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DIVERSITY OF APHID FAUNA (HEMIPTERA: APHIDIDAE) OF KERALA

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ABSTRACT

Extensive surveys were undertaken across Kerala during 2018-22, to explore the diversity of aphid fauna associated with different flora. The study recorded 25 species of aphids under 17 genera in four tribes belonging to four subfamilies of Aphididae. Aphidinae was the predominant subfamily, followed by Greenideinae, Hormaphidinae and Eriosomatinae. Aphidinae was represented by two tribes, Aphidini and Macrosiphini. The tribes Aphidini (*Aphis* (L.), *Rhopalosiphum* Koch, *Hysteroneura* Davis and *Melanaphis* van der Goot) and Macrosiphini (*Pentalonia* Coquerel, *Brevicoryne* van der Goot, *Macrosiphoniella* del Guercio, *Macrosiphum* Passerini, *Metopolophium* Mordvilko, *Acyrthosiphon* Mordvilko, *Uroleucon* Mordvilko and *Aulacorthum* Mordvilko) were represented by four and eight genera, respectively. The subfamily Greenideinae was represented by two genera in a single tribe (Greenideini); Hormaphidinae represented by two genera in a single tribe (Cerataphidini), while only one genus in a single tribe (Eriosomatini) was recorded in the subfamily Eriosomatinae. The genus *Aphis* was the most diverse with five species. *Aphis gossypii* Glover exhibited a wider host range with 20 host plants. The study records new distribution of three aphid species from south India and seven species from Kerala.

Key words: Aphididae, subfamilies, Aphidinae, Aphidini, Macrosiphini, Greenideinae, Eriosomatinae, Hormaphidinae, host range, species diversity, Kerala, distribution

Aphids (Aphididae) are considered as one of the major groups of phytophagous insects owing to their polyphagism, polymorphism, fast development, host alteration and peculiar reproductive habits. They are remarkable for their role as the largest group of insect vector of plant viral diseases, with 247 listed viral diseases of plants (Kennedy et al., 1962). The aphid-transmitted viruses belong to 19 of the 70 recognized virus genera and comprise approximately 275 virus species, about 50% of insect-borne plant viruses (Nault, 1997). Among these, 164 diseases are stated to be transmitted by nearly 200 species of aphids (Singh, 2000). They can migrate great distances, mainly through passive dispersal by winds and colonise new habitat during favourable environmental condition. Many aphid species have become serious pests of agricultural, horticultural crops and forestry plants (Basilova, 2010). The family Aphididae is composed of 24 subfamilies that globally include 5109 species under 527 genera. In India, only 16 subfamilies were recognized comprising of 794 species under 208 genera (Singh and Singh, 2019). The detailed food plant association of Indian aphids was recently updated by Singh and Singh (2018). Raychaudhuri et al. (1981) had reported 43 species of aphids distributed over 26 genera under 3 subfamilies from south India. Joshi (2008) recorded 66 aphid species under 38 genera belonging to seven subfamilies from Karnataka. Reports on the aphid fauna of Kerala was scanty till 1981, when Zoological Survey of India reported a few species from Palakkad and Silent Valley (Raychaudhuri et al., 1981). However, there are no published reports on aphid diversity in Kerala, subsequent to this publication. In this background, a study was carried out to document the aphid fauna of Kerala to provide an updated information on the species diversity, distribution and host range of Aphididae from the state.

MATERIALS AND METHODS

Purposive sampling surveys were conducted in different localities across Kerala from 2018 to 2022, to collect aphids on different host plants including cultivated crops, ornamental plants, trees and weed plants. The field photographs of aphid colonies on host plants were captured with a digital macro camera (OnePlus) (Fig. 1, 2). The infested plant parts along

