



Association of the aphids (Insecta: Homoptera: Aphididae) with basal and some core eudicots flowering plants in India

Rajendra Singh*, Abhilasha Srivastava

Department of Zoology, Deendayal Upadhyay University of Gorakhpur, Uttar Pradesh, India

Abstract

The present article deals with the association of aphids (Hemiptera: Aphididae) with the plants belonging to the families of the orders of basal eudicots (orders Buxales, Proteales and Ranunculales) and also the families of two early orders of core eudicots, Saxifragales and Vitales in India. The order Buxales include only one family Buxaceae of which only 2 species of plants are associated with 3 species of aphids. In the order Proteales only a single species of lotus, *Nelumbo nucifera* Gaertn. of the family Nelumbonaceae is recorded as host plant of a single species of aphid, *Rhopalosiphum nymphaeae* (Linnaeus) in India. In the order Ranunculales, 27 species of plants under 15 genera included in 5 families are associated with 47 species of aphids belonging to 25 genera. Among the Indian flora of Saxifragales and Vitales, only 10 and 3 species are found associated with 14 and 10 species of aphids, respectively. In all, 43 species of plants belonging to 12 families of 5 orders are associated with 67 species of aphids belonging to 37 genera and 8 subfamilies. Four species of the aphids belonging to the genus *Liosomaphis* Walker are specifically associated with basal eudicots order Ranunculales. Two species, *Aphis (Aphis) gossypii* Glover, 1877 and *Myzus (Nectarosiphon) persicae* (Sulzer, 1776) are highly polyphagous on early eudicots. Total 37 species of aphids are associated with a single species of host plants belonging to above mentioned orders.

Keywords: buxales, proteales, ranunculales, saxifragales, vitales, food plant, aphids, checklist

Introduction

The aphids (Hemiptera: Aphididae) are small soft-bodied plant sap-sucking insects. They are almost worldwide in distribution but are most abundant in the temperate climates. More than 250 species of aphids are known to damage agricultural and horticultural crops either directly by sucking their nutrients or indirectly by secreting high amount of honeydew that blocks the stomata hampering the normal plant physiology, and by transmitting hundreds of viral diseases^[1, 2]. Small size, thelytokous parthenogenetic viviparous reproduction, complex life-cycles with alternation of sexual and asexual generations depending on environmental factors, host plant alternation, polymorphism, short and telescopic generations are the major traits that make the aphids highly prolific in reproduction and quickly attaining the pest status^[3]. At present all true aphids belong to a single family Aphididae which consists of 23 subfamilies, and 5109 species under 527 genera^[4]. In India, 794 species of aphids under 208 genera are reported out of which about 385 are endemic^[5].

The Eudicots (Eudicotidae/Eudicotyledons) is one of the clades of flowering plants (angiosperms) characterized by having two seed leaves upon germination and is usually divided into the basal eudicots (a paraphyletic group) and the core eudicots (a monophyletic group)^[6]. The basal eudicots includes 4 paraphyletic orders: Ranunculales, Proteales, Trochodendrales and Buxales. The core eudicots include 2 orders (Gunnerales, Dilleniales) and 2 clades (Superrosids, Superasterids). The clades Superrosids and Superasterids include majority of orders and families of Eudicots. The clade Superrosids comprises 2 orders, Saxifragales and Vitales and a clade Eurosids that include 16 orders of Eudicots. The clade Superasterids include rest of the orders of the flowering plants^[7].

The cataloguing of aphid and its host plants is essential as several aphid species are known to ruin the agricultural and horticultural crops in India and abroad not only by sucking their saps but also by transmitting several viral diseases^[2, 8]. Raychaudhury^[9] was the first to catalogue the food plants of Indian aphids updated by Chakrabarti & Sarkar^[10]. Later on, the food plant catalogue of Indian species of aphids (aphid family-wise) was updated in series of articles^[11-20]. Recently, the checklists of food plants-aphids of several plant families, e.g. Fabaceae^[21], Brassicaceae^[22], Polygonaceae^[23], Solanaceae^[24], and families included under orders Caryophyllales and Santalales^[25] were compiled. In this series of publications, the present paper deals with the association of aphids with the plants belonging to the families of the orders of basal eudicots (orders Buxales, Proteales and Ranunculales) and also the families of two early orders of core eudicots, Saxifragales and Vitales in India.

Materials and Methods

The aphid and host plant records in this checklist are taken from a wide variety of resources such as books, journals, proceedings and a few authentic theses and websites up to September 5, 2022. It may unavoidably include some percentage of misidentifications, both of aphids and their host plants. Some aphid species may also be vagrant individuals^[10]. In older literature, several errors crept in the scientific names of both of the aphids and plants and even in the recent ones as such contents become outdated quickly and, due to their perceived comprehensiveness, authors often overlook newer sources of data. The names of aphids, as well as plants that were misspelt in the original records have been corrected where we logically ascertain the intended species. Also, the research on aphid taxonomy as

well as their host plants is continuous with the description of new taxa, the modified status of others, and the publication of other nomenclatural decisions. In the present checklist, attempts have been made to provide the valid scientific names of the aphids following Favret ^[4], and of the plants, following WFO ^[26]. In the first inventory of plant names, their synonymy recorded in India are also provided. The synonymies of the aphids recorded in India on these plants are given by Singh & Singh ^[11-20]. Only 1-2 references of each record were cited.

Results and Discussion

The basal eudicots includes 4 paraphyletic orders, Ranunculales, Proteales, Trochodendrales and Buxales out of which Trochodendrales is not recorded in India. The core eudicots include 2 orders (Gunnerales, Dilleniales) but both are not recorded in India. Among the two clades of core Eudicots (Superrosids, Superasterids), the clades Superrosids comprises 2 orders, Saxifragales and Vitales and both are represented in India. Following is the details of host plant association of aphids with these plants in India.

