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Keys to the species of Aphidinae (Homoptera) intercepted at import inspection in Japan

Shun'ichiro SUGIMOTO and Ken'ichi KITAGAWA

Yokohama Plant Protection Station
5-57, Kitanakadori, Naka-ku, Yokohama 231, Japan

Abstract : Practical keys are given to 52 species of apterous viviparous females of the subfamily Aphidinae intercepted at import inspection in Japan.
Key words : Keys, Aphidinae, intercept, plant quarantine

Introduction

Recently, the imports of fresh fruits, vegetables, cut flowers and nursery stocks into Japan have been increasing year by year, so that many kinds of pests have been intercepted at import inspection in Japan (ITO, 1990; KATO, 1990, KARASAWA, 1992).

Since 1989, small in size pests such as aphids, thrips and mites, which are found frequently on the above-mentioned plants, have been collected at plant protection stations in Japan (HAYASE,1991; KANEDA and MASAKI, 1994; MASAKI, 1991; ODA, 1993; ODA and HAYASE, 1994; SUGIMOTO and KITAGAWA, 1991, 1994). From 1989 to 1993, about 1,500 samples of aphids were sent to us for identification. These samples were originally from Asia, Europe, North America and Oceania. We found that 99% of samples belonged to the subfamily Aphidinae. Among them 52 species were determined (Table 1).

We used the keys presented by MARTIN (1983) and BLACKMAN and EASTOP (1984) to identify the samples and found some new host plants and distribution records which were not included in those keys.

Therefore, practical keys for identification of the 52 species of aphids which have been found at import inspection in Japan are given. New host plants and distribution records which we have found in our study, are included in the key in addition to the information from BLACKMAN and EASTOP (1984).

Key to the tribe of the subfamily Aphidinae

1 Lateral tubercles usually present on 1st and 7th abdominal segments. Distance between 1st and 2nd abdominal spiracles 1/2-1/3 as long as between 2nd and 3rd abdominal spiracles (Fig. 1, 2). .....Aphidini

- Lateral tubercles usually absent from 1st and 7th abdominal segments. If lateral tubercles present on 1st abdominal segment then they are present on 2nd to 5th segments. 1st and 2nd abdominal spiracles usually close together (Fig. 3, 4, 5). .....Macrosiphini

Tribe Aphidini

Key to the apterous aphids intercepted at import inspection in Japan

1 Lateral tubercles on 7th abdominal segment placed posteroventral to the spiracles of the same segment (Fig. 1). .....Subtribe Aphidina 2

- Lateral tubercles on 7th abdominal segment placed posterodorsal to the spiracles of the same segment (Fig. 2). ..... Subtribe Rhopalosiphina 8

2 Hind tibia with a row of short peg-like spines (Fig. 51). Distribution: East Asia, Southeast Asia, India. Host plant: Anacardiaceae, Araliaceae,

Table 1. Aphidinae species intercepted at import inspection in Japan from 1989 to 1993

Tribe	Subtribe	Aphid species	Frequency
Aphidini	Aphidina	*Aphis craccivora* KOCH	29
		Aphis fabae SCOPOLI	53
		Aphis gossypii GLOVER	266
		Aphis intybi KOCH	9
		Aphis nasturtii KALTENBACH	7
		Aphis spiraecola PATCH	40
		Toxoptera odinae (VAN DER GOOT)	1
	Rhopalosiphina	*Hysteroneura setariae* (THOMAS)	1
		Rhopalosiphum maidis (FITCH)	16
		Rhopalosiphum nymphaeae (LINNAEUS)	8
		Rhopalosiphum padi (LINNAEUS)	32
		Rhopalosiphum rufiabdominale (SASAKI)	13
		Schizaphis graminum (RONDANI)	1
		Schizaphis rotundiventris (SIGNORET)	1
		Paraschizaphis sp.	1
Macrosiphini		*Acyrthosiphon pisum* (HARRIS)	1
		Aulacorthum circumflexum (BUCKTON)	8
		Aulacorthum solani (KALTENBACH)	86
		Brachycaudus cardui (LINNAEUS)	3
		Brachycaudus helichrysi (KALTENBACH)	26
		Brevicoryne brassicae (LINNAEUS)	47
		Cavariella aegopodii (SCOPOLI)	12
		Ceruraphis eriophori (WALKER)	1
		Chaetosiphon tetrarhodum (WALKER)	3
		Delphiniobium sp.	3
		Dysaphis apiifolia (THEOBALD)	10
		Dysaphis cynarae (THEOBALD)	6
		Dysaphis foeniculus (THEOBALD)	2
		Dysaphis tulipae (BOYER DE FONSCOLOMBE)	23
		Elatobium abietinum (WALKER)	1
		Eucarazzia elegans (FERRARI)	1
		Fimbriaphis fimbriata RICHARDS	1
		Hyperomyzus lactucae (LINNAEUS)	2
		Liosomaphis berberidis (KALTENBACH)	2
		Lipaphis erysimi (KALTENBACH)	16
		Macrosiphum euphorbiae (THOMAS)	144
		Macrosiphum rosae (LINNAEUS)	9
		Macrosiphum stellariae THEOBALD	1
		Metopolophium dirhodum (WALKER)	1
		Myzus ascalonicus DONCASTER	15
		Myzus cymbalariae STROYAN	6
		Myzus hemerocallis TAKAHASHI	3
		Myzus ornatus LAING	2
		Myzus persicae (SULZER)	390
		Nasonovia ribisnigri (MOSLEY)	11

