Entomology

An updated checklist of arthropod predators of aphids (Homoptera: Aphididae) infesting *Artemisia* species (Asteraceae) across India

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Abstract

Artemisia species support diverse aphid communities and their natural enemies, yet information on their tri-trophic associations in India has remained fragmented. This review compiles published records of aphidophagous predators associated with aphids infesting *Artemisia* spp. in India. A total of 51 predator species belonging to 13 families and seven arthropod orders were recorded preying on 19 aphid species infesting three *Artemisia* taxa, resulting in 110 tri-trophic associations (TTAs) across nine states and union territories. Coleoptera, represented exclusively by 26 coccinellid species, dominated the predator complex, contributing 73 TTAs (64.6%), followed by Diptera with 11 species and 22 TTAs, whereas the remaining orders were comparatively less diverse and geographically restricted. *Oenopia sauzeti* exhibited the broadest prey range, followed by *Propylea luteopustulata*, *Oenopia billieti, Hippodamia variegata, Adalia tetraspilota, Betasyrphus serarius*, and *Chrysoperla zastrowi sillemi*. Among the aphids, *Capitophorus formosartemisiae, Macrosiphoniella pseudoartemisiae*, and *Aphis kurosawai* supported the richest predator assemblages. *Artemisia vulgaris* was the principal host, harbouring 13 aphid species, 39 predator species, and 71 TTAs across seven States/UTs. Overall, the review demonstrates the predominance of coccinellid beetles in *Artemisia*-associated aphid food webs and identifies key generalist predators with potential for conservation biological control. The compiled checklist provides a baseline for future ecological studies and integrated pest management of aphids infesting Artemisia in India.

Keywords: Aphid, *Artemisia*, Biological control, Checklist, Hover flies, Lacewings, Ladybirds, Predator, Spiders, Tri-trophic associations

Introduction

The genus *Artemisia* L. (Asteraceae) is one of the largest genera of flowering plants, comprising more than 500 species distributed predominantly throughout the temperate regions of the Northern Hemisphere [32, 39]. In India, about 45 species have been recorded, occurring mainly in the northwestern and northeastern Himalaya, with a few species extending into the Western Ghats and peninsular hills [27, 29]. Among these, *Artemisia absinthium* L., *Artemisia indica* Willd., *Artemisia vestita* Wall. ex Besser, and *Artemisia vulgaris* L. are widely distributed and economically important medicinal and aromatic plants. They inhabit diverse ecosystems, including temperate grasslands, forest margins, alpine meadows, shrublands, roadsides, cultivated fields, and disturbed habitats, where they contribute significantly to ecosystem functioning by supporting a diverse assemblage of insects, including herbivores, pollinators, predators, and parasitoids [1].

Artemisia species possess considerable medicinal, ecological, and economic importance owing to their rich content of essential oils, terpenoids, flavonoids, sesquiterpene lactones, coumarins, and phenolic compounds. These phytochemicals exhibit antimicrobial, antioxidant, anti-inflammatory, hepatoprotective, antiparasitic, anticancer, and immunomodulatory activities, resulting in the extensive utilisation of *Artemisia* species in Ayurveda, Unani, Siddha, Tibetan medicine, and modern pharmaceutical, cosmetic, perfumery, and aromatherapy industries [1, 6, 30, 44]. Furthermore, several *Artemisia* species produce bioactive compounds with insecticidal, acaricidal, nematicidal, antifeedant, and repellent properties, making them valuable sources of botanical pesticides and important components of sustainable agricultural systems [18, 31].

Despite their chemical defenses, *Artemisia* species are attacked by several aphid species (Hemiptera: Aphididae), which feed on phloem sap, weaken plant growth, deform shoots and inflorescences, excrete honeydew that promotes sooty mould development, and may transmit economically important plant viruses [56]. In both natural and cultivated habitats, aphid populations are regulated by a diverse guild of aphidophagous natural enemies comprising predators such as coccinellid beetles, syrphid flies, lacewings, predatory bugs, spiders, and hymenopteran parasitoids, particularly members of the subfamily Aphidiinae (Braconidae), which play a crucial role in naturally suppressing aphid populations [17, 37, 55, 61]. Conservation of these beneficial insects is fundamental to maintaining ecological balance and reducing reliance on chemical insecticides.

The interactions among *Artemisia* species, aphids, and their natural enemies constitute complex tri-trophic systems that underpin ecosystem functioning and biological control.

Documentation of these interactions through annotated checklists provides an essential foundation for understanding host specificity, trophic relationships, species distributions, and food-web structure [54, 62]. Such inventories facilitate the identification of key biological control agents, reveal geographical and taxonomic knowledge gaps, support biodiversity assessments, and provide baseline information for conservation biological control, habitat management, ecological network analyses, and integrated pest management programmes [21, 36]. Moreover, validated tri-trophic datasets are increasingly valuable for predicting the responses of insect communities to habitat alteration and climate change while promoting the conservation of native natural enemies in agroecosystems.

