

DREPANOSIPHINE APHIDS (HOMOPTERA : APHIDIDAE)
AND THEIR DISTRIBUTION IN INDIA

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(With 5 Text-figures)

INTRODUCTION

Drepanosiphinae, one of the subfamilies of aphids, is very close to Chaitophorinae both morphologically and phylogenetically (Heie, 1966). These aphids contribute about 11% of the total aphid fauna of the world (Eastop and van Emden, 1972). Buckton (1899) reported a species of this group of aphids for the first time from India but systematic work on these aphids was lacking till late 1960's, excepting a few stray reports. The study of Indian aphids started more or less in a comprehensive way from different parts of India practically in late 1960's. As a result, 49 species of Drepanosiphinae distributed over 29 genera are now known from different areas of India. This constitutes about 7.5% of the total aphid fauna so far explored from India.

These aphids are distinctive in being restricted to some specific host-plant families, *e. g.*, Betulaceae, Ericaceae, Fagaceae, Graminae and Sapindaceae and as a result of which most of the species under the group show host-specificity and monoecious habit.

Most of these aphids were collected and reported by many workers from different places, from different altitudes and on different host-plants. The change in altitude has been observed to influence the different vegetational pattern and consequently the aphid fauna of a locality, and these components form a complex.

This paper presents an analysis of the data so far received on the abundance and pattern of distribution of Drepanosiphine aphids in India and its correlation with altitude, vegetation and other factors.

RESULTS AND DISCUSSIONS

Bio-geographic distribution in India : The mountains of India falls under two broad groups, *viz.*, the penninsular and extra-penninsular

(Mani, 1973). The penninsular mountains, *i. e.*, Eastern ghats, Western ghats, Aravalli ranges, the Vindhya and Satpura ranges include the south India. Himalaya belongs to the extra-penninsular group and includes East Himalaya, Nepal Himalaya, Kumaon Himalaya and North West Himalaya. East Himalaya or Assam Himalaya and its plateau from the north east India while Kumaon Himalaya, north west Himalaya and its plateau from north west India. In between the extra-penninsular and penninsular area is a part which is commonly known as central India. The vegetation and other climatic conditions are most varied in these four different parts of India.

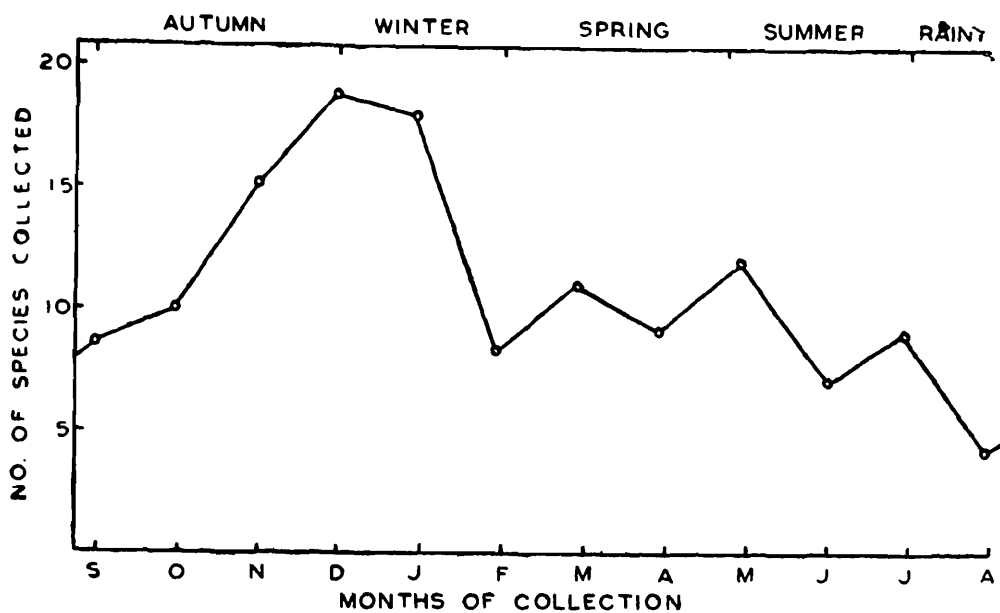
Out of these 49 species, 35 species, are known to be endemic (including the area of Himalaya covering part of Nepal and Pakistan) and the rest 14 are exotic in origin). The distribution of these aphids within India reveals that 34 species are found in north east India, 18 in the north west India, four in the south India and only one species in central India. Only seven species namely, *Betulaphis* sp., *Neobetulaphis pusilla* Basu, *Shivaphis celti* Das, *Takecallis arundinariae* (Essig), *Taoia indica* (Ghosh and Raychaudhuri) and *Tinocalloides montanus* Basu are common between north east and north west India, while two species, *Shivaphis celti* Das and *Tinocallis kahawaluokalani* (Kirkaldy), are common between north east and south India, only one species, *Shivaphis celti* Das, is common between north east, north west and south India and one species, *Saltusaphis scripa* Theobald, is common between south India and central India.

