Aphids (Hemiptera, Aphididae) on ornamental plants in greenhouses in Bulgaria

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Abstract
Investigations on the species composition and host range of aphids on ornamental greenhouse plants in Bulgaria were conducted over a period of five years, from 2008 to 2012. Twenty greenhouses, growing ornamentals for landscaping, plant collections and other purposes were observed. They were located in the regions of Sofia, Plovdiv, Smolyan, Pavlikeni, Varna and Burgas. The total number of collected aphid samples was 279. Their composition included 33 aphid species and one subspecies from 13 genera and 5 subfamilies. Twenty-eight species were found to belong to subfamily Aphidinae. Almost 70 % of all recorded species were polyphagous. The most widespread aphid species was Myzus persicae, detected in 13 greenhouses all year round, followed by Aulacorthum solani (10 greenhouses) and Aphis gossypii (9 greenhouses). The widest host range was shown by Myzus persicae (43 hosts), Aulacorthum solani (32 hosts) and Aulacorthum circumflexum (23 hosts).

The list of host plants includes 114 species from 95 genera and 58 families. The greatest variety of aphid species was detected on Hibiscus (9 species). Out of all aphid samples 12.9 % were collected on Hibiscus and 6.8 %, on Dendranthema. The greatest variety of aphid species was detected on Hibiscus (9 species).
Periphyllus californiensis and Aphis (Aphis) fabae mordvilkoi are reported for the first time for Bulgaria. Furthermore, Aphis spiraecola has been found in new localities and has widened its host range in this country.

Keywords
Aphididae, aphids, ornamental plants, greenhouses, Bulgaria

Introduction

Aphids cause serious damage in greenhouses, where conditions are favorable for their development throughout the year and where they can reach high density over a short period of time. The damage caused by aphids may lead to deterioration of the ornamental qualities of infested plants and sometimes even death. One of the most important and serious consequences is virus transmission.

Currently, there is no extensive research on ornamental plants in greenhouses in Bulgaria, which prompted the current study. The only survey on this topic was conducted by Tashev (1962). He reported 6 aphid species: Aulacorthum (Neomyzus) circumflexum (Buckton, 1876); Macrosiphoniella sanborni (Gillette, 1908); Macrosiphum euphorbiae (Thomas, 1878); Myzus (Myzus) ornatus Laing, 1932; Myzus (Nectarosiphon) ascalonicus Doncaster, 1946; Myzus (Nectarosiphon) persicae (Sulzer, 1776).

The results of our survey contribute to the scientific knowledge in the investigated field, but also have a practical application, benefitting producers of ornamental crops. The purpose of this study was to identify the species composition of aphids on greenhouse ornamentals, their host range and the most frequently infested ornamental species in Bulgaria.

Material and methods

The investigation was conducted over a period of five years, from 2008 to 2012. Twenty greenhouses, located in the regions of Sofia, Plovdiv, Smolyan, Pavlikeni, Varna and Burgas, were observed. Several types of greenhouses were included: for growing and propagation of ornamentals, for landscaping (annuals, perennials, rooting cuttings), for acclimatization of imported plants, for winter preservation of cold-tender species and for plant collections.

The observed greenhouses are designated as follows:

Greenhouses with a permanent plant composition: Greenhouses of University of Forestry (GL); Greenhouses of Bulgarian Academy of Science (GB); Greenhouses of the University Botanic Gardens (GS); Greenhouses of Euxinograd park (GE); Greenhouses of Vrana park (GV); Greenhouses of Krichim park (GK); Ravda (R1);
Greenhouses with a constant circulation of plant species: private greenhouses in Sofia (S1, S2, S3, S4, S5, S6); Varna (V1, V2); Burgas (B1); Ravda (R2); Pavlikeni (PV); Plovdiv (PL); Smolyan (SM).

Aphids were collected in plastic bags together with the infested plant parts. Larvae were reared in laboratory conditions to the stage of adults.

The species identification was carried out using permanent microscope slides, after the traditional method of Hille Ris Lambers (1950). Identification keys included Blackman and Eastop (1994, 2000, 2006), Shaposhnikov (1964) and Stroyan (1984).

**Results**

The total number of collected samples of aphids on ornamental plants during the observed five-year period was 279.

In total, 33 aphid species and one subspecies from 13 genera and 5 subfamilies (Lachninae, Chaitophorinae, Calaphidinae, Aphidinae and Eriosomatinae) were identified. Four species were identified only to the generic level but they are included in a total number of species because of the presence of clear distinguishing characters proving that they are separate species. Fourteen species belong to genus *Aphis* (42 %) and three species belong to genus *Myzus* (9 %). Genera *Aulacorthum*, *Brachycaudus*, *Macrosiphum* and *Rhopalosiphum* are represented by 2 species. Genera *Cinara*, *Idioterus*, * Macrosiphoniella*, *Ovatus*, *Periphyllus*, *Prociphilus* and *Tinocallis* are represented by 1 species.

All aphid species and their host plants, including the data of Tashev (1962), are presented in alphabetical order in Table 1.