Table 1. (Continued.)

Ovatus crataegarius (WALKER)	1
Pentalonia nigronervosa COQUEREL	50
Rhodobium porosum (SANDERSON)	26
Semiaphis heraclei (TAKAHASHI)	10
Sitobion luteum (BUCKTON)	7
Uroleucon gobonis (MATSUMURA)	1
Uroleucon sp.	5

Rubiaceae, Caprifoliaceae. ..... *Toxoptera odinae*

- Hind tibia without short peg-like spines. ..... *Aphis* spp. 3

3 Dorsal abdomen with a large dark patch (Fig. 7). ..4

- Dorsal abdomen without a dark patch. 5

4 Posterior seta on middle trochanter 2/3 - 1.2 times as long as diameter of trochanter-femoral suture (Fig. 52). Distribution: World wide. Host plant: Polyphagous. ..... *A. craccivora*

- Posterior seta on middle trochanter 1/3 as long as diameter of trochanter-femoral suture (Fig. 53). Distribution: Europe. Host plant: *Cichorium intybus* (Compositae). ..... *A. intybi*

5 Siphunculus and cauda pale (Fig. 42). Distribution: India, the Middle East, Europe, North America. Host plant: Polyphagous. ..... *A. nasturtii*

- Siphinculus black to dark. Cauda dusky to dark. ..6

6 Eighth abdominal tergum normally with 4 setae (Fig. 43). Distribution: World wide. Host plant: Polyphagous. ..... *A. fabae*

- Eighth abdominal tergum with 2 setae. 7

7 Siphunculus and cauda black. Cauda with 6 - 16 setae (Fig. 44). Distribution: World wide. Host plant: Polyphagous. ..... *A. spiraecola*

- Siphunculus dark. Cauda dusky, usually with 4 - 5 setae (Fig. 45). Distribution: World wide. Host plant: Polyphagous. ..... *A. gossypii*

8 Siphunculus wholly dark. Cauda pale. Distribution: Japan, Southeast Asia, India, North America, Africa, Australia. Host plant: Gramineae. In Japanese plant quarantine *Ananas comosus* is recorded (Sugimoto and Kitagawa, 1991). ..... *Hysteroneura setariae*

- Siphunculus and cauda dark to dusky, if cauda paler than siphunculus then siphunculus wholly dusky, often dark at apex. 9

9 Siphunculus with a more or less flange (Fig. 28, 29, 46, 47). Dorsum with row of minute spinules forming polygonal reticulation (Fig. 6). ..... *Rhopalosiphum* spp. 10

- Siphunculus without a flange. Polygonal reticulation on dorsum indistinctly. 13

10 Eighth abdominal tergum with 4 - 8 setae. Distribution: World wide. Host plant: Root of various plants, mainly Gramineae. In Japanese plant quarantine *Alstroemeria* sp., *Apium graveolens* and *Pteroselium crispum* are recorded (SUGIMOTO and KITAGAWA, 1991). ..... *R. rufiabdominale*

- Eighth abdominal tergum with 2 setae. 11

11 Processus terminalis 1.8 - 2.5 times as long as the base of last antennal segment. Siphunculus imbricated (Fig. 29). Distribution: World wide. Host plant: Gramineae. In Japanese plant quarantine *Ornithogalum* sp. is recorded (SUGIMOTO and KITAGAWA, 1991). ..... *R. maidis*

