

An updated checklist of aphids (Homoptera: Aphididae) infesting brassica plants (Angiospermae: Brassicales: Brassicaceae) in India

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Abstract

The present aphid-host plant checklist demonstrates that at least 27 species of plants of the family Brassicaceae are infested by 31 species of aphids belonging to a single subfamily Aphidinae (Homoptera: Aphididae) in India. The maximum number of aphid species are found to colonise on *Brassica oleracea* L. and *Raphanus sativus* L. (15 species each), followed by *Brassica napus* L. (9 species). Similarly, the maximum number of plant species (19 plant species) were infested by *Myzus (Nectarosiphon) persicae* (Sulzer), followed by *Lipaphis (Lipaphis) erysimi* (Kalt.) (18 plant species) and *Brevicoryne brassicae* L. (15 plant species).

Keywords: brassicaceae, aphididae, aphids, pests, cabbage, cauliflower, mustard, radish

Introduction

Brassicaceae, commonly known as the family of mustards, the crucifers, or the cabbage, is a medium-sized and economically important family, being mostly herbaceous or shrubs and includes 372 genera and 4,060 accepted species [1]. The family contains several agricultural crops particularly the vegetables such as broccoli, cabbage, cauliflower, collards, kale (*Brassica oleracea* L.); Chinese cabbage, turnip (*Brassica rapa* L.); radish (*Raphanus sativus* L.); rocket salad/arugula (*Eruca vesicaria* (L.) Cav.), garden cress (*Lepidium sativum* L.), watercress (*Nasturtium officinale* R. Br.) oil seeds (*Brassica napus* L. (rapeseed, possibly providing the largest volume of vegetable oils), *Sinapis alba* L. (white/yellow mustard), *Brassica juncea* (L.) Czern. (Indian mustard or brown mustard), *Brassica nigra* (L.) K. Koch (black mustard); few ornamental plants etc. Except in Antarctica and some parts of the tropics, the family Brassicaceae can be found everywhere on the earth.

Several species of aphids (Insecta: Heteroptera: Homoptera: Aphidoidea: Aphididae) such as *Brevicoryne brassicae* L., *Lipaphis (Lipaphis) erysimi* Kalt., *Lipaphis (Lipaphis) pseudobrassicae* (Davis), and *Myzus (Nectarosiphon) persicae* (Sulzer) are pestiferous on several brassica crops particularly on cabbage, cauliflower, radish (vegetables) and mustard (oil seeds) in India and warrant their control measure. These aphids feed by sucking sap from their host plants, leading to stunted growth, and they excrete a considerable amount of honeydew that covers the stomatal openings, hampering their normal physiological processes, like photosynthesis, transpiration and respiration and also allowing the growth of black sooty mould onto the leaves, which in turn proves detrimental to the normal activity of plant life [2]. In addition, these aphids also transmit viral diseases, e.g., *Myzus (Nectarosiphon) persicae* transmits more than 110 plant viruses, while *Lipaphis (Lipaphis) erysimi* alone transmits 13 viruses (Turnip mosaic virus, Beet mosaic virus, Cauliflower mosaic virus, Radish mosaic virus) [3]. Thelytokous parthenogenetic viviparity, complex life-cycles

with alternation of sexual and asexual generations, host plant alternation, polymorphism, short and telescopic generations are major traits that make aphids highly prolific in reproduction [4, 5]. The economic importance of the aphids infesting plants of the family Brassicaceae has already been dealt by several workers in India [6-9].

Probably, Lefroy & Howlett [10] were first to record an aphid, *Brevicoryne brassicae* on the radish, *Raphanus sativus* from India followed by Krishnamurthi [11] who observed *Lipaphis (Lipaphis) erysimi* on the black mustard, *Brassica nigra* in Karnataka (India). After a decade, Ghulam-Ullah [12] recorded *Brevicoryne brassicae*, *Lipaphis (Lipaphis) erysimi* and *Myzus (Nectarosiphon) persicae* on several species of *Brassica* crops both vegetables and oil seed. After independence, several workers, particularly the team of Zoological Survey of India, Kolkata and others worked hard in documenting the aphids on these plants. Raychaudhury [13] was the first to catalogue the food plants of Indian aphids. After almost two decades, Chakrabarti and Sarkar [14] updated this catalogue. Later on, Singh and Singh [15-23] and Singh *et al.* [24] updated the food plant catalogue of Indian species of aphids. Recently, the checklists of aphid-food plants of two plant families, Solanaceae [25] and Polygonaceae [26] were prepared. The present article provides an updated checklist of aphids infesting plants belonging to the family Brassicaceae in India.