**Discussion**

Twenty three of all recorded aphid species (69.7 %) have been reported on indoor ornamental plants (Weiss 1916, Cichocka and Goszczynski 1975, Achremowicz et al. 1986, Cichocka 1992, Łabanowski 2008, Rafi et al. 2010) and only six (18.2 %) have been found on ornamentals in Bulgarian greenhouses (Tashev 1962).

Twenty one of all recorded aphid species are polyphagous, 9 are oligophagous and only one is monophagous (Blackman and Eastop 1994, 2000, 2006). Seven of the polyphagous species were observed more frequently (Fig. 1).

During the survey, the most common species, represented by the highest numbers of samples, was *Myzus persicae*, found throughout the year in 13 greenhouses (61 samples, 21.9 %) (Fig. 1), followed by *Aulacorthum solani* (10 greenhouses, 51 samples, 18.3 %), *Aulacorthum circumflexum* (3 greenhouses, 33 samples, 11.8 %), *Aphis gossypii* (9 greenhouses, 26 samples, 9.3 %), *Aphis spinacea* (4 greenhouses, 11 samples, 3.9 %), *Macrosiphum euphorbiae* (3 greenhouses, 9 samples, 3.2 %) and *Aphis fabae*
| Aphid species | Host plant family | Host plant species | Greenhouse | Date          |
|---------------|-------------------|--------------------|------------|---------------|
| *Aphis* (*Aphis*) *craccivora* Koch, 1854 | Fabaceae | *Robinia pseudoacacia* L. | GL | 27.07.2010 |
| Malvaceae | *Hibiscus rosa-sinensis* L. | GL | 11.07.2011 |
| Nyctaginaceae | *Bougainvillea glabra* Choisy | GE | 27.05.2009 |
| Portulacaceae | *Portulaca umbraticola* Kunth | B1 | 17.08.2010 |
| *Aphis* (*Aphis*) *fabae* Scopoli, 1763* | Agavaceae | *Yucca elephantipes* Hort. ex Regel | S1 | 05.07.2011 |
| Aizoaceae | *Aptenia cordifolia* (L.f.) Schwantes | GL | 18.09.2009 |
| | | | | 30.06.2009 |
| Araceae | *Anthurium andraeanum* Linden | GE | 01.06.2010 |
| Asteraeae | *Cosmos bipinnatus* Cav. | GL | 11.07.2011 |
| Nyctaginaceae | *Bougainvillea glabra* Choisy | GE | 13.07.2009 |
| Solanaceae | *Datura hybrid* Ten. | GE | 27.05.2009 |
| *Aphis* (*Aphis*) *fabae mordvilko* Börner & Janich, 1922 | Tropaeolaceae | *Tropaeolum majus* L. | GE | 01.06.2010 |
| *Aphis* (*Aphis*) ex gr. *fabae* | Araceae | *Anthurium andraeanum* Linden | GE | 01.06.2010 |
| *Aphis* (*Aphis*) *farinosa* Gmelin, 1790 | Salicaceae | *Salix matsudana* Koiz. | GB | 26.05.2010 |
| *Aphis* (*Aphis*) ex gr. *frangulae* | Asteraceae | *Gazania heterophylla* Willd. ex Steud. | S2 | 06.08.2010 |
| *Aphis* (*Aphis*) *gossypii* Glover, 1877 | Acanthaceae | *Aphelandra squarrosa* Nees | S1 | 13.03.2009 |
| | | | | 18.03.2009 |
| | | | | 26.05.2010 |
| | | | S3 | 28.04.2010 |
| Araliaceae | *Schefflera arboricola* (Hayata) Merr. | GS | 05.03.2010 |
| Asteraeae | *Chrysanthemum hybridum* Guss. | S1 | 17.02.2009 |
| | | | | 25.11.2008 |
| | | | S1 | 13.02.2009 |
| | | | | 13.03.2009 |
| | | | S6 | 26.11.2009 |
| | | | | 25.11.2008 |
| Malvaceae | *Hibiscus rosa-sinensis* L. | GL | 05.11.2010 |
| | | | | 08.10.2010 |
| | | | | 11.07.2011 |
| | | | | 18.09.2009 |
| | | | | 20.07.2011 |
| | | | | 31.08.2010 |
| | | | GV | 28.10.2008 |
| | | | R1 | 01.06.2010 |
| | | | | 19.07.2010 |
| | | | | | 25.11.2008 |
| | | | | GB | 04.08.2010 |
| Primulaceae | *Cyclamen persicum* Mill. | S4 | 03.08.2010 |
| Rosaceae | *Eriobotrya japonica* (Thunb.) Lindl. | R1 | 17.07.2009 |
| Scrophulariaceae | *Hebe* sp. | S1 | 01.07.2010 |
| Aphid species | Host plant family | Host plant species          | Greenhouse | Date       |
|---------------|-------------------|----------------------------|------------|------------|
| *Aphis* (Aphis) *hederae* Kaltenbach, 1843 | Araliaceae         | *Hedera helix* L.          | GE         | 23.07.2010 |
|               |                   |                            | S2         | 06.08.2010 |
|               |                   |                            |           | 12.07.2011 |
|               |                   |                            |           | 27.05.2010 |
| *Aphis* (Aphis) *nasturtii* Kaltenbach, 1843 | Malvaceae          | *Hibiscus rosa-sinensis* L. | GL         | 05.11.2010 |
|               |                   | *Hibiscus syriacus* L.     | GL         | 31.08.2010 |
|               | Primulaceae       | *Cyclamen persicum* Mill. | S4         | 03.08.2010 |
| *Aphis* (Aphis) *nerii* Boyer de Fonscolombe, 1841 | Apocynaceae        | *Nerium oleander* L.       | R1         | 17.07.2009 |
|               |                   |                            |           | 19.07.2010 |
|               | Asclepiadaceae    | *Asclepias curassavica* L. | R1         | 17.07.2009 |
| *Aphis* (Aphis) *sedi* Kaltenbach, 1843 | Crassulaceae       | *Sedum adolphii* Raym.-Hamet | GE         | 27.05.2009 |
|               |                   | *Sedum glaucophyllum* R. T. Clausen | GE       | 27.05.2009 |
