of process terminalis with 3 setae. Primary rhinaria small, round and non-ciliated, and secondary rhinaria absent. Rostrum short, reaching between fore and middle coxae. Apical rostral segment wedge-shaped, apical part of rostrum brown, 1.33x as long as basal diameter of the segment, 1.28x as long as second hind tarsal segment, with 4 primary and 2 accessory setae.

Thorax distinctly segmented, metathorax and abdominal tergite I indistinctly segmented. Thorax pale, with dense transverse spinulose stripes dorsally and ventrally. Mesothorax and metathorax spiracular plates with dense spinules. Mesosternal furca with stems widely separated, length of each stem 0.05 mm, 0.32x as long as antennal segment III. Pronotum with a pair of spinal, a pair of pleural and a pair of marginal setae, marginal setae conspicuously and finely tuberculate at bases. Mesonotum with 6, 4, 5 spinal, pleural, marginal setae, respectively. Metanotum with 5, 8, 12 spinal, pleural, marginal setae, 2 pairs of pleural setae with distinctly tuberculate bases. Legs short, tarsi brown, coxae with transverse spinulose stripes, femora with sparse wrinkles, tibiae smooth. Hind femora 1.91x as long as antennal segment III, hind tibiae 0.20x as long as body. Setae on legs short, stout with acute apices, length of setae on hind tibiae 0.02 mm, and 0.50x as long as middle diameter of the segment. First tarsal chaetotaxy: 2, 2, 2.

Abdomen pale, with transverse spinulose stripes dorsally and ventrally. Spiracles nephroid, spiracular plates pale and slightly prominent. Tergites I-VII each with 8-10, 8, 8, 10, 9, 6, 2 spinal and 4, 6, 6, 10, 8, 4, 4 marginal setae, respectively, 2 spinal setae on tergite II with distinctly tuberculate bases, some spinal setae on tergites IV-VI, some pleural setae on tergites IV and some marginal setae on tergites I, III, IV with slight sclerotizations at bases, tergite VIII with 4 setae, length of marginal setae on tergite I 0.01 mm, spinal setae on tergite VIII 0.02 mm, 0.55x and as long as basal diameter of antennal segment III, respectively. Siphunculus short and cylindrical, slightly constricted at base, with small flange and spinulose imbrications, without setae, not constricted on apex, 3.79x as long as basal width, 0.63x as long as antennal segment III, 1.67x as long as cauda. Cauda coniform with blunt apex, 0.48x as long as basal width, with 4 setae. Genital plate round, with 6 short and fine posterior and 2 anterior setae. Gonapophyses indistinct.

Holotype: fundatrix, CHINA: Sichuan Province: Yanbian County, (N26.41°, E101.50°), 11.iv.2005, No.17127, on a kind of plant of Rosacea, Coll. X. L. Huang; *paratypes*: 3 fundatrices and 1 fundatrix nymph, with the same collection data as holotype.

Type locality: China (Sichuan).

Etymology: The species name is composed of “*tuberculus* (Latin)”, which means tubercles, referring to its dorsal setae on the body with tubercles at their bases.

Distribution: China: Sichuan (Yanbian County).

Biology: The fundatrices and nymphs infest the under surface of the young leaves and form pseudo-galls along the lateral veins

Comments: The new species is similar to *T. uwamizusakurae* Sorin and Remaudière, but differs in the following: some dorsal body setae with tuberculate bases (*T. uwamizusakurae*: setae without tuberculate bases), middle front tubercle conspicuously prominent, as high as antennal tubercles, frons distinctly W-shaped (*T. uwamizusakurae*: middle front tubercle slightly prominent), siphunculus short and constricted at bases (*T. uwamizusakurae*: siphunculus longer than the former, without constriction at bases).

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Table 1. *Tuberocephalus (Trichosiphoniella) tuberculus*, sp. nov. biometrics
(mean, range) (in mm).

Part		Fundatrix nymph (n=1)	Fundatrices (n=4)	
Length (mm)	Body length	1.898	2.06(1.96-2.20)	
	Body width	0.956	1.19(1.06-1.27)	
	Ant.I	0.045	0.04(0.03-0.05)	
	Ant.II	0.027	0.036(0.027-0.043)	
	Ant.III	0.151	0.21(0.20-0.22)	
	Ant.IV	0.070	0.95(0.09-0.10)	
	Ant.Vb	0.081	0.105(0.10-0.11)	
	PT	0.070	0.095(0.09-0.10)	
	URS	0.083	0.086(0.082-0.090)	
	BW URS	0.056	0.053(0.051-0.056)	
	Hind femur	0.289	0.38 (0.36-0.40)	
	Hind tibiae	0.377	0.56(0.50-0.61)	
	MW Hind tibia	0.034	0.035(0.03-0.04)	
	H.t.II	0.064	0.064(0.060-0.067)	
	Siphunculus	0.093	0.096(0.091-0.097)	
	BW SIPH	0.029	0.031(0.027-0.033)	
	DW SIPH	0.037	0.035(0.034-0.037)	
	Cauda	0.061	0.117(0.117)	
	BW Cauda	0.127	0.116(0.112-0.222)	
	b.d.III	0.022	0.019(0.018-0.020)	
	Cephalic setae	0.012	0.012(0.011-0.014)	
	Setae on Ant.III	—	0.009(0.008-0.010)	
	Setae on Tergum VIII	0.022	0.032(0.028-0.036)	
	Setae on Hind tibia	0.017	0.020(0.017-0.022)	
	Ratio (times)	Whole antennae / Body	0.23	0.27(0.26-0.28)
		Hind femur /Ant.III	1.91	1.86(1.67-2.06)
		Hind tibia / Body	0.20	0.27(0.25-0.29)
PT / Ant.VIb		0.87	0.93(0.90-0.95)	
URS / BW URS		1.33	1.70(1.65-1.76)	
URS / H.t.II		1.28	1.39(1.37-1.42)	
Cauda / BW Cauda		0.48	1.19(1.19)	
Cephalic setae / b.d.III		0.56	0.46(0.43-0.49)	
Setae on Ant.III / b.d.III		—	0.49(0.38-0.59)	
Setae on Tergum VIII / b.d.III		1.00	1.46(1.27-1.64)	
Setae on hind tibia / MW Hind tibiae		0.50	0.61(0.59-0.63)	