Although numerous publications have documented aphids, predators, and parasitoids associated with individual *Artemisia* species from different parts of India, these records remain scattered across taxonomic revisions, faunistic surveys, floristic accounts, biological control studies, and regional journals. Consequently, information on the diversity, distribution, and tri-trophic associations of aphids and their natural enemies associated with *Artemisia* species has never been synthesized comprehensively. The present review aims to compile and critically evaluate the available literature on predators and parasitoids associated with aphids infesting different *Artemisia* species in India, update their taxonomy, document their geographical distribution, and provide an annotated checklist of tri-trophic associations. Such a synthesis will serve as a valuable reference for entomologists, ecologists, taxonomists, and biological control practitioners, while contributing to the conservation and sustainable utilization of natural enemies in *Artemisia*-based ecosystems.

Materials and Methods

The checklist was prepared through a comprehensive review of published literature on aphidophagous predators associated with aphids infesting *Artemisia* species in India. Relevant information was compiled from research articles, books, monographs, conference proceedings, technical bulletins, theses, and reports published up to 31 May 2026, retrieved from Google Scholar, Web of Science, Scopus, CAB Abstracts, Biodiversity Heritage Library, and other institutional repositories. Additional references were traced from the bibliographies of relevant publications.

Only records explicitly documenting predator–aphid–*Artemisia* associations from India were included. Duplicate records and reports lacking adequate taxonomic or host plant information were excluded. Predator nomenclature was updated according to the Global Biodiversity Information Facility (https://www.gbif.org) and other authoritative taxonomic resources, aphid taxonomy was validated using the Aphid Species File (https://aphid.speciesfile.org), and botanical names were verified following World Flora Online (https://www.worldfloraonline.org). Synonyms and outdated scientific names were revised to their currently accepted nomenclature.

For each record, data on predator species, aphid species, *Artemisia* host, locality (State/Union Territory), and literature source were extracted. Tri-trophic associations (predator–aphid–host plant) were treated as the basic unit of analysis, and summaries were prepared to determine predator diversity, prey range, host plant associations, and geographical distribution across India.

Results

A total of 51 aphidophagous predator species belonging to 13 families and seven arthropod orders were recorded preying on 19 aphid species infesting three *Artemisia* taxa, resulting in 110 tri-trophic associations (TTAs) distributed across nine States and Union Territories of India (Table 1). Coleoptera was the dominant order, represented exclusively by 26 coccinellid species (47.1%), which attacked 13 aphid species and accounted for 73 TTAs (64.6%) across eight States/UTs. Diptera ranked second with 11 species belonging to three families, contributing 22 TTAs involving six aphid species in four States/UTs. The remaining orders, namely Araneae (7 species, 7 TTAs), Hemiptera (4 species, 4 TTAs), Neuroptera (2 species, 3 TTAs), Trombidiformes (2 species, 3 TTAs), and Dermaptera (1 species, 1 TTA), were comparatively less diverse and exhibited restricted geographical distributions (Table 1).

Table 1: Number of species of predators belonging to different taxa preying on aphids infesting *Artemisia* and their tri-trphic associations (TTAs) and distribution in different number of states/union territories (ST/UT) of India

Orders	Number of					
	Families	Predator species	Aphid species	Plant species	TTAs	ST/UT
1. Trombidiformes	2	2	3	2	3	1
2. Araneae	3	7	2	2	7	2
3. Coleoptera	1	26	13	2	73	8
4. Dermaptera	1	1	1	1	1	1
5. Diptera	3	11	6	2	22	4
6. Hemiptera	2	4	4	2	4	2
7. Neuroptera	1	2	5	3	3	2
Total	13	51	19	3	110	9

The documented predator–aphid–*Artemisia* interactions showed a markedly uneven geographical distribution (Figure 1). Uttarakhand contributed the highest number of TTAs (64; 56.6%), followed by Manipur (21; 18.6%) and Jammu & Kashmir (12; 10.6%). Collectively, these three regions accounted for 97 TTAs (85.8%), indicating that most documented interactions are concentrated in the Himalayan and northeastern parts of India. In contrast, Nagaland contributed nine TTAs, Himachal Pradesh six, Sikkim and West Bengal five each, whereas only a single TTA was reported from Punjab and Karnataka. This pronounced geographical bias most likely reflects uneven sampling intensity, with substantially greater research effort in the Himalayan region than elsewhere in the country.