| *Aphis* (Aphis) *spiraecola* Patch, 1914 | Aizoaceae          | *Aptenia cordifolia* (L.f.) Schwantes | GL      | 14.07.2010 |
|               |                   |                            |           | 31.08.2010 |
|               | Caprifoliaceae    | *Viburnum tinus* L.        | R1         | 01.06.2010 |
|               | Malvaceae         | *Hibiscus rosa-sinensis* L. | GL         | 05.11.2010 |
|               |                   |                            |           | 08.10.2010 |
|               | Rosaceae          | *Aronia melanocarpa* Nutt. ex Elliott | R1      | 17.07.2009 |
|               |                   | *Spiraea douglasii* Hook.  | PV         | 14.07.2010 |
|               |                   | *Spiraea japonica* L.  f.  | PV         | 14.07.2010 |
|               | Scrophulariaceae  | *Hebe* sp.                 | S1         | 01.07.2010 |
| *Aphis* (Aphis) *spiraephaga* F. P. Müller, 1961 | Rosaceae          | *Spiraea douglasii* Hook.  | S2         | 06.08.2010 |
| *Aphis* (Aphis) *verbasci* Schrank, 1801 | Buddlejaceae      | *Buddleja daviddii* Franch. | GB       | 04.08.2010 |
| *Aphis* (Aphis) sp. | Begoniaceae       | *Begonia semperflorens* Hook. | PL      | 19.08.2010 |
| *Aulacorthum* (Aulacorthum) *solani* (Kaltenbach, 1843) | Acanthaceae      | *Aphelandra squarrosa* Nees | R2       | 01.06.2010 |
|               |                   |                            | S1         | 28.04.2010 |
|               | Aceraceae         | *Acer palmatum* Thunb.     | GB         | 05.11.2010 |
|               | Apocynaceae       | *Mandevilla sanderae* (Hemsld.) Woodson | S5     | 12.07.2011 |
|               |                   | *Nerium oleander* L.       | GL         | 08.06.2011 |
|               |                   | *Vinca major* L.           | GL         | 08.06.2011 |
|               | Aracéeae          | *Anthurium andraeanum* Lindén | GE     | 23.07.2010 |
|               |                   |                            | S1         | 28.04.2010 |
|               | Syngonium podophyllum Schott | GL     | 08.06.2011 |
|               | Syngonium sp.     |                            | R2         | 01.06.2010 |
| *Araliaceae* | *Aralia japonica* Thunb. | GL       | 14.03.2012 |
|               | *Hedera helix* L.  | GL                            | 28.03.2011 |
| *Chefflera* arboricola* (Hayata) Merr. | *Chefflera arboricola* (Hayata) Merr. | GL       | 08.06.2011 |
|               |                   |                            | R1         | 01.06.2010 |
| Aphid species | Host plant family | Host plant species | Greenhouse | Date |
|---------------|-------------------|--------------------|------------|------|
| *Aulacorthum (Aulacorthum) solani* (Kaltenbach, 1843) | Asteraceae | *Chrysanthemum hybridum* Guss. | S4 | 12.07.2011 |
| | | *Dahlia x cultorum* Thorsrud & Reisaeter | S5 | 26.05.2010 |
| | | *Dendranthema sp.* | S4 | 12.07.2011 |
| | | *Gerbera jamesonii* Adlam | GL | 08.06.2011 |
| | | *Senecio macroglossus* DC. | GV | 28.10.2008 |
| | Begoniaceae | *Begonia elatior* Hort. ex Steud. | S5 | 01.07.2010 |
| | Caesalpiniaceae | *Gleditsia triacanthos* L. | GL | 08.06.2011 |
| | Caprifoliaceae | *Weigela floribunda* C. A. Mey | R1 | 01.06.2010 |
| | | *Weigela florida* A. DC. | GL | 08.06.2011 |
| | Geraniaceae | *Pelargonium peltatum* (L.) L’Hér. | GL | 05.11.2010 |
| | | | | 14.03.2012 |
| | | | | 28.03.2011 |
| | | | S2 | 19.05.2011 |
| | | *Pelargonium roseum* Ehrh. | GL | 08.06.2011 |
| | | *Pelargonium zonale* (L.) L’Hér. | GL | 01.04.2010 |
| | | | | 05.11.2010 |
| | | | | 14.07.2010 |
| | | | | 18.09.2009 |
| | | | | 21.03.2011 |
| | | | | 27.04.2010 |
| | | | S2 | 19.05.2011 |
| | | | | 24.01.2011 |
| | Lamiaceae | *Coleus x hybridus* Hort. | GB | 05.11.2010 |
| | | *Mentha sp.* | GB | 05.11.2010 |
| | | *Thymus sp.* | GB | 05.11.2010 |
| | Lauraceae | *Persea americana* Mill. | GL | 08.06.2011 |
| | Liliaceae | *Tulipa sp.* | S5 | 26.05.2010 |
| | Malvaceae | *Hibiscus rosa-sinensis* L. | GB | 07.10.2010 |
| | | | GL | 08.06.2011 |
| | | | | 11.07.2011 |
| | | | | 28.03.2011 |
| | | | | 28.05.2011 |
| | Onagraceae | *Fuchsia hybrida* Hort. | GL | 08.06.2011 |
| | Solanaceae | *Calibrachoa sp.* | S5 | 26.05.2010 |
| | | | | 28.04.2010 |
| | Verbenaceae | *Verbena sp.* ex Vilm. | S5 | 26.05.2010 |
| *Aulacorthum (Neomyzus) circumflexum* (Buckton, 1876) | Acanthaceae | *(Acanthus sp.)* | GB | Tashev (1962) |
| | | *(Ruellia speciosa)* Lindau | GB | Tashev (1962) |
| | Adiantaceae | *Adiantum capillus-veneris* L. | GL | 21.03.2011 |
| | Amaryllidaceae | *Nerine sp.* | GB | Tashev (1962) |
| | Anthericaceae | *Chlorophytum comosum* (Thunb.) Jacques | GL | 17.02.2009 |
| | | | | 26.05.2010 |
Aphids (Hemiptera, Aphididae) on ornamental plants in greenhouses in Bulgaria