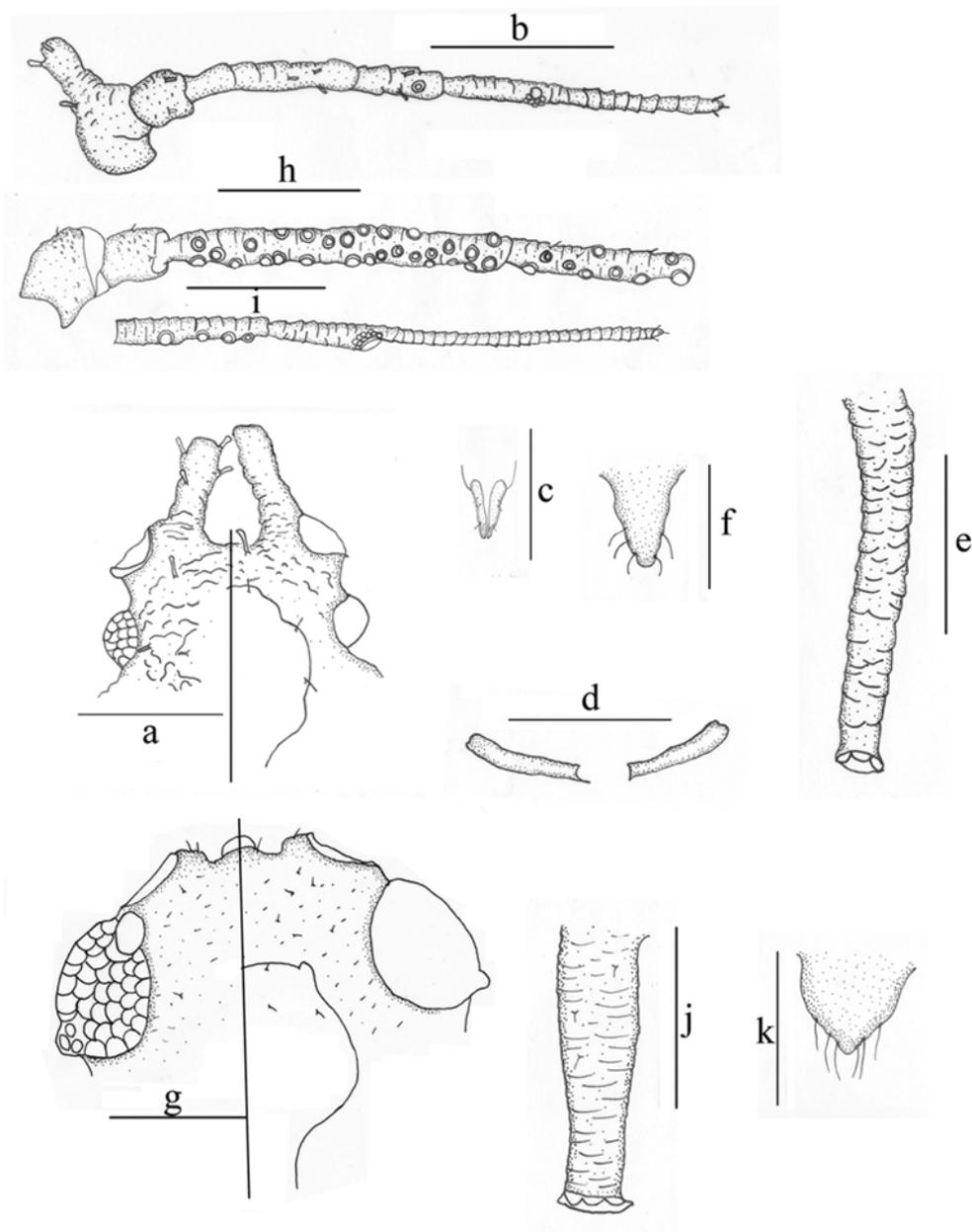


Fig. 1. *Tuberocephalus (Tuberocephalus) asterisiae*, apterous viviparous female (Alienicola): a, dorsal (left) and ventral (right) view of head; b, antennal segments I-V; c, ultimate rostral segment, d, mesosternal furca; e, siphunculus; f, cauda; Alate viviparous female (Emigrant): g, dorsal (left) and ventral (right) view of head; h, antennal segments I-IV; i, antennal segment VI. Scale bars=0.10 mm.

