

A New Record of *Aphis solanella* (Hemiptera: Aphididae) from South Korea

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ABSTRACT

The *Aphis solanella*, had been classified as a subspecies of *Aphis fabae*, is currently recognized as a separated species with *A. fabae*. The *A. solanella* is morphologically similar to *A. fabae* and has the same primary host, but there are differences in the range of the secondary host, physiological and ecological traits, so it has been suggested as a separated species. Since it had not been covered when recording the *A. fabae* at least including three subspecies in 2006 from South Korea, we recently collected and reconfirmed *A. solanella* in Busan. Therefore, we report the *Aphis solanella* as a new record with its description and illustrations.

Keywords: *Aphis solanella*, Aphididae, morphology, *Aphis fabae* complex

INTRODUCTION

The genus *Aphis* is the largest genus of aphids (Hemiptera: Aphididae) and recorded 614 valid species worldwide (Favret, 2023). In South Korea, 48 species were recorded for the genus (National Institute of Biological Resources, 2021). They are mostly small to medium size among aphids and have a variety of colors and hosts (Blackman and Eastop, 2007). Among them, *Aphis solanella* was previously classified as one of the subspecies of *Aphis fabae* (Heie, 1986; Stroyan, 1984). This group, *Aphis fabae* complex, had been described with four subspecies, *A. fabae fabae* Scopoli 1763, *A. fabae cirsilacanthoidis* Scopoli 1763, *A. fabae mordvilkoii* Börner & Janich 1922, and *A. fabae solanella* Theobald 1914 (Stroyan, 1984; Heie, 1986). They are morphologically very similar and have a common primary host and are separated by differences in the range of secondary hosts (Dixon and Thieme, 2007; Blackman, 2010). Recently, *A. f. solanella* had been suggested that there are physiological and ecological differences from *A. f. fabae* (Thieme and Dixon, 1996; Thieme and Dixon, 2004) and then it was elevated to separated species (Blackman and Eastop, 2007).

In South Korea, although Kim et al. (2006) recorded the *Aphis fabae*, they did not employ the subspecific division.

However, after *Aphis solanella* had been elevated to a species, this taxon has not been treated in South Korea. As a result of examination of the specimens collected from *Solanum nigrum* L. in 2021, we report the *Aphis solanella* for the first time in South Korea.

MATERIALS AND METHODS

Samples were collected from Busan, South Korea in 2021 and then stored in 95% alcohol. Among them, 17 apterous adults were made the slide glass specimens using Canada balsam for morphological observation, and these voucher specimens were deposited in Animal Systematics Laboratory of Kunsan National University. Morphological observation was performed with Leica DM2500 microscope (Leica, Germany). Photographs of the specimens were taken using a Leica ICC50 E Camera with Leica Application Suite version 4.11.0 (Leica). Morphological terminology and diagnostic characters were based on Kim et al. (2006) and Blackman and Eastop (2007).

Abbreviations for descriptions were as follows: Ant.I, Ant.II, Ant.III, Ant.IV, Ant.V, Ant.VI, Ant.VIb, antennal segments I, II, III, IV, V, VI and the base of Ant.VI, respec-