A. Order: Buxales

The order Buxales include only one family Buxaceae that comprises 133 species under 6 genera in the world ^[26], but only 10 species belonging to 3 genera are recorded in India ^[27] and among them only 2 species of plants are associated with 3 species of aphids as given below. One species, *Buxus wallichiana* Baill. is used for making wood craft, fuel, fodder and other purposes in Jammu & Kashmir ^[28] while other one, *Sarcococca coriacea* Sweet is bee forage plant in Garhwal Himalaya ^[29].

1. *Buxus wallichiana* Baill

- *Amplicercidus tuberculatus* David *et al.*, 1970 ^[13]

2. *Sarcococca coriacea* Sweet (= *Sarcococca pruniformis* Lindl.)

- *Jacksonia* sp. ^[14]

3. *Sarcococca* sp.

- *Aphis* (*Toxoptera*) *aurantii* Boyer de Fonscolombe, 1841 ^[12]

B. Order: Proteales

The order Proteales consists of four families and all these families are recorded in India (Table 1). However, only a single species, *Nelumbo nucifera* Gaertn. (syn. *Nelumbo speciosa* Willd.), commonly known as sacred lotus or Indian lotus, of the family Nelumbonaceae is recorded as host plant of a single species of aphid, *Rhopalosiphum nymphaeae* (Linnaeus, 1761) in India ^[12]. The lotus is economically important as its all parts are edible, with the rhizome and seeds being the main consumption parts.

C. Order: Ranunculales

The order Ranunculales is one of the paraphyletic groups of the basal eudicots. It includes 7 families comprising 6801 species under 201 genera ^[26]. In India, only 6 families are recorded consisting of 421 species described under 64 genera ^[27], however, only 27 species under 15 genera included in 5 families are recorded as host plants of 47 species of aphids belonging to 25 genera (Table 1). Its members are commonly called as poppies, barberries, hellebores, and buttercups.

1. Family: Berberidaceae

The family Berberidaceae consists of 15 genera and 902 species globally ^[26], but only 79 species under 9 genera are known from India ^[27]. Among them, only 8 species of a single genus *Berberis* L. are associated with 17 species of aphids belonging to 10 genera (Table 1). The plants of this genus are commonly called as barberries which are evergreen deciduous shrubs. Some of the species of *Berberis* L. are popular garden shrubs, grown for ornamental leaves, yellow flowers, or red or blue-black berries. Four species of the aphid, *Liosomaphis* Walker, 1868 are known to feed these plants. The detail host plant – aphid association is mentioned below.

1. *Berberis aristata* DC

- *Liosomaphis atra* Hille Ris Lambers, 1966 ^[14]
- *Liosomaphis himalayensis* Basu, 1964 ^[14]

2. *Berberis asiatica* DC.

- *Liosomaphis atra* Hille Ris Lambers, 1966 ^[14]
- *Liosomaphis himalayensis* Basu, 1964 ^[14]

3. *Berberis lycium* Royle

- *Liosomaphis atra* Hille Ris Lambers, 1966 ^[14, 30]
- *Liosomaphis berberidis* (Kaltenbach, 1843) ^[14]
- *Liosomaphis himalayensis* Basu, 1964 ^[14]
- *Liosomaphis ornata* Miyazaki, 1971 ^[31]
- *Myzus* (*Nectarosiphon*) *persicae* (Sulzer, 1776) ^[32]

4. *Berberis pachyacantha* subsp. *zabeliana* (C.K.Schneid.) Jafri

- *Liosomaphis atra* Hille Ris Lambers, 1966 ^[14]
- *Liosomaphis himalayensis* Basu, 1964 ^[30]

5. *Berberis pseudoumbellata* R. Parker

- *Liosomaphis atra* Hille Ris Lambers, 1966 ^[14]
- *Liosomaphis himalayensis* Basu, 1964 ^[30]
- *Hyalopterus pruni* (Geoffroy, 1762) ^[30]

6. *Berberis umbellata* Wall. ex G. Don.

- *Liosomaphis berberidis* (Kaltenbach, 1843) ^[14]
- *Liosomaphis himalayensis* Basu, 1964 ^[14]
- *Tricaudatus polygoni* (Narzikulov, 1953) ^[15]

7. *Berberis vulgaris* L.

- *Myzocallis* (*Neodryomyzus*) *polychaetus* David, 1969 ^[16]

8. *Berberis wallichiana* DC.

- *Liosomaphis himalayensis* Basu, 1964 ^[14]

9. *Berberis* spp.

- *Aphis* (*Aphis*) *gossypii* Glover, 1877 ^[12, 33]
- *Aphis* (*Aphis*) *spiraecola* Patch, 1914 ^[12, 34]
- *Aphis* (*Toxoptera*) *aurantii* Boyer de Fonscolombe, 1841 ^[12]
- *Aphis* (*Toxoptera*) *citricidus* (Kirkaldy, 1907) ^[12]
- *Aphis* (*Toxoptera*) *odinae* (van der Goot, 1917) ^[12]
- *Greenidea* (*Trichosiphum*) *kumaoni* Chakrabarti & Raychaudhuri, 1978 ^[18]
- *Liosomaphis atra* Hille Ris Lambers, 1966 ^[14]
- *Liosomaphis himalayensis* Basu, 1964 ^[14]
- *Macrosiphum* (*Macrosiphum*) *pachysiphon* Hille Ris Lambers, 1966 ^[14]
- *Rhopalosiphum rufiabdominalis* (Sasaki, 1899) ^[12]
- *Xenosiphonaphis conandri* Takahashi, 1961 ^[15]

2. Family: Lardizabalaceae

The family Lardizabalaceae includes includes 7 genera with 41 known species globally but it is represented in India by only 3 genera with 8 species of woody plants. Among them, only one species, *Stauntonia latifolia* (Wall.) R. Br. (syn. *Holboellia latifolia* Wall.), commonly known as sausage vine, is associated with two endemic species of aphids, *Hillerislambersia darjeelingi* Basu, 1968 [14, 35] and *Sinonipponaphis holboelliae* (Ghosh & Raychaudhuri, 1973) [19, 36]. The plant is also native to the Himalayas and is ornamental.