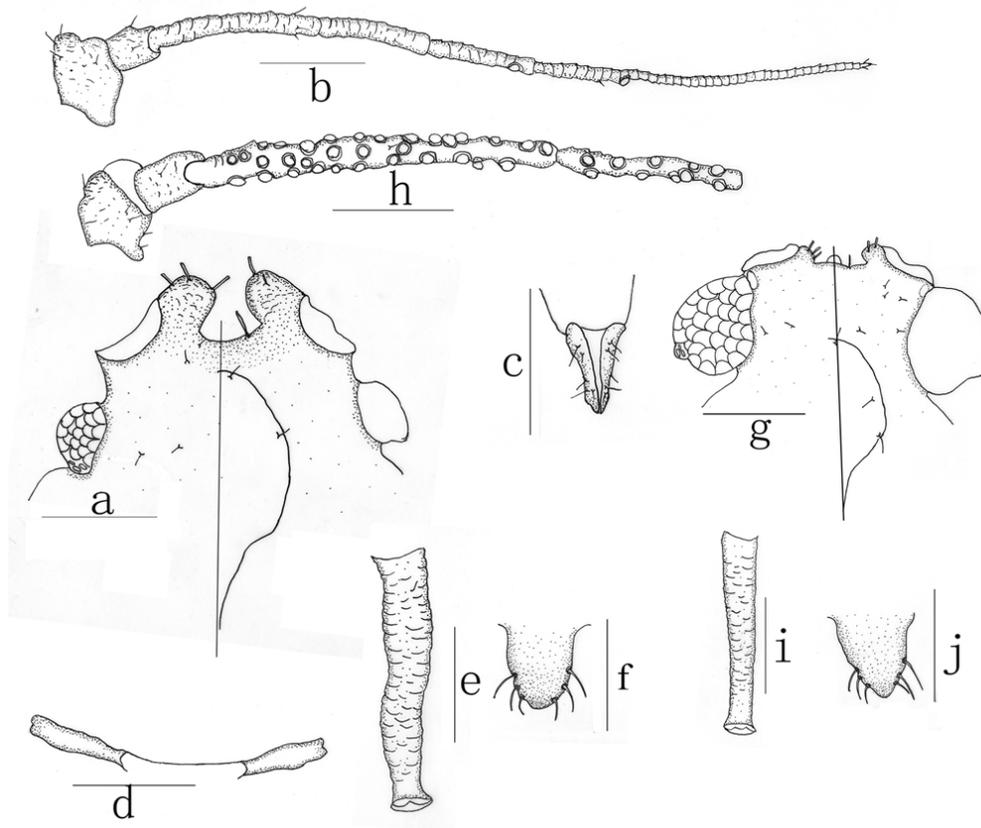


Fig. 2. *Tuberocephalus (Tuberocephalus) sasakii*, apterous viviparous female (Alienicola): a, dorsal (left) and ventral (right) view of head; b, antennal segments I-VI; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda. Alate viviparous female (gynopara): g, dorsal (left) and ventral (right) view of head; h, antennal segments I-IV; i, siphunculus; j, cauda. Scale bars=0.10 mm.

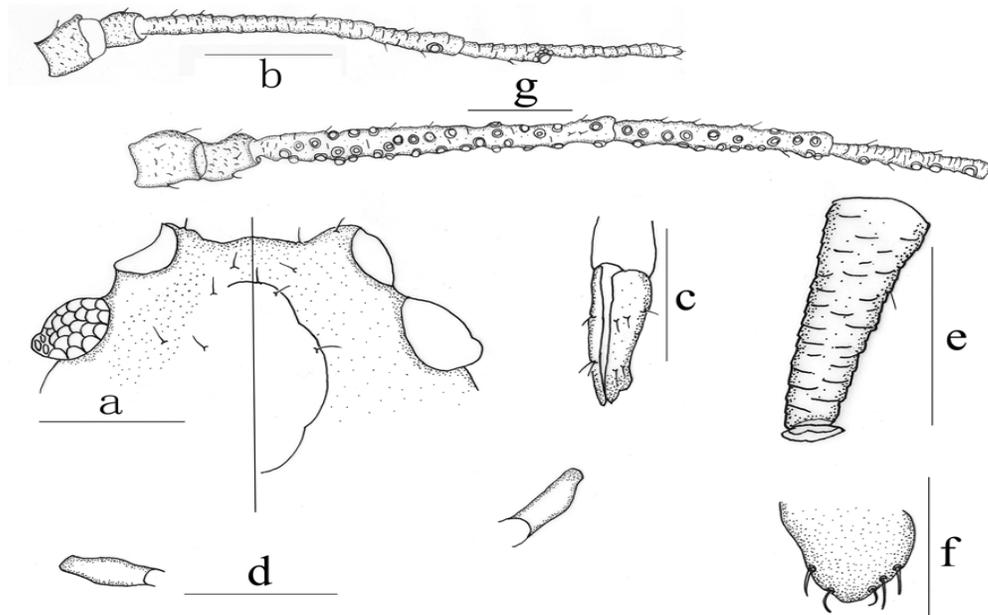


Fig. 3. *Tuberocephalus (Tuberocephalus) higansakurae*, fundatrix: a, dorsal (left) and ventral (right) view of head; b, antennal segments I-V; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda; Alate viviparous female (emigrant): g, antennal segments I-V. Scale bars=0.10 mm.