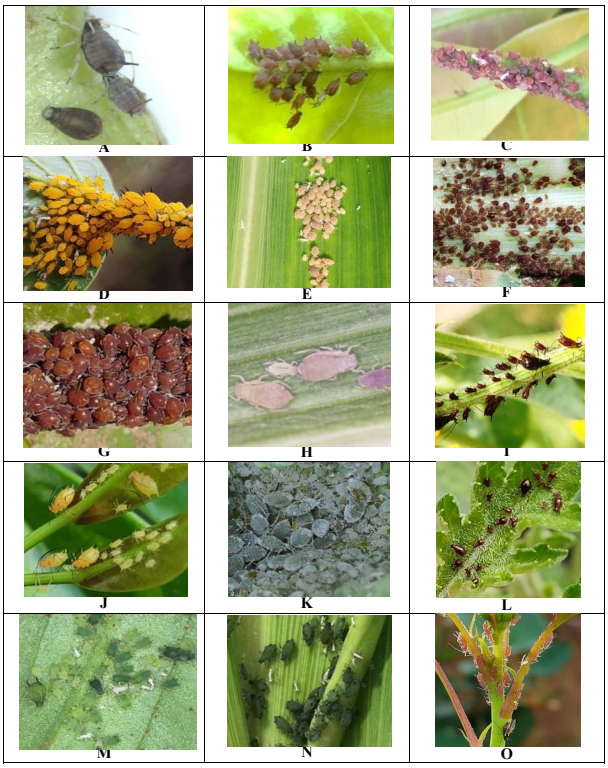

Fig. 1. A- *Aphis craccivora* Koch; B- *Aphis aurantii* (Boyer de Fonscolombe); C- *Aphis odinae* (van der Goot); D- *Aphis nerii* Boyer de.; E- *Melanaphis sacchari* (Zehntner); F- *Hysteroneura setariae* (Thomas); G- *Rhopalosiphum nymphaeae* (L); H- *Rhopalosiphum rufiabdominalis* (Sasaki); I- *Uroleucon compositae* (Theobald); J- *Aulacorthum magnoliae* (Essig and Kuwana); K- *Brevicoryne brassicae* (L); L- *Macrosiphoniella sanborni* (Gillette); M- *Aphis gossypii* Glover; N- R*hopalosiphum maidis* (Fitch); O- *Macrosiphum euphorbiae* (Thomas)

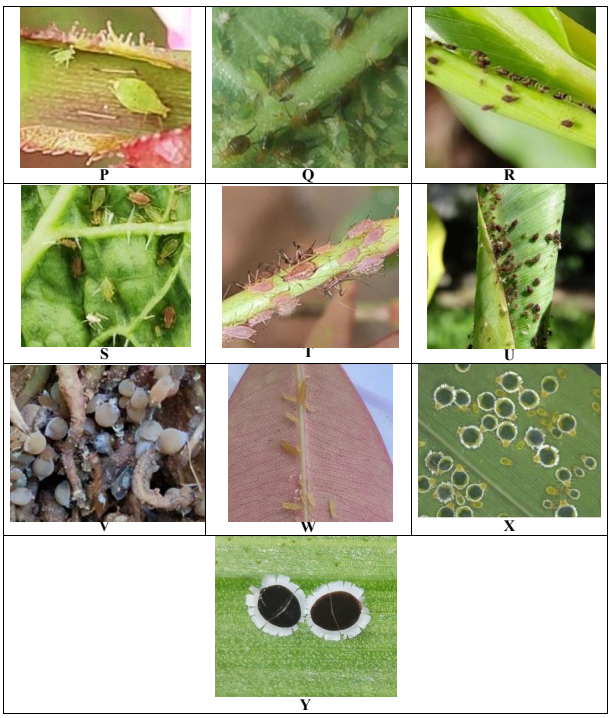

Fig. 2. P-*Metopolophium dirhodum* (Walker); Q-*Greenidea artocarpi* (Westwood); R-*Pentalonia caladii* van der Goot; S-*Acyrthosiphon gossypii* Mordvilko; T- *Macrosiphum rosae* (L.); U- *Pentalonia nigronervosa* Coquerel; V- *Tetraneura nigriabdominalis* (Sasaki); W- *Greenideoida ceyloniae* van der Goot; X- *Astegopteryx formosana* Takahasi; Y-*Cerataphis brasiliensis*