3. Family: Menispermaceae

The members of the family Menispermaceae are usually either climber or twining vines. It consists of 74 genera with 671 species [26] distributed throughout low-lying tropical areas with some species present in temperate and arid regions. In India, it is represented by 20 genera with 45 species [27]. Most of the plants have medicinal values. However, among these, only 4 species of plants are associated with 6 species of aphids (Table 1) as mentioned below.

1. *Cissampelos pareira* L.

- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]
- *Aphis* (*Aphis*) *craccivora* Koch, 1854 [36, 37]
- *Aphis* (*Aphis*) *glycines* Matsumura, 1917 [12]
- *Myzus* (*Myzus*) *formosanus* Takahashi, 1923 [14]

2. *Stephania hernandiifolia* Walp.

- *Acyrtosiphon* (*Acyrtosiphon*) *phaseoli* Chakrabarti et al., 1971 [13]

3. *Stephania* sp.

- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]

4. *Tinospora cordifolia* (Willd.) Hook.f. & Thoms.

- *Aphis* (*Aphis*) *craccivora* Koch, 1854 [12, 36]

5. *Tinospora* sp.

- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]

6. Unidentified plant

- *Aiceona* (*Aiceona*) *retipennis* David et al., 1970 [11]

4. Family: Papaveraceae

The Papaveraceae, the poppy family, is a highly economically important family of basal eudicots having 45 genera and 1088 known species [26] distributed mostly in temperate and subtropical climates. Most of them are herbaceous plants. Almost all members of this family produce latex which may be milky or watery white, yellow or red juice. Some members are cultivated as ornamental plants because of their striking coloured flowers. In India, the family is represented by 5 genera and 31 species [27] and among them only 4 species are associated with 6 species of aphids. One species, *Papaver somniferum* L. is cultivated legally to obtain opium that contains morphine and other narcotic chemicals and for poppy seeds used in cooking and baking. The host plant – aphid association of Papavaraceae is given below.

1. *Argemone mexicana* L.

- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]
- *Myzus* (*Nectarosiphon*) *persicae* (Sulzer, 1776) [32]

2. *Dactylicapnos scandens* (D. Don) Hutch.

- *Aulacorthum* (*Neomyzus*) *dicentrae* Basu, 1968 [13]

3. *Papaver orientale* L.

- *Brachycaudus* (*Brachycaudus*) *helichrysi* (Kaltenbach, 1843) [13]

4. *Papaver somniferum* L.

- *Aphis* (*Aphis*) *fabae* Scopoli, 1763 [12]
- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]
- *Myzus* (*Nectarosiphon*) *ascalonicus* Doncaster, 1946 [14]
- *Myzus* (*Nectarosiphon*) *persicae* (Sulzer, 1776) [32]

5. Unidentified plant

- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]
- *Myzus* (*Nectarosiphon*) *persicae* (Sulzer, 1776) [32]

5. Family: Ranunculaceae

The family Ranunculaceae (buttercup or crowfoot family) is a family of 4095 valid species of basal eudicots in 58 genera and is widely distributed globally [26]. The plants of this family are mostly herbaceous annuals or perennials. The family is economically important as few species are used as herbal medicines both in allopathy and homeopathy while few are of ornamental importance and grown in gardens. In India, the family is represented by 257 species belonging to 31 genera [27]. Among them, only 11 species of 7 genera are associated with 24 species of aphids of 14 genera (Table 1) as mentioned below.

1. *Anemone* sp.

- *Himalayaphis anemones* Ghosh & Verma, 1973 [14, 38]

2. *Clematis buchananiana* Wall.

- *Aphis* (*Aphis*) *longituba* Hille Ris Lambers, 1966 [12]
- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]
- *Matsumuraja capitophoroides* Hille Ris Lambers, 1966 [4]

3. *Clematis* sp.

- *Aphis* (*Aphis*) *longituba* Hille Ris Lambers, 1966 [12]
- *Aphis* (*Aphis*) *fabae* Scopoli, 1763 [12]
- *Aphis* (*Aphis*) *gossypii* Glover, 1877 [33]
- *Aphis* (*Aphis*) *nasturtii* Kaltenbach, 1843 [12]

4. *Delphinium ajacis* L. Schur (syn. *Consolida ajacis* (L.)

- *Nasonovia* (*Nasonovia*) *jammuensis* Verma, 1970 [15, 39]

5. *Delphinium denudatum* Wall.

- *Nasonovia* (*Nasonovia*) *jammuensis* Verma, 1970 [15, 40]

6. *Delphinium* sp.

- *Macrosiphum* (*Macrosiphum*) *minatii* (Das et al., 1981) [14, 41]
- *Myzus* (*Nectarosiphon*) *persicae* (Sulzer, 1776) [32]
- *Nasonovia* (*Nasonovia*) *jammuensis* Verma, 1970 [15]
- *Uroleucon* (*Uroleucon*) *simlaense* Chakrabarti et al., 1971 [15, 42]

7. *Eriocapitella rivularis* (Buch. -Ham. ex DC.) Christenh. & Byng (syn. *Anemone rivularis* Buch. -Ham. ex DC.)