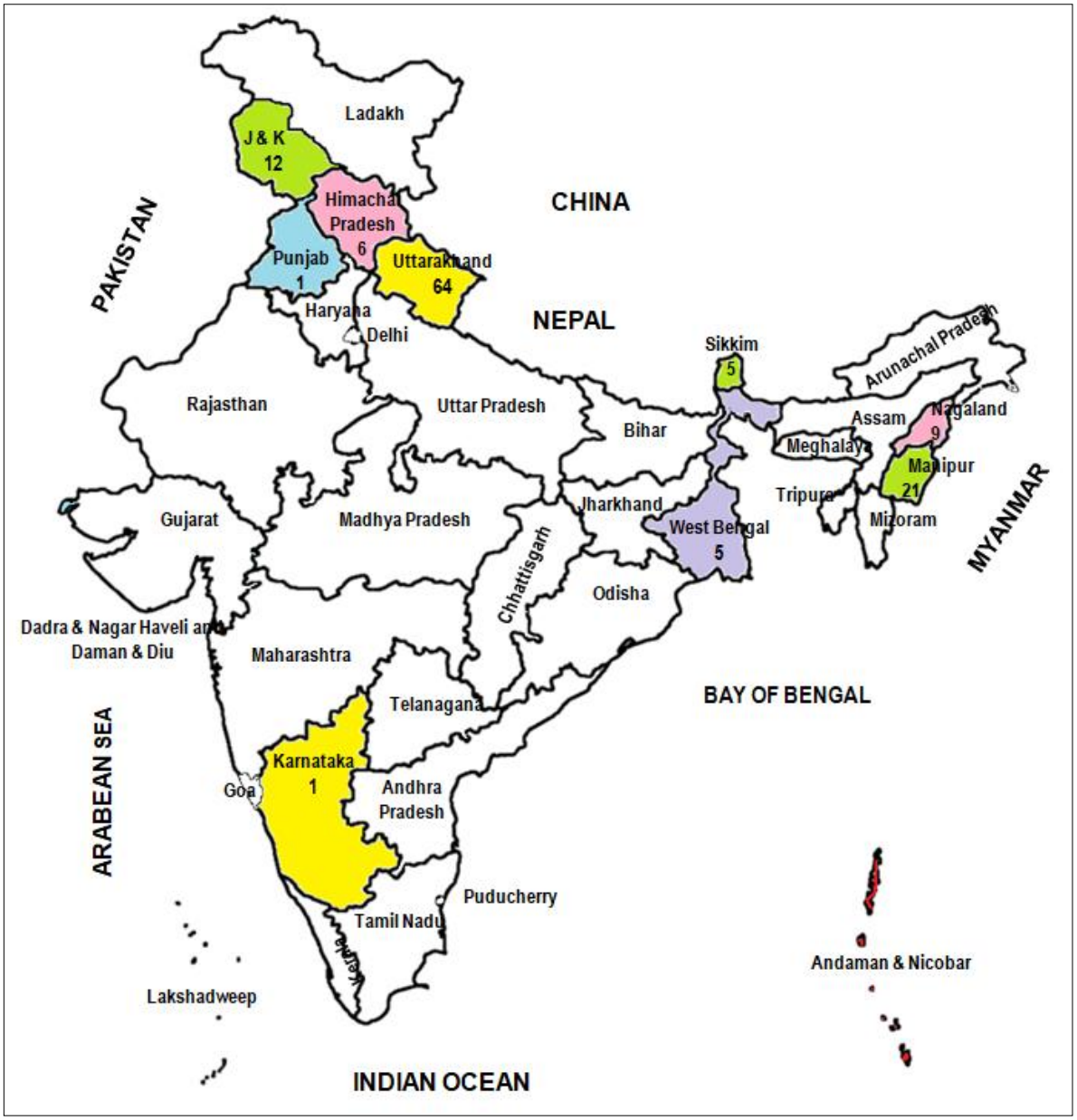

Fig 1: Map of showing the number of tri-trophic associations of predators of aphids infesting *Artemisia* in different states/union territories of India. No species of the predator was recorded in unshaded states/union territories of India

Among the non-insect predators, nine species belonging to two arachnid orders and five families were recorded, collectively contributing 10 TTAs (Table 2). Araneae predominated, comprising seven species distributed among Araneidae (3 species), Salticidae (2 species), and Thomisidae (2 species).

Table 2: Number of species of predators preying on aphids infesting *Artemisia* species and tri-trophic associations (TTAs) in different number of states/union territories (ST/UT) of India.

Order/Family	Species of the predators	Number of			
		Aphid species	Plant species	TTAs	ST/UT
Order: Trombidiformes					
Anystidae	1. *Anystis* sp.	1	1	1	1
Podothrombiidae	2. *Podothrombium* sp.	2	2	2	1
Order: Araneae					
Araneidae	3. *Araneus* sp.	1	1	1	1
	4. *Neoscona mukerjei*	1	1	1	1
	5. *Neoscona* sp.	1	1	1	1
Salticidae	6. *Marpissa* sp.	1	1	1	1
	7. *Myrmarachne* sp.	1	1	1	1
Thomisidae	8. *Henriksenia hilaris*	1	1	1	1