with an aphid colony were collected in small plastic containers with appropriate label and brought to the laboratory. The aphid specimens collected were preserved in 70% ethyl alcohol in small plastic vials (1.5 ml) and each vial was furnished with data on locality, host plant, date of collection and collector's name etc. The preserved aphid specimens were slide mounted under a stereo binocular microscope (Zeiss Stemi 305) as per the method suggested by Eastop and van Emden (1972), for species-level identification. The slide was labelled using a thick card label pasted on the right hand side with details on the host plant, locality, date of collection and name of the collector. The slide-mounted specimens were observed under a research trinocular microscope ((RADICAL, RXLr-4) for key taxonomic characters and identified up to species level using published and online taxonomic keys (Aphids on World Crops (Identification and information guide), and http://www.aphidsonworldsplants.info/) and on confirmation of the identity with the third author. The details of location of collection of different species in this study was used for the preparation of the distribution map, using Quantum GIS software.

RESULTS AND DISCUSSION

The study recorded 25 species of Aphididae belonging to 17 genera viz., *Aphis* (L.), *Rhopalosiphum* Koch, *Pentalonia* Coquerel, *Macrosiphum* Oestlund, *Greenida* (Westwood), *Brevicoryne* van der Goot, *Macrosiphoniella* del Guercio, *Hysteroneura* Davis, *Greenideoida* (*Paragreenideoida*) van der Goot, *Acyrthosiphon* Mordvilko, *Tetraneura* Hartig, *Melanaphis* van der Goot, *Metopolophium* Mordvilko, *Astegopteryx* Karsch, *Cerataphis* (Hempel) and *Aulacorthum* Mordvilko under three subfamilies viz., Aphidinae (tribes Aphidini and Macrosiphini), Greenideinae (tribe Greenideini), Eriosomatinae (tribe Eriosomatini) and Hormaphidinae (tribe Cerataphidini) in association with 68 host plants from different localities of Kerala (Table 1). The genus *Aphis* was the most diverse with five species viz., *Aphis nerii* Boyer de Fonscolombe, *A. odinae* (van der Goot), *A. gossypii* Glover, *A. craccivora* Koch and *A. aurantii*

Table 1. Aphid fauna of Kerala and associated host plants

Aphid species	Host plant	Host plant family	Locations	GPS coordinates Latitude (^{0}N)	Longitude (^{0}E)
Subfamily Aphidinae					
Tribe Aphidini					
Aphis gossypii	*Gerbera* sp.	Asteraceae	Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
Glover	*Solanum melongena*	Solanaceae			
	Zinnia elegans	Asteraceae			
	Capsicum annuum	Solanaceae			
	Commelina benghalensis	Commelinaceae			
	Hibiscus sp.	Malvaceae			
	Cucumis sativus	Cucurbitaceae			
	Limnocharis flava	Alismataceae			
	Abelmoschus moschatus	Malvaceae			
	Hylocereus undatus	Cactaceae			
	Trichosanthes cucumerina	Cucurbitaceae			
	Colocasia esculenta	Araceae			
	Capsicum annuum	Solanaceae	Kumbalacode, Thrissur	10^{0}39’54” N	76^{0}24’22” E
	Rosa sp.	Rosaceae	Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
	Capsicum frutescens	Solanaceae	Pattambi, Palakkad	10^{0}81’14” N	76^{0}19’03” E
	Ageratum conyzoides	Asteraceae	Odakkali, Ernakulam	10^{0}05’33” N	76^{0}33’36” E
	Helianthus annuus	Asteraceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
	Coccinia sp.	Cucurbitaceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
	Abelmoschus esculentus	Malvaceae	Kayamkulam, Kollam	09^{0}10’35” N	76^{0}31’01” E
	Momordica charantia	Cucurbitaceae	Mararikulum, Alappuzha	09^{0}33’48” N	76^{0}19’01” E
	Trichosanthes cucumerina	Cucurbitaceae			
	Colocasia esculenta	Araceae			
Aphis (*Toxoptera*)	*Artocarpus heterophyllus*	Moraceae	Kasaragod	12^{0}49’95” N	74^{0}98’69” E
aurantii (Boyer de	*Theobroma cacao*	Malvaceae	Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
Fonscolombe)	*Gardenia gummifera*	Rubiaceae	Mayiladumpara, Idukki	09^{0}53’15” N	77^{0}09’23” E
	Coffea arabica	Rubiaceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
	Artocarpus heterophyllus	Moraceae			
	Theobroma cacao	Malvaceae			
	Camellia sinensis	Theaceae	Munnar, Idukki	10^{0}05’13” N	77^{0}04’31” E
	Mesua ferrea	Calophyllaceae	Thiruvananthapuram	08^{0}45’06” N	77^{0}01’36” E
Hysteroneura	*Paspalum plicatulum*	Poaceae	Odakkali, Ernakulam	10^{0}05’33” N	76^{0}33’36” E
setariae (Thomas)	*Eleusine indica*		Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
	Eleusine coracana				
	Oryza sativa				
	Pennisetum pedicellatum		Madakathara, Thrissur	10^{0}55’05” N	76^{0}26’58” E
	Digitaria ciliaris		Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
	Cymbopogon citratus		Palode, Thiruvananthapuram	08^{0}45’06” N	77^{0}01’36” E
	Eleusine coracana		Mararikulum, Alappuzha	09^{0}33’48” N	76^{0}19’01” E
	Cyperus iria		Mararikulum, Alappuzha	09^{0}33’48” N	76^{0}19’01” E
	Eleusine indica		Kayamkulum, Kollam	09^{0}10’35” N	76^{0}31’01” E
Aphis craccivora	*Phaseolus vulgaris*	Fabaceae	Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
Koch	*Vigna unguiculata*		Mannuthy, Thrissur	10^{0}32’06” N	76^{0}16’02” E
			Chalakkudi, Thrissur	10^{0}18’45” N	76^{0}20’30” E
			Mannuthy, Thrissur	10^{0}32’06” N	76^{0}16’02” E
			Padannakkad, Kasaragod	12^{0}25’66” N	75^{0}11’69” E
			Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
			Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
	Glyricidia sepium		Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
	Psophocarpus tetragonolobus		Vellayani, Thiruvananthapuram	08^{0}25’47” N	76^{0}59’25” E
	Centrosema sp.		Thiruvananthapuram	08^{0}32’41” N	76^{0}54’54” E
	Vigna unguiculata		Mararikulum, Alappuzha	09^{0}33’48” N	76^{0}19’01” E