- *Acyrtosiphon* (*Acyrtosiphon*) *malvae* (Mosley, 1841) [13]
- *Aphis* (*Aphis*) *spiraecola* Patch, 1914 [34]

- *Capitophorus carduinus* (Walker, 1850) ^[11]
 - *Eriolophium takahashii* (Ghosh, 1969) ^[15]
- 8. *Ranunculus arvensis* L.**
- *Aulacorthum (Aulacorthum) solani* (Kaltenbach, 1843) ^[13]
 - *Sitobion (Sitobion) miscanthi* (Takahashi, 1921) ^[15, 43]
- 9. *Ranunculus hirtellus* Royle**
- *Thecabius (Thecabius) affinis* (Kaltenbach, 1843) ^[17]
- 10. *Ranunculus muricatus* L.**
- *Acyrtosiphon* sp. ^[13]
- 11. *Ranunculus* spp.**
- *Macrosiphum (Macrosiphum) centranthi* Theobald, 1915 ^[14]
 - *Sitobion (Sitobion) miscanthi* (Takahashi, 1921) ^[14, 43]
 - *Sitobion (Sitobion) pseudoluteum* Ghosh, 1969 ^[14, 43]
- 12. *Thalictrum chelidonii* DC.**
- *Longicaudus? dunlopi* Hille Ris Lambers, 1965 ^[14]
- 13. *Thalictrum dioicum* L. (syn. *Thalictrum pauciflorum* Raf.)**
- *Acyrtosiphon (Acyrtosiphon) ranunculum* Ghosh, 1986 ^[14]
- 14. *Thalictrum* sp.**
- *Longicaudus cornutus* Chakrabarti & Banerjee, 1991 ^[14, 44]
 - *Longicaudus kumauni* Chakrabarti & Banerjee, 1991 ^[14, 44]
- 15. *Trollius* sp.**
- *Aphis (Aphis) craccivora* Koch, 1854 ^[12, 36]

D. Order: Saxifragales

The Saxifragales (saxifrages) is one of the orders of core eudicot (Pentapetalae: Superrosids) being extremely diverse group of plants that includes trees, shrubs, perennial herbs, succulent and aquatic plants and is found worldwide. It consists of 15 families, 130 genera and 3,929 species ^[26]. However, the Indian contribution is small, only having 205 species described under 29 genera belonging to 9 families ^[27]. Several plants of this order are economically important being used as foodstuffs, timber and ornamentals. Among the Indian flora, only 10 species of 10 genera are found associated with 14 species of aphids belonging to 10 genera (Table 1) as stated below.

1. Family: Crassulaceae

1. *Echeveria* sp.

- *Macrosiphum (Macrosiphum) centranthi* Theobald, 1915 ^[14]
- *Macrosiphum (Macrosiphum) hellebori* Theobald & Walton 1923 ^[14]

2. *Kalanchoe pinnata* (Lam.) Pers.

- *Aphis (Aphis) nerii* Boyer de Fonscolombe, 1841 ^[12]
- *Myzus (Nectarosiphon) persicae* (Sulzer, 1776) ^[32]

3. *Kalanchoe* sp.

- *Aphis (Aphis) spiraecola* Patch, 1914 ^[34]
- *Myzus (Nectarosiphon) persicae* (Sulzer, 1776) ^[32]

4. *Umbilicus* sp.

- *Clethrobius dryobius* Chakrabarti & Raychaudhuri, 1976 ^[16]

2. Family: Grossulariaceae

The family Grossulariaceae consists of a single genus *Ribes* L. with 279 species ^[26], most of them are distributed in the temperate regions of the Northern Hemisphere. The plants of this family are commonly known as currants or gooseberries, and some are cultivated for their edible fruit or as ornamental plants. In India, 11 species are known ^[27], however, only one unidentified species is associated with a single species of aphid, *Hyperomyzus (Hyperomyzus) lactucae* (Linnaeus, 1758) ^[14, 45].

3. Family: Hamamelidaceae

1. *Corylopsis* sp.

- *Micromyzus* sp. ^[14]
- *Scleromyzus corylopsis* (Basu, Ghosh & Raychaudhuri, 1973) ^[15, 46]

2. *Parrotiopsis jacquemontiana* Rehder

- *Neothoracaphis* sp. ^[19]

3. Unidentified sp.

- *Chaitophorus indicus* Ghosh *et al.*, 1970 ^[11]

4. Family: Saxifragaceae

1. *Astilbe rivularis* Buch. -Ham.

- *Taiwanomyzus darjeelingensis* Ghosh *et al.*, 1977 ^[15]
- *Taiwanomyzus montanus* Takahashi, 1925 ^[15]

2. *Deutzia crenata* Siebold & Zucc.

- *Aphis (Aphis) fabae* Scopoli, 1763 ^[12]

3. *Hydrangea robusta* Hook.f. Thoms.)

- *Tuberoaphis hydrangeae digitata* Hille Ris Lambers & Basu, 1966 ^[15, 47]

E. Order: Vitales

The Vitales is a small order of core eudicot containing a single family Vitaceae that comprises 18 genera and 1344 species ^[26] and commonly known as grapevines and Virginia creepers. Some plants of this family are highly economically important, e.g. *Vitis* spp. (grapes). In India, 68 species of 9 genera are known ^[27], among which 3 species are associated with 10 species of aphids as stated below.

1. *Leea* sp.

