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PRELIMINARY OBSERVATIONS ON GRAMINACEOUS APHIDS (HOMOPTERA:APHIDIDAE) OF THE PERADENIYA UNIVERSITY PARK

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ABSTRACT

Fourty two grass species, mostly weeds, found within about 70 hectares of the Peradeniya University Park, were examined for aphids. Eight species of aphids were recorded from 21 grass species in the study area. Two of the aphid species collected, *Hysteroneura setariae* (Thomas) and *Rhopalosiphum padi* (L.) had not been previously recorded from Sri Lanka. Seven of the aphid species recorded are well known potential viral vectors of graminaceous and other crops, world over. Yet, only *Leersia hexandra* (SW) infested with *Rhopalosiphum maidis* (Fitch) showed signs of viral infection. *H. setariae*, the most abundant aphid species was present on 16 grasses that formed the predominant grass species of the study area. Colonies of *Tetraneura nigriabdominalis* (Sasaki) (=*hirsuta* Baker) infesting roots of *Axonopus affinis* (A Chose) were observed only when the host grew on moist, aerated, loose soil. Seven species of predatory insects (F. Coccinellidae & Hemerobiidae) and one species of parasitoids (F. Braconidae) were collected from aphid colonies recorded from the study area.

INTRODUCTION

Aphids (Homoptera : Aphididae) constitute a large group of small, softbodied insects, that infest plants. They feed on the phloem sap of different parts of the plant such as the stem, inflorescence, young fruits (pods) and young leaves. Due to their sap feeding habit, aphids are able to transmit viral diseases in plants. As much as 60% of the viral diseases in plants are transmitted by aphids. Over 4000 species of aphids are known to occur in the world and of them about 300 species are recorded as viral vectors. (Harris & Maramorosch, 1977).

The aphid fauna of Sri Lanka is poorly known. *Greenidea (=Siphonophora) artocarpi* Westwood was the very first species to be recorded from Sri Lanka (Westwood 1890). Thereafter, Schouteden (1905) described four new aphid species, van der Goot (1918) listed another fifteen, and Judenko and Eastop (1963) recorded 36 aphid species. These aphids had been collected from both herbaceous and graminaceous hosts. Apart from these records, and of those on economic crops, the aphid fauna has not been examined previously. In the present study aphids on graminaceous weeds were collected and identified with a view to determine the role of grasses as alternative hosts for economically important aphid species, that are known to be potential vectors of viral disease.

MATERIALS AND METHODS

The study was confined to the University Park that covers an area of about 700 hectares; located in the Central Province of Sri Lanka, at an elevation of about 600m. The study area comprised of a variety of grassland ecosystems associated with rice-fields, small streams, marshy areas, dry uplands and recreation sports grounds. The grasses growing in approximately 1/10 of the study area (60-70 hectares) were examined over a period of six months.

Grasses were examined for aphids in the early hours of the day (0700-0800 hrs) and the evening (1700-1800). On locating an aphid colony on grass, adults (apterae and alate) were carefully removed using a fine moistened brush, into vials containing 70% ethanol. Data recorded of aphids at the time of collection included their live colour, relative colony size, position of the colony on the plant, whether attended by ants or not, as well as any other useful ecological information. Grasses that harboured aphids were carefully examined for signs of viral infection such as crumpling, curling and discolouration of leaves. The type of habitat associated with the grass hosts was also noted. At the time of collection, aphid colonies were observed for natural enemies. Predatory insects that were feeding on aphids were collected and later identified. Parasitized aphid mummies were collected into expanded polythene bags and held in the laboratory until emergence of parasitoids. Grasses harbouring aphids were collected with the inflorescence and mounted on herbaria sheets for later identification.

Aphids held in alcohol were slide mounted using the technique of Martin (1983). Identification of aphids was based on the keys of Martin (1983) and Blackman and Eastop (1985). Grasses harbouring aphids were identified using Senaratne (1956) & Amarasinghe (1978) and confirmed by the Curator, National Herbarium Peradeniya. The identify of certain aphids and their natural enemies were confirmed through the International Institute of Entomology, London.