- Processus terminalis more than 3 times as long as the base of last antennal segment. Siphunculus smooth. 12

12 Siphunculus more than twice as long as cauda (Fig. 46). Distribution: World wide. Host plant: Mainly various water plants. In Japanese plant quarantine *Ornithogalum* sp. is recorded (SUGIMOTO and KITAGAWA, 1991). ..... *R. nymphaeae*

- Siphunculus about twice as long as cauda (Fig. 47). Distribution: World wide. Host plant: Gramineae. In Japanese plant quarantine *Asparagus officinalis* and *Ornithogalum* sp. are recorde (SUGIMOTO and KITAGAWA, 1991). ..... *R. padi*

13 Setae on 3rd antennal segment distinctly longer than the basal diameter of the segment. Eighth abdominal tergum with 6-10 setae. Distribution:

Sri Lanka. Host plant: Cyperaceae. .... *Paraschizaphis* sp.

- Setae on 3rd antennal segment as long as or shorter than the basal diameter of the segment. Eighth abdominal tergum with 2 setae. .... *Schizaphis* spp. 14

14 Siphunculus dark. Distribution: The tropics and subtropics. Host plant: Palmae. .... *S. rotundiventris*

- Siphunculus wholly pale, often dark at apex. Distribution: World wide. Host plant: Gramineae. In Japanese plant quarantine *Cocos nucifera* is recorded (SUGIMOTO and KITAGAWA, 1994). .... *S. graminum*

Tribe Macrosiphini

Key to the apterous aphids intercepted at import insection in Japan

1 Cauda semicircular or pentagonal, as long as or shorter than its basal width (Fig. 39, 40). 2

- Cauda much longer than its basal width. 8

2 Siphunculus distinctly swollen distal half (Fig. 30). Third antennal segment with 1-3 rhinaria near apex (Fig. 23) Distribution: The Middle East, the Mediterranean region. Host plant: Labiatae. .... *Eucarazzia elegans*

- Siphunculus cylindrical. Third antennal segment without rhinaria. 3

3 Head, 7th and 8th abdominal segments usually with spinal tubercles. ..... *Dysaphis* spp. 4

- Head, 7th and 8th abdominal segments without spinal tubercles. ..... *Brachycaudus* spp. 7

4 Dorsal setae of head longer than basal diameter of 3rd antennal segment. 5

- Dorsal setae of head shorter than basal diameter of 3rd antennal segment. 6

5 Diameter of spinal tubercles as long as diameter of spiracles. Distribution: India, the Mediterranean region, Africa, Australia, New Zealand. Host plant: Umbelliferae. ..... *D. foeniculus*

- Diameter of spinal tubercles longer than diameter of spiracles (Fig. 4). Distribution: World wide. Host plant: Liliaceae, Iridaceae. ..... *D. tulipae*

6 Ultimate rostral segment about twice as long as its basal width. Distribution : The Mediterranean region. Host plant: *Cynara scolymus* (Compositae). ..... *D. cynarae*

- Ultimate rostral segment 2.5 times as long as its basal width. Distribution: Central Asia, Europe, Africa, North and South America. Host plant: Umbelliferae. ..... *D. apiifolia*

7 Dorsal abdomen with a large dark patch (Fig. 8). Siphunculus 2.1 - 3.4 times as long as cauda. Distribution: India, the Middle East, Europe, North Africa, North America. Host plant: Compositae. ..... *B. cardui*

- Dorsal abdomen without a dark patch. Siphunculus 1.1 - 1.3 times as long as cauda. Distribution: World wide. Host plant: Polyphagous, mainly Compositae. ..... *B. helichrysi*

8 Siphunculus with reticulation at apex. 9

- Siphunculus without reticulation. 15

9 Thoracic spiracles much larger than abdominal spiracles (Fig. 5). Distribution : Europe. Host plant: *Delphinium* spp. (Ranunculaceae). .... *Delphiniobium* sp.

- Thoracic spiracles smaller than abdominal spiracles. 10

10 First tarsal segment with 5 setae (Fig. 54). .... *Uroleucon*. spp. 11

- First tarsal segment with 3 setae (Fig. 55). 12

11 Cauda black. Distribution: East Asia. Host plant: *Arctium lappa* (Compositae). ..... *U. gobonis*

- Cauda pale. Distribution: Europe. Host plant: *Cichorium intybus* (Compositae). .... *Uroleucon* sp.