Sexual forms : Sexual forms of nine species namely, *Chromaphis hirsutustibis* Kumar and Lavigne, *Myzocallis (Agrioaphis) polychaetus* David, *Shivaphis bambusicola* David et al, *Taoia indica* (Ghosh and Raychaudhuri), *Tinocallis distincta* Ghosh, Ghosh and Raychaudhuri, *Tinocalloides montanus* Basu and *Tuberculatus* sp. are known to produce apterous oviparous females in India, while four species viz., *Chromaphis hirsutustibis* Kumar and Lavigne, *Myzocallis (Agrioaphis) polychaeta* David, *Tinocallis distincta* Ghosh, Ghosh and Raychaudhuri and *Tinocalloides montanus* Basu are known to produce alate males [Basu, A. N. (1969), Chakrabarti (1978), Chakrabarti and Raychaudhuri (1974), David et al (1970), Ghosh, A. K. et al (1971, 1972), Ghosh, M. R. et al (1970, 1971)]. This indicates that about 16% of Drepanosiphine aphids produce gamic forms in India and majority of species have the parthenogenetic mode of reproduction.

Out of these species, seven species are known from north east India and two species are known from north west India. From the abundance of different species and also the capacity of production of sexual forms

it can be said that these aphids prefer north east and north western part of the country and the most favourable part is north east India.

Seasonal fluctuation : The distribution of these aphids in different months has been presented in Text-fig. 1. It is evident from the number of catches that the peak period of abundance of these species is during the months of November to January when the temperature is low and day length is short. Thus, 15 species during November, 19 during December and 18 during January were reported to infest different plants. The number of species decreases in later months and the least was