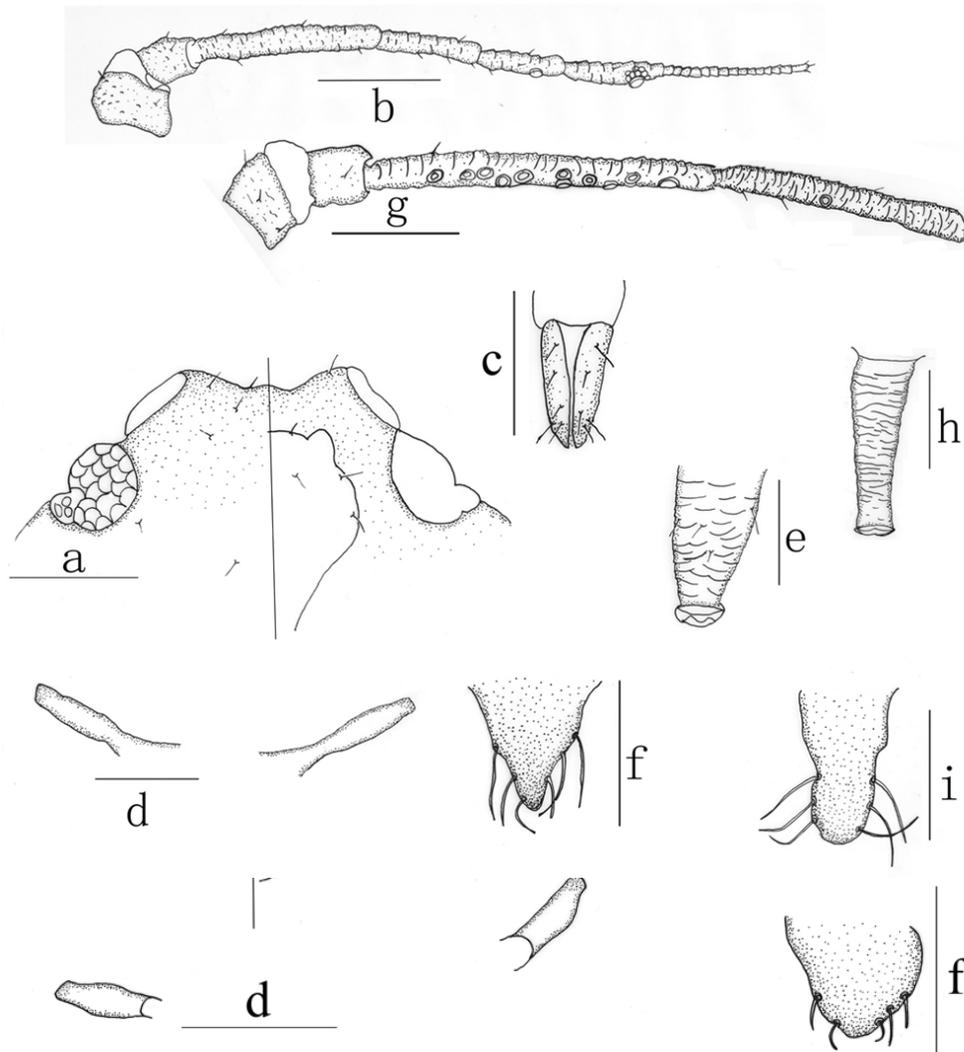


Fig. 4. *Tuberocephalus (Tuberocephalus) jinxiensis*, apterous viviparous female (fundatrigenia): a, dorsal (left) and ventral (right) view of head; b, antennal segments I-VI; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda. Alate viviparous female (emigrant): g, antennal segments I-IV. Scale bars=0.10 mm.

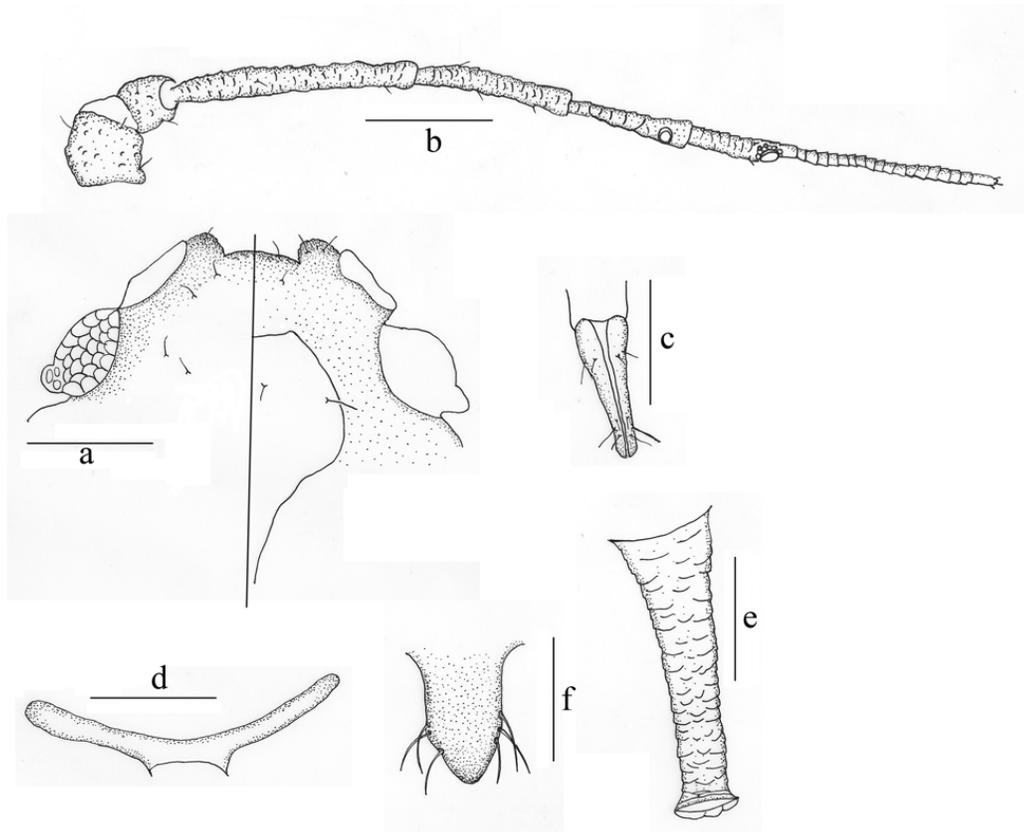


Fig. 5. *Tuberocephalus (Tuberocephalus) lazikouensis*, apterous viviparous female (alienicola): a, dorsal (left) and ventral (right) view of head; b, antennal segments I-VI; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda. Scale bars=0.10 mm.