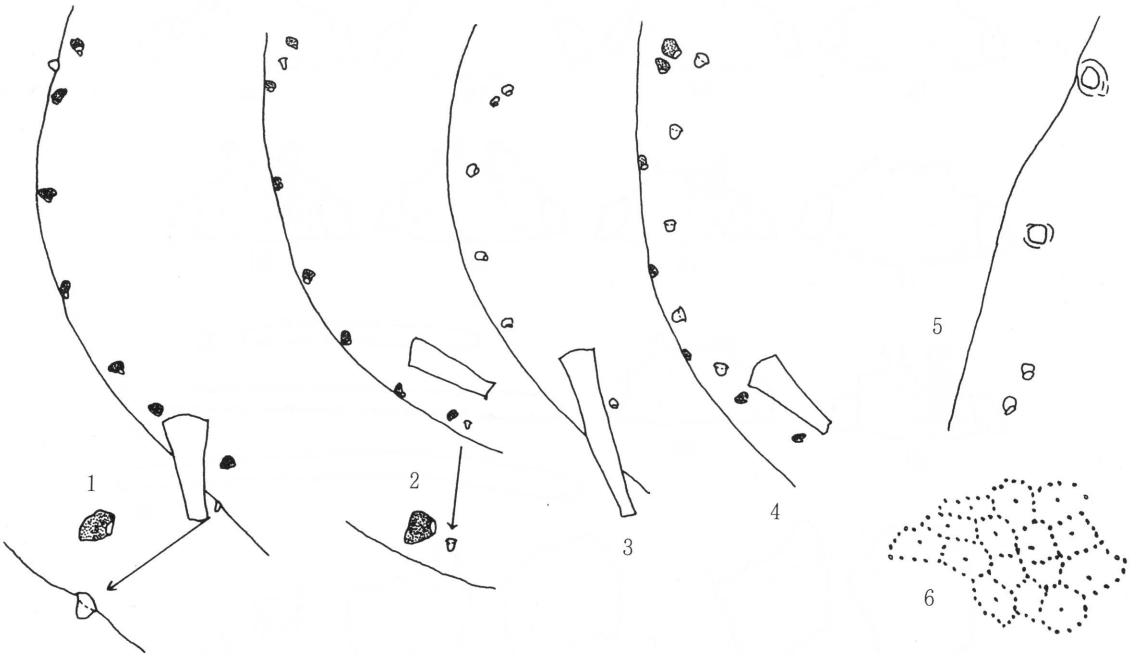
12 Dorsal abdomen with a oval large dark patch (Fig. 9). Distribution: Southeast Asia, Europe, Central and South America, the Pacific region, Australia. Host plant: Orchidaceae. ..... *Sitobion luteum*

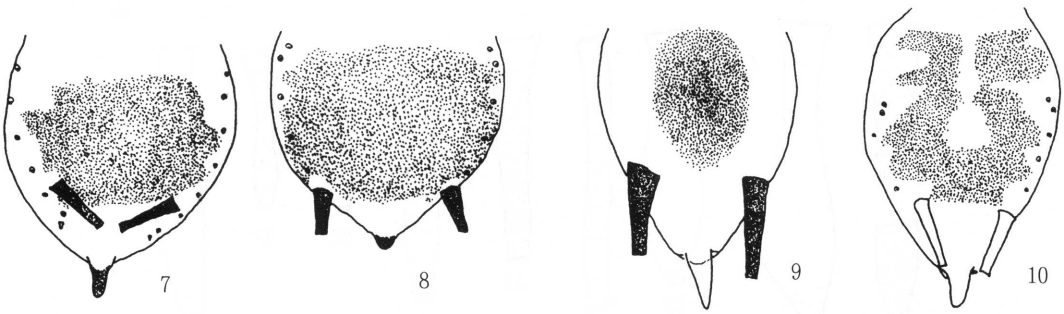
- Dorsal abdomen without a dark patch. .... *Macrosiphum* spp. 13

13 Siphunculus black, often pale at apex. Third antennal segment with rhinaria restricted to basal black part. Distribution: World wide, except eastern Asia. Host plant: *Rosa* spp. *Fragaria* spp. (Rosaceae). ..... *M. rosae*

- Siphunculus plae or fuscous, at least basally. Antennal segment pale to fuscous. 14