| Aphid species | Host plant family | Host plant species | Greenhouse | Date |
|---------------|-------------------|--------------------|------------|------|
| *Aulacorthum* (Neomyzus) *circumflexum* (Buckton, 1876) | Apocynaceae | Catharanthus sp. | GL | 28.03.2011 |
| | | Vinca major L. | GL | 01.04.2010 |
| | | | | 08.06.2011 |
| | | | | 11.07.2011 |
| | Araceae | *Arum* sp. | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | *Anthurium andreanum* Linden | GE | 30.06.2009 |
| | Alocasia macrorrhiza (L.) G. Don | Schott | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | Araceae | *Colocasia antiquorum* Schott | GB | Tashev (1962) |
| | | | GL | 01.04.2010 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| | Araceae | *Zantedeschia aethiopica* (L.) Spreng. | GL | 08.06.2011 |
| | | *Anthurium andraeanum* Linden | GE | 30.06.2009 |
| | | *Arum* sp. | GB | Tashev (1962) |
| | | | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| | | *Aulacorthum* (Neomyzus) *circumflexum* (Buckton, 1876) | Apocynaceae | Catharanthus sp. | GL | 28.03.2011 |
| | | Vinca major L. | GL | 01.04.2010 |
| | | | | 08.06.2011 |
| | | | | 11.07.2011 |
| | | Alocasia macrorrhiza (L.) G. Don | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | *Anthurium andreanum* Linden | GE | 30.06.2009 |
| | | *Arum* sp. | GB | Tashev (1962) |
| | | | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| | | *Zantedeschia aethiopica* (L.) Spreng. | GL | 08.06.2011 |
| | | *Anthurium andraeanum* Linden | GE | 30.06.2009 |
| | | *Arum* sp. | GB | Tashev (1962) |
| | | | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| | | *Zantedeschia aethiopica* (L.) Spreng. | GL | 08.06.2011 |
| | | *Anthurium andraeanum* Linden | GE | 30.06.2009 |
| | | *Arum* sp. | GB | Tashev (1962) |
| | | | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| | | *Zantedeschia aethiopica* (L.) Spreng. | GL | 08.06.2011 |
| | | *Anthurium andraeanum* Linden | GE | 30.06.2009 |
| | | *Arum* sp. | GB | Tashev (1962) |
| | | | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| | | *Zantedeschia aethiopica* (L.) Spreng. | GL | 08.06.2011 |
| | | *Anthurium andraeanum* Linden | GE | 30.06.2009 |
| | | *Arum* sp. | GB | Tashev (1962) |
| | | | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| | | *Zantedeschia aethiopica* (L.) Spreng. | GL | 08.06.2011 |
| | | *Anthurium andraeanum* Linden | GE | 30.06.2009 |
| | | *Arum* sp. | GB | Tashev (1962) |
| | | | GB | Tashev (1962) |
| | | | GL | 28.03.2011 |
| | | | | 03.12.2008 |
| | | | | 17.02.2009 |
| | | | | 28.03.2011 |
| | | | | 30.06.2009 |
| Aphid species | Host plant family | Host plant species | Greenhouse | Date       |
|---------------|-------------------|--------------------|------------|------------|
| Aulacorthum (Neomyzus) circumflexum (Buckton, 1876) | Nymphaeaceae | *Nymphaea corolla* Lam. | GB | Tashev (1962) |
| | | *Nymphaea sp.* | GB | Tashev (1962) |
| | Oxalidaceae | *Oxalis floriibunda* Lehm. | GB | Tashev (1962) |
| | | *Oxalis sp.* | GL | 28.03.2011 |
| | | *Oxalis violacea* L. | GB | Tashev (1962) |
| | Polypodiaceae | *Polypodium vulgare* L. | GB | Tashev (1962) |
| | Primulaceae | *Cyclamen persicum* Mill. | GL | 28.03.2011 |
| | | *Cyclamen sp.* | GB | Tashev (1962) |
| | Ranunculaceae | *Aquilegia vulgaris* L. | GL | 08.06.2011 |
| | Rosaceae | *Aronia melanocarpa* Nutt. ex Elliott | GL | 08.06.2011 |
| | Rubiaceae | *Hoffmannia refugens* Hemsl. | GE | 23.07.2010 |
| | Saxifragaceae | *Saxifraga sarmentosa* L.f. | GB | Tashev (1962) |
| | Tiliaceae | *Sparmannia palmata* Hort. ex Lindl. | GB | Tashev (1962) |
| Brachycaudus (Acaudus) cardui (Linnaeus, 1758) | Asteraceae | *Chrysanthemum frutescens* L. | GB | 05.11.2010 |
| | | *Dahlia x cultorum* Thorsrud & Reisaeter | SM | 05.09.2011 |
| | | *Senecio cineraria* DC. | GL | 08.06.2011 |
| | | | | 11.07.2011 |
| | | | | 28.03.2011 |
| Brachycaudus (Brachycaudus) helichrysi (Kaltenbach, 1843) | Asteraceae | *Senecio mikanioides* Otto ex Walp. | GB | 04.08.2010 |
| Cinara (Cinara) neubergeri (Arnhart, 1930) | Pinaceae | *Pinus piniaster* Aiton | R1 | 29.05.2009 |
| Idiopterus nephrolepidis Davis, 1909 | Adiantaceae | *Adiantum capillus-veneris* L. | S1 | 25.05.2011 |
| | Araceae | *Syngonium podophyllum* Schott | GL | 23.03.2011 |
| | Aspleniaceae | *Asplenium nidus* L. | V1 | 13.07.2009 |
| | Blechnaceae | *Blechnum sp.* | S1 | 25.05.2011 |
| | Davalliaceae | *Nephelepis exaltata* (L.) Schott | GL | 25.04.2012 |
| | | | | 30.03.2012 |
| | | | | 13.03.2009 |
| | | | | 25.05.2011 |
| | | | | 06.08.2010 |
| | | | | 19.05.2011 |
| | Piperaceae | *Peperomia elitisifolia* Hook. | GL | 28.03.2011 |
| | Polypodiaceae | *Platycerium bifurcatum* (Cav.) C. Chr. | V1 | 13.07.2009 |
| Aphid species                          | Host plant family | Host plant species                  | Greenhouse | Date            |
|----------------------------------------|-------------------|-------------------------------------|------------|-----------------|
| *Idiopterus nephrelepidis* Davis, 1909 | Pteridaceae       | *Pteris cretica* L.                 | GL         | 28.03.2011      |
|                                        |                   | *Pteris* sp.                        | S1         | 25.05.2011      |
| **Macroisphoniella** *(Macroisphoniella)* sanborni (Gillette, 1908) | Asteraceae        | *Chrysanthemum hybridum* Guss.      | S1         | 20.10.2010      |
|                                        |                   |                                     | S4         | 12.07.2011      |
|                                        |                   |                                     | S5         | 07.10.2010      |