	9. *Xysticus* sp.	1	1	1	1
Order*:* Coleoptera					
Coccinellidae	10. *Adalia tetraspilota*	5	2	5	3
	11. *Alloneda dodecaspilota*	1	1	1	1
	12. *Calvia punctata*	2	1	2	1
	13. *Cheilomenes sexmaculata*	3	3	3	3
	14. *Coccinella septempunctata*	2	2	3	4
	15. *Coccinella transversalis*	2	1	2	1
	16. *Coelophora bissellata*	2	1	2	2
	17. *Coelophora inaequalis*	1	1	1	1
	18. *Coelophora saucia*	1	1	1	1
	19. *Cryptogonus* sp.	2	1	2	1
	20. *Halyzia sanscrita*	1	1	1	1
	21. *Harmonia dimidiata*	1	1	1	1
	22. *Harmonia eucharis*	2	2	3	3
	23. *Hippodamia variegata*	5	2	6	2
	24. *Oenopia billieti*	5	2	8	4
	25. *Oenopia kirbyi*	5	2	7	3
	26. *Oenopia manipurensis*	1	1	1	1
	27. *Oenopia mimica*	1	1	1	1
	28. *Oenopia sauzeti*	9	2	11	3
	29. *Oenopia sexareata*	3	1	3	2
	30. *Oenopia* sp.	1	1	1	1
	31. *Platynaspis saundersii*	3	1	3	1
	32. *Platynaspis variegata*	1	1	1	2
	33. *Propylea luteopustulata*	6	2	7	4
	34. *Scymnus pyrocheilus*	1	1	1	1
	35. *Scymnus* sp.	3	1	3	1
Order*:* Dermaptera					
Forficulidae	36. *Forficula beelzebub*	1	1	1	1
Order*:* Diptera					
Asilidae	37. *Machimus indianus*	1	1	1	1
Chamaemyiidae	38. *Leucopis* sp.	1	1	1	1
Syrphidae	39. *Betasyrphus serarius*	4	2	4	2
	40. *Dideopsis aegrota*	1	1	1	2
	41. *Episyrphus balteatus*	2	1	2	1
	42. *Eupeodes confrater*	1	1	1	1
	43. *Eupeodes latifasciatus*	1	1	1	1
	44. *Ischiodon scutellaris*	2	1	2	2
	45. *Paragus politus*	1	1	1	1
	46. *Paragus tibialis*	2	1	2	1
	47. *Syrphus fulvifacies*	1	1	1	1
Order*:* Hemiptera					
Anthocoridae	48. *Orius lindbergi*	1	1	1	1
	49. *Orius niger*	1	1	1	1
Miridae	50. *Lygus* sp.	1	1	1	1
	51. *Psallus* sp.	1	1	1	1
Order*:* Neuroptera					
Chrysopidae	52. *Chrysoperla zastrowi sillemi*	4	2	5	2
	53. *Cunctochrysa jubingensis*	1	2	2	1
Total		**19**	**3**	**110**	**9**

Within Coleoptera, all recorded predators belonged to the family Coccinellidae, comprising 26 species associated with aphids infesting *Artemisia*. Together, they attacked 13 aphid species occurring on two *Artemisia* species, forming 73 TTAs across eight States/UTs, confirming coccinellids as the principal predator group in the *Artemisia*–aphid system (Table 2). *Oenopia sauzeti* exhibited the broadest trophic range, preying on nine aphid species and contributing the highest number of TTAs (11) across three States/UTs. Other widely distributed and polyphagous species included *Propylea luteopustulata* (6 aphid species, 7 TTAs, 4 States/UTs), *Oenopia billieti* (5 aphid species, 8 TTAs, 4 States/UTs), *Hippodamia variegata* (5 aphid species, 6 TTAs, 2 States/UTs), and *Adalia tetraspilota* (5 aphid species, 5 TTAs, 3 States/UTs). Although *Cheilomenes sexmaculata* preyed on only three aphid species, it was unique in being associated with

all three *Artemisia* taxa, contributing three TTAs across three States/UTs. Most of the remaining coccinellids exhibited comparatively narrow trophic ranges, each being associated with one to three aphid species and contributing one to three TTAs, with several species confined to a single aphid–host plant combination in one State/UT. These findings indicate considerable interspecific variation in prey breadth and geographical distribution, with a small number of generalist species accounting for a disproportionately large share of the documented tri-trophic associations.

The remaining insect predator orders comprised Dermaptera, Diptera, Hemiptera, and Neuroptera, together representing 18 species in seven families (Table 2). Diptera was the second most diverse order, dominated by Syrphidae (9 species). Among syrphids, Betasyrphus serarius exhibited the broadest prey range, attacking four aphid species on two *Artemisia* species and contributing four TTAs across two States/UTs. Episyrphus balteatus, Ischiodon scutellaris, and Paragus tibialis each preyed on two aphid species, whereas the remaining syrphids, together with the asilid Machimus indianus and the chamaemyiid Leucopis sp., were each associated with a single aphid species and one TTA. Neuroptera was represented by two chrysopid species, of which Chrysoperla zastrowi sillemi exhibited the broadest trophic range, feeding on four aphid species on two *Artemisia* species and contributing five TTAs, while Cunctochrysa jubingensis formed two TTAs on two host plants. Hemiptera comprised four predatory bug species belonging to Anthocoridae and Miridae, each recorded from a single aphid species and host plant. Dermaptera was represented solely by Forficula beelzebub, which formed a single TTA. Overall, these predator groups were less species-rich and exhibited narrower trophic ranges than coccinellids, although several syrphid and chrysopid species displayed relatively broad prey spectra.