RESULTS

Fourty two species of grasses growing in the study area were examined for aphids. However, only twenty one grass species harboured aphids (Table 1). In the study area, the dominant grass species such as *Axonopus affinis* A Chose, *Brachiaria subquadripara* (Trim) Hitche, *Digitaria ciliaris* (Refzi) Koel, *Eleusine indica* L. (Link), *Leersia hexandra* SW, *Panicum maximum* Jeca, *Paspalum conjugatum* Berg and *Setaria barbata* (Lam.) Kunth, along with less dominant grass species contained colonies of aphids (Table 1). During the study period the majority of the grass species were at the growing (tillering) stage and only a few species (*A. affinis, B. subquadripara* and *S. barbata*) bore an inflorescence. Consequently, majority of the aphids were collected from young leaves. Whenever the grasses bore an inflorescence, aphids were collected off the spikelets.

A total of eight aphid species were collected (Table 2). They belonged to two families: Aphididae (Subfamily Aphidinae: Tribes-Aphidini & Macrosiphini) and Pemphiginae. Of the grasses harbouring aphids, *Leersia hexandra* supporting large colonies of *Rhopalosiphum maidis* (Fitch) showed symptoms of viral infection, with vein clearing and discolouration of leaves.

Of the eight aphid species collected from the study area, *Hysteroneura setariae* (Thomas) was the most predominent aphid species (Table 2) occuring on 16 of the 42 grasses species (37%) examined (Fig.1). Moreover, its hosts were among the most abundant grass species in the study area. The aphids, *Pentalonia nigronervosa, Rhopalosiphum maidis* and *Schizaphis graminum* were each collected from a single grass species, while colonies of *Rhopalosiphum padi, Sitobion avenae, Sitobion miscanthi* and *Tetraneura nigriabdominalis* were present on two to four different grass species (Table 2). *Tetraneura nigriabdominalis* was largely collected from the root base of *Axonopus affinis*. Although this grass species was very abundant in the study area only a few plants were infested with the aphid. Only when *A. affinis* grew on relatively moist, aerated, loose soil were *T. nigriabdominalis* infestations evident. Whenever colonies of *T. nigriabdominalis* was present on the roots, ants and ant-nests were associated with the roots of the plant. *T. nigriabdominalis* when collected from the aerial parts of *Echinochloa colonum, Brachiaria subquadripara* and *Setaria barbata* consisted of a few migratory alates only. *Pentalonia nigronervosa* found on the lower surface of old leaves of *Crytococcum muricatus* consisted of a few alates only. Colonies of *Rhopalosiphum maidis* on *Leersia hexandra* were confined to a few patches even though this grass species was abundant in the study area.