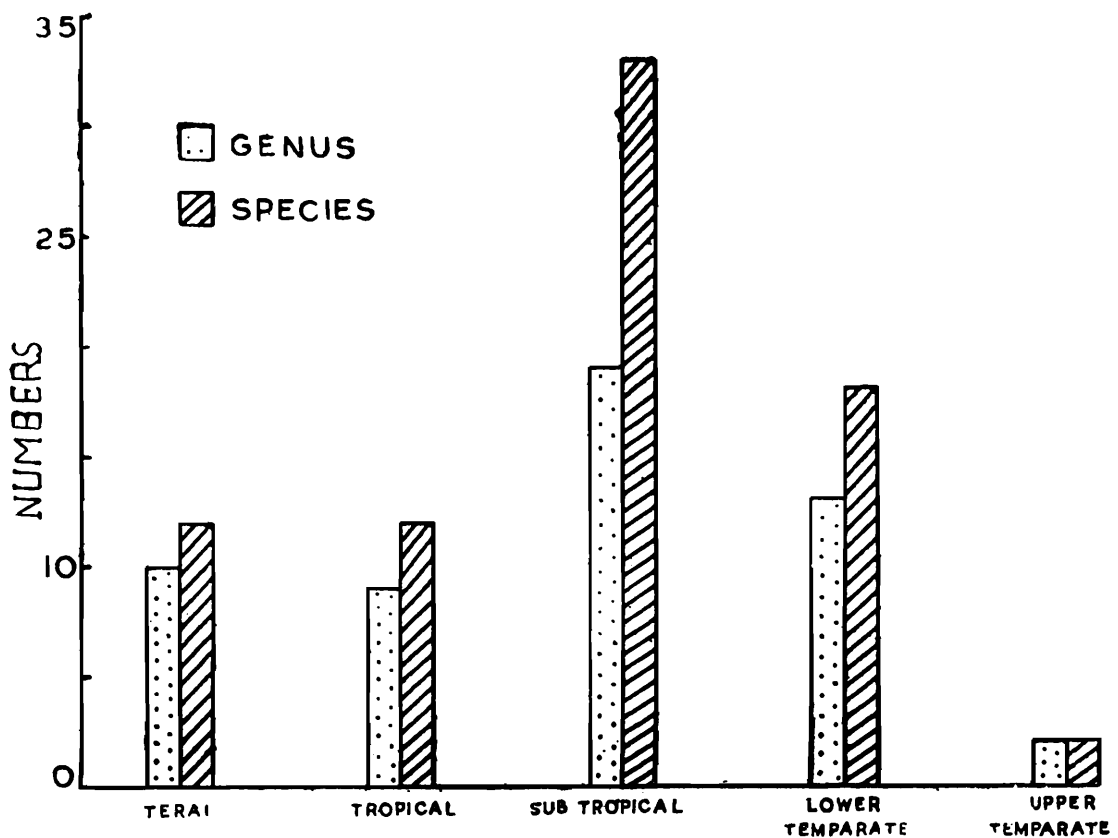


Text-fig. 1. —Species fluctuation in different seasons of *Drepanosiphine* aphids in India.

reported during August when only four species are found. From September, the species number again tends to increase and rises to its peak during December and January. Most of the sexual forms were known to occur during the months of November to January. But the males and oviparous females of *Chromaphis hirsutustibis* Kumar and Lavigne were found during the months of May and June.

Vertical distribution and vegetational pattern : Attempts to correlate the vertical distribution of aphids in general in India with the abundance of specific host-plants have been made by Chakrabarti (1977), Ghosh (1977a, 1977b), Ghosh and Raychaudhuri (1977). Keeping this view in mind, attempt is being made in this paper to correlate the distribution of *Drepanosiphine* aphids with certain vegetational belts and its altitudes. The total vegetational type in which aphids are found can be divided into tropical (upto c 900 m), subtropical (from c 900 m to c. 2000 m), temperate (from c 2000 to c 3600m) and alpine (from c 3600 m to 5500m) vegetations [Biswas (1966), Champion *et al* (1968), Puri (1960), Sagreiya (1967)].

The tropical belt has a lower terai vegetation extending upto c 300 m while temperate belt has a lower temperate vegetation (from c 2000 m to c 3000 m) and an upper temperate vegetation (from 3000 to c 3600 m). The alpine belt also has lower alpine vegetation (from c 3600 m to c 4800 m) and a higher alpine vegetation (from c. 4800 m to 5500 m). Above the alpine zone lies the snow line. These different areas along with their plant species in Darjeeling and Sikkim region of North east India has been dealt with elaborately by Biswas (1966). Although the main division more or less exists both in north east and north west Himalaya but the altitude for a particular vegetational type may vary in some localized parts.



Text-fig. 2.—Total distribution of genera and species in vegetational belts.

The total abundance of Drepanosiphine species in each of the above vegetational belt was observed. Further, the abundance of species in these belts were analysed on monthly basis with a view to find out the comparative incidence of these species in different seasons.

The distribution of total genera and species in different vegetational belts is provided in Text-fig. 2 and the analysis of each belt is presented below.

The terai vegetation of tropical belt having different species of *Anona*, *Celtis*, *Cyperus*, *Duabanga*, *Lagerstromia*, *Medicago*, *Phyllanthus*, *Randia* etc. as the main host-plants for the Drepanosiphine aphids

shows 10 genera and 12 aphid species. Only five species are reported during the months of January, two each during December, April, July and one each species during the months of March, June, September and November. This stratum is unrepresented by any of these aphids during the months of February, May, August and October.

The rest of the tropical belt having different species of *Alnus*, *Celtis*, *Duabanga*, *Lagerstromia*, *Machilus*, *Prunus*, *Quercus* etc. as the main host-plants for Drepanosiphine aphids shows nine genera and 12 aphid species ; seven species during the month of December, five species during November and January, four species during February, three species during March, two species during October and one species during April, May, August and September are known to occur. This area is unrepresented by any Drepanosiphine aphid during June and July.