- *Aphis (Toxoptera) aurantii* Boyer de Fonscolombe, 1841 ^[12]
- *Aphis (Toxoptera) odinae* (van der Goot, 1917) ^[12]

2. *Parthenocissus semicordata* Planch (= *Vitis semicordata* Wall.)

- *Sinomegoura citricola* (van der Goot, 1917) ^[15]
- *Greenidea (Paragreenidea) parthenocissi* Saha & Chakrabarti, 1988 ^[48, 49]
- *Neothelaxes parthenocissi* Chakrabarti & Quednau, 1996 ^[20, 50]
- *Neothelaxes viticola* Chakrabarti & Quednau, 1996 ^[20, 50]

3. *Vitis vinifera* L.

- *Aphis (Aphis) gossypii* Glover, 1877 ^[33]

- *Aphis (Aphis) punicae* Passerini, 1863 [12]
- *Aphis (Aphis) solanella* Theobald, 1914 [12]

4. Unidentified sp.

- *Myzus (Myzus) ornatus* Laing, 1932 [14]

The data presented in Table 1 demonstrated that out of 4 orders of basal eudicots, only 3 orders, Buxales, Proteales (only single family Nelumbonaceae among 4 families) and Ranunculales (5 families, Berberidaceae, Lardizabalaceae, Menispermaceae, Papaveraceae, Ranunculaceae, out of 7 families) are recorded in India which are associated with the aphids. In the clade Superrosids of core eudicots, the orders Saxifragales and Vitales both are known in India. Among the 15 families of the order Saxifragales, only 4 families,

Crassulaceae, Grossulariaceae, Hamamelidaceae and Saxifragaceae are known in India which are associated with aphids. In all, 43 species of plants belonging to 12 families stated here are associated with 67 species of aphids belonging to 37 genera and 8 subfamilies, among which 57 species belong to the subfamily Aphidinae (Table 2). Four species of the aphids belonging to the genus *Liosomaphis* Walker, 1868 are specifically associated with basal eudicots order Ranunculales. Two species, *Aphis (Aphis) gossypii* Glover, 1877 (associated with 10 plant species) and *Myzus (Nectarosiphon) persicae* (Sulzer, 1776) (associated with 7 species of plants) are highly polyphagous on early eudicots (Table 2) similar to the higher eudicots [32, 33]. Total 55 species of aphids are associated with a single species of host plants belonging to above mentioned orders.

Table 1: Number of plant species belonging to the different orders/families of the some Eudicot clade of flowering plants (Angiospermae) in the world [26] and in India [27]; and number of host plant species of each family infested by aphids; and number of aphid species infesting these plants in India.

Orders/Families	In world		In India					
	Genera	Species	Genera	Species	Host plant species infested by aphids		Aphid species infesting these host plants	
					Genera	Species	Genera	Species
Buxales	6	133	3	10	2	2	3	3
Buxaceae	6	133	3	10	2	2	3	3
Proteales	92	2443	8	25	1	1	1	1
Nelumbonaceae	1	5	1	1	1	1	1	1
Platanaceae	1	14	1	2	0	0	0	0
Proteaceae	87	2240	4	9	0	0	0	0
Sabiaceae	3	184	2	13	0	0	0	0
Ranunculales	201	6801	64	421	15	27	25	47
Berberidaceae	15	902	4	79	1	8	10	17
Circaeasteraceae	1	1	0	0	0	0	0	0
Eupteleaceae	1	3	1	1	0	0	0	0
Lardizabalaceae	7	41	3	8	1	1	2	2
Menispermaceae	74	671	20	45	3	3	4	6
Papaveraceae	45	1088	5	31	3	4	4	6
Ranunculaceae	58	4095	31	257	7	11	14	24
Trochodendrales	2	2	0	0	0	0	0	0
Trochodendraceae	2	2	0	0	0	0	0	0
Saxifragales	130	3969	29	205	10	10	10	14
Altingiaceae	1	15	1	4	0	0	0	0
Aphanopetalaceae	1	2	0	0	0	0	0	0
Cercidiphyllaceae	1	3	0	0	0	0	0	0
Crassulaceae	42	2218	9	59	3	4	4	6
Cynomoriaceae	1	1	0	0	0	0	0	0
Daphniphyllaceae	1	31	1	2	0	0	0	0
Grossulariaceae	1	279	1	11	1	1	1	1
Haloragaceae	7	196	3	11	0	0	0	0
Hamamelidaceae	30	121	6	6	2	2	4	4
Iteaceae	2	29	1	3	0	0	0	0
Paeoniaceae	1	48	1	1	0	0	0	0
Penthoraceae	1	3	0	0	0	0	0	0
Peridiscaceae	4	11	0	0	0	0	0	0
Saxifragaceae	36	1011	6	108	3	3	3	3
Tetracarpaeaceae	1	1	0	0	0	0	0	0
Vitales	18	1344	9	68	3	3	5	10
Vitaceae	18	1344	9	68	3	3	5	10
Total	449	14692	113	729	30	43	35	69

Table 2: Number of orders, families, genera and species of plants belonging to the order basal and some core eudicots flowering plants infested by different species of aphids in India.