Materials and Methods

This checklist is based on the literature published in recent past books, journals and a few authentic theses and websites up to 31 May, 2022. In the present checklist, attempts have been made to provide the valid scientific names of the aphids following Favret [27] and <https://www.gbif.org>, and for the plants, following <https://www.gbif.org>, <http://www.ars-grin.gov>, and <http://www.theplantlist.org>. In the first inventory, their synonymies recorded in India are also mentioned. The synonymies of the aphids recorded on brassica plants are given by Singh & Singh [16-19].

Results and Discussion

Among 794 species of aphids described under 208 genera in India [28], only 31 species of aphids belonging to a single subfamily Aphidinae (Tribe Aphidini: 8 species; Tribe Macrosiphini: 23 species) were recorded on at least 27 species of plants of the family Brassicaceae in India. The following checklist demonstrates that maximum number of the aphid species are found to colonise on *Brassica oleracea* and *Raphanus sativus* (15 species each), *Brassica napus* (9 species), and *Rorippa indica* (6 species), *Brassica juncea*, *Brassica rapa*, *Iberis amara* and *Lepidium didymum* (5 species on each) and less than 4 aphid species on rest of the plant species. Similarly, maximum number of plant species (19 plant species) were colonised by *Myzus (Nectarosiphon) persicae* followed by *Lipaphis (Lipaphis) erysimi* (18 plant species), *Brevicoryne brassicae* (15 plant species), *Aphis (Aphis) gossypii*, *Lipaphis (Lipaphis) pseudobrassicae*, *Myzus (Myzus) ornatus* (7 plant species by each), and *Aphis (Aphis) spiraecola* (5 plant species) and less than 5 plant species in case of other aphid species. Economic importance and food plant association of following aphid species that have been found to be pestiferous on brassica crops has earlier been dealt by several workers, e.g. of *Aphis (Aphis) gossypii* Glover [29], *Aphis (Aphis) spiraecola* Patch [30], *Brevicoryne brassicae* L. [6], *Lipaphis (Lipaphis) erysimi* (Kalt.) [8], *Lipaphis (Lipaphis) pseudobrassicae* (Davis) [9], *Myzus (Nectarosiphon) persicae* (Sulzer) [7] and *Sitobion (Sitobion) miscanthi* (Takahashi) [31]. Following are the updated aphid wise as well as plant wise (subgeneric name of the aphids and author names are excluded) checklist of aphids infesting the plants belonging to the Polygonaceae in India.

I. Aphid-food plant checklist

A. Subfamily: Aphidinae; Tribe: Aphidini

1. *Aphis (Aphis) craccivora* Koch, 1854

- *Brassica oleracea* L. (syn. *B. campestris* subsp. *sylvestris* (L.) Janch.; *B. cauliflora* Garsault; *B. oleracea* f. *alba* DC.; *B. o. capitata* (L.) Metzg.; *B. o. oleracea* L.; *B. o.* var. *acephala* DC.; *B. o.* var. *capitata* L.; *B. o.* var. *gongyloides* L.; *B. o.* var. *kashmiriana* Naqshi & Javeid; *B. o.* var. *laciniata* L.; *B. o.* var. *oleracea*) [32, 33]
- *Brassica rapa* L. (syn. *Brassica campestris* L.; *B. c.* var. *rapa* (L.) C. Hartm; *B. c. rapa* (L.) Hook. f.; *B. c.* var. *sarson* Prain; *B. rapa campestris* (L.) A.R.Clapham; *B. rapa sarson* (Prain) Denford; *B. r.* var. *dichotoma* (Roxb. ex Fleming) Kitam.; *Sinapis dichotoma* Roxb. [32]
- *Raphanus sativus* L. [32, 34]

2. *Aphis (Aphis) gossypii* Glover, 1877

- *Brassica juncea* (L.) Czern. [35]
- *Brassica oleracea* L. [35, 36]
- *Brassica* sp. [35] (Raychaudhuri, 1973)
- *Capsella bursapastoris* (L.) Medik [37]
- *Iberis amara* L. [14]
- *Lepidium didymum* L. (syn. *Coronopus dydimus* (L.) Sm.; *Senebiera pinnatifida* DC.) [35]
- *Raphanus sativus* L. [34, 35]
- *Sisymbrium* sp. [38]