The subtropical vegetational belt having, different species of *Acer*, *Alnus*, *Aleuroites*, *Arundinaria*, *Bambusa*, *Betula*, *Castenospermum*, *Cedrella*, *Duabanga*, *Juglans*, *Lagerstromia*, *Machilus*, *Magnolia*, *Prunus*, *Quercus*, *Rubus*, *Ulmus* etc., as the main host-plants of the Drepanosiphine aphids shows the maximum concentration, having 19 genera and 33 species. All the three species of *Betulaphis*, three species of *Neobetulaphis*, five species of *Tinocallis*, four species of *Tuberculatus* and two species each of *Mesocallis*, *Shivaphis*, *Subtakecalis* are known from this area. The maximum abundance of species is noticed during the months of November, December and January when 15, 16 and 14 species are found respectively. Eight species are found during the months of February, March and October, whereas seven species occur during July, six species during the months of April and May, five species during September, four species during April and only one species during the month of June.

The lower temperate vegetational belt having *Aleuroites*, *Alnus*, *Arundinaria*, *Bambusa*, *Betula*, *Celtis*, *Juglans*, *Prunus*, *Quercus*, *Ulmus* etc., as the principal host-plants for the Drepanosiphine aphids represents 13 genera and 18 species. No significant peak period of incidence of species would be noticed in this vegetational belt. The months of February, July and April are not represented by any aphids while five species are found during March and January, four during May, three during June, September and October, two during December, and only one during the month of November.

The upper temperate vegetational belt having *Aibes*, *Cotoniastaria*, *Rhododendron*, *Rosa*, *Viburnum* etc. as the predominant plant genera do

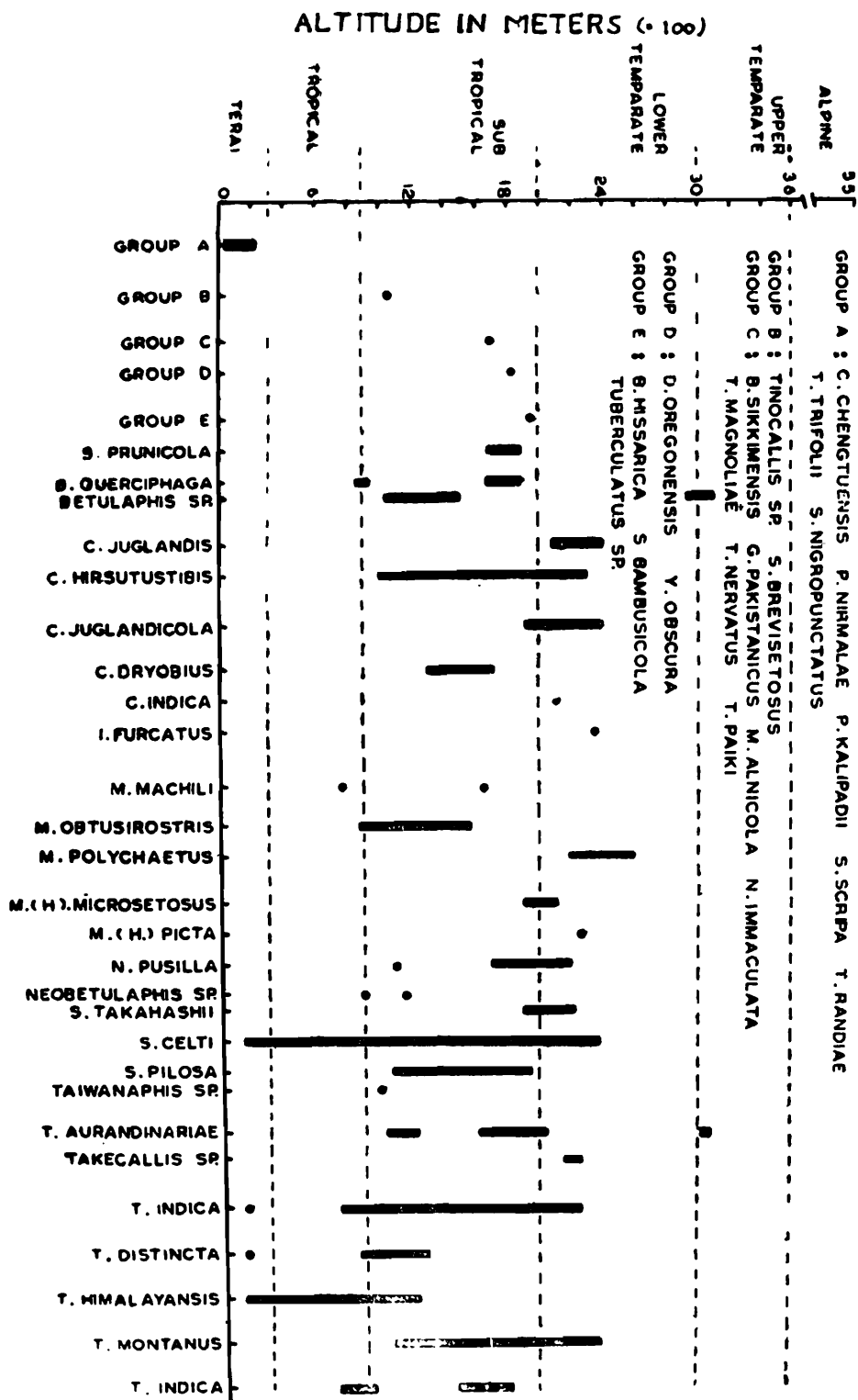
not harbour the Drepanosiphine aphids. However, in some local pockets, *Arundinaria* and *Betula* (both are mainly found in lower temperate belt) are found and on these plants two species, one each during the month of June and November are found to occur.