14 Apex of femur and reticulated part of siphunculus fuscous. Distribution: World wide. Host plant:





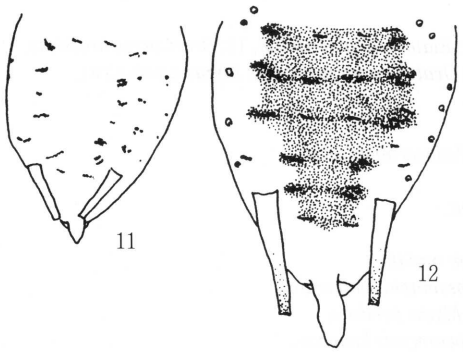


Fig. 1-5 : Abdominal margin in dorsal view.
1: *Aphis fabae.*
2: *Rhopalosiphum maidis.*
3: *Aulacorthum solani.*
4: *Dysaphis tulipae.*
5: *Delphiniobium* sp.

Fig. 6 : Dorsal abdomen of *Rhopalosiphum nymphaeae.*

Fig. 7-12 : Pigmentation of dorsal abdomen.
7: *Aphis craccivora.*
8: *Brachycaudus cardui.*
9: *Sitobion luteum.*
10: *Aulacorthum circumflexum.*
11: *Myzus ornatus.*
12: *Nasonovia ribisnigri.*

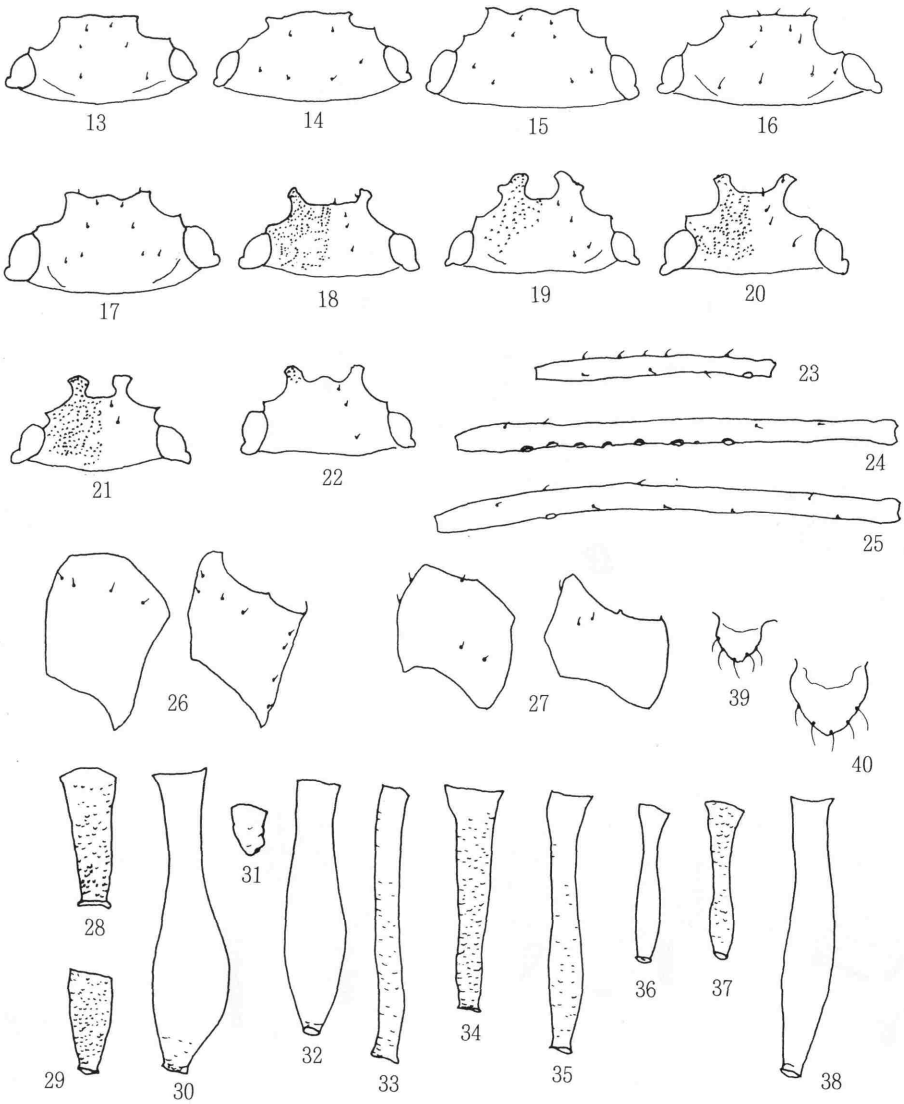


Fig. 13-22 : Head.
13: *Semiaphis heraclei*, 14: *Liosomaphis berberidis*, 15: *Elatobium abiertinum*, 16: *Brevicoryne brassicae*, 17: *Lipaphis erysimi*, 18: *Pentalonia nigronervosa*, 19: *Ovatus crataegarius*, 20: *Myzus ascalonicus*, 21: *Myzus cymbalariae*, 22: *Fimbriaphis fimbriata*.