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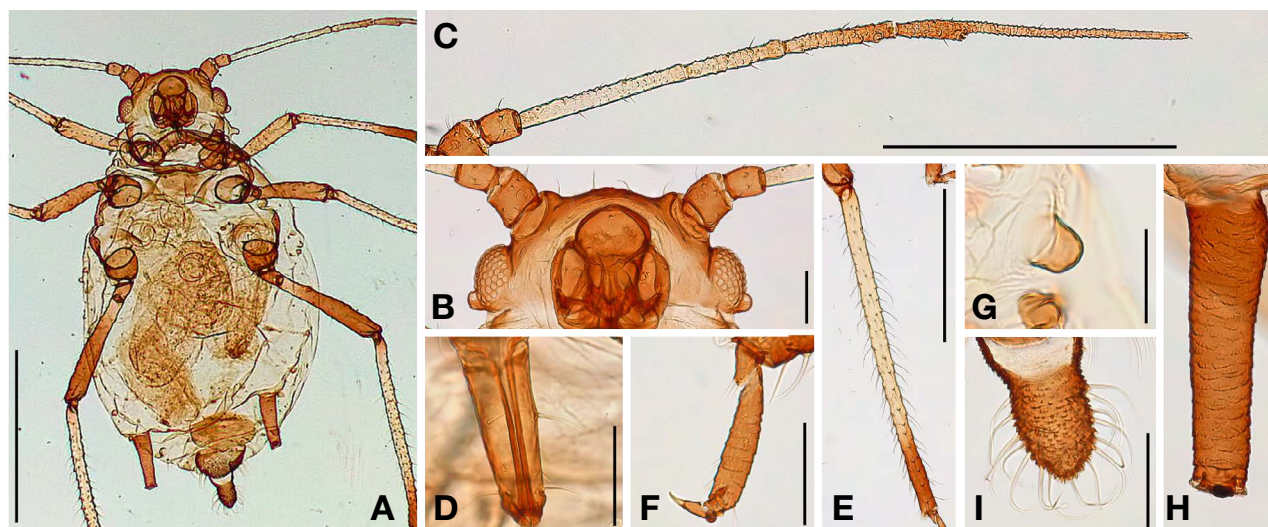


Fig. 1. *Aphis solanella*. Apterous viviparous female: A, Body; B, Head; C, Antennal segments (I–VI); D, Ultimate segment of rostrum; E, Hind tibia; F, Hind tarsal segment II; G, Marginal tubercle on abdominal tergum I; H, Siphunculus; I, Cauda. Scale bars: A=1 mm, B, D, F, H, I=0.1 mm, C, E=0.5 mm, G=0.05 mm.

tively; Ant.IIIBD, basal diameter of antennal segment III; PT, processus terminalis; URS, ultimate rostral segment; 2HT, second segment of hind tarsus; AbdT.I, AbdT.II, AbdT.III, AbdT.IV, AbdT.V, AbdT.VI, AbdT.VII, AbdT.VIII, abdominal tergum I, II, III, IV, V, VI, VII, VIII; SIPH, siphunculus; GP, genital plate; apt., apterous viviparous female, apterae.

SYSTEMATIC ACCOUNTS

Order Hemiptera Linnaeus, 1758
Family Aphididae Latreille, 1802

¹*Genus *Aphis* Linnaeus, 1758

Subgenus *Aphis* sensu stricto

Aphis Linnaeus, 1758. Systema Naturae 1: 451–453.

Apathaphis Bomer, 1952.

Aphidula Nervsky, 1929.

Asiataphis Narzikulov, 1970.

Bituberculaphis Busanova, 1943.

Brachysiphum van del' Goot, 1913.

Cerosipha del Guercio, 1900.

Chaitophoroides Mordvilko, 1908.

Comaphis Bomer, 1940.

Debilisiphon Shaposhnikov, 1950.

Doralida Börner, 1950.

Doralina Börner, 1940.

Doralis auctt. nec Leach, 1827.

Leueosiphon Bomer, 1952.

Longirostrina Kumar & Burkhardt, 1971.

Longirostris Kumar Burkhardt, 1970 nee S. D. W. 1836.

Medoralis Bomer, 1952.

Miosiphon del Guercio, 1907.

Papillaphis Bomer, 1952.

Pergandeida Schouteden, 1903.

Tuberculaphis Bomer, 1952.

Uraphis del Guercio, 1907.

Wapuna Hottes & Wehrle, 1951.

Type species: *Aphis sambuci* Linnaeus, 1758.

²**Aphis* (*Aphis*) *solanella* Theobald, 1914

(Table 1, Fig. 1)

Aphis compositae Theobald, 1915.

Aphis dusmeti Gómez-Menor, 1950 partim.

Aphis (*Aphis*) *evonymi* Abashidze 1951 auctt. prior to 1950, nec Fabricius, 1775.

Aphis solanophilus Blanchard, 1923.