Specificity of different species to different vegetational pattern : From the account provided in the earlier sections of this paper, subtropical region appears to be the most preferred niche for the Drepanosiphine aphids in India. It is interesting to note that some aphid species may be restricted to a specific bio-geographical region although host-plants for the same may be available in other regions. *Tuberculatus* spp. feeding on *Quercus* spp. are only found in north east India although the hosts are also available in north west India while *Myzocallis* spp. feeding on *Quercus* spp., are only found in north west but not in north east India when *Quercus* are abundant. Different species or species complex feed on the same host-plant in different areas either at the same period or at a successive period during the year.

The composition of aphid species in each vegetational belt appears distinctive and contiguous belts may have some species in common while two widely different belts have substantially different faunal composition. The abundance of different species in relation to vegetational belts and altitudes is presented in Text-fig. 3.

It is apparent from Text-fig. 3 although 10 genera and 12 species are found in terai vegetation, only six genera and seven species are endemic to that, five species are common to the tropical belt, five to subtropical belt and two to the lower temperate belt. In the tropical vegetational belt nine genera and 12 species occur and none of these species is endemic to this area ; out of these species, five are common to terai, 11 to subtropical and five to lower temperate vegetational belts. The subtropical vegetational belt have five genera and 17 species endemic to this area ; of these species, four are common with terai, 11 with tropical, 10 with lower temperate and two with upper temperate vegetational belts. The temperate vegetational belt embodies 14 genera and 18 species ; of these, three genera and seven species are endemic to that area, 10 species are common to subtropical, five to tropical, two to terai and one to upper temperate vegetational belts. Only one species viz., *Shivaphis celti* Das is found to occur widely from terai to lower temperate vegetational belt. This is perhaps due to the wide adaptability of the different species of the host-plant, i. e., *Celtis* spp. in different vegetational belt. Although *Takecallis arundinariae* (Essig) and *Betulaphis* sp. are reported to occur from the upper

temperate belt infesting Bamboo and *Betula* sp. respectively, these host-plants and aphids may really be considered as belonging to lower temperate belt.