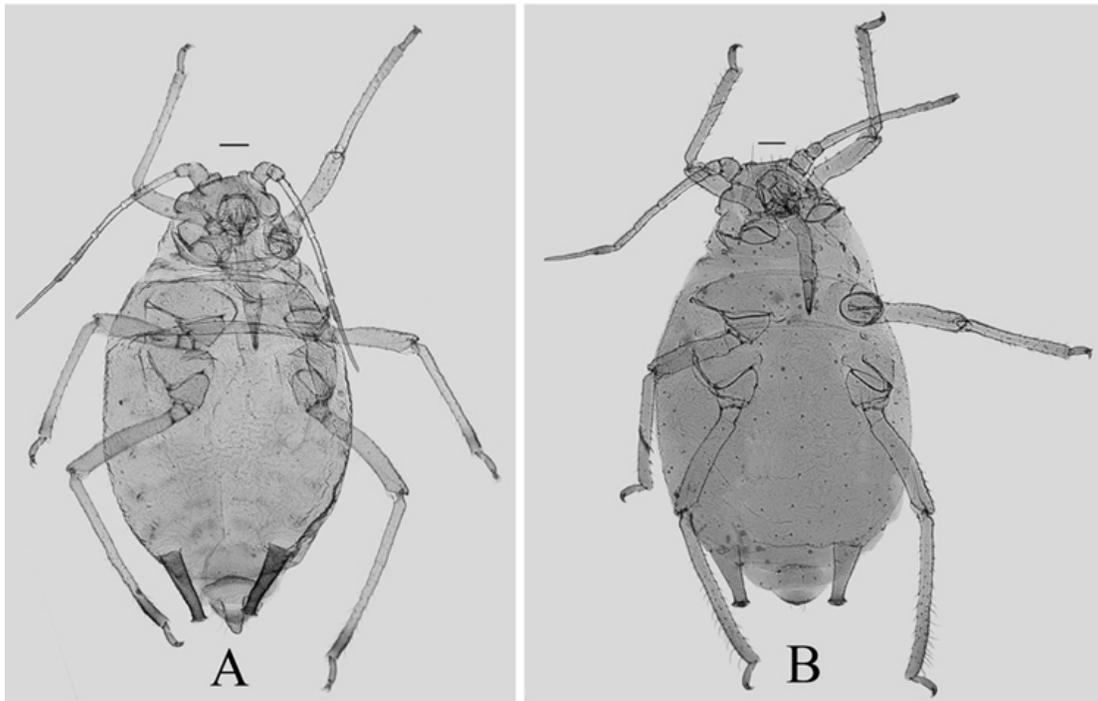


Fig. 6. *Tuberocephalus* (*Tuberocephalus*) *lazikouensis*, A, apterous viviparous female (alienicola); B, the fourth instar nymph. Scale bars=0.10 mm.

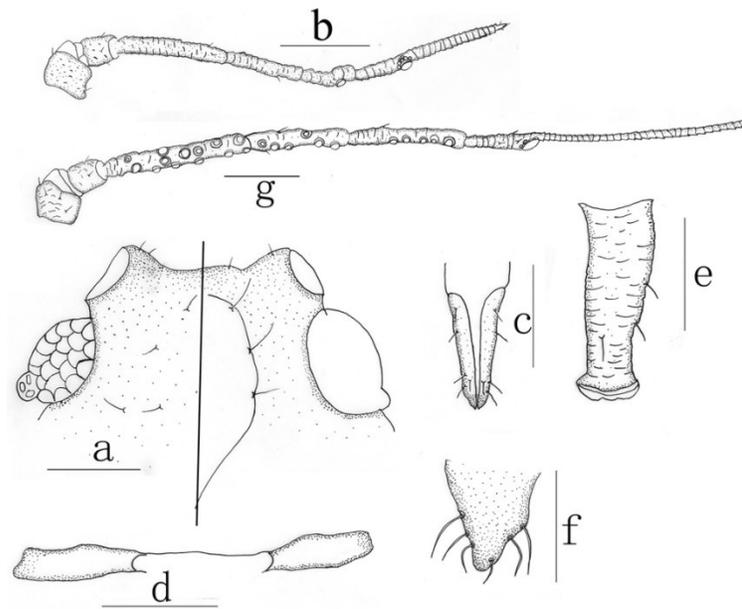


Fig. 7. *Tuberocephalus (Tuberocephalus) liaoningensis*, apterous viviparous female (fundatrigenia): a, dorsal (left) and ventral (right) view of head; b, antennal segments I-VI; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda. Alate viviparous female (emigrant): g, antennal segments I-VI. Scale bars=0.10 mm.