|                                        |                   |                                     |            | 18.12.2008      |
|                                        |                   |                                     |            | 26.05.2010      |
|                                        |                   |                                     |            | 28.04.2010      |
|                                        |                   |                                     | S6         | 01.11.2011      |
|                                        |                   |                                     |            | 26.11.2009      |
|                                        |                   | *Chrysanthemum indicum* L.          | GB         | Tashev (1962)   |
| **Dendranthema** sp.                   |                   |                                     | GE         | 27.05.2009      |
|                                        |                   |                                     | GV         | 28.10.2008      |
|                                        |                   |                                     | R1         | 23.07.2010      |
|                                        |                   |                                     |            | 29.05.2009      |
|                                        |                   |                                     | S1         | 20.10.2010      |
|                                        |                   |                                     | S4         | 12.07.2011      |
|                                        |                   |                                     | S5         | 07.10.2010      |
|                                        |                   |                                     |            | 18.12.2008      |
|                                        |                   |                                     |            | 26.05.2010      |
|                                        |                   |                                     |            | 28.04.2010      |
|                                        |                   |                                     | S6         | 01.11.2011      |
|                                        |                   |                                     |            | 26.11.2009      |
| **Macrosiphum** *(Macrosiphum)* euphorbiae (Thomas, 1878) | Acanthaceae       | *Aphelandra squarrosa* Nees         | R2         | 01.06.2010      |
|                                        | Anthericaceae     | *Chlorophytum comosum* (Thunb.) Jacques | R2         | 01.06.2010      |
|                                        | Apocynaceae       | *Mandevilla sandersii* (Hemsl.) Woodson | R2         | 01.06.2010      |
|                                        |                   | *Vinca major* L.                    | R1         | 29.05.2009      |
|                                        | Araliaceae        | *Schefflera arboricola* (Hayata) Merr. | R1         | 01.06.2010      |
|                                        | Asteraceae        | *Cineraria* sp.                     | GB         | Tashev (1962)   |
|                                        | Hydrangeaceae     | *Hydrangea tortensis* Sm.           | GB         | Tashev (1962)   |
|                                        | Malvaceae         | *Hibiscus rosa-sinensis* L.         | GL         | 28.03.2011      |
|                                        |                   |                                     |            | 30.06.2009      |
|                                        |                   |                                     | R2         | 01.06.2010      |
| **Macrosiphum** *(Macrosiphum)* rosae (Linnaeus, 1758) | Rosaceae          | *Rosa hybrida* Vill.                | GE         | 27.05.2009      |
|                                        |                   | *Rosa rugosa* Thunb.                | GB         | 05.11.2010      |
| **Myzus** *(Myzus)* ornatus Laing, 1932 | Acanthaceae       | *Acanthus* sp.                      | GB         | Tashev (1962)   |
|                                        |                   | *Fittonia argyronima* E. Coem.      | GB         | Tashev (1962)   |
|                                        |                   | *Ruellia speciosa* Lindau           | GB         | Tashev (1962)   |
|                                        | Amaranthaceae     | *Iresine herbstii* Hook.            | GV         | 25.05.2009      |
|                                        | Araliaceae        | *Aralia sieboldii* Hort. ex K. Koch | GB         | Tashev (1962)   |
| Aphid species                | Host plant family | Host plant species | Greenhouse | Date       |
|------------------------------|-------------------|--------------------|------------|------------|
| Myzus (Myzus) ornatus Laing, 1932 | Asparagaceae      | Asparagus sp.      | GB         | Tashev (1962) |
|                              | Asteraceae        | Centaurea macrocephala Muss. Pushk. ex Willd. | GB         | Tashev (1962) |
|                              |                   | Chrysanthemum indicum L. | GB         | Tashev (1962) |
|                              |                   | Cineraria sp.      | GB         | Tashev (1962) |
| Begoniaceae                  | Begonia sp.       |                    | GB         | Tashev (1962) |
| Brassicaceae                 | Arabis alpina L.  |                    | GB         | Tashev (1962) |
| Ericaceae                    | Erica australis L. |                    | GB         | Tashev (1962) |
