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FLORAL ASSEMBLAGE AND FAUNAL DIVERSITY IN APHIDOIDEA (HOMOPTERA : INSECTA) IN EASTERN INDIA

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ABSTRACT

Aphids, perhaps form the most important group of crops pests on a world scale. A total of 653 species under 198 Genera of aphids have been recorded from India and its adjacent areas till 1975,of which at least 306 species and 37 genera are endemic in origin, a large percentage (more than 70%) of these aphid species could be found in Eastern India, especially in areas between *ca* 600 m to *ca* 3,000 m. A co-relation between floral assemblage in the region and the abundance and diversity of aphid fauna, has been discussed.

INTRODUCTION

Aphids have a long history which dates to 300 millon years as evidenced by records. The aphid-host plant relations has played an important role in their phylogeny and evolution and it has been considered that association with geologically old plant groups can be regarded as an plesiomorphic character and those with geologically young plant group as an apomorphic character (Heie, 1967).

Most aphid species are monohagous, feeding on plant species belonging to only one genus or oligophagous, feeding on plants of different genera of same family but several species are polyphagous and feed on plants belonging to different genera of non-related or distantly related plant families ; many aphid species of last two categories are heterecious. They exhbiit many interesting and curious phenomena in their pattern of infestation and complexities of life cycle. The seasonal cycle of temperate flora and great diversity of growth pattern perhaps necessiated the elaborate systems of polymorphism amongst aphid; the largest aphid family Aphididae, is also regarded to achieve evolutionary success and as agricultural pests through parasitic exploitation of temperate flora (Kennedy and Stroyan, 1959). However, in the tropical and subtropical vegetation and the moist temparate forests as evidenced in the region under study, a major change in the life cycle, involving anholocyclic parthenogenetic reproduction could be noticed

A total of 653 species under 198 genera of aphids have been recorded from India and its adjacent countries till 1975 of which at least 306 species and 37 genera are endemic in origin (Ghosh, 1977). A large percentage of these(more than 70%) aphid species could be found in Eastern India especially in areas

between *c* 600 m to *c* 3,000 m. An analysis of vegetation type of India with special reference to Eastern India may help to co-relate the abundance of flora with unique assemblage of aphid fauna.

VEGETATION TYPES AND SPECIES DIVERSITY

Ths flora of India has been considered to be composed largely of relatively young intrusive elements but show marked evidence of influence of Himalayan uplift, both in composition and distributional pattern. A number of typical peninsular elements have also spread and infiltrated deep into the Himalaya (Mani, 1974). Floristic composition reveals that tropical Asiatic elements of Indo-Chinese and Malayan affinities represent the most dominant members of present day flora ; this can be evidenced most clearly in Eastern India where Assam-Meghalaya region has been considered as the gateway for influx of humid-tropical element from neighbouring areas. The floral composition of the region, show extremely rich assemblage of tropical elements along with temperate and alpine types, each composing numerous subtypes (Rao, 1974).

The tropical vegetation, which could be seen upto an altitude of ca 900 m, covers evergreen or semievergreen forests, deciduous forests and Grassland. Ferns and Orchids, representing rich epiphytic elements show a large number of interesting aphid-species (Ghosh, 1975) ; of the 11 species of aphids infesting Ferns in India, at least eight are only known from eastern India and of these four are endemic in origin (Table—1) ; at

Table 1. Aphid species on ferns
(Species marked * are endemic in origin)

Aphid species	Host plants
*1. *Antracosiphoniella maculatum* Basu	*Asplenium esculentum*
	Athyrium sp.
*2. *Amphorophora ampullata bengalensis* H. R. L. et Basu	*Cheilanthus* sp.
	Pteris acquilina Indet. Fern
3. *Macromyzus polypodicola* (Tak.)	*Asplenium esculentum*
4. *Macromyzus woodwardiae* (Takahashi)	*Asplenium curioularium*
	Asplenium esculentum
5. *Micromyzodium dasi* Verma	Indet. Fern
6. *Micromyzodium filicum* David	*Asplenium trichomonas*
	Adiantum tinctum
	Lastrea sp.
	Nephrolepis sp.
	Pitygramma peruviana
	Polypodium sp.
	Pteris critica
	Straptocarpus sp.
7. *Micromyzus judenkoi* Carver	*Cheilanthes* sp.
*8. *Micromyzus mawphlangensis* Ghosh	*Polypodium* sp.
9. *Micromyzus nigrum* v. d. Goot	Indet. Fern
*10. *Myzus filicis* Basu	Indet. Fern
11. *Shinjia pteridifoliae* (Shinji)	*Pteris acquilina*
	Polypodium sp.