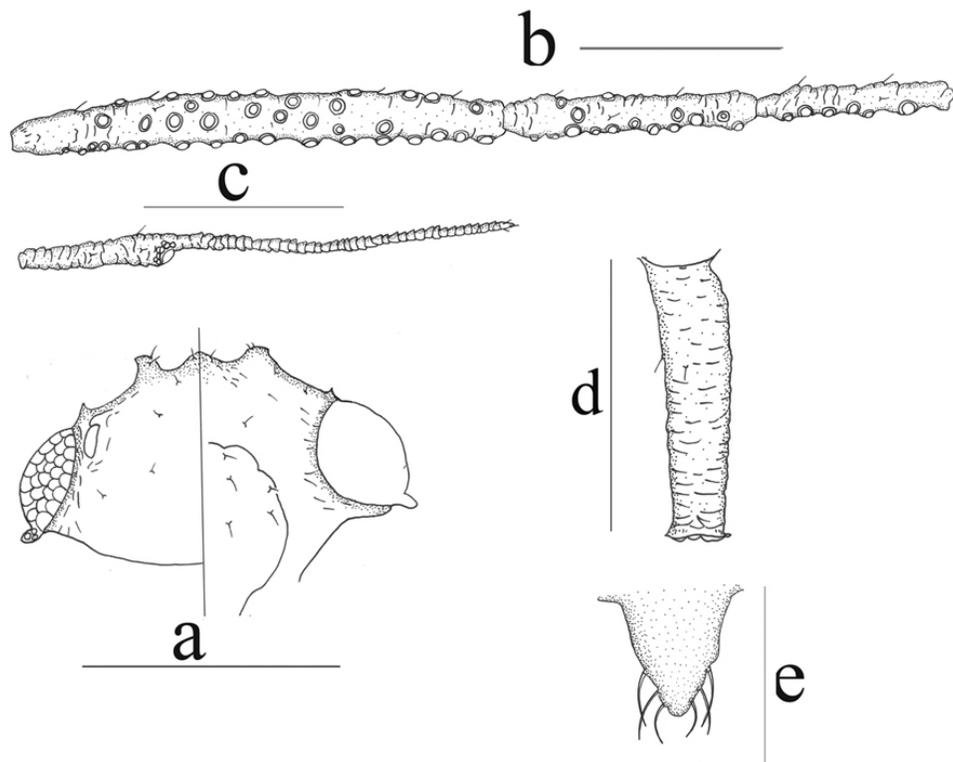


Fig. 8. *Tuberocephalus (Tuberocephalus) misakurae*, alate viviparous female (gynopara): a, dorsal (left) and ventral (right) view of head; b, antennal segment III-V; c, antennal segment VI; d, siphunculus; e, cauda. Scale bars=0.10 mm.

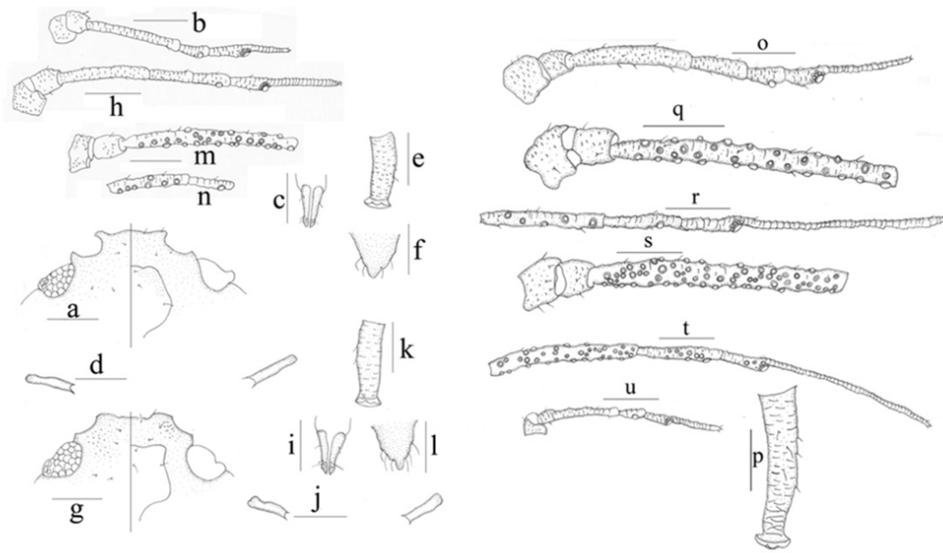


Fig. 9. *Tuberocephalus (Tuberocephalus) momonis*, apterous viviparous female (fundatrigenia): a, dorsal (left) and ventral (right) view of head; b, antennal segments I-VI; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda. Fundatrix: g, dorsal (left) and ventral (right) view of head; h, antennal segments I-V; i, apical rostral segment; j, mesosternal furca; k, siphunculus; l, cauda. Apterous viviparous female (autumn morph): o, antennal segments I-VI; p, siphunculus. Apterous viviparous female (autumn morph): o, antennal segments I-VI; p, siphunculus. Alate gynopara: q, antennal segments I-III; r, antennal segments IV-VI. Alate male: s, antennal segments I-III; t, antennal segments IV-VI. Apterous oviparous female: u, antennal segments I-V. Scale bars=0.10 mm.