(contd.)

(contd. Table 1)

Rhopalosiphum nymphaeae (Linnaeus)	*Nuphar lutea*	Nymphaeaceae	Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
	Nymphaea sp.				
	Nymphaea sp.		Thiruvananthapuram	08^{0}32’41” N	76^{0}54’54” E
	Salvinia sp.	Salviniaceae	Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
Aphis nerii Boyer de Fonscolombe	*Calotropis procera*	Apocynaceae	Odakkali, Ernakulam	10^{0}05’33” N	76^{0}33’36” E
	Adenium sp.		Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
Aphis (*Toxoptera) odinae* (van der Goot)	*Mangifera indica*	Anacardiaceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
	Anacardium occidentale	Anacardiaceae	Madakkathara, Thrissur	10^{0}55’05” N	76^{0}26’58” E
Rhopalosiphum maidis (Fitch)	*Sorghum bicolor*	Poaceae	Padannakkad, Kasaragod	12^{0}25’66” N	75^{0}11’69” E
Melanaphis sacchari (Zehntner)	*Sorghum bicolor*	Poaceae	Vellanikkara, Thrissur	10^{0}32’52” N	76^{0}16’58” E
Tribe: Macrosiphini					
Pentalonia caladii (van der Goot)	*Alpinia purpurata*	Zingiberaceae	Kannara, Thrissur	10^{0}32’24” N	76^{0}19’11” E
	Heliconia psittacorum	Heliconiaceae			
	Elettaria cardamomum	Zingiberaceae	Mayiladumpara, Idukki	09^{0}53’15” N	77^{0}09’23” E
Pentalonia nigronervosa Coquerel	*Musa* sp.	Musaceae	Kannara, Thrissur	10^{0}32’24” N	76^{0}19’11” E
			Chalakkudi, Thrissur	10^{0}18’45” N	76^{0}20’30” E
			Mayiladumpara, Idukki	09^{0}53’15” N	77^{0}09’23” E
			Pampadumpara, Idukki	09^{0}79’57” N	77^{0}15’91” E
Brevicoryne brassicae (L.)	*Brassica oleracea var. botrytis*	Brassicaceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
Macrosiphoniella sanborni (Gillette)	*Chrysanthemum* sp.	Asteraceae	Pampadumpara, Idukki	09^{0}79’57” N	77^{0}15’91” E
Acyrthosiphon gossypi Mordvilko	*Brassica rapa* subsp. *pekinensis*	Brassicaceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
Macrosiphum euphorbiae (Thomas)	*Rosa* sp.	Rosaceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
Macrosiphum rosae					
Metopolophium dirhodum (Walker)					
Aulacorthum magnoliae (Essig and Kuwana)	*Schefflera arboricola*	Araliaceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
Subfamily Greenideinae					
Tribe Greenideini					
Greenida artocarpi (Westwood)	*Artocarpus heterophyllus*	Moraceae	Ambalvayal, Wayanad	11^{0}37’03” N	76^{0}12’44” E
			Kozhikode	11^{0}25’87” N	75^{0}48’04” E
Greenideoida (Paragreenideoida) ceyloniae van der Goot	*Mesua ferrea*	Calophyllaceae	Palode, Thiruvananthapuram	08^{0}45’06” N	77^{0}01’36” E
Subfamily Hormaphidinae					
Tribe Cerataphidini					
Astegopteryx formosana (Takahashi)	*Bambusa* sp.	Poaceae	Vellanikkara, Thrissur	10^{0}32’52”N	76^{0}16’58”E
Cerataphis brasiliensis (Hempel)	*Areca catechu, Cocos nucifera*	Arecaceae	Vellanikkara, Thrissur	10^{0}32’52”N	76^{0}16’58”E