Description. Apterous viviparous female. Color (in life): black, blackish brown or blackish, sometimes white on dorsal of abdomen or basal of siphunculus. antennal segments I–II black; antennal segments III–V pale; antennal segment V black. Legs on coxae, trochanter, mid and hind femur, distal apex of tibiae and tarsi black; otherwise pale. Siphunculi and cauda black. Color (in macerated specimens): Head and abdomen pale, thorax and near parts dark brown (sclerotic); dor-

Table 1. Biometric data of *Aphis solanella*

	Part	Apterous vivipara (n=17)	
Length (mm)	Body	2.14 (1.88–2.39)	
	Whole antennae	1.48 (1.08–1.79)	
	Ant.I	0.07 (0.03–0.09)	
	Ant.II	0.07 (0.03–0.09)	
	Ant.III	0.34 (0.24–0.43)	
	Ant.IV	0.22 (0.15–0.28)	
	Ant.V	0.22 (0.16–0.29)	
	Ant.VIb	0.12 (0.09–0.15)	
	PT	0.43 (0.33–0.55)	
	URS	0.13 (0.11–0.16)	
	Hind femur	0.61 (0.53–0.69)	
	Hind tibia	1.13 (1.03–1.28)	
	2HT	0.14 (0.12–0.16)	
	SIPH	0.3 (0.23–0.38)	
	Cauda	0.17 (0.14–0.22)	
	Setae on Ant.III	0.02 (0.01–0.03)	
	Setae on AbdT.III	0.03 (0.01–0.05)	
	No. of hairs on	Mandibular lamina	5 (2–8)
		Ant.I	3 (3–4)
		Ant.II	3 (3–5)
Ant.III		6 (3–8)	
URS (subsidiary)		3	
Tergite between SIPH		2	
Tergite VIII		4 (3–4)	
Median of GP		0 (0–2)	
Posterior margin of GP		11 (8–13)	
Cauda		11 (9–15)	
No. of Rhinaria on	Ant.III	0	
Ratio (times)	Whole Antennae/Body	0.69 (0.57–0.75)	
	PT/Ant.III	1.26 (1.28–1.38)	
	PT/Ant.VIb	3.58 (3.67–3.67)	
	URS/2HT	0.93 (0.91–1.00)	
	URS/Ant.VIb	1.08 (1.07–1.20)	
	SIPH/Body	0.14 (0.12–0.16)	
	SIPH/Ant.III	0.88 (0.88–0.96)	
	SIPH/Hind femur	0.49 (0.43–0.55)	
	SIPH/Cauda	1.76 (1.64–1.73)	
	Cauda/Width of cauda	2.43 (2.33–2.75)	
	Setae on Ant.III/Ant.III BD	0.67 (0.50–1.00)	
	Setae on AbdT.III/Ant.III BD	1 (0.50–1.67)	

Values are presented as means (min. - max.).

Abbreviations are explained in text. A blank cell in the range columns means that all measurements were identical.

sum with pairs of irregular spinal sclerites on anterior tergum I–IV(–V), with intersegmental muscle sclerites. Antennae dark brown on Ant.I–II, distal half of Ant.V to Ant.VI; otherwise pale. URS dark brown. Legs pale except coxae, trochanter, basal half of femur, distal apex of tibiae and tarsi dark brown. GP dark brown. Siphunchuli and cauda black.

Morphology. Body ovoid, 1.88–2.39 mm from antennal tubercle to end of cauda (Fig. 1A). Head: smooth dorsally and

ventrally, with one pair of acuminate setae on dorsum, longest seta as long as or slightly longer than Ant.III BD; median tubercle on frons not developed, frontal line between antennal tubercles almost straight with four setae on vertex (Fig. 1B). Antennae six segmented, shorter (0.57–0.75 times) than body length without secondary rhinarium; Ant.I smooth with 3–4 setae; Ant.II smooth with 3–5 setae; Ant.III imbricate with 5–8 setae, longest seta 0.5–1.0 times as long as Ant.III BD;