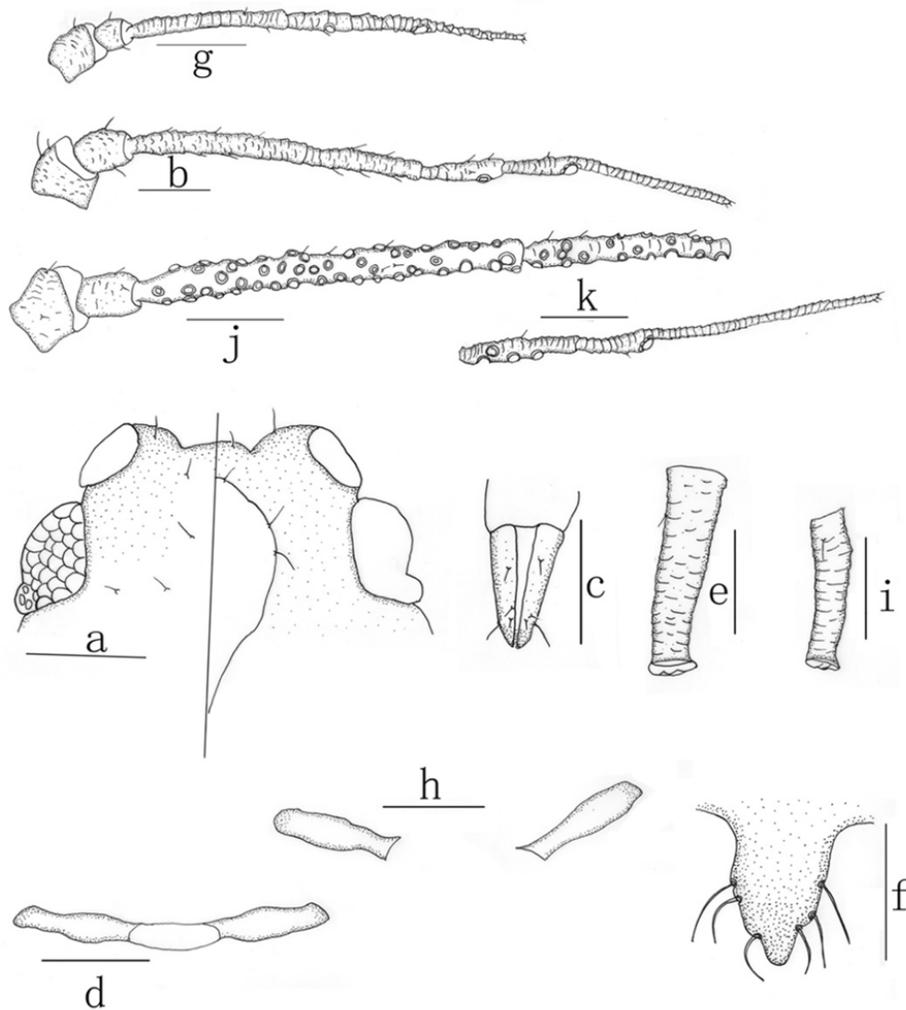


Fig. 10. *Tuberocephalus (Tuberocephalus) sakurae*, apterous viviparous female (fundatrigenia): a, dorsal (left) and ventral (right) view of head; b, antennal segments I-VI; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda. Fundatrix: g, antennal segments I-V; h, mesosternal furca; i, siphunculus. Alate viviparous female (emigrant): j, antennal segments I-IV; k, antennal segment V-VI. Scale bars=0.10 mm.

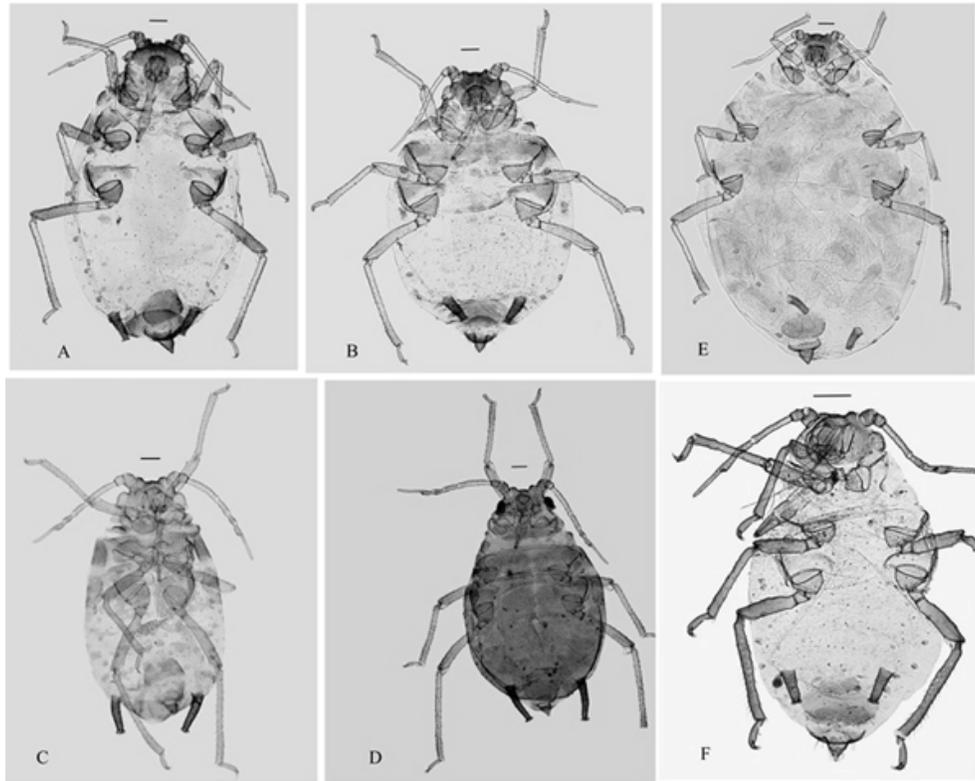


Fig. 11. *Tuberocephalus momonis*, A, apterous viviparous female (spring morph, April); B, apterous viviparous female (spring morph, May); C, apterous viviparous female (summer morph, August); D, apterous viviparous female (autumn morph, September); E, fundatrix; F, apterous oviparous female. Scale bars=0.10 mm.