|                             | Erica lautanica Rudolfi |              | GB         | Tashev (1962) |
|                             | Erica sp.         |                    | GB         | Tashev (1962) |
| Fabaceae                     | Lupinus sp.       |                    | GB         | Tashev (1962) |
| Gesneriaceae                 | Saintpaulia ionantha H. Wendl. |   | GB         | Tashev (1962) |
| Hydrangeaceae                | Hydrangea hortensis Sm. |             | GB         | Tashev (1962) |
| Lamiaceae                    | Coleus x hybridus Hort. |                | GV         | 25.05.2009  |
|                             |                    |                    | GB         | Tashev (1962) |
| Mimosaceae                   | Acacia floribunda Willd. |              | GB         | Tashev (1962) |
| Oxalidaceae                  | Oxalis floribunda Lehm. |             | GB         | Tashev (1962) |
| Primulaceae                  | Primula sp.       |                    | GB         | Tashev (1962) |
| Saxifragaceae                | Heuchera sp.      |                    | GB         | Tashev (1962) |
| Scrophulariaceae             | Digitalis purpurea L. |              | GB         | Tashev (1962) |
| Urticaceae                   | Laportea gigas Wedd. |             | GB         | Tashev (1962) |
| Valerianaceae                | Valeriana montana L. |              | GB         | Tashev (1962) |
| Violaceae                    | Viola sp.         |                    | GB         | Tashev (1962) |
| Myzus (Nectarosiphon) ascalonicus Doncaster, 1946 | Cucurbitaceae | Lagenaria vulgaris Ser. | GB         | Tashev (1962) |
|                             | Geraniaceae       | Pelargonium sp.    | GB         | Tashev (1962) |
|                             | Hydrangeaceae     | Hydrangea hortensis Sm. | GB         | Tashev (1962) |
|                             | Lamiaceae         | Salvia sp.         | GB         | Tashev (1962) |
| Aphid species                      | Host plant family | Host plant species                  | Greenhouse | Date          |
|------------------------------------|-------------------|-------------------------------------|------------|---------------|
| Myzus (Nectarosiphon) ascalonicus  | Malvaceae          | Hibiscus rosa-sinensis L.            | GL         | 28.03.2011    |
| Doncaster, 1946                    |                   |                                     |            |               |
|                                    | Resedaceae        | Reseda odorata L.                    | GB         | Tashev        |
|                                    |                   |                                     |            | (1962)        |
|                                    | Scrophulariaceae  | Hebe sp.                            | S1         | 01.07.2010    |
| Myzus (Nectarosiphon) persicae     | Acanthaceae       | Aphelandra aurantiaca Lindl.         | GB         | 07.10.2010    |
| (Sulzer, 1776)                     |                   | Thunbergia coccinea Wall.            | GB         | 09.03.2009    |
|                                    |                   |                                     |            | 20.12.2008    |
|                                    | Agavaceae         | Cordyline terminalis Kunth.          | GS         | 05.03.2010    |
|                                    | Aizoaceae         | Aportenia cordifolia (L.f.) Schwantes| GL         | 24.01.2011    |
|                                    | Amaranthaceae     | Pleopetalum darwinii Hook. f.        | GS         | 17.03.2009    |
|                                    | Anthericaceae     | Chlorophytum comosum (Thunb.) Jacques| GK         | 31.05.2010    |
|                                    | Apocynaceae       | Catharanthus sp.                     | GL         | 28.03.2011    |
|                                    |                   | Mandevilla sunderii (Hemsl.) Woodson | S5         | 01.07.2010    |
|                                    |                   |                                     |            | 03.08.2010    |
|                                    |                   |                                     |            | 26.05.2010    |
|                                    | Araceae           | Anthurium andraeanum Linden          | V2         | 14.07.2009    |
|                                    |                   | Syngonium podophyllum Schott         | GL         | 24.01.2011    |
|                                    |                   | Zantedeschia aethiopica (L.) Spreng. | GV         | 28.10.2008    |
|                                    | Araliaceae        | Hedera helix L.                      | GL         | 14.03.2012    |
|                                    |                   | Schefflera arboricola (Hayata) Merr. | GB         | 02.09.2010    |
|                                    |                   |                                     |            | 04.08.2010    |
|                                    |                   |                                     |            | 07.10.2010    |
|                                    |                   |                                     |            | 01.06.2010    |
|                                    | Asteraceae        | Bellis perennis L.                   | GB         | 20.10.2010    |
|                                    |                   | Chrysanthemeum hybridum Guss.        | S1         | 13.03.2009    |
|                                    |                   | Chrysanthemeum indicum L.            | GB         | Tashev        |
|                                    |                   |                                     |            | (1962)        |