3. *Aphis (Aphis) nasturtii* Kaltentbach, 1843

- *Rorippa indica* (L.) Hiern (syn. *Nasturtium indicum* (L.) DC.) [35, 39]

4. *Aphis (Aphis) nerii* Boyer de Fonscolombe, 1841

- *Raphanus sativus* L. [40]

5. *Aphis (Aphis) spiraecola* Patch, 1914

- *Brassica napus* L. [41]
- *Brassica oleracea* L. [35, 42]
- *Iberis amara* L. [42]
- *Raphanus sativus* L. [43, 44]
- *Rorippa indica* (L.) Hiern [35]

6. *Aphis (Toxoptera) aurantii* Boyer de Fonscolombe, 1841

- *Lepidium* sp. (syn. *Senebiera* sp.) [34]

7. *Aphis (Toxoptera) citricidus* (Kirkaldy, 1907)

- *Rorippa indica* (L.) Hiern [35]

8. *Hyalopterus pruni* (Geoffroy, 1762)

- *Brassica oleracea* L. [45, 46]

B. Subfamily: Aphidinae; Tribe: Macrosiphini

9. *Acyrtosiphon (Acyrtosiphon) malvae* (Mosley, 1841)

- *Sisymbrium* sp. [35, 47]

10. *Akkaia bengalensis* Basu, 1968

- *Raphanus sativus* L. [48]

11. *Akkaia sikkimensis* Agarwala & Raychaudhuri, 1977

- *Raphanus sativus* L. [34, 49]

12. *Aulacorthum (Aulacorthum) solani* (Kaltenbach, 1843)

- *Brassica oleracea* L. [35]
- *Cardamine hirsuta* L. [50]

13. *Brachycaudus (Brachycaudus) helichrysi* (Kaltenbach, 1843)

- *Brassica napus* L. [35]
- *Brassica oleracea* L. [35, 51]
- *Lepidium didymum* L. [35]

14. *Brevicoryne barbareae* Nevsky, 1929

- *Barbarea vulgaris* R. Br. [44, 52]
- *Brassica* sp. [53]
- *Nasturtium* sp. [44, 52]
- *Raphanus sativus* L. [52]

15. *Brevicoryne brassicae* (Linnaeus, 1758)

- *Brassica carinata* A. Braun [9]
- *Brassica juncea* (L.) Czern. [52]
- *Brassica napus* L. [41, 53]
- *Brassica nigra* (L.) K. Koch [36, 54]
- *Brassica oleracea* L. [51, 55]
- *Brassica rapa* L. [56]
- *Brassica rapa* L. [35, 53]
- *Brassica* sp. [12, 47]
- *Capsella bursapastoris* (L.) Medik [53]
- *Cardamine hirsuta* L. [52, 53]
- *Cardamine impatiens* L. [57]
- *Descurainia* sp. [51]
- *Iberis* sp. [58]
- *Matthiola incana* (L.) R. Br. (syn. *Guttarda incana* auct. n.) [57]
- *Nasturtium officinale* R. Br. [14]
- *Raphanus sativus* L. [10, 12]

16. Capitophorus sp.

- *Brassica oleracea* L. [59]

17. Dysaphis (cotoneasteria) microsiphon (nevsky, 1929)

- *Brassica oleracea* L. [60, 61]

18. Liosomaphis himalayensis Basu, 1964

- *Brassica napus* L. [34]
- *Brassica* sp. [35]
- *Raphanus sativus* L. [34]

19. Lipaphis (Lipaphis) erysimi (Kaltenbach, 1843)

- *Brassica carinata* A. Braun [62]
- *Brassica juncea* (L.) Czern. [35, 63]
- *Brassica juncea* (L.) Czern. [64]
- *Brassica napus* L. [35, 55]
- *Brassica nigra* (L.) K. Koch [11, 41]
- *Brassica oleracea* L. [12, 53]
- *Brassica rapa* L. [59, 65]
- *Cardamine hirsuta* L. [59]
- *Eruca vesicaria* (L.) Cav. (syn. *Eruca sativa* Miller) [66, 67]
- *Erysimum cheiri* (L.) Crantz (syn. *Cheiranthus cheiri* L.) [37]
- *Iberis amara* L. [35, 57]
- *Lepidium didymum* L. [37]
- *Lepidium sativum* L. [37]
- *Matthiola incana* (L.) R.Br. [57, 65]
- *Nasturtium officinale* R. Br. [14]
- *Nasturtium* sp. [37]
- *Raphanus sativus* L. [41, 65]
- *Rorippa indica* (L.) Hiern [35, 53]
- *Sisymbrium irio* L. [37]