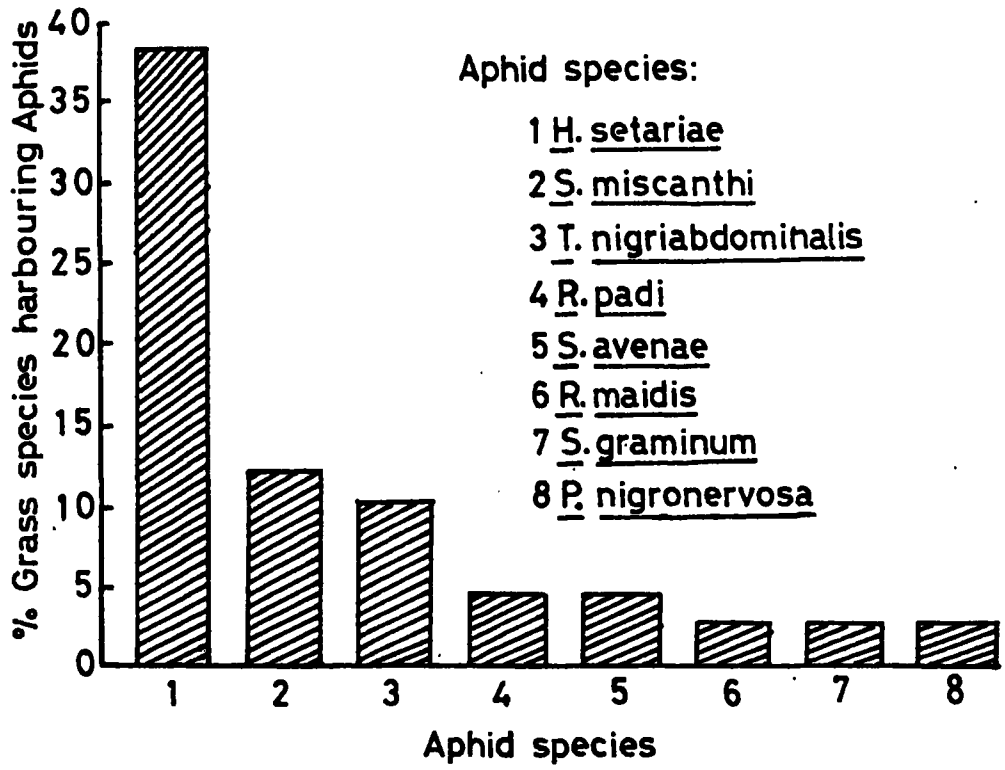

Fig 1. Incidence of the different aphid species on grasses (n=42) during the study period

Only a few natural enemies were associated with aphid colonies (Table 3). Seven species of insects predatory on colonies of four different aphid species were collected. These belonged to the families: Coccinellidae and Hemerobiidae. Only one species of parasitoids was recorded, and this was parasitic on colonies of three different aphid species.

The temperature, humidity and rainfall measurements (obtained from the Agricultural Research Station at Gannoruwa; 3 km from the study site) respectively during the study period ranged from 16.9 - 29.2°C, 79 - 86% and 58.5 - 401.2 mm. During the rains, aphid populations were low due to them getting washed off the host. One or two days after a period of rain aphid populations began to increase due to the new growth in the grass. Sunlight was also seen to favour aphids; 95% of the aphids collected occurred on grasses that grew in open sunny areas.

DISCUSSION

Amarasinghe (1976) reported that of the 60 listed grass species of the campus, only 27 are predominant, the rest showing a rather localized distribution. Accordingly, in the present study too, only 42 species of grasses were readily encountered. However, of these grasses only 21 species harboured colonies of aphids. The majority of the grasses (n = 10) were at the tillering stage. Perhaps such plants may not be as attractive as those with inflorescence for alate aphids to settle and start a colony.

Of the 8 species of aphids recorded from the study area, two species, *Hysteroneura setariae* and *Rhopalosiphum padi*, have not been previously recorded from Sri Lanka. *H. setariae* which is of North American origin has recently spread to warmer parts of the world. It has been recorded from Australia for the first time in 1967. In the tropics it is confined to graminaceous hosts (Blackman & Eastop 1985). *Rhopalosiphum padi* is palaearctic in origin. It is now virtually world-wide in distribution and in the tropics it is confined to graminae.

Of the aphids recorded, all species expect *T. nigrabdominalis*, have been reported as viral vectors (Blackman & Eastop 1985). Nevertheles, only the grass, *L. hexandra* infested with *R. maidis*

showed clear symptom of viral infection. *H. setariae*, in particular, is a well known viral vector the world-over and is responsible for the sugarcane mosaic, soyabean mosaic, cucumber mosaic and water-melon mosaic among other diseases (Blackman & Eastop 1985). Yet, none of its grass hosts showed signs of viral infection in the study area. Abeygunawardena in 1968 reported about eight viral diseases in ten economic crops, as being transmitted by six species of aphids.

The aphid - ant association, observed throughout the study, is a well known symbiotic relationship where both participating species benefit from each other. It has been suggested that the ants induce the reproduction of aphids, thus increasing the population considerably (Harris & Maramorosch 1977).

The relative paucity of natural enemies evident during the study period could mostly be due to the fact that aphid colonies were at a stage that they were just building up. Perhaps, given time the predatory and parasitic insects would establish themselves, as most graminaceous aphids are known to be attacked by a wide range of natural enemies (C.I.B.C. status paper 1977).