Ant.IV imbricate with 2–5 setae; Ant.V imbricate with 2–4 setae; Ant.VI strongly imbricate with 1–3 setae on Ant.VIb, 3–5 setae including apical setae on PT, PT 3.58–3.67 times as long as Ant.VIb (Fig. 1C). Rostrum reaching to about middle coxae; clypeus with four setae; mandibular laminae with 1–4 setae on each side; URS 0.91–1 times as long as 2HT, 1.07–1.20 times as long as Ant.VIb, bearing six long accessory setae (Fig. 1D). Thorax: pronotum smooth with one pair of minute spinal setae and two pairs of marginal setae close to marginal tubercle on each side; meso- and metathoracic dorsum with well developed polygonal reticulations and marginal sclerites. Hind coxae smooth with approximately eight setae; posterior seta on hind trochanter 1.0–1.2 times as long as width of trochanter-femoral joint; hind femur smooth, bearing long setae, longest of posterior setae 0.6–0.86 times as long as middle width of segment; longest seta of tibiae 0.9–1.3 times as long as middle width of segment (Fig. 1E); hind tarsal chaetotaxy; 2HT imbricate with 3–four setae. Abdomen: dorsum weakly reticulated with approximately eight setae on each segment of terga I–IV; terga I, VII with marginal tubercles, occasionally rather small tubercles present on terga II–VI (Fig. 1A); longest spinal seta of tergum III 0.5–1.0 times as long as Ant.IIIBD; tergum VI with two spinal setae between SIPH; tergum VIII with 3–4 setae; genital plate with 0–2 median setae and 8–13 setae on posterior margin. SIPH cylindrical imbricate, narrower at apex than at base, 1.64–1.73 times as long as cauda; apical flange weakly developed (Fig. 1H). Cauda tongue-shaped or rather triangular, slightly or not constricted, with 9–15 setae (Fig. 1I).

Key to *Aphis fabae* and *Aphis solanella* from South Korea

1. Setae on Ant.III 0.82–1.65 × Ant.IIIBD. Number of hairs on URS subsidiary 2. Cauda 1.29–2.37 × width of cauda. Number of hairs on median of GP 2–10..... *Aphis fabae*
2. Setae on Ant.III 0.50–1.00 × Ant.IIIBD. Number of hairs on URS subsidiary 3. Cauda 2.33–2.75 × width of cauda. Number of hairs on median of GP absence or less than 2..... *Aphis solanella*

Material examined. South Korea, 17♀ apt.: Busan, on *Solanum nigrum* Linn. (Solanaceae), 17 Nov 2021, deposited in Animal Systematics Laboratory, Department of Biological Science, Kunsan National University, Gunsan, South Korea.

Host plants. *Chenopodium album*, *Chenopodium glaucum*, *Viburnum lentago*, *Viburnum opulus*, *Beta vulgaris*, *Spinacia oleracea*, *Chaerophyllum hirsutum*, *Eryngium bourgatii*, *Eryngium campestre*, *Ferula linkii*, *Foeniculum vulgare*, *Laserpitium latifolium*, *Orlaya grandiflora*, *Petroselinum crispum*, *Scandix pecten-veneris*, *Seseli elatum* subsp. *austriacum*, *Sium sisarum*, *Nerium oleander*, *Polyscias balfouriana*, *Adenos-*