Subfamily Eriosomatinae					
Tribe Eriosomatini					
Tetraneura nigriabdominalis (Sasaki)	*Pennisetum glaucum*	Poaceae	Vellanikkara, Thrissur	10^{0}32’52”N	76^{0}16’58”E
	Brachiaria ramosa				
	Echinochloa esculenta				

(Boyer de Fonscolombe). This was followed by the genera *Rhopalosiphum* Koch, *Pentalonia* Coquerel and *Macrosiphum* Passerini, with two species each viz., *R. nymphaeae* (L) and *R. maidis* (Fitch); *P. caladii* (van der Goot) and *P. nigronervosa* Coquerel; *Macrosiphum rosae* (L.) and *Macrosiphum euphorbiae* (Thomas), respectively. One species each were recorded from the other genera viz., *Greenida artocarpi* (Westwood), *Brevicoryne brassicae* (L), *Macrosiphoniella sanborni* (Gillette), *Hysteroneura setariae* (Thomas), *Greenideoida* (*Paragreenideoida*) *ceyloniae* van der Goot, *Acyrthosiphon gossypi* Mordvilko, *Tetraneura nigriabdominalis* (Sasaki), *Melanaphis sacchari* (Zehntner), *Metapolophium dirhodum* (Walker), *Astegopteryx formosana* (Takahashi), *Cerataphis brasiliensis* (Hempel) and *Aulacorthum magnoliae* (Essig and Kuwana). The field diagnostic characters of different aphid species collected in the study are furnished in Table 2. In this study, aphids belonging to only four subfamilies were recorded from Kerala. Aphidinae was identified as the predominant subfamily in the region, recording 20 species under two tribes viz., Aphidini (10 species) and Macrosiphini (10 species). Subfamily Greenideinae was represented by two species under a single tribe, Greenideini and subfamily Hormaphidinae was represented by two species under a single tribe Cerataphidini**,** while subfamily Eriosomatinae was represented by a single species under the tribe Eriosomatini. *Aphis* (Aphidini) was the predominant genus recorded in the study, with five species. Aphididae of the world is classified into 24 subfamilies (Singh and Singh, 2019). Aphidinae is the largest subfamily under the family Aphididae with 3100 extant species worldwide (Singh and Singh, 2019). Earlier studies on aphid fauna of south India, mainly explored the states of Tamil Nadu and Karnataka (Gadiyappanavar, 1970; David, 1975; Raychaudhuri et al., 1981; Joshi, 2008) and only nine species of aphids were reported from Kerala (Raychaudhuri et al., 1981). David (1975) recorded 25 species under Aphidini and 39 species under Macrosiphini from south India, but the study did not cover Kerala. Studies on the aphid fauna of Karnataka reported 66 species under 38 genera in seven subfamilies. The subfamily Aphidinae was the dominant group with 65.15 per cent of the total species recorded. The tribe Aphidini was represented by 22 species and the tribe Macrosiphini by 21 species. The largest genus was *Aphis*, represented by nine species (Joshi, 2008).