The preliminary observations made during this study reflect the importance of graminaceous weeds as alternative hosts that harbour economically important aphids. Further investigations are now under way, to investigate the movement of aphids between graminaceous crops and graminaceous weeds.

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Table 1. An annotated list of grasses harbouring aphids in the study area

Grass species	Aphid Species
Alloteropsis cimicina (L.) Stapf Very common in open lawns with little disturbance, spike-like racemes.	*Hysteroneura setariae* (Thomas)
Axonopus affinis A chose. Very common and predominant in shady places having moist soils. Inflorescence a spike like raceme.	*Hysteroneura setariae* (Thomas) *Tetraneura nigriabdominalis* (Sasaki)
Bothriochloa petusa (L.) Common in open lawns where mechanical moving is frequent. A tufted perennial growing appressed to the ground, inflorescence a spike like raceme.	*Hysteroneura setariae* (Thomas)
Brachiaria brizantha (Hochst. ex A. Rich). Commonly found in open lawns. Blades broad and stiff. Inflorescences a raceme.	*Sitobion miscanthi* (Takahashi)
Brachiaria subquadriapara (Trim) Hitche. Predominantly found in open lawns. Inflorescence a raceme.	*Hysteroneura setariae* (Thomas) *Tetraneura nigriabdominalis* (Sasaki)
Crytococcum muricatus (Retzi) Bor. Not common, a characteristic species in shady places where light intensity is very low.	*Hysteroneura setariae* (Thomas) *Pentalonia nigronervosa* (Coquerel)
Cymbopogon nardus (L.) Rendle A common grass, narrow and ribbon like inflorescence with a big panicle. Has a characteristic aromatic smell.	*Sitobion avenae* (Fabricius)
Dactyloctenium aegyptium (L.) P. Beavr. Not common, grows on open road sides where soil is hard and dry. Inflorescence a short, thick spike.	*Hysteroneura setariae* (Thomas)
Digitaria ciliaris (Refzi) Koel. Predominant species on open lawn.	*Hysteroneura setariae* (Thomas) *Sitobion miscanthi* (Takahashi)
Digitaria timorensis (Kunth) Bal. Not common, occurring on open lawns.	*Schizaphis graminum* (Rondani)
Echinochloa colonum (L.) Link Not common, grows in wet clayey soils. Inflorescence a panicle.	*Tetraneura nigriabdominalis* (Sasaki) *Rhopalosiphum padi* (L.)
Eleusine indica L. (Link). Predominant on dry land.	*Sitobion miscanthi* (Takahashi) *Hysteroneura setariae* (Thomas)

Eragrostis gangetica (Roxb) Stend. Not common, found along road sides and in hard soils.	*Hysteroneura setariae* (Thomas)
Eragrostis nigra (L.) Common on road sides, Inflorescence a panicle, dark green spikelets laterally compressed.	*Sitobion avenae* (Fabricius)
Ischaemum indicum (Hott.) Merr Not common, inflorescence a spike-like raceme.	*Hysteroneura setariae* (Thomas)
Leersia hexandra SW Predominant, slender and aquatic in habits. Panicles contracted ascending from a creeping base.	*Rhopalosiphum maidis* (Fitch)
Panicum maximum Jeca Predominant in open lawns, appears to be drought resistant.	*Hysteroneura setariae* (Thomas) *Sitobion miscanthi* (Takahashi)
Panicum repens (L.) Not common, found in open lawns in scattered patches. Inflorescence with open panicle.	*Hysteroneura setariae* (Thomas)
Paspalum conjugatum Bery Predominant, found in shady places. Inflorescence a paired raceme.	*Hysteroneura setariae* (Thomas) *Sitobion miscanthi* (Takahashi)
Setaria barbata (Lam.) Kunth Predominant along road sides with hard soils.	*Hysteroneura setariae* (Thomas) *Tetraneura nigriabdominalis* (Sasaki)
Sporobolus africanus (Retzi) Beauv. Frequent in open lawns where the soil is rather compact. Panicles large, spike like.	*Hysteroneura setariae* (Thomas)