Table 2. Aphid species on orchids

Aphid species	Host plants
1. *Cerataphis orchideavum* (Westwood)	*Aerides fieldingii* *Epidendron* sp.
*2. *Aulacorthum* (*Neomyzus*) *dendrobium* Basu	*Dendrobium* sp.
*3. *Macrosiphum* (*Sitobion*) *indicum* Basu	*Cymbidium eburneum* *Cymbidium elegans* *Cymbidium longifolium*
4. *Macrosiphum* (*Sitobion*) *luteum* Buckton	*Calanthae masuca* *Cymbidium insifolium* *Cymbidium lowianum* *Cymbidium monronianum* *Cymbidium tracyanum* *Cyperorchus elegans* *Dendrobium densiflorum* *Dendrobium longicornu* *Eria bambusifolia* *Otochilus porrecta* *Pamhiopedilum insigne* *Vanda caralea*
*5. *Macrosiphum* (*Sitobion*) *pseudoluteum* Ghosh	*Coelogyne ocpaci* *Cymbidium eburneum* *Cymbidium eleagns* *Mandenvallia sp.* *Cymbidium sinense*

least five orchid-infesting aphid species are restricted to the region, of which three are endemic (Table—2) ; similarly, the lush Bamboo vegetation reveals at least 15 species in India, all of which may be found in the region and five of these species have been described as new to science from localities of Eastern India (Table—3). *Castanopsis-Quercus* compex of tropical vegetation, exhibit an array of at least 30 endemic species besides some other species having a wider distribution in south east Asia, most of the species infesting Fagaceae being included under Greenideinae besides some belonging to Drepanosiphinae, Hormaphidinae and Lachninae of Aphidoidea ; a large number of interesting and some endemic aphid species mostly belonging to genera of Greenideinae have also been recorded from other conspicuous plant elements of tropical vegetation e. g. *Duabanga* (Lythraceae), *Engelhardtia* (Juglandaceae), *Eugenia* (Myrtaceae) *Ficus* (Moraceae), *Schima* (Ternstromiaceae) .etc. However, deciduous forests with dominating *Shorea rebusta* appears very poor in aphid-fauna. Tropical grassland of *Saccharum*, *Phragmites* and *Arundo* and other genera also offer an interesting group of species belonging to *Forda*, *Geoica*, *Ceratovacuna*, *Hyalopterus*, *Lorgiunguis*, *Schizaphis*, *Tetraneura*, many of which feed on the sub-aerial parts of the plants (Ghosh, 1975).

The temperate vegetation occurring at elevations from *ca* 1000 m to *ca* 3000 m may also exhibit an admixture of tropical or subtropical vegetation. Salient features of temperate vegetation include the assemblage of

Table 3. Aphid species on bamboo

Ahid species	Host plants
*1. *Astegopteryx bambusae* (Buckton) (=A. *lutecens* v. d. Goot)	*Bambusa arundinaria*
2. *Astegoptoryx minuta* (v. d. Goot)	Bamboo (unidentified)
*3. *Ceratoglyphina bambusae bengalensis* L. K. Ghosh	*Bambusa* sp.
*4. *Ceratovacuna indica* M. R. Ghosh, Pal, Raychaudhuri	Bamboo (Unidentified)
5. *Ceratovacuna silvestrii* (Takahashi)	*Bambusa* sp.
6. *Chaitoregma tattakana* (Takahashi)	*Arundinaria* sp.
*7. *Cranaphis bambusicola* David, Rajasingh, Narayanan	Bamboo (Unidentified)
8. *Glyphinaphis bambusae* v. d. Goot.	Bamboo (unidentified) Graminae *Physanolae maxima*
9. *Melanaphis arundinariae* (Takahashi)	*Arundinaria* sp.
10. *Melanaphis bambusae* (Fullaway)	*Arundinaria* sp. *Bambusa* sp. *Phyllostachys* sp.
11. *Paraoregma alexandrii* (Takahashi)	*Bambusa* sp.
*12. *Pseudoastegopteryx himalayensis* M. R. Ghosh, Pal, Raychaudhuri	Bamboo (Unidentified)
13. *Pseudoregma bambusicola* (Takahashi)	*Bambusa* sp.
*14. *Subtakecallis pilosa* (David, Rajasingh, Narayanan)	Bamboo (Unidentified)
15. *Takecallis arundinariae* (Essig.)	*Arundinaria* *Phyllostachys* sp.

Populus-Salix (Saliaceae), *Alnus-Betula* (Betulaceae), *Castanopsis-Quercus* (Fagaceae), *Polygonum-Rumex* (Polygonaceae), *Magonilia-Michelia* (Magnoliaceae), *Litsaea-Machilus* (Lauraceae), *Hydrangea-Saxifraga* (Saxifragaceae), *Eriobotrya-Photinia-Prunus-Pyrus-Rosa-Rubus-Spiraea* (Rosaceae), *Pieris-Rhododendron* (Ericaceae), *Artemisia-Erigeron* (Compositae) and each of these plant genera is known to harbour one or more aphid species which are rare in their distribution elsewhere or endemic in origin (Raychaudhuri, 1973 ; Ghosh, *op. cit.*) ; some examples may be cited to illustrate the point *viz.* Seven species of aphids **Chaetomyzus rhododendri*, Ghosh & Raychaudhuri, **Indiaphis crassicornis*. Basu, **Indiaphis rostrata*, A. K. Ghosh & Raychaudhuri, *Neoacyrthosiphon* (*P*) *holstii* (Takahashi),