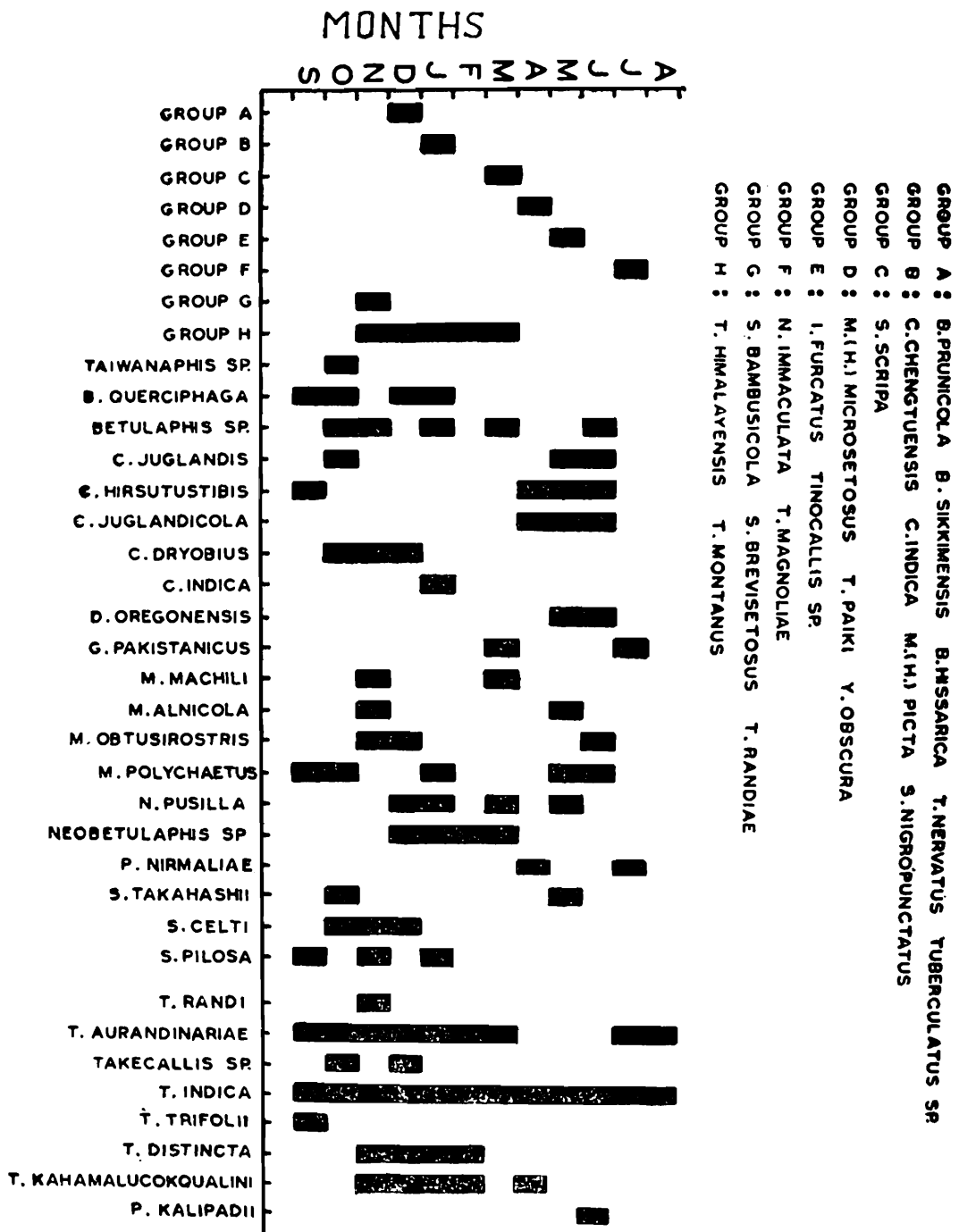


Text-fig. 3.—Abundance of species at different vegetational belts and altitudes.

Distribution of some individuals species : The foregoing analysis only denotes the quantitative characters of Indian Drepanosiphinae in relation to seasons and altitudes. A qualitative analysis of the available data may also reflect the distribution of a species in different seasons.

and altitudes. The abundance of different species at different months is presented in Text-fig. 4.