Subfamily/Aphid species	Plants infested by aphids			
	Orders	Families	Genera	Species
1. Subfamily: Aiceoninae				
1. <i>Aiceona (Aiceona) retipennis</i>	1	1	1	1
2. Subfamily: Aphidinae				

2. <i>Acyrtosiphon (Acyrtosiphon) malvae</i>	1	1	1	1
3. <i>Acyrtosiphon (Acyrtosiphon) phaseoli</i>	1	1	1	1
4. <i>Acyrtosiphon (Acyrtosiphon) ranunculum</i>	1	1	1	1
5. <i>Amphicercidus tuberculatus</i>	1	1	1	1
6. <i>Aphis (Aphis) longituba</i>	1	1	1	2
7. <i>Aphis (Aphis) craccivora</i>	1	2	3	3
8. <i>Aphis (Aphis) fabae</i>	2	3	3	3
9. <i>Aphis (Aphis) glycines</i>	1	1	1	1
10. <i>Aphis (Aphis) gossypii</i>	2	5	9	10
11. <i>Aphis (Aphis) nasturtii</i>	1	1	1	1
12. <i>Aphis (Aphis) nerii</i>	1	1	1	1
13. <i>Aphis (Aphis) punicae</i>	1	1	1	1
14. <i>Aphis (Aphis) solanella</i>	1	1	1	1
15. <i>Aphis (Aphis) spiraeicola</i>	2	3	3	3
16. <i>Aphis (Toxoptera) aurantii</i>	3	3	3	3
17. <i>Aphis (Toxoptera) citricidus</i>	1	1	1	1
18. <i>Aphis (Toxoptera) odinae</i>	2	2	2	2
19. <i>Aulacorthum (Aulacorthum) solani</i>	1	1	1	1
20. <i>Aulacorthum (Neomyzus) dicentrae</i>	1	1	1	1
21. <i>Brachycaudus (Brachycaudus) helichrysi</i>	1	1	1	1
22. <i>Capitophorus carduinus</i>	1	1	1	1
23. <i>Hillerislambersia darjeelingi</i>	1	1	1	1
24. <i>Himalayaphis anemones</i>	1	1	1	1
25. <i>Hyalopterus pruni</i>	1	1	1	1
26. <i>Hyperomyzus (Hyperomyzus) lactucae</i>	1	1	1	1
27. <i>Jacksonia</i> sp	1	1	1	1
28. <i>Liosomaphis atra</i>	1	1	1	5
29. <i>Liosomaphis berberidis</i>	1	1	1	2
30. <i>Liosomaphis himalayensis</i>	1	1	1	7
31. <i>Liosomaphis ornata</i>	1	1	1	1
32. <i>Longicaudus? Dunlopi</i>	1	1	1	1
33. <i>Longicaudus cornutus</i>	1	1	1	1
34. <i>Longicaudus kumauni</i>	1	1	1	1
35. <i>Macrosiphum (Macrosiphum) centranthi</i>	2	2	2	2
36. <i>Macrosiphum (Macrosiphum) minatii</i>	1	1	1	1
37. <i>Macrosiphum (Macrosiphum) pachysiphon</i>	1	1	1	1
38. <i>Matsumuraja capitophoroides</i>	1	1	1	1
39. <i>Micromyzus</i> sp.	1	1	1	1
40. <i>Myzus (Myzus) formosanus</i>	1	1	1	1
41. <i>Myzus (Myzus) ornatus</i>	1	1	1	1
42. <i>Myzus (Nectarosiphon) ascalonicus</i>	1	1	1	1
43. <i>Myzus (Nectarosiphon) persicae</i>	2	4	5	6
44. <i>Nasonovia (Nasonovia) jammuensis</i>	1	1	1	2
45. <i>Neoacyrtosiphon takahashii</i>	1	1	1	1
46. <i>Rhopalosiphum nymphaeae</i>	1	1	1	1
47. <i>Rhopalosiphum rufiabdominalis</i>	1	1	1	1
48. <i>Scleromyzus corylopsi</i>	1	1	1	1
49. <i>Sinomegoura citricola</i>	1	1	1	1
50. <i>Sitobion (Sitobion) miscanthi</i>	1	1	1	1
51. <i>Sitobion (Sitobion) pseudoluteum</i>	1	1	1	1
52. <i>Taiwanomyzus darjeelingensis</i>	1	1	1	1
53. <i>Taiwanomyzus montanus</i>	1	1	1	1
54. <i>Tricaudatus polygoni</i>	1	1	1	1
55. <i>Tuberoaphis hydrangeae digitata</i>	1	1	1	1
56. <i>Uroleucon (Uroleucon) simlaense</i>	1	1	1	1
57. <i>Xenosiphonaphis conandri</i>	1	1	1	1
3. Subfamily: Calaphidinae				
58. <i>Clethrobium dryobius</i>	1	1	1	1
59. <i>Myzocallis (Neodryomyzus) polychaetus</i>	1	1	1	1
4. Subfamily: Chairaphorinae				
60. <i>Chaitophorus indicus</i>	1	1	1	1
5. Subfamily: Eriosomatinae				
61. <i>Thecabius (Thecabius) affinis</i>	1	1	1	1
6. Subfamily: Greenideinae				
62. <i>Greenidea (Paragreenidea) parthenocissi</i>	1	1	1	1
63. <i>Greenidea (Trichosiphum) kumaoni</i>	1	1	1	1
7. Subfamily: Hormaphidinae				
64. <i>Neothoracaphis</i> sp.	1	1	1	1

65. <i>Sinonipponaphis holboelliae</i>	1	1	1	1
8. Subfamily: Thelaxinae				
66. <i>Neothelaxes parthenocissi</i>	1	1	1	1
67. <i>Neothelaxes viticola</i>	1	1	1	1