20. Lipaphis (Lipaphis) pseudobrassicae (Davis, 1914)

- *Brassica juncea* (L.) Czern. [55]
- *Brassica juncea* (L.) Czern. [51]
- *Brassica oleracea* L. [55]
- *Brassica oleracea* L. [51]
- *Brassica rapa* L. [55]
- *Matthiola incana* (L.) R.Br. [68]
- *Raphanus sativus* L. [55, 68]

21. Macromyzus (Macromyzus) manoji Raha & Raychaudhuri, 1978

- *Matthiola fruticulosa* (L.) Maire (syn. *Cheiranthus varius* Sibth. & Sm.) [69]

22. Macromyzus (Macromyzus) woodwardiae (Takahashi, 1921)

- *Matthiola fruticulosa* (L.) Maire [53]

23. Macrosiphoniella (Macrosiphoniella) pseudoartemisiae Shinji, 1933

- *Brassica* sp. [70]

24. Myzus (Myzus) cerasi (Fabricius, 1775)

- *Cardamine* sp. [46, 71]

25. Myzus (Myzus) dycei Carver, 1961

- *Raphanus sativus* L. [45]

26. Myzus (Myzus) ornatus Laing, 1932

- *Brassica napus* L. [35]
- *Brassica oleracea* L. [35]
- *Cardamine hirsuta* L. [35]

- *Iberis amara* L. [35]
- *Iberis* sp. [57]
- *Lepidium didymum* L. [35]
- *Raphanus sativus* L. [35]
- *Rorippa indica* (L.) Hiern [35]

27. Myzus (Nectarosiphon) ascalonicus Doncaster, 1946

- *Lepidium didymum* L. [72]

28. Myzus (Nectarosiphon) persicae (Sulzer, 1776)

- *Brassica carinata* A. Braun [9]
- *Brassica juncea* (L.) Czern. [12, 35]
- *Brassica napus* L. [35, 73]
- *Brassica nigra* (L.) K. Koch [42]
- *Brassica oleracea* L. [12, 41]
- *Brassica rapa* L. [12, 44]
- *Brassica* sp. [51]
- *Capsella bursapastoris* (L.) Medik [37]
- *Cardamine impatiens* L. [57]
- *Descurainia sophia* (L.) Webb ex Prantl (syn. *Descorina sofia* auct. n.) [74]
- *Eruca vesicaria* (L.) Cav. [37]
- *Erysimum cheiri* (L.) Crantz [37]
- *Iberis amara* L. [57]
- *Iberis* sp. [56]
- *Lepidium didymum* L. [35, 37]
- *Lepidium sativum* L. [37]
- *Nasturtium* sp. [37]
- *Raphanus sativus* L. [35, 70]
- *Rorippa indica* (L.) [35]
- *Sinapis alba* L. (syn. *Brassica alba* (L.) Rabenh.; *B. a. alba* (L.) Rabenh.) [35]
- *Sisymbrium irio* L. [37]

29. Sitobion (Sitobion) miscanthi (Takahashi, 1921)

- *Brassica napus* L. [44]
- *Brassica oleracea* L. [75]

30. Sitobion (Sitobion) avenae (Fabricius, 1775)

- *Brassica napus* L. [38]

31. Sitobion (Sitobion) rosaeiformis (Das, 1918)

- *Sisymbrium irio* L. [76]