An analysis of the available records of different species reveals that 22 species are found only for a single month duration in a year, nine



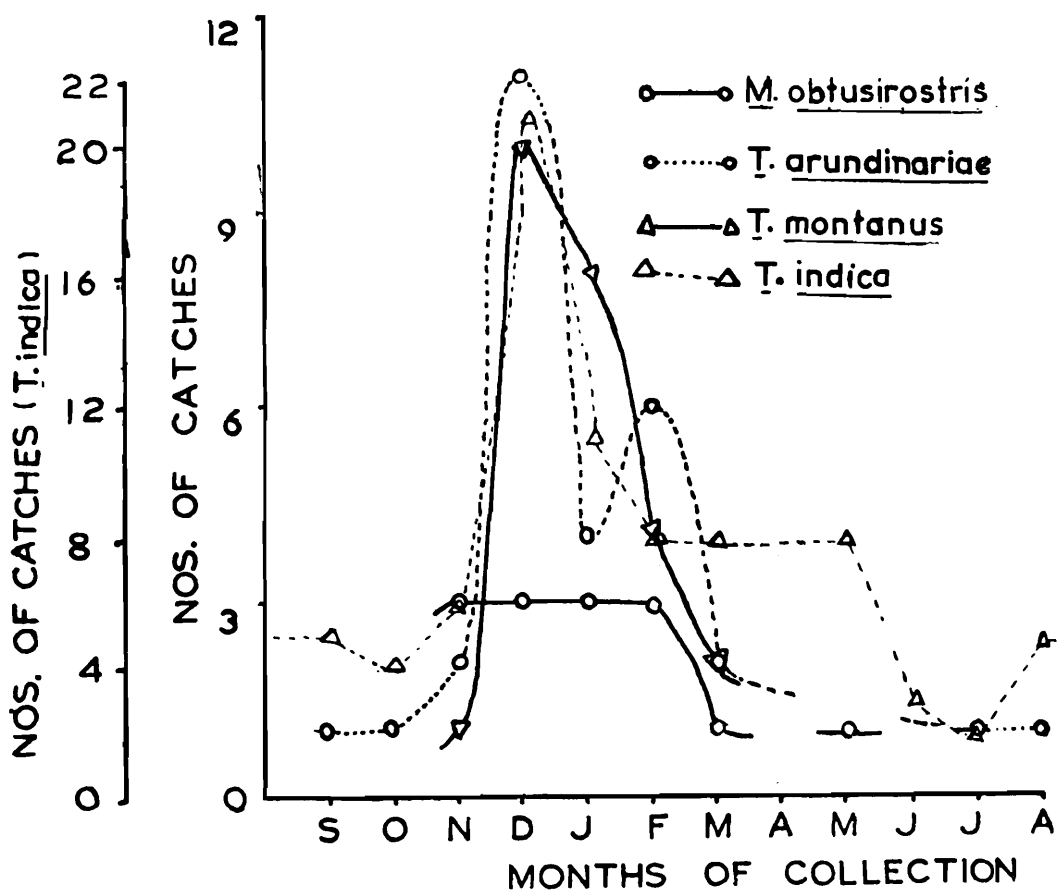
Text-fig. 4.—Abundance of different species in different months of a year.

species for two months, three species for three months, four species for four months, eight species for five months, one species for six months and one species for nine months duration in a year. Only one species viz., *Taovia indica* (Ghosh and Raychaudhuri) is found throughout the year.

The population size of the species where they occur for a number of months are found to vary in different seasons. Though no survey

has so far been conducted with a view to establish the population dynamics of these aphids, the number of catches appear variable in different months, both in hand collections and in the Yellow Pan Water Trap collections. Considering this fact, the total catches of some species have been analysed to have some ideas on the abundance of a species in different seasons and also their population size.

Taovia indica (Ghosh and Raychaudhuri), which is found throughout the year, has been found more in number during December and least in number during July (Text-fig. 5). *Mesocallis obtusirostris* Ghosh though occurs for six months in a year but no significant population size



Text-fig. 5.—Relative abundance of four Drepanosiphine aphid species in different seasons in India.

has been noticed. *Takecallis arundinariae* (Essig) which is found for nine months in a year, has been observed to be more abundant during the months of December. *Tinocalloides montanus* Basu is found for five months in a year and form the highest population size during December. *Chromaphis hirsutustibis* Kumar and Lavigne is found for four months in a year and the population appears to be highest during April. In case of other species no such correlation is possible at present. This suggest that the peak period of infestation varies from species to species.

Although several species are found in different strata at different seasons, but no significant finding is available to show the migration of species at different altitudes with the change of seasons.