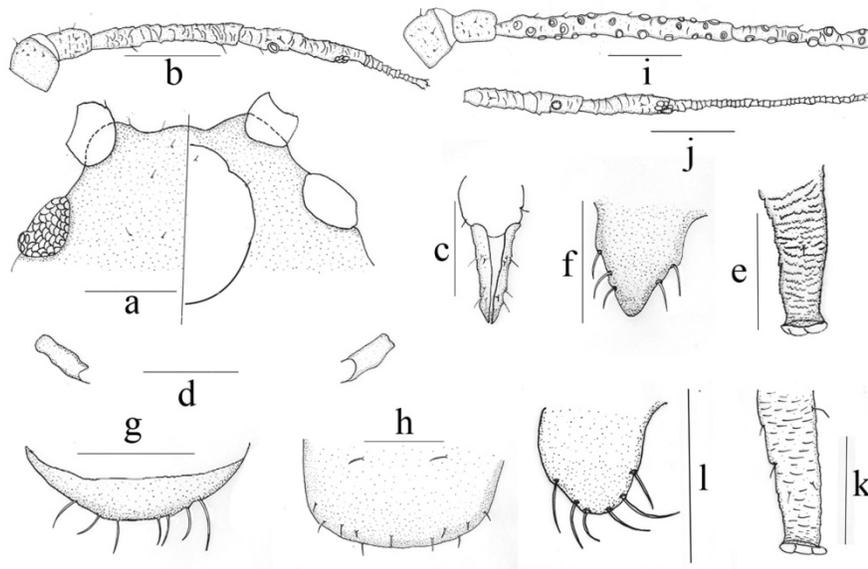


Fig.12. *Tuberocephalus (Trichosiphoniella) tianmushanensis*, Fundatrix: a, dorsal (left) and ventral (right) view of head; b, antennal segments I-V; c, ultimate rostral segment; d, mesosternal furca; e, siphunculus; f, cauda; g, anal plate; h, genital palte. Alate viviparous female (emigrant): i, antennal segments I-IV; j, antennal segments V-VI; k, siphunculus; l, cauda. Scale bars=0. 10 mm.



Fig. 13. *Tuberocephalus (Trichosiphoniella) tianmushanensis*, A, fundatrix; B, alate viviparous female (emigrant). Scale bars=0.10 mm.

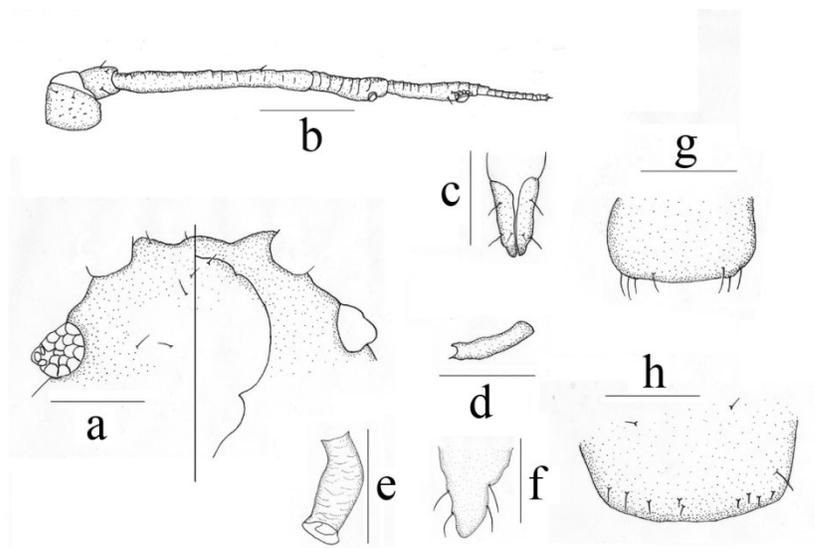


Fig. 14. *Tuberocephalus (Trichosiphoniella) tuberculus* sp. nov. Fundatrix: a, dorsal (left) and ventral (right) view of head; b, antennal segments I-V; c, ultimate rostral segment; d, mesosternal furca (right); e, siphunculus; f, cauda; g, anal plate; h, genital plate. Scale bars=0.10mm.

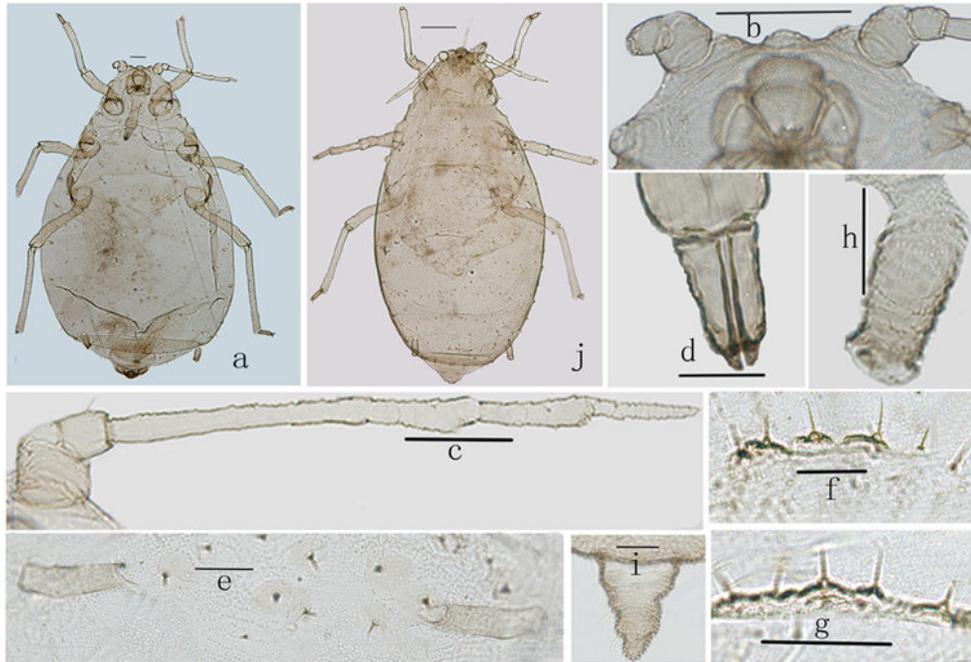


Fig. 15. *Tuberocephalus (Trichosiphoniella) tuberculus* sp. nov. Fundatrix: a, dorsal view of body; b, dorsal view of head; c, antennal segments 1-V; d, ultimate rostral segment; e, mesosternal furca; f, setae with tubercles bases on mesonotum; g, setae with tubercles bases on abdominal tergite III; h, siphunculus; i, cauda; Fundatrix nymph: j, dorsal view of body. Scale bars=0.10mm.