|                                    |                   | Cineraria sp.                        | GB         | Tashev        |
|                                    |                   |                                     |            | (1962)        |
|                                    |                   | Dendranthema sp.                     | S1         | 13.03.2009    |
|                                    |                   | Gazania heterophylla Willd. ex Steud.| S4         | 26.05.2010    |
|                                    |                   | Senecio hybridus Scheidw.            | S1         | 13.03.2009    |
|                                    |                   | Senecio rowleyanus H. Jacobsen       | GB         | 18.12.2008    |
|                                    |                   | Zinnia elegans Jacq.                | GE         | 01.06.2010    |
|                                    | Bignoniaceae      | Campsis radicans (L.) Seem.          | S5         | 30.08.2010    |
|                                    | Bombacaceae       | Ceiba pentandra Gaertn.              | GL         | 14.03.2012    |
|                                    | Brassicaceae      | Arabis alpina L.                     | GB         | 20.10.2010    |
|                                    |                   |                                     |            | 24.01.2011    |
|                                    | Cactaceae         | Zygocactus truncatus K. Schum.       | GS         | 05.03.2010    |
|                                    | Caprifoliaceae    | Viburnum tinus L.                    | GB         | 02.09.2010    |
|                                    |                   |                                     |            | 07.10.2010    |
|                                    | Caryophyllaceae   | Dianthus hybridus Schmidt ex Tausch  | S6         | 31.05.2011    |
| Aphid species                        | Host plant family | Host plant species | Greenhouse | Date          |
|--------------------------------------|-------------------|--------------------|------------|---------------|
| *Myzus (Nectarosiphon) persicae*     | Convolvulaceae    | *Ipomoea purpurea* (L.) Roth | S4         | 28.04.2010    |
| (Sulzer, 1776)                      |                   |                    |            | 26.05.2010    |
|                                     |                   |                    |            | 28.04.2010    |
| Droseraceae                         | *Dionaea* sp.     |                    | S3         | 06.08.2010    |
| Gesneriaceae                        | *Aeschynanthus* radicans Jack | GB | 05.03.2010 |
| Hydrangeaceae                       | *Hydrangea bortensis* Sm. | GB | Tashev (1962) |
| Lamiaceae                           | *Thymus* sp.      |                    | GB         | 05.11.2010    |
| Malvaceae                           | *Hibiscus rosa-sinensis* L. | GB | 07.10.2010 |
|                                     |                    |                    |            | 09.03.2009    |
|                                     |                    |                    |            | 24.01.2011    |
|                                     |                    |                    |            | 04.11.2009    |
|                                     |                    |                    |            | 17.12.2008    |
|                                     |                    |                    |            | 28.05.2011    |
| Nyctaginaceae                       | *Bougainvillea glabra* Choisy | GB | 04.08.2010 |
| Oleaceae                            | *Jasminum officinale* L. | GB | 09.03.2009 |
| Primulaceae                         | *Cyclamen persicum* Mill. | S1 | 13.03.2009 |
| Solanaceae                          | *Calibrachoa* sp.  |                    | S5         | 26.05.2010    |
|                                     | *Datura hybrida* Ten. |               | GE         | 27.05.2009    |
|                                     | *Solandra maxima* (Sessè & Moc.) P. S. Green | GB | 04.08.2010 |
|                                     |                    |                    |            | 05.03.2010    |
|                                     |                    |                    |            | 07.10.2010    |
|                                     | *Solandra* sp.     |                    | GB         | 26.05.2010    |
|                                     | *Solanum* sp.      |                    | GB         | 26.05.2010    |
| Zamiaceae                           | *Zamia pumila* L.  |                    | GB         | 18.12.2008    |
| *Ovatus (Ovatus) crataegarius*      | Lamiaceae         | *Monarda didyma* L. | R1         | 01.06.2010    |
| (Walker, 1850)                      |                   |                    |            | 20.10.2010    |
| *Periphyllus californiensis* (Shinji, 1917) | Aceraceae   | *Acer palmatum* Thunb. | GB | 01.06.2010 |
| *Prociphilus* (Meliarhizophagus) fraxinifolii* (Riley in Riley & Monell, 1879) | Oleaceae | *Fraxinus* sp. | R1 | 17.02.2009 |
| *Prociphilus* sp.                   | Oleaceae          | *Fraxinus excelsior* L. | GL | 17.02.2009 |
| *Rhopalosiphum nymphaeae* (Linnaeus, 1761) | Nymphaeaceae | *Nymphaea alba* L. | GV | 28.10.2008 |
| *Rhopalosiphum padi* (Linnaeus, 1758) | Asphodelaceae | *Kniphophia uvaria* (L.) Hook. | R1 | 29.05.2009 |
| Poaceae                             | *Aegrostis stolonifera* L. | S4 | 18.11.2010 |
| *Tinocallis (Sarucallis) kahawaluokalani* (Kirkaldy, 1907) | Lythraceae | *Lagerstroemia indica* L. | R1 | 01.06.2010 |