SUMMARY

This paper provides an account of seasonal and altitudinal distribution of 49 Drepanosiphine aphids found in India. Out of these, 35 are so far endemic to India. These aphids are found from sea level to c 3060 meters, *i.e.*, from terai vegetational belt to upper temperate vegetational belt. The maximum abundance of species is observed in the subtropical vegetational belt between c 1500 and 2000 meters. The period extending from November to January has been observed to be best favoured period, showing the maximum number of these species and month of August as the least favoured period. The seasonal abundance of the species has also been discussed.

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REFERENCES

- BASU, A. N. 1969. Further records of new and little known aphids (Homoptera) from West Bengal, India. *Oriental Ins.*, 3 (4) : 355-371.
- BISWAS, K. P. 1966. *Plants of Darjeeling and Sikkim Himalayas*. Vol. I, West Bengal Govt. Press, Alipore, West Bengal, pp. 540.
- BUCKTON, G. B. 1899. Notes on two new species of aphids. *Indian Mus. Notes*, 4 : 277-278.
- CHAKRABARTI, S. 1977. Drepanosiphine aphids (Homoptera : Aphididae) and their distribution in India. *Symp. Second Oriental Entomology*, Madras : 67-68.
- CHAKRABARTI, S. 1978. Sexual morphs of *Chromaphis hirsutustibis* Kumar and Lavigne (Homoptera : Aphididae) from India. *Entomon.*, 3 (2) : 295-296.

- CHAKRABARTI, S. AND RAYCHAUDHURI, D. N. 1978. New and little known aphids (Homoptera : Aphididae) from Kumaon Himalaya, India. *Entomon.*, **3** (1) : 95-103.
- CHAMPION, G. T. AND SETH, S. K. 1968. *A revised survey of the forest types of India*. Nasik, Govt. of India Press, pp. 404.
- DAVID, S. K., RAJASINGH, S. G. AND NARAYANAN, K. 1970. New aphids (Homoptera) from Darjeeling in north eastern India. *Oriental Ins.*, **4** (4) : 407-412.
- EASTOP, V. F. AND VAN EMDEN, H. F. 1972. Insect material (in van Emden ed. *Aphid Technology*, Academic Press, London) : 1-45.
- GHOSH, A. K. 1977a. Effects of physical environment on abundance, polymorphism and dispersal of aphids (Insecta : Homoptera) in India. *Sym. Insects and Environment*, Delhi. 4-5.
- GHOSH, A. K. 1977b. Aphid (Homoptera : Insecta) fauna and vegetation of eastern India. *Sym. Second Oriental Entomology*, Madras : 65-66.
- GHOSH, A. K., GHOSH, M. R. AND RAYCHAUDHURI, D. N. 1971. Studies on the aphids (Homoptera : Aphididae) from eastern India-VII. *Oriental Ins.*, **5** (2) : 209-222.
- GHOSH, A. K., GHOSH, M. R. AND RAYCHAUDHURI, D. N. 1972. Studies on the aphids (Homoptera : Aphididae) from eastern India-XI. *Oriental Ins.*, **6** (3) : 333-342.
- GHOSH, M. R., GHOSH, A. K. AND RAYCHAUDHURI, D. N. 1970. Studies on the aphids (Homoptera : Aphididae) from eastern India—III. *Oriental Ins.*, **4** (4) : 377-393.
- GHOSH, M. R., GHOSH, A. K. AND RAYCHAUDHURI, D. N. 1971. Studies on the aphids (Homoptera : Aphididae) from eastern India-VI. *Proc. zool. Soc.*, Calcutta, **24** (1) : 47-51.
- GHOSH, M. R. AND RAYCHAUDHURI, D. N. 1977. Stratigraphic distribution of aphids in Darjeeling district of West Bengal and Sikkim, *Indian J. Ent.*, **29** (3) : 262-270.
- HEIE, O. 1967. Studies on fossil aphids (Homoptera : Aphidoidea) especially in the Copenhagen collection of fossils in Baltic amber. *Spolia Zool. Mus. Hauniensis*, **26** : 1:274.
- MANI, M. S. 1973. *Ecology and Biogeography of India*. W Junk Publisher, Hague, The Netherlands. pp. 775.
- PURI, G. S. 1960. *Ecology*, vol. 1. Oxford Books, pp. 318.
- SAGREIYA, K. P. 1967 *Forests and Forestry*. National Book Trust, India, New Delhi, pp. 218.