Overall, the aphidophagous predator complex associated with *Artemisia*-infesting aphids in India is taxonomically diverse but strongly dominated by coccinellid beetles, which accounted for nearly two-thirds of all recorded TTAs and exhibited the broadest prey breadth and geographical distribution. Although most predator species showed restricted trophic ranges and localized distributions, a few generalist predators, particularly *Oenopia sauzeti, Propylea luteopustulata, Oenopia billieti, Hippodamia variegata, Adalia tetraspilota, Betasyrphus serarius,* and *Chrysoperla zastrowi sillemi,* were associated with multiple aphid species and *Artemisia* hosts, suggesting their important role in the natural regulation of aphid populations. Conversely, the relatively limited records of spiders, predatory bugs, earwigs, predatory mites, and several dipteran predators likely reflect both ecological rarity and inadequate sampling. The compiled tri-trophic associations therefore provide a robust baseline for future studies on predator diversity and conservation biological control in *Artemisia* ecosystems.

Among the aphids, *Capitophorus formosartemisiae* supported the richest predator assemblage, being attacked by 20 predator species and accounting for the highest number of TTAs (24) on two *Artemisia* species across three States/UTs (Table 3). *Macrosiphoniella pseudoartemisiae* similarly supported 20 predator species, forming 21 TTAs, although all records originated from Uttarakhand. *Aphis kurosawai* ranked third, being associated with 18 predator species, 22 TTAs, and three host plants across four States/UTs, representing the widest geographical distribution among the aphids. *Macrosiphoniella yomogifoliae* was preyed upon by 13 predator species, forming 13 TTAs on two *Artemisia* species in three States/UTs, whereas *Macrosiphoniella artemisiae* and *Brachycaudus helichrysi* supported five TTAs each. *Aphis spiraecola, Macrosiphoniella sanborni, Myzus cerasi, Myzus dycei,* and an unidentified aphid were each associated with two predator species, while the remaining aphid species were each attacked by only one or two predators, indicating substantial variation in predator richness among aphid taxa.

Table 3: Number of species of aphids infesting *Artemisia* species consumed by different numbers of predator species forming different number of TTAs across India

Aphid species	Number of			
	Predator species	Host plant species	TTAs	ST/UT
1. *Aphis craccivora*	1	1	1	1
2. *Aphis kurosawai*	18	3	22	4
3. *Aphis spiraecola*	2	1	1	3
4. *Brachycaudus helichrysi*	4	2	5	4
5. *Capitophorus formosartemisiae*	20	2	24	3
6. *Coloradoa artemisiae*	1	1	1	1
7. *Coloradoa artemisicola*	1	1	1	1
8. *Macrosiphoniella artemisiae*	5	1	5	2
9. *Macrosiphoniella kikungshana*	1	1	1	1
10. *Macrosiphoniella pseudoartemisiae*	20	2	21	1
11. *Macrosiphoniella sanborni*	2	2	2	2
12. *Macrosiphoniella yomogifoliae*	13	2	13	3
13. *Macrosiphoniella* sp.	3	1	3	1
14. *Macrosiphum* sp.	1	1	1	1
15. *Myzakkaia verbasci*	1	1	1	1
16. *Myzus cerasi*	2	1	2	2
17. *Myzus dycei*	2	1	2	2
18. *Myzus sorbi*	1	1	1	1
19. *Pleotrichophorus glandulosus*	1	1	1	1
20. Unidentified aphid	2	1	2	1
Total	51	3	110	9

Three *Artemisia* host taxa, including one identified only to the genus level, were recorded supporting predator–aphid interactions in India (Table 4). *Artemisia vulgaris* harboured the richest tri-trophic assemblage, supporting 13 aphid species, 39 predator species, and 71 TTAs across seven States/UTs, thereby serving as the principal reservoir of aphidophagous predator diversity within the genus. *Artemisia* sp. supported 12 aphid species, 23 predator species, and 39 TTAs across five States/UTs, whereas *Artemisia absinthium* was associated with only one aphid species, one predator species, and a single TTA recorded from one State/UT.

Table 4: Number of species of *Artemisia* infested by different numbers of aphid species consumed by different numbers of predator species in different number of States/union territories (ST/UT) of India

Plant species	Number of			
	Aphid species	Predator species	TTAs	ST/UT
1. *Artemisia absinthium*	1	1	1	1
2. *Artemisia vulgaris*	13	39	70	7
3. *Artemisia* sp.	12	23	39	5

Discussion

The present review provides the first comprehensive synthesis of the tri-trophic associations among *Artemisia* species, aphids, and their aphidophagous predators in India. The compilation revealed a remarkably diverse predator assemblage comprising 51 species belonging to seven arthropod orders, demonstrating that *Artemisia* plants support complex food webs despite possessing a wide array of defensive secondary metabolites. Such chemically defended plants are known to sustain specialised aphid communities that subsequently support diverse guilds of their natural enemies, thereby contributing to ecosystem stability and natural biological control [19, 20, 26]. The large number of tri-trophic associations documented in the present review highlights the ecological importance of *Artemisia* as a reservoir of beneficial arthropods in both natural and semi-natural habitats.