Members of the tribe Aphidini were found to be highly polyphagous with a wider host range of 57 plant species in 26 families. The tribe Aphidini is one of the two tribes of the subfamily Aphidinae, which is the largest subfamily of the aphids being represented by 830 described species assigned to 33 genera in the world. In India nine genera and 70 species of Aphidini were recorded infesting 940 plant species belonging to 138 families, of which only 19 families are monocot (Singh and Singh, 2017a). Among the different species collected during the study, *A. gossypii* recorded a wider host range with 20 host plants in nine families. *A. gossypii* is a cosmopolitan, polyphagous aphid species infesting host plants belonging to very distantly related families (Raychudhuri et al., 1981). In India, it was recorded on 569 food plant species under 103 families (Singh et al., 2014). Singh and Singh (2017a) provided a check list of Indian Aphidini with their host plants. Joshi (2008) recorded *A. gossypii* on 55 host plants in 27 families and *A. aurantii* on 17 hosts in 12 families, from Karnataka. In this study, *A. aurantii* was recorded on eight host plants in five families from Kerala. *A. aurantii* is a polyphagous aphid species with 177 host plant records in 47 families in India (Singh and Singh, 2017a). All other species of Aphidinae recorded narrow host range in this study. In India only six species of *Rhopalosiphum* had been reported viz., *R. esculentus* (Raychaudhuri and Raychaudhuri), *R. maidis* (Fitch), *R. nymphaeae* (L.), *R. padi* (L.), *R. rufiabdominalis* (Sasaki) and *R. yoksumi* (Sasaki) (Raychaudhuri, 1980). The rice-root aphid, *R. rufiabdominalis* was reported as a major pest of upland paddy in Meghalaya (Raychaudhuri, 1981). Saraswati et al. (1990) recorded the water lily aphid, *R. nymphaeae* on different aquatic plants viz., *Euryale ferox* (L.), *Ipomoea* (L.), *Nymphoides* (Seg.), *Marsilea* (L.), *Hydrilla* (Rich.), *Vallisneria* (L.), *Eichhornia* (Kunth), *Polygonum* (L.), *Pistia* (L.), *Ranunculus* (L.) and *Nymphaea* (L.) in freshwater ponds of north Bihar. The aphid was also reported from Karnataka earlier on *Nymphaea lotus* (L.) and *Eleusine coracana* (L.) (Joshi, 2008). Krishna (2014) recorded this aphid on five food plants viz., *Brassica oleracea* var. *botrytis*, *Colocasia* sp. *Lycopersicon esculentum* (Mill.), *Echinoclo colona* (L.) and *Eleusine corcana* (L.) from Bihar. Adults and nymphs of the aphid were collected on *Azolla filiculoides* (Lam.) in Guilan Province, Iran (Farahpour et al., 2015). Jaydeep et al. (2020) reported the occurrence of water lily aphid on different aquatic plants from Varanasi and adjoining regions, Uttar Pradesh.

The tribe Macrosiphini contains about 2166 species belonging to 242 genera globally. Out of these, only 96 genera and 374 species are recorded from India infesting hundreds of plant species belonging to several families