**Neoacyrthosiphon* (*P*) *rhododendri*, M. R. Ghosh *et. al.*, **Vesiculaphis grandis*, Basu, **Vesiculaphis rhododendri*, A. K. Ghosh & Raychaudhuri are known to infest Rhododendron spp., of which six have been described from the region (*) : similarly out of eight species of aphids under four genera recorded from India on *Salix*, five species of *Cavariella* and one of *Tuberolachnus* are known from the region ; on *Prunus* and *Pyrus* group of hosts, at least nine species of aphids belonging to nine different aphid genera viz. *Betacallis*, *Brachycaudus*, *Dysaphis*, *Eriosoma*. *Hyalopterus*, *Nippolachnus*, *Pyroluchnus*, *Schizaphis*, *Tinocalloides* are known from India, of which all except one species could be largely seen in the region. Conifer forest in temperate vegetation type is mostly composed of Pine trees, on which three species **Cinara atrotibtals* David & Narayanan ; *Eulachnus thunbergii* (Wilson) and *Schizoldchnus orientalis* (Takahashi), have been recorded of which one was described as new to science (*), from the region, On the whole, a curious and wide admixture of genera of almost all subfamilies of Aphididae and Adelgidae could be noticed in the temperate vegetation area viz. *Eulachnus*, *Ciñara*, *Lachnus*, *Tuberolachnus* (Lachninae), *Chaitophorus*, *Periphyllus*, *Trichaitophorns* (Chaitophorinae) *Betacallis*, *Tinocallis*, *Tuberoculatus*, *Tinocalloides* (Drepanosiphinae), *Pterocomma* (Pterocommatinae) *Anomalophis Schoutedenia*, *Eutrichosiphum*, *Greenidea*, *Holotrichosiphon Paratrichosiphum* (Greenideinae) *Aiceoea* and *Anoecia* (Aiceoninae), *Cerataphis*, *Nipponaphis*, *Metanipponaphis*, *Astegopteryx*, *Ceratavacuna* (Hormaphidinae), *Pemphigus-Ericsoma Prociphilus* (Pemphiginae), *Pineus*, (Adelgidae), besides a host of genera under Aphidinae. The exploitation of temperate flora yielded an extremely rich aphid fauna but unlike in other temperate region, extent of polymorphism appear poor, involving mostly parthenogenetic apterae and alatae yiviparae, leading largely anholocyclic life cycle ; sexual forms, both males and oviparae have however been recorded in only 12 species but no evidence has yet been obtained about successful completion of holocyclic life cycle amongst these species. Besides, origin of a large number of endemic aphid species on temperate flora, a wide spread polyphagism may be noticed in many species of aphids in the region, some infesting as many as 200 host plant species belonging to 50 plant families ; some aphid taxa have been described or recorded from host-plants (Like *Tinocalloides* a genus under Drepanosiphinae, described from Rosaceae in the region) which would have otherwise been considered incredible, had the flora of the region been not surveyed for aphid-pests.

The alpine vegetation which is known to be limited at altitudes of *c* 4500 m to 5500 m has been rather poorly surveyed for aphid pests. It is mostly composed of stunted *Rhododendron* species besides *Rheum*, *Sedum* and some other plant genera ; a more systematic and sustained study of alpine flora may pehaps reveal some more interesting aphid species as has been shown by studies of Ghosh et. al. (1971).

DISCUSSION

An analysis of aphid-fauna of the region clearly indicates that maximum potential for multiplition exists when nutritionally optimum condition in the host plants coincide with the climatically optimum condition of the pests. (Kennedy and Stroyan, *op. cit*). This can be illustrated taking a reference from the preceding text : it has been seen that a large number of aphid species feed on bamboos between *c* 300m and 2400 m in the Eastern Himalaya but in the valley of Brahmaputra and gangetic plains of West Bengal, bamboos are poorly infested by aphids. In the case of *Rhododendron* which is known to harbour at least seven species of aphids including six endemic species, in lower altitudes, has been

hardly noted to be infested at higher altitudes in Alpine vegetation belt *i.e.* above *c* 4500m. These indicate that the presence of host plants alone does not provide the favourable habitat condition to form colonies and it is the interaction of biotic and abotic factors which determines the infestation pattern. Physical environment plays an important role through its effect of Plant phenelogy and growth habit on the reproductive behaviour and often, as in moist tropics, could lead to rapid population built up by con inous parthenogenesis. Acquisition of new hosts by many species in the region under review, indicate further advance towards polyphagy enabling the fauna to cover more completely the available ecological niches. As such the entire floral assemblage of Eastern India, offers an unique opportunity to study the effect of bio-climatic condition on a group of phytophagous insects involving their abundance, diversity and reproductive cycle.

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