The overwhelming dominance of coccinellid beetles observed in the present study agrees with numerous investigations demonstrating that ladybird beetles constitute the most effective and abundant predators of aphids worldwide [28, 40, 60]. Their predominance can largely be attributed to their high searching efficiency, broad prey range, rapid development, high reproductive capacity, and ability to exploit dense aphid colonies on a wide range of host plants [35]. The broad trophic ranges exhibited by *Oenopia sauzeti*, *Propylea luteopustulata*, *Oenopia billieti*, *Hippodamia variegata*, and *Adalia tetraspilota* further indicate that these species are important generalist predators capable of exploiting several aphid species across different *Artemisia* hosts. Such ecological plasticity enhances their value in conservation biological control programmes because generalist predators can maintain populations even when individual aphid species fluctuate seasonally [49, 50, 52, 59].

Although syrphids represented the second most diverse predator group, their contribution was considerably lower than that of coccinellids. Syrphid larvae are well-known aphid predators, whereas adults depend primarily on nectar and pollen, making their abundance strongly influenced by floral resource availability and habitat structure [7, 47]. The relatively broad prey ranges of *Betasyrphus serarius*, *Episyrphus balteatus*, and *Ischiodon scutellaris* indicate that these hoverflies may complement coccinellids in suppressing aphid populations on *Artemisia* [51, 53]. Similarly, the occurrence of *Chrysoperla zastrowi sillemi* on multiple aphid species reflects the generalist predatory behaviour widely reported for chrysopids, whose larvae attack numerous soft-bodied arthropods and are frequently exploited in augmentative biological control [22, 58].

In contrast, spiders, predatory mites, predatory bugs, and earwigs contributed relatively few tri-trophic associations. Their apparent scarcity probably reflects both biological and methodological factors. Unlike aphid specialists, these predators are predominantly opportunistic generalists that consume a wide range of arthropod prey rather than aphids alone [38, 48, 57, 63]. Furthermore, many faunistic surveys on aphids primarily target conspicuous insect predators, whereas ground-dwelling or nocturnal predators such as spiders and earwigs are often inadequately sampled. Consequently, their ecological significance in *Artemisia*-associated food webs is likely underestimated.

The highly uneven geographical distribution of tri-trophic associations, with more than 85% of records originating from Uttarakhand, Manipur, and Jammu & Kashmir, probably reflects both ecological conditions and differences in sampling intensity. These regions encompass temperate and sub-temperate Himalayan ecosystems where *Artemisia* species are naturally abundant and aphid diversity is comparatively high [27]. At the same time, these states have historically received greater attention from aphid taxonomists and biological control researchers, resulting in a disproportionately large number of published records. The paucity of records from central, western, and peninsular India therefore should be interpreted cautiously, as it more likely represents inadequate survey effort than genuinely lower predator diversity.

The pronounced variation in predator richness among aphid species also reflects differences in aphid abundance, colony persistence, and geographical distribution. *Capitophorus formosartemisiae*, *Macrosiphoniella pseudoartemisiae*, and *Aphis kurosawai* supported the richest predator assemblages, probably because they form relatively large and persistent colonies that provide abundant prey resources capable of sustaining diverse predator communities. In contrast, several aphid species were associated with only one or two predator species, which may indicate genuine host specialization, restricted distributions, or insufficient field observations. Similar patterns have been documented in other aphid–natural enemy systems, where common aphid species generally support richer predator guilds than rare or localised aphids.

Among the host plants, *Artemisia vulgaris* emerged as the principal reservoir of predator diversity, supporting the largest numbers of aphids, predators, and tri-trophic associations. This result is consistent with its wide geographical distribution, ecological amplitude, and occurrence in diverse natural and disturbed habitats throughout India [27]. Greater host abundance and habitat heterogeneity generally promote higher herbivore diversity, which in turn supports richer communities of natural enemies through increased prey availability and habitat complexity [26, 36]. Conversely, the limited records from *Artemisia absinthium* almost certainly reflect insufficient investigation rather than an intrinsically depauperate arthropod fauna.

Overall, the present synthesis highlights the ecological significance of *Artemisia* species in conserving aphidophagous predator diversity in India. The documented tri-trophic associations identify several coccinellid beetles, syrphid flies,

and chrysopid lacewings as promising candidates for conservation biological control of aphids associated with *Artemisia*. At the same time, the pronounced geographical and taxonomic biases evident in the available literature emphasize the need for standardized surveys across underexplored regions, coupled with integrative taxonomic approaches and long-term ecological studies. Such efforts will improve our understanding of predator diversity, trophic interactions, and food-web dynamics while strengthening the scientific basis for sustainable integrated pest management and biodiversity conservation in *Artemisia*-based ecosystems.