References

- Singh R, Singh G. Aphids and their biocontrol. In: Ecofriendly Pest Management for Food Security (Ed. Omkar). Academic Press, 2016, 63-108.
- Ghosh A, Chakrabarti S, Mandal B, Krishna Kumar NK. Aphids as Vectors of the Plant Viruses in India. In.: A Century of Plant Virology in India (Eds. Mandal B, Rao GP, Baranwal VK, Jain RK). Springer Nature Singapore, Pte Limited, 2017, 515-536. https://doi.org/10.1007/978-981-10-5672-7_23.
- Singh R, Singh G. Reproductive strategies in aphids. In: Reproductive Strategies in Insects (Eds. Omkar and Mishra, G.), Taylor & Francis Group, LLC, 2022, 259-282.
- Favret C. Aphid Species File. Version 5.0/5.0. <http://Aphid.SpeciesFile.org>, retrieved, 2022.
- Singh R, Singh G. Species diversity of Indian aphids (Hemiptera: Aphididae). International Journal of Biological Innovations, 2019;1(1):23-29. <https://doi.org/10.46505/IJBI.2019.1105>
- Worberg A, Quandt D, Barniske AM, Löhne C, Hilu KW, Borsch T. Phylogeny of basal eudicots: insights from non-coding and rapidly evolving DNA. Organisms, Diversity and Evolution, 2007;7(1):55-77. doi:10.1016/j.ode.2006.08.001.
- Chase MW, Christenhusz MJM, Fay MF, Byng JW, Judd WS, Soltis DE, et al. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnean Society, 2016;181(1):1-20. <https://doi.org/10.1111/boj.12385>
- Singh R, Singh G. Aphids. In: Polyphagous Pests of Crops (Ed. Omkar). Springer Nature Singapore, 2021, 105-182.
- Raychaudhuri DN. Food Plant Catalogue of Indian Aphididae. Graphic Printall, Calcutta (India), 1983, 204.
- Chakrabarti S, Sarkar A. A supplement to the food-plant catalogue of Indian Aphididae. Journal of Aphidology, 2001;15:9-62.
- Singh G, Singh R. Food plant records of aphids (Aphididae: Sternorrhyncha: Hemiptera) in India belonging to subfamilies Aiceoninae, Anoeciinae, Chaitophorinae and Drepanosiphinae. International Journal of Zoological Investigations, 2016;2(2):281-295.
- Singh G, Singh R. Food plant records of Aphidini (Aphidinae: Aphididae: Hemiptera) in India. Journal of Entomology & Zoology Studies, 2017;5(2):1280-1302.
- Singh G, Singh R. Updated checklist of food plants of Macrosiphini (Aphididae: Hemiptera) in India – 1. International Journal of Research Studies in Zoology, 2017;3(1):6-33. <http://dx.doi.org/10.20431/2454-941X.0301002>
- Singh G, Singh R. Updated checklist of food plants of Macrosiphini (Aphididae: Hemiptera) in India – 2. International Journal of Research Studies in Zoology, 2017;3(1):42-76. <http://dx.doi.org/10.20431/2454-941X.0301004>
- Singh G, Singh R. Updated checklist of food plants of Macrosiphini (Aphididae: Hemiptera) in India – 3. International Journal of Research Studies in Zoology, 2017;3(2):1-31. <http://dx.doi.org/10.20431/2454-941X.0302001>
- Singh G, Singh R. Updated checklist of host plants of Calaphidinae (Aphididae: Hemiptera) in India. International Journal of Contemporary Research & Review, 2017;8(2):20171-20190. <http://dx.doi.org/10.15520/ijcrr/2017/8/02/111>
- Singh G, Singh R. Updated check-list of Indian Eriosomatinae (Aphidinae: Aphididae: Hemiptera) and their food plants. Journal of Entomology & Zoology Studies, 2017;5(1):921-936.
- Singh G, Singh R. Updated checklist of Greenideinae (Aphididae: Hemiptera) and its host plants in India. International Journal of Contemporary Research and Review, 2017;8(3):20191-20219. <http://dx.doi.org/10.15520/ijcrr/2017/8/03/139>
- Singh G, Singh R. Updated check-list of Indian Hormaphidinae (Aphididae: Hemiptera) and their food plants. Journal of Entomology & Zoology Studies, 2018;6(2):1345-1352.
- Singh G, Prasad M, Singh R. Updated check-list of Lachninae, Lizeriinae, Mindarinae, Phyllaphidinae, Saltusaphidinae, Taiwanaphidinae and Thelaxinae (Aphididae: Hemiptera) and their food plants in India. Journal of Entomology and Zoology Studies, 2018;6(2):3157-3166.
- Singh R, Singh G, Sharma A. Updated checklist of aphids (Insecta: Homoptera: Aphididae) infesting legumes (Angiospermae: Fabales: Fabaceae) in India. International Journal of Research Studies in Zoology, 2015;2(1):30-44. <http://dx.doi.org/10.20431/2454-941X.0201005>
- Singh R, Agrawal R. An updated checklist of aphids (Homoptera: Aphididae) infesting brassica plants (Angiospermae: Brassicales: Brassicaceae) in India. Journal of Applied Entomologist, 2022;2(2):14-19.
- Singh R, Agrawal R. Diversity of aphids (Homoptera: Aphididae) infesting polygonaceous plants (Angiospermae: Caryophyllales: Polygonaceae) in India. International Journal of Biological and Environmental Investigations, 2021;1(2):159-172. <https://doi.org/10.33745/ijbei.2021.v01i02.005>
- Singh R, Singh G. Diversity of aphids (Homoptera: Aphididae) infesting solanaceous plants (Angiospermae: Solanales: Solanaceae) in India. International Journal of Biological Innovations, 2022;4(1):189-204. <https://doi.org/10.46505/IJBI.2022.4121>
- Singh R, Khan AA. Aphids (Insecta: Homoptera: Aphididae) infesting plants of the order Caryophyllales and Santalales (Eudicots: Superasterids: Angiospermae) in India. International Journal of Entomology Research, 2022;7(9):34-41.