Fig. 23-25 : Third antennal segment.
23: *Eucarazzia elagans*, 24: *Rhodobium porosum*, 25: *Aulacorthum solani*.

Fig. 26, 27 : Dorsum and venter of first antennal segment.
26: *Acyrthosiphon pisum*, 27: *Metopolophium dirhodum*.

Fig. 28-38 : Siphunculus.
28: *Rhopalosiphum rufiabdominale*, 29: *Rhopalosiphum maidis*, 30: *Eucarazzia elegans*, 31: *Semiaphis heraclei*, 32: *Liosomaphis berberidis*, 33: *Elatobium abietinum*, 34: *Myzus hemerocallis*, 35: *Myzus persicae*, 36: *Myzus ascalonicus*, 37: *Myzus cymbalariae*, 38: *Hyperomyzus lactucae*.

Fig. 39, 40 : Cauda.
39: *Brachycaudus helichrysi*, 40: *Dysaphis tulipae*.

Polyphagous. ····· *M. euphorbiae*

- Apex of femur and reticulated part of siphunculus black. Distribution: Europe. Host plant: Caryophyllaceae. ····· *M. stellariae*

15 Eight abdominal segment with supracaudal process (Fig. 48). Processus terminalis less than 1.3 times as long as the base of last antennal segment. Ultimate rostral segment without secondary setae (Fig. 56). Distribution: World wide. Host plant: Umbelliferae. ····· *Cavariella aegopodii*

- Without this combination of characters. ····· 16

16 Head smooth. Antennal tubercles undeveloped (Fig. 13 - 17). ····· 17

- Head smooth or granulated. Antennal tubercles developed (Fig. 18 - 22). ····· 22

17 Third antennal segment with secondary rhinaria. Dorsal abdomen sclerotized. Distribution: Europe, North America. Host plant: *Viburnum* spp. (Caprifoliaceae). ····· *Ceruraphis eriophori*

- Third antennal segment without secondary rhinaria. ····· 18

18 Siphunculus shorter than cauda, bent inward (Fig. 31). Distribution: East Asia, South east Asia, Hawaii. Host plant: Umbelliferae. ····· *Semiaphis heraclei*

- Siphunculus as long as or longer than cauda. ····· 19

19 Siphunculus considerably swollen (Fig. 32). Distribution: Asia, Europe, North America, Australia, New Zealand. Host plant: Berberidaceae. ····· *Liosomaphis berberidis*

- Siphunculus not swollen. ····· 20

20 Siphunculus twice as long as cauda, slightly S-curved (Fig. 33). Processus terminalis 1.0-1.6 times as long as the base of last antennal segment. Distribution: World wide, except Africa. Host plant: Pinaceae. ····· *Elatobium abietinum*

- Siphunculus less than twice as long as cauda. Processus terminalis more than twice as long as the base of last antennal segment. ····· 21

21 Siphunculus fuscous, as long as cauda (Fig. 49). Distribution: The temperate region. Host plant: Cruciferae. ····· *Brevicoryne brassicae*

- Siphunculus dusky expect at apex, longer than cauda (Fig. 50). Distribution: World wide. Host plant: Cruciferae. ····· *Lipaphis erysimi*

22 Head granulated or spinulated over dorsum (Fig.18 - 21). ····· 23

- Head smooth or at most on granulated antennal tubercles (Fig. 22). ····· 32

23 Head and femur spinulated (Fig. 18, 57). Distribution: The tropics and subtropics. Host plant: Araceae, Musaceae, Zingiberaceae. ····· *Pentalonia nigronervosa*

- Head granulated (Fig. 19 - 21). Femur smooth. ··· 24

24 Third antennal segment with secondary rhinaria. ····· 25

- Third antennal segment without secondary rhinaria. ····· 27

25 Third antennal segment with 4 - 16 rhinaria on basal half (Fig. 24). Distribution: World wide. Host plant: *Rosa* spp. (Rosaceae). ····· *Rhodobium porosum*

- Third antennal segment with 1 - 2 rhinaria near base (Fig. 25). ····· *Aulacorthum* spp. 26