Table 2. An annotated list of aphids and their graminaceous hosts in the study area

Aphid species	Graminaceous host
SF. Aphidinae: Aphidini	
**Hysteroneura setariae* (Thomas). Small, brown aphids with dark siphunculi and a pale cauda. Hind wing of alate with a single oblique vein. Usually forms colonies at the bases of spikelets, or on leaves. Often attended by ants. A vector of sugar cane mosaic, soybean mosaic and cucumber mosaic.	*Alloteropsis cimicina* *Axonopus affinis* *Bothriochloa petusa* *Brachiaria subquadripara* *Crytococcum muricatus* *Dactyloctenium aegyptium* *Digitaria ciliaris* *Eleusine indica* *Eragrostis gangetica*

	Ischaemum ndicum *Panicum maximum* *Panicum repens* *Paspalum conjugatum* *Paspalum dilatatum* *Setaria barbata* *Sporobolus africanus*
Rhopalosiphum maidis (Fitch). Small, bluish green, some times dusted with wax. Feeds on the upper surface of leaves at the leaf base. A vector of sugar cane mosaic virus.	*Leersia hexandra*
**Rhopalosiphum padi* (L.) Medium in size. Green aphids, that feed on mature leaves. A vector of maize dwarf mosaic.	*Echinochloa colonum* *Paspalum conjugatum*
Schizaphis graminum (Rondani). Small, green aphids. Feed on lower surface of leaves. A vector of sugar cane mosaic and maize dwarf mosaic virus.	*Digitaria timorensis*
SF. Aphidinae: Macrorosiphini	
***Pentalonia nigronervosa* (Coquerel). Small, black aphids, confined to a few alates at the base of mature leaves.	*Cryptococcum muricatus*
**Sitobion avenae* (Fabricius) Large in size, dark brown aphids.	*Eragrostis nigra* *Cymbopogon nurdus*
Sitobion miscanthi (Takahashi). Medium in size, dark brown in colour.	*Paspalum conjugatum* *Brachiaria brizantha* *Digitaria ciliaris* *Eleusine indica* *Panicum maximum* *Paspalum conjugatum*
F. Pemphiginae	
Tetraneura nigriabdominalis (Sasaki) Medium in size, pale yellowish or brownish, root feeding colonies.	*Axonopus affinis* *Brachiaria subquadripara* *Echinochloa colnum* *Setaria barbata*

* Species previously not recorded from Sri Lanka
** Species previously not recorded from grasses
(Except *T. nigriabdominalis* all aphid species listed are potential viral vectors)

Table 3. Natural enemies associated with graminaceous aphids in the study area

Predator/Parasitoid	Associated aphid
Predators	
Order - Coleoptera	
Family - Coccinellidae	
Brumoides suturalis (Fabricius)	*Sitobion avenae* (Fabricius)
	Sitobion miscanthi (Takahashi)
Coccinella octomaculata (Fabricius)	*Hysteroneura setariae* (Thomas)
	Sitobion miscanthi (Takhashi)
Coccinella transversalis (Fabricius)	*Hysteroneura setariae* (Thomas)
	Sitobion miscanthi (Takahashi)
	Sitobion avenae (Fabricius)
Chelomenes sexmaculata (Fabricius)	*Rhopalosiphum maidis* (Fitch)
Micraspis discolor (Fabricus)	*Sitobion avenae* (Fabricius)
Scymnus nubilus Mulsant	*Sitobion miscanthi* (Takahashi)
Order - Neuroptera	
Family - Hemerobiidae	
(One species not identified)	*Hysteroneura setariae* (Thomas)
	Sitobion miscanthi (Takahashi)
Parasitoids	
Order - Hymenoptera	
Family - Braconidae	
Aphidius sp.	*Hysteroneura setariae* (Thomas)
	Sitobion avenae (Fabricius)
	Sitobion miscanthi (Takahashi)