Following is the detailed account of arthropod predators of aphids infesting *Artemisia* species in different States/union territories of India:

I. Class: Arachnida
A. Order: Araneae
a. Family: Araneidae
1. *Araneus* sp.
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia* sp. - Himachal Pradesh [11]
2. *Neoscona mukerjei* Tikader, 1980
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [13]
3. *Neoscona* sp.
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [13]
b. Family: Salticidae
1. *Marpissa* sp.
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia* sp. - Uttarakhand [13]
2. *Myrmarachne* sp.
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [13]
c. Family: Thomisidae
1. *Henriksenia hilaris* (Thorell, 1877)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [13]
2. *Xysticus* sp.
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [13]

B. Order: Trombidiformes
a. Family: Anystidae
1. *Anystis* sp.
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [13]
b. Family: Podothrombiidae
1. *Podothrombium* sp.
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia* sp. - Uttarakhand [13]
• ***Myzakkaia verbasci*** **(Chowdhuri, Basu, Chakrabarti & Raychaudhuri, 1969)**
-*Artemisia* sp. - Uttarakhand [13]

II. Class: Insecta
A. Order: Coleoptera
a. Family: Coccinellidae
1. *Adalia tetraspilota* (Hope, 1831)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [25]
• ***Brachycaudus helichrysi*** **(Kaltenbach, 1843)**
- *Artemisia vulgaris* L. - West Bengal [10]
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia* sp. - Jammu & Kashmir [34]
• ***Macrosiphoniella artemisiae*** **(Boyer de Fonscolombe, 1841)**
- *Artemisia* sp. - Jammu & Kashmir [34]
• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia* sp. - Jammu & Kashmir [34]
2. *Alloneda dodecaspilota* (Hope, 1831)
• ***Macrosiphoniella artemisiae*** **(Boyer de Fonsc., 1841)**
- *Artemisia* sp. - Sikkim [33]
3. *Calvia punctata* (Mulsant, 1853)
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia* sp. - Jammu & Kashmir [34]
• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia* sp. - Jammu & Kashmir [34]
4. *Cheilomenes sexmaculata* (Fabricius, 1781)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Manipur [15]; Uttarakhand [25]
• ***Brachycaudus helichrysi*** **(Kaltenbach, 1843)**
- *Artemisia vulgaris* L. - Nagaland [15]
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]
5. *Coccinella septempunctata* Linnaeus, 1758
• ***Brachycaudus helichrysi*** **(Kaltenbach, 1843)**
- *Artemisia vulgaris* L. - Sikkim [10]
- *Artemisia* sp. - Sikkim [46]; West Bengal [12]
• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [15]
6. *Coccinella transversalis* Fabricus, 1781
• ***Brachycaudus helichrysi*** **(Kaltenbach, 1843)**
- *Artesemia vulgaris* L. - Manipur [15]
• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [15]
7. *Coelophora bissellata* Mulsant, 1850
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Manipur [15]
• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [10]; Nagaland [10]
8. *Coelophora inaequalis* (Fabricius, 1775)
• ***Macrosiphum* sp.**
- *Artemisia vulgaris* L. - West Bengal [2, 12]
9. *Coelophora saucia* (Mulsant, 1850)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Manipur [15]
10. *Cryptogonus* sp.
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia* sp. - Himachal Pradesh [11]

• ***Pleotrichophorus glandulosus*** **(Kaltenbach, 1846)**
- *Artemisia* sp. - Himachal Pradesh [11]

11. *Halyzia sanscrita* Mulsant, 1853

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [25]

12. *Harmonia dimidiata* (Fabricius, 1781)

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

13. *Harmonia eucharis* (Mulsant, 1853)

• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [15]; Nagaland [10, 15]

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]
- *Artemisia* sp. - Uttarakhand [9]

14. *Hippodamia variegata* (Goeze, 1777)

• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [25]
- *Artemisia* sp. - Jammu & Kashmir [34]

• ***Macrosiphoniella artemisiae*** **(Boyer de Fonscolombe, 1841)**
- *Artemisia* sp. - Jammu & Kashmir [34]

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia* sp. - Jammu & Kashmir [34]

15. *Oenopia billieti* (Mulsant, 1853)

• **Unidentified aphid**
- *Artemisia* sp. - Sikkim [42]

16. *Oenopia kirbyi* Mulsant, 1850

• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [25]
- *Artemisia* sp. - Uttarakhand [24]

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [25]
- *Artemisia* sp. - Uttarakhand [24]

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Macrosiphoniella*** **sp.**
- *Artemisia* sp. - Uttarakhand [24]

• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [15]; Nagaland [10]

17. *Oenopia manipurensis* Devi, Singh & Singh, 1991

• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [15]

18. *Oenopia mimica* Weise, 1902

• **Unidentified aphid**
- *Artemisia* sp. - Sikkim [42]

19. *Oenopia sauzeti* Mulsant, 1866

• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [25]
- *Artemisia* sp. - Himachal Pradesh [11];Uttarakhand [24]

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia* sp. - Himachal Pradesh [11]; Uttarakhand [24]

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Coloradoa artemisiae*** **(del Guercio, 1913)**
- *Artemisia vulgaris* L. - Manipur [10]

• ***Coloradoa artemisicola*** **Takahashi, 1965**
- *Artemisia vulgaris* L. - Manipur [3]

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [15]; Nagaland [10]

• ***Macrosiphoniella*** **sp.**
- *Artemisia* sp. - Uttarakhand [24]

• ***Myzus cerasi*** **(Fabricius, 1775)**
- *Artemisia vulgaris* L. - Manipur [15]; Nagaland [10]

• ***Myzus dycei*** **Carver, 1961**
- *Artemisia vulgaris* L. - Manipur [15]; Nagaland [15]

20. *Oenopia sexareata* (Mulsant, 1853)

• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [10]; Nagaland [10]

• ***Myzus cerasi*** **(Fabricius, 1775)**
- *Artemisia vulgaris* L. - Manipur [15]

21. *Oenopia* sp.