Table 2. Field diagnostic characters of aphid species

Aphid species	Colour and shape	Site of infestation
Aphis gossypii	Nymphs and adults are oval, dark green, dark blackish, green to mottled green and dark green to pale yellow	Lower surface of leaves, flower buds, and tender shoots
Aphis aurantii	Nymphs and apterous adults oval, reddish-brown or brownish-black, black-and-white banded antennae; alate adults, dark brown	Lower surface of leaves and tender shoots
Hysteroneura setariae	Nymphs and adults, oval, brown with distinctly white legs and antennae; alate adults greenish-grey abdomen	Inflorescence, leaves and leaf sheath
Aphis craccivora	Apterous adults, oval, shiny black; nymphs: light brownish or blackish with a dusty wax layer on the body	Growing shoot tips and tender leaves
Rhopalosiphum nymphaeae	Nymphs and apterous adults oval, reddish brown to dark brown with a whitish bloom on the ventral surface of the body; alate adults are dark brown to shiny black	Lower surface of leaves and tender shoots
Aphis nerii	Nymphs and adults are oval, bright yellow with black appendages and black antennae	Under surface of leaves, along veins
Aphis (Toxoptera) odinae	Nymphs and adults oval, greyish-brown to reddish brown in colour; alate reddish brown to dark-brown abdomen	Under surface of leaves, along main veins and tender shoots
Rhopalosiphum maidis	Nymphs and adults elongate, narrow body and short antenna; apterous adults and nymphs dark olive-green or bluish green body, occasionally dusted with whitish waxy material; alates have yellowish green to dark green colour body	Leaf whorl, leaf sheath, as well as both lower and upper surface of leaves
Melanaphis sacchari	Nymphs and adults are elongate and yellowish in colour	Upper and lower surfaces of matured leaves
Pentalonia caladii	Nymphs and adult aphids are elongate oval and black with antenna longer than the body and long slender legs	Leaf sheath, flowers and flower buds
Pentalonia nigronervosa	The aphid species closely resembles *P. caladii*	Leaf sheath of only banana plants
Brevicoryne brassicae	Nymphs and apterous adults are oval, whitish grey in colour with white waxy coating on the body	Upper surface of matured leaves
Macrosiphoniella sanborni	Nymphs and adults are elongate, shiny brown or black with antennae and legs slender and longer than body	Tender shoots and young leaves
Acyrthosiphon gossypii	Nymphs and adults are elongate, either greenish or pinkish in colour; antennae and appendages are long and slender	Lower surface of leaves along the veins
Macrosiphum euphorbiae	Nymphs and adults are elongate, spindle-shaped and pink in colour, characterized by long antennae, legs and siphunculi	Tender shoots of the host plant, *Rosa* sp.
Macrosiphum rosae	Adults and nymphs are elongate, spindle-shaped and pale green, characterized by long antenna, legs and siphunculi	Tender shoots of rose plants
Metopolophium dirhodum	Nymphs and adults are elongate, spindle-shaped, pale green with long antennae, legs and siphunculi	Tender shoots of rose plant
Aulacorthum magnoliae	Nymphs and adults are spindle shaped; nymphs pale yellow, while adults shiny yellow with orangish yellow head and thorax; antenna and legs are black; antenna longer than the body	Lower surface of tender leaves along the midrib rib of dwarf umbrella tree, *Schefflera arboricola*
Greenida artocarpi	Adults are with yellow thorax and greenish-brown abdomen and very long black hairy siphunculi, while nymphs are light green in colour with paler siphunculi	Lower surface of tender leaves along the mid rib and the main veins
Greenideoida (Paragreenideoida) cyloniae van der Goot	Adults are pale yellowish brown in colour with slender elongate body; siphunculi are long and slender with numerous hairs, pale at the basal half and dark distally; nymphs are pale yellow in colour	Lower surface of tender leaves along the midrib rib of the iron wood tree, *Mesua ferrea*
Astegopteryx formosana	Apterae very broad, round; abdomen with a pale yellow or greenish-yellow, with a dark bluish-green dorsal patch, and a small marginal fringe of wax bloom	The infestation was found on leaves and tender shoots
Cerataphis brasiliensis	Small, sedentary aphids with a dark brown, flattened, almost circular body fringed with white wax; legs short and hidden under body	Leaves and nuts of Arecaceae plants
Tetraneura nigriabdominalis	Nymphs and adults are oval or pear-shaped and pale brownish grey in colour with white waxy coating on the body and very short antenna	Roots of grasses (Poaceae)