tyles leucophylla, *Bidens pilosa*, *Calendula arvensis*, *Calendula officinalis*, *Carduus acanthoides*, *Carduus arabicus*, *Carduus corymbosus*, *Carduus defloratus*, *Carduus hamulosus*, *Carduus onopordioides*, *Carlina corymbosa*, *Carthamus lanatus*, *Centaurea cheiranthifolia*, *Centaurea cyanus*, *Centaurea iberica*, *Centaurea jacea*, *Centaurea moschata*, *Cirsium alatum*, *Cirsium arvense*, *Cirsium glabrum*, *Cirsium setosum*, *Cirsium straminispinum*, *Cirsium vulgare*, *Cosmos bipinnatus*, *Cousinia* spp., *Cynara scolymus*, *Dahlia pinnata*, *Doronicum austriacum*, *Gerbera jamesonii*, *Helianthus annuus*, *Helianthus tuberosus*, *Lapsana communis*, *Leontodon hispidus*, *Leucanthemum vulgare*, *Mulgedium tataricum*, *Onopordum acanthium*, *Senecio vulgaris*, *Silybum marianum*, *Solidago canadensis*, *Sonchus oleraceus*, *Tripleurospermum inodorum*, *Zinnia elegans*, *Echium vulgare*, *Arabidopsis halleri*, *Barbarea stricta*, *Capsella bursa-pastoris*, *Capsella rubella*, *Capsella rubella*, *Descurainia sophia*, *Campanula latifolia*, *Campanula medium*, *Michauxia campanuloides*, *Platycodon grandiflorus*, *Centranthus calcitrapa*, *Centranthus ruber*, *Dipsacus fullonum*, *Valeriana* spp., *Euonymus europaeus*, *Kalanchoe* sp., *Benincasa hispida*, *Luffa* sp., *Euphorbia helioscopia*, *Euphorbia peplus*, *Manihot esculenta*, *Lathyrus odoratum*, *Robinia pseudoacacia*, *Sophora alopecuroides*, *Vicia faba*, *Vigna unguiculata*, *Gentiana lutea*, *Perovskia atriplicifolia*, *Salvia tortuosa*, *Astragalus sieversianus*, *Hibiscus* spp., *Mirabilis jalapa*, *Cephalanthera damasonium*, *Chloraea grandiflora*, *Dactylorhiza sambucina*, *Oxalis pes-caprae*, *Fumaria muralis*, *Fumaria officinalis*, *Papaver argemone*, *Papaver hybridum*, *Papaver rhoeas*, *Papaver somniferum*, *Digitalis purpurea*, *Plantago lanceolata*, *Zea mays*, *Persicaria amphibia*, *Persicaria bistorta*, *Rheum compactum*, *Rheum rhabarbarum*, *Rheum rhaponticum*, *Rumex acetosa*, *Rumex acetosella*, *Rumex conglomeratus*, *Rumex crispus*, *Rumex dentatus*, *Rumex hastatus*, *Rumex nepalensis*, *Rumex obtusifolius*, *Rumex pulcher*, *Rumex turcestanicus*, *Emex pulcher*, *Fagopyrum esculentum*, *Fallopia convolvulus*, *Fallopia sachalinensis*, *Ranunculus cortusifolius*, *Potentilla reptans*, *Pyrus communis*, *Galium aparine*, *Galium mollugo*, *Galium murale*, *Galium spurium*, *Galium verum*, *Rubia cordifolia*, *Rubia fruticosa*, *Citrus limon*, *Cestrum euanthes*, *Cestrum nocturnum*, *Cestrum parqui*, *Cyphomandra clavata*, *Datura metel*, *Datura stramonium*, *Lycopersicon esculentum*, *Solanum americanum*, *Solanum dulcamara*, *Solanum intrusum*, *Solanum luteum*, *Solanum marginatum*, *Solanum nigrum*, *Solanum quineense*, *Solanum sisymbriifolium*, *Solanum texanum*, *Solanum torvum*, *Solanum tuberosum*, *Solanum villosum*, *Tamarix tetrandra*, *Lantana camara*, *Verbena officinalis* (Blackman and Eastop, 2019).

Distribution. Korea (new), Asia, Africa, Europe and South America.

Remarks. DNA sequences of our samples were confirmed to be completely consistent with *Aphis solanella* (NC_068764.1)

and *Aphis fabae solanella* (AB506722.1) registered in GenBank through cytochrome c oxidase subunit I (COI) barcodes. In previous study, Kim et al. (2006) found at least three subspecies, *A. fabae fabae*, *A. fabae mordwilkoii* and *A. fabae solanella*, but did not treat them as separate subspecies. In this study, we newly collected and reconfirmed *A. solanella* as a species in Korea.

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CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

This research was supported by a grant from the Korea Environment Industry & Technology Institute (KEITI) through Exotic Invasive Species Management Program (2018002270005) and supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR202203201). It was also supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2022R1A2C1091308).

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Received January 16, 2023

Revised May 4, 2023

Accepted August 14, 2023