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

22. *Platynaspis saundersii* Crotch, 1874

• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [13]

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

23. *Platynaspis variegata* Crotch, 1874

• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia vulgaris* L. - Manipur [15]; Nagaland [10]

24. *Propylea luteopustulata* (Mulsant, 1850)

• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Punjab [41]
- *Artemisia* sp. - Uttarakhand [24]

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia* sp. - Uttarakhand [24]

• ***Macrosiphoniella artemisiae*** **(Boyer de Fonscolombe, 1841)**
- *Artemisia* sp. - Jammu & Kashmir [34]

• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Macrosiphoniella sanborni*** **(Gillette, 1908)**
- *Artemisia vulgaris* L. - Manipur [3, 10]

• ***Macrosiphoniella*** **sp.**
- *Artemisia* sp. - Uttarakhand [24]

25. *Scymnus pyrocheilus* Mulsant, 1853

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia* sp. - Himachal Pradesh [11]

26. *Scymnus* sp.

• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [25]

• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [25]
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [25]

B. Order: Dermaptera
Family: Forficulidae
1. *Forficula beelzebub* (Burr, 1900)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [13]

C. Order: Diptera
a. Family: Asilidae
1. *Machimus indianus* Ricardo, 1919
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia* sp. - Uttarakhand [5]
b. Family: Chamaemyiidae
1. *Leucopis* sp.
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia* sp. - Uttarakhand [13]
c. Family: Syrphidae
1. *Betasyrphus serarius* (Wiedemann, 1830)
• ***Aphis craccivora*** **Koch, 1854**
- *Artemisia vulgaris* L. - West Bengal [12]
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia* sp. - Uttarakhand [13]
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [13]
2. *Dideopsis aegrota* (Fabricius, 1805)
• ***Aphis spiraecola*** **Patch, 1914**
- *Artemisia vulgaris* L. - Karnataka [43]; West Bengal [43]
3. *Episyrphus balteatus* (De Geer, 1776)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [23]
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [23]
4. *Eupeodes confrater* (Wiedemann, 1830
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [13]
5. *Eupeodes latifasciatus* (Macquart, 1829)
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [23]
6. *Ischiodon scutellaris* (Fabricius, 1805)
• ***Aphis spiraecola*** **Patch, 1914**
- *Artemisia vulgaris* L. - Manipur [45]
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [23]
7. *Paragus politus* Wiedemann, 1830
• ***Macrosiphoniella sanborni*** **(Gillette, 1908)**
- *Artemisia* sp. - Uttarakhand [13]
8. *Paragus tibialis* (Fallén, 1817)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia vulgaris* L. - Uttarakhand [13]
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [23]
9. *Syrphus fulvifacies* Brunetti, 1913
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [23]

D. Order: Hemiptera
a. Family: Anthocoridae
1. *Orius lindbergi* Wagner, 1952
• ***Macrosiphoniella artemisiae artemisiae*** **(Boyer de Fonscolombe, 1841)**
- *Artemisia* sp. - Jammu & Kashmir [4]
2. *Orius niger* (Wolff, 1811)
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [13]
b. Family: Miridae
1. *Lygus* sp.
• ***Myzus sorbi*** **Bhattacharya & Chakrabarti, 1982**
- *Artemisia* sp. - Uttarakhand [13]
2. *Psallus* sp.
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [13]

E. Order: Neuroptera
Family: Chrysopidae
1. *Chrysoperla zastrowi sillemi* (Esben-Petersen, 1935)
• ***Capitophorus formosartemisiae*** **(Takahashi, 1921)**
- *Artemisia vulgaris* L. - Uttarakhand [16]
- *Artemisia* sp. - Jammu & Kashmir [34]
• ***Macrosiphoniella kikungshana*** **Takahashi, 1937**
- *Artemisia* sp. - Uttarakhand [16]
• ***Macrosiphoniella pseudoartemisiae*** **Shinji, 1933**
- *Artemisia vulgaris* L. - Uttarakhand [16]
• ***Macrosiphoniella yomogifoliae*** **(Shinji, 1922)**
- *Artemisia* sp. - Jammu & Kashmir [34]
2. *Cunctochrysa jubingensis* (Hölzel, 1973)
• ***Aphis kurosawai*** **Takahashi, 1921**
- *Artemisia absinthium* L. - Uttarakhand [8]
- *Artemisia vulgaris* L. - Uttarakhand [14]

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