II. Food plant-aphid checklist

1. **Barbarea vulgaris:** *Brevicoryne barbareae*
2. **Brassica carinata:** *Brevicoryne brassicae*, *Lipaphis erysimi*, *Myzus persicae*
3. **Brassica juncea:** *Aphis gossypii*, *Brevicoryne brassicae*, *Lipaphis erysimi*, *Lipaphis pseudobrassicae*, *Myzus persicae*
4. **Brassica napus:** *Aphis spiraecola*, *Brachycaudus helichrysi*, *Brevicoryne brassicae*, *Liosomaphis himalayensis*, *Lipaphis erysimi*, *Myzus ornatus*, *Myzus persicae*, *Sitobion miscanthi*, *Sitobion avenae*
5. **Brassica nigra:** *Brevicoryne brassicae*, *Lipaphis erysimi*, *Myzus persicae*
6. **Brassica oleracea:** *Aphis craccivora*, *Aphis gossypii*, *Aphis spiraecola*, *Aulacorthum solani*, *Brachycaudus helichrysi*, *Brevicoryne brassicae*, *Capitophorus* sp., *Dysaphis microsiphon*, *Hyalopterus pruni*, *Lipaphis erysimi*, *Lipaphis pseudobrassicae*, *Lipaphis pseudobrassicae*, *Myzus ornatus*, *Myzus persicae*, *Sitobion miscanthi*

7. **Brassica rapa**: *Aphis craccivora*, *Brevicoryne brassicae*, *Lipaphis erysimi*, *Lipaphis pseudobrassicae*, *Myzus persicae*
8. **Brassica sp.**: *Aphis gossypii*, *Brevicoryne barbareae*, *Brevicoryne brassicae*, *Liosomaphis himalayensis*, *Lipaphis erysimi*, *Macrosiphoniella pseudoartemisiae*, *Myzus persicae*
9. **Capsella bursapastoris**: *Aphis gossypii*, *Brevicoryne brassicae*, *Myzus persicae*,
10. **Cardamine hirsuta**: *Aulacorthum solani*, *Brevicoryne brassicae*, *Lipaphis erysimi*, *Myzus ornatus*
11. **Cardamine impatiens**: *Brevicoryne brassicae*, *Myzus persicae*
12. **Descurainia sophia**: *Myzus persicae*
13. **Descurainia sp.**: *Brevicoryne brassicae*
14. **Eruca vesicaria**: *Lipaphis erysimi*, *Myzus persicae*
15. **Erysimum cheiri**: *Lipaphis erysimi*, *Myzus persicae*
16. **Iberis amara**: *Aphis gossypii*, *Aphis spiraeicola*, *Lipaphis erysimi*, *Myzus ornatus*, *Myzus persicae*
17. **Iberis sp.**: *Brevicoryne brassicae*, *Myzus ornatus*, *Myzus persicae*
18. **Lepidium didymum**: *Aphis gossypii*, *Brachycaudus helichrysi*, *Lipaphis erysimi*, *Myzus ornatus*, *Myzus persicae*
19. **Lepidium sativum**: *Lipaphis erysimi*, *Myzus persicae*
20. **Lepidium sp.**: *Aphis aurantii*
21. **Matthiola fruticulosa**: *Macromyzus manoji*, *Macromyzus woodwardiae*
22. **Matthiola incana**: *Brevicoryne brassicae*, *Lipaphis erysimi*, *Lipaphis pseudobrassicae*
23. **Nasturtium officinale**: *Brevicoryne brassicae*, *Lipaphis erysimi*
24. **Nasturtium sp.**: *Brevicoryne barbareae*, *Lipaphis erysimi*, *Myzus persicae*
25. **Raphanus sativus**: *Akkaia bengalensis*, *Akkaia sikkimensis*, *Aphis craccivora*, *Aphis gossypii*, *Aphis nerii*, *Aphis spiraeicola*, *Brevicoryne barbareae*, *Brevicoryne brassicae*, *Liosomaphis himalayensis*, *Lipaphis erysimi*, *Lipaphis pseudobrassicae*, *Lipaphis pseudobrassicae*, *Myzus dycei*, *Myzus ornatus*, *Myzus persicae*
26. **Rorippa indica**: *Aphis nasturtii*, *Aphis spiraeicola*, *Aphis citricidus*, *Lipaphis erysimi*, *Myzus ornatus*, *Myzus persicae*
27. **Sinapis alba**: *Myzus persicae*
28. **Sisymbrium irio**: *Lipaphis erysimi*, *Myzus persicae*, *Sitobion rosaeiformis*
29. **Sisymbrium sp.**: *Acyrtosiphon malvae*, *Aphis gossypii*

Conclusion

The present checklist displays that 27 species of brassica plants are infested by 31 species of aphids in India. Plant species, *Brassica oleracea* and *Raphanus sativus* are infested by 15 species of aphids. Two major aphid pests on agricultural crops, *Myzus (Nectarosiphon) persicae* and *Lipaphis (Lipaphis) erysimi* infest 19 and 18 brassica species.

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