26. WFO. World Flora Online. <http://www.worldfloraonline.org>, retrieved, 2022.
27. BSI. <https://efloraIndia.gov.in>. Botanical Survey of India, Kolkata, retrieved, 2022.
28. Pant S. *Buxus wallichiana* L, a multipurpose Himalayan tree in peril. *International Journal of Biodiversity and Conservation*, 2011;3(5):175-177.
29. Gairola A, Tiwari P, Tiwari JK, Ballabha R. *Sarcococca coriacea* (Hook.) Sweet: A bee forage plant for dearth period in Garhwal Himalaya, India. *Journal of The Kalash Science*, 2013;1(1):67-69.
30. Bhagat RC. Aphids (Insecta) damaging medicinal and aromatic plants of Jammu and Kashmir state (India): an updated checklist and biodiversity. *Indian Journal of Applied & Pure Biology*, 2012;27(1):1-10.
31. Nadda G, Joshi S. First report of aphid, *Liosomaphis ornata* Miyazaki, 1971 (Homoptera: Aphididae) from India. *Halteres*, 2015;6:51-55.
32. Singh R, Singh G, Tiwari AK, Sharma A, Patel A, Pratibha. *Myzura* (Nectarosiphon) *persicae* (Sulzer, 1776) (Homoptera: Aphididae): Updated Check List of Host Plants in India. *International Journal of Zoological Investigations*, 2015;1:8-25.
33. Singh G, Singh NP, Singh R. Food plants of a major agricultural pest *Aphis gossypii* Glover (Homoptera: Aphididae) from India: an updated checklist. *International Journal of Life Sciences Biotechnology & Pharma Research*, 2014;3(2):1-26.
34. Singh G, Singh R. Distribution of *Aphis* (*Aphis*) *spiraecola* Patch 1914 (Aphidini: Aphidinae: Aphididae: Hemiptera) and its food plants recorded in India. *International Journal of Recent Advances in Multidisciplinary Research*, 2016;3(12):2100-2111.
35. Raychaudhuri DN. Aphids of North-East India and Bhutan. *Zoological Society, Calcutta*, 1980, 521.
36. Ghosh AK, Raychaudhuri DN. Studies on the aphids (Homoptera: Aphididae) from eastern India. XV. A study of *Nipponaphis* Pergande and related genera with descriptions of a new genus and eight new species from India. Part I, *Kontyu*, 1973;41:148-165.
37. Khan AA, Shah MA. Records of aphids and their natural enemies in agro-ecosystem with special reference to horticultural ecosystem of Kashmir. *Journal of Entomology & Zoology Studies*, 2017;5(4):189-203.
38. Ghosh AK, Verma KD. A new genus and new species of aphid (Homoptera: Aphididae) from northwest Himalaya. *Oriental Insects*, 1973;7:271-274. <https://doi.org/10.1080/00305316.1973.10434220>
39. Ghosh LK. A Conspectus of Aphididae (Homoptera) of Himachal Pradesh in North-west Himalaya, India. *Zoological Survey of India, Kolkata, Technical Monograph*, 1986;16:1-282.
40. Verma KD. Two new species of aphids from northwest India (Homoptera: Aphididae). *Bulletin of Entomology*, 1970;11:95-97.
41. Das SK, Raychaudhuri D, Raychaudhuri DN. Some new species and hitherto unknown morphs of aphids (Homoptera: Aphididae) from Himachal Pradesh, northwest India. *Entomon*, 1981;6(1):47-56.
42. Chakrabarti S, Debnath M. Diversity of aphidophagous parasitoids (Insecta) of northwest and western Himalayas, India. In: *Biodiversitat und Naturausstattung im Himalaya, III* (Eds. Hartmann M, Weipert J), *Naturkundemuseum Erfurt*, 2009, 441-454.
43. Singh G, Singh R. Updated Checklist of Food Plants of Species of *Sitobion* Mordvilko, 1914 (Macrosiphini: Aphididae: Hemiptera) in India. *International Journal of Biological and Environmental Investigations*, 2021;1(2):141-156.
44. Chakrabarti S, Banerjee PK. A review of the genus *Longicaudus* (Homoptera: Aphididae) with descriptions of two new species from India. *Oriental Insects*, 1991;25(1):199-210. <https://doi.org/10.1080/00305316.1991.10432229>
45. Ghosh AK. A list of Aphids (Homoptera: Aphididae) from India and adjacent countries. *Journal of the Bombay Natural History Society*, 1975;71(2):201-225.
46. Basu RC, Ghosh AK, Raychaudhuri DN. Studies on the aphids (Homoptera: Aphididae) from eastern India. 18. Five new species and thirty new records from Assam. *Proceedings of the Zoological Society, Calcutta*, 1973;26:89-101.
47. Hille Ris Lambers D, Basu AN. Some new or little-known genera, subgenera, species and subspecies of Aphididae from India (Homoptera: Aphididae). *Entomologische Berichten*, 1966;26:12-20.
48. Saha S, Chakrabarti S. A new species and hitherto unknown morphs of Greenideine aphids (Homoptera: Aphididae) from Western Himalaya. *Proceedings of the Zoological Society, Calcutta*, 1988;37:45-53.
49. Ghosh AK, Agarwala BK. The fauna of India and the adjacent countries – Part 6. Subfamily: Greenideinae. *Zoological Survey of India, Kolkata*, 1993, 330.
50. Chakrabarti S, Quednau FW. A new genus, *Neothelaxes*, and two new species of *Thelaxinae* from India (Homoptera: Aphididae). *Canadian Entomologists*, 1996;128:1005-1011.