26 Dorsal abdomen with a large dark patch (Fig. 10). Distribution: World wide. Host plant :Polyphagous. ····· *A. circumflexum*

- Dorsal abdomen without a dark patch. Distribution: World wide. Host plant: Polyphagous. ····· *A. solani*

27 Antennal tubercle with a forwardly-directed process which is shorter than its basal width in dorsal view (Fig. 19). Distribution: World wide. Host plant : Labiatae. ····· *Ovatus crataegarius*

- Antennal tubercles converging, but not directed anteriorly in dorsal view (Fig. 20, 21). ····· *Myzus* spp. 28

28 Dorsal abdomen with small pigmented patches (Fig. 11). Distribution: World wide. Host plant: Polyphagous. ····· *M. ornatus*

- Dorsal abdomen without a pigmented patch. ····· 29

29 Antennae 2/3 as long as body. Siphunculus cylindrical, uniformly imbricated (Fig. 34). Distribution: East Asia, India, South Africa. Host plant: *Hemerocallis* spp. (Liliaceae). ····· *M. hemerocallis*

- Antennae as long as body. Siphunculus swollen distal half (Fig. 35 - 37). ····· 30

30 Siphunculus (Fig. 35) as long as 3rd antennal segment. Distribution: World wide. Host plant: Polyphagous. ····· *M. persicae*