(Singh and Singh, 2017d). The present study recorded 13 species of Macrosiphini on 12 host plants. David (1975) and Joshi (2008) had recorded *Macrosiphum euphorbiae* and *M. rosae* on rose from south India. *Metopolophium dirhodum* is a cosmopolitan species with a wide range of occurrences (Blackman and Eastop, 2000). Hassan et al. (2010) reported this species on *Triticum* sp. from northern areas of Pakistan, while Amin et al. (2017) reported the species on *Rosa* sp. in Pakistan. Eastop (1971) treated *Aphis sesbaniae* Kanakaraj David which had been described in 1956 from southern India from the papilionaceous plant *Sesbania grandiflora* as a synonym of *A. gossypii*. *M. sanborni* and *U. compositae* had earlier been reported from Karnataka (Joshi, 2008). Ghosh (1972) described alate male of *Aulacorthum magnoliae* for the first time from India. Later the species was recorded on the host plants *Luffa acutangula* (L.), from Assam (Ghosh and Ghosh, 2006) and *Sechium edule* (Jacq.) from Sikkim (Agarwala and Raychaudhuri, 1981; Datta et al., 1982).

The subfamily Greenideinae consists of three tribes: Cervaphidini, Greenideini and Schoutedeniini. In India, Cervaphidini is represented by three genera and seven species, Greenideini is represented by five genera and 88 species, while Schoutedeniini is least diversed containing only one genus and two species. Host range of Greenideinae in India comprises of 112 plant species belonging to 73 genera and 45 families (Singh and Singh 2017b). Goot (1916) was the first person to report three aphid species of the tribe Greenideini from northern Eastern India. Raychaudhuri (1956) provided the first description of *Greenideoidea ceyloniae*. It was reported to be a monophagous aphid species feeding only on *M. ferrea* (Ghosh and Agarwala, 1993; Singh and Singh 2017b).

The Subfamily Hormaphidinae includes three tribes: Hormaphidini, Nipponaphidini and Cerataphidini. A total of 57 species of Hormaphidinae were recorded from India under 23 genera, of which 35 species are endemic. Cerataphidini includes 34 aphid species that feed on 46 species of host plants belonging to 15 families (Singh, 2018). The genus *Astegopteryx* is an oriental aphid group with more than twenty species, and is the largest genus in the tribe Cerataphidini (Blackman and Eastop, 2018; Favret, 2018). Joshi (2008) reported *A. formosana* on *Bambusa* sp. from Karnataka. Josephrajkumar et al. (2011) reported the palm aphid *Cerataphis brasiliensis* on the 'Kalparaksha' variety of coconut from research farm of Central Plantation Crops Research Institute, Kayamkulam, Kerala. The subfamily Eriosomatinae is represented by 470 described species assigned to 53 genera in the world. In India, 19 genera and 64 species of Eriosomatini were recorded infesting 130 plant species belonging to 30 families. Plants belonging to the family Poaceae have been reported to be the most preferred host of *Tetraneura nigiabdominalis* (Singh and Singh, 2017c). In this study, *Aulacorthum magnolia*, *Greenideoidea ceyloniae* and *Metopolophium dirhodum* are new distribution records from south India. In addition, seven species of aphids viz., *Rhopalosiphum nymphaeae, Rhopalosiphum rufiabdominalis, Acyrthosiphon gossypii, Macrosiphoniella sanborni, Macrosiphum euphorbiae, Macrosiphum rosae, Uroleucon compositae, Greenidea artocarpi, Astegopteryx formosana* and *Cerataphis brasiliensis* are recorded for the first time from Kerala. *Schefflera arboricola* and *Mesua ferrea* are new host records for the aphids *Aulacorthum magnoliae* and *Aphis* (*Toxoptera*) *aurantia*, respectively.

AUTHOR CONTRIBUTION STATEMENT

This is a part of the first author, Sharanabasappa M G's PhD research programme. The first author, second author (Haseena Bhaskar) and third author (Sunil Joshi) conceptualized and designed the experimental work. Saharanabasappa performed the field and laboratory works under the guidance of Sunil Joshi and Haseena Bhaskar. Sharanabasappa and Haseena Bhaskar wrote the manuscript with substantial input from all other authors. All authors have read and approved the final manuscript.

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CONFLICT OF INTEREST

No conflict of interest.

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