* The specimens of *Aphis (Aphis) fabae* are not identified to the subspecies level.
Aphids (Hemiptera, Aphididae) on ornamental plants in greenhouses in Bulgaria

(3 greenhouses, 8 samples, 2.9 %). All other species were found very rarely and were represented by 5 or less samples (< 1.8 %).

The present study indicates that in greenhouses with a permanent plant composition, aphid infestations are more frequent, more widespread, and are caused by a greater variety of species compared to infestations in greenhouses with a constant circulation of plant species (Fig. 2).

The widest host range was shown by *Myzus persicae* (43 hosts, 38 %), *Aulacorthum solani* (32 hosts, 28 %), *Aulacorthum circumflexum* (23 hosts, 20 %), *Aphis gossypii* (9 hosts, 8 %), *Aphis spiralaeola* (8 hosts, 7 %), *Aphis fabae* (7 hosts, 6 %) and * Macrosiphum euphorbiae* (6 hosts, 5 %).

*Periphyllus californiensis* and *Aphis (Aphis) fabae mordvilkoi* are reported for the first time for Bulgaria. Furthermore, *Aphis spiralaeola* has been found in new localities and has widened its host range in this country. So far, this species had been reported only on apple by Rasheva and Andreev (2007). All hosts reported in the present study for *Aphis spiralaeola* are new for Bulgaria.

The list of host plants includes 114 species from 95 genera and 58 families. The most frequently infested plant species belong to Asteraceae (50 samples) and Malvaceae (37 samples). Eighteen samples were collected from Araceae; 16 samples from Apocynaceae; 15 samples from Araliaceae; 13 samples from Geraniaceae; and 10 samples from Acanthaceae, Solanaceae and Rosaceae.

The most frequently infested plants belong to the genera *Hibiscus* (12.9 %, 36 samples), *Dendranthema* (6.8 %, 19 samples), *Chrysanthemum* (5 %, 14 samples) and *Pelargonium* (4.7 %, 13 samples).

The highest diversity of aphid species was observed on *Hibiscus rosa-sinensis* and consists of 9 species (from 29 samples). Five species were identified on *Dendranthema* sp. (19 samples), *Chrysanthemum hybridum* (13 samples) and *Anthurium andreanum*

![Figure 1](image.jpg)

**Figure 1.** Number of samples and number of host plant species found by polyphagous aphid species.
Figure 2. Distribution of number of samples and number of aphid species by greenhouses.

(6 samples). Four species were found on Cyclamen persicum, Shefflera arboricola and Syngonium podophyllum. Three species were recorded on Apenia cordifolia, Bougainvillea glabra, Chlorophytum comosum, Hebe sp., Hedera helix, Hibiscus syriacus, Mandevilla sanderi and Vinca major.

Conclusion

The aphids established on ornamental plants in greenhouses in Bulgaria comprise 33 species and one subspecies from 13 genera and 5 subfamilies. The most widespread aphid species is Myzus persicae, followed by Aulacorthum solani and Aphis gossypii. The widest host ranges were shown by Myzus persicae, Aulacorthum solani and Aulacorthum circumflexum.

The list of host plants includes 114 species from 95 genera and 58 families. The most infested plants belong to the genera Hibiscus and Dendranthema. The largest number of aphid species was detected on Hibiscus (9 species).
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