- Siphunculus shorter than 3rd antennal segment. ···· 31

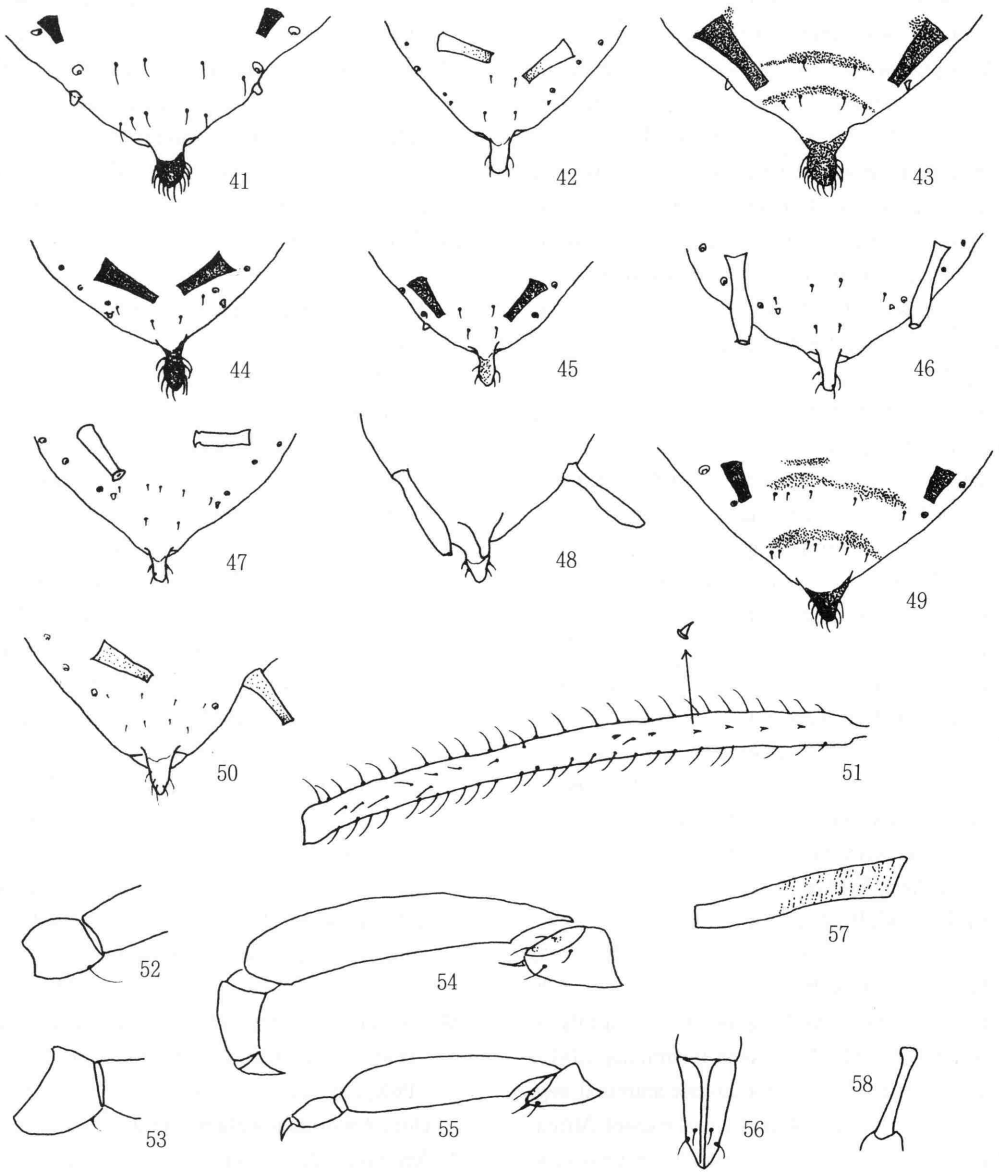


Fig. 41-50 : Apex of abdomen.
41: *Toxoptera odinae*, 42: *Aphis nasturtii*, 43: *Aphis fabae*,
44: *Aphis spiraecola*, 45: *Aphis gossypii*, 46: *Rhopolosiphum nymphaeae*,
47: *Rhopalosiphum padi*, 48: *Cavariella aegopodii*, 49: *Brevicoryne brassicae*,
50: *Liaphis erysimi*.
Fig. 51 : Hind tibia of *Toxoptera odinae*.
Fig. 52, 53 : Hind trochanter. 52: *Aphis craccivora*, 53: *Aphis intybi*.
Fig. 54, 55 : Hind tarsus. 54: *Uroleucon gobonis*, 55: *Sitobion luteum*.
Fig. 56 : Ultimate rostral segment of *Cavariella aegopodii*.
Fig. 57 : Hind femur of *Pentalonia nigronervosa*.
Fig. 58 : Seta on dorsal abdomen of *Chaetosiphon tetrarhodum*.

31 Antennal tubercles parallel in dorsal view (Fig. 20). Narrowest width of siphunculus (Fig. 36) slightly less than middle diameter of hind tibia. Eighth abdominal tergum with 4 setae. Distribution: World wide. Host plant: Polyphagous. ..... *M. ascalonicus*

- Antennal tubercles converging in dorsal view (Fig. 21). Narrowest width of siphunculus (Fig. 37) greater than middle diameter of hind tibia. Eighth abdominal tergum with 2 setae. Distribution: India, Europe, South Africa, Australia, New Zealand. Host plant: Polyphagous. ..... *M. cymbalariae*

32 Dorsal body setae capitate (Fig. 58). Distribution: World wide, expect Southeast Asia. Host plant: *Rosa* spp. (Rosaceae). ..... *Chaetosiphon tetrarhodum*

- Dorsal body setae not capitate. 33

33 Dorsal abdomen with paired dark intersegmental sclerites (Fig. 12). Distribution: Europe, North and South America. Host plant: Solanaceae, Compositae. ..... *Nasonovia ribisnigri*

- Dorsal abdomen without pigmentation. 34

34 Siphunculus swollen (Fig. 38). Distribution: World wide. Host plant: Compositae. ..... *Hyperomyzus lactucae*

- Siphunculus cylindrical. 35

35 Head smooth dorsally, at least granulated on antennal tubercles (Fig. 22). Distribution: North America. Host plant: *Fragaria* spp. (Rosaceae). ..... *Fimbriaphis fimbriata*

- Head smooth entirely. 36

36 Body 3 - 4.5 times as long as siphunculus. First antennal segment with more than 12 setae (Fig. 26). Distribution: World wide. Host plant: Leguminosae. ..... *Acyrthosiphon pisum*

- Body 5 - 6 times as long as siphunculus. First antennal segment with less than 11 setae (Fig. 27). Distribution: World wide. Host plant: Gramineae. In Japanese plant quarantine *Alstroemeria* sp. is recorded (SUGIMOTO and KITAGAWA, 1994). ..... *Metopolophium dirhodum*

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和 文 摘 要

輸入検疫で発見されたアブラムシの検索表

杉本俊一郎・北川 憲一

横浜植物防疫所

1989年以降，輸入検疫で発見されるアブラムシを組織的に収集し，約1,500のサンプルが集まった。このうち，99%はアブラムシ亜科に属し，52種が同定された。植物検疫で発見されるアブラムシは世界各地の様々な植物に付着してくるため，既存の資料では分類が困難である。このため，寄主植物及び分布に関する情報を含め同定された52種についての検索表を作成した。