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HITHERTO UNKNOWN MORPHS OF *CAVARIELLA INDICA* MAITY AND CHAKRABARTI (HOMOPTERA : APHIDIDAE) WITH NOTES ON ITS BIOLOGY

By

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INTRODUCTION

Cavariella indica Maity and Chakrabarti (in Maity *et al.*, 1982) was described from apterous viviparous female and apterous oviparous female morphs infesting the weeping willow, *Salix babylonica* in the Mussoorie hill tracts of Uttar pradesh, India. This plant is commonly grown as ornamental one in North India, both in the plains as well as in the hills upto an altitude of about 2700 meter (Watt, 1972). During the 3 years' study (1982-1984) at Joshimath (*c* 1900 m), a locality of the Garhwal range of north west Himalaya, routine observations enabled us to collect its hitherto unknown alate viviparous females and alate males, which are described in this paper. Field observations on some garden willows were made with a view to know the seasonal activities, morph composition and natural enemies of this aphid, results of which are presented here under Morphology and Biology.

Cavariella indica Maity and Chakrabarti

Cavariella indica Maity and Chakrabarti, In Maity, Bhattacharya and Chakrabarti, 1982. *Annales zool.*, 36 : 505.

MORPHOLOGY

Materials examined (Specimens mounted and preserved) : INDIA : UTTAR PRADESH, Garhwal, Joshimath, 2 apterous viviparous females, 2 alate viviparous females and

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3 nymphs, 28.x.1982 ; 6 apterous oviparous females, 6 alate viviparous females, 7 alate males and 2 nymphs, 27.xi.1982 ; 1 apterous viviparous female, 2 alate viviparous females and 2 nymphs, 8.xi.1984 ; 2 apterous oviparous females, 3 alate viviparous females, 2 alate males and 1 nymph, 23.xi.1984 ; 2 apterous oviparous females, 1 alate viviparous female and 2 alate males, 9.xii.1984 (Coll. P. K. Medda) ; 1 apterous viviparous female and 3 nymphs, 18.v.1983 ; 3 apterous viviparous females, 1 alate viviparous female and 1 nymph, 26.v.1983 ; 1 apterous viviparous female and 2 alate viviparous females, 10.vi.1983 ; 2 apterous viviparous females and 2 nymphs, 18.vi.1983 ; 2 apterous viviparous females and 1 nymph, 8.vii.1983 ; 2 apterous viviparous famales and 2 nymphs, 6.viii.1983 ; 5 apterous viviparous females and 3 nymphs, 30.ix.1983 ; 1 apterous viviparous female, 3 alate viviparous females and 2 nymphs, 12.x.1983 ; 2 apterous oviparous females, 2 alate viviparous females, 4 alate males and 2 nymphs, 10.xi.1983 ; 3 apterous oviparous females and 3 alate males, 16.xii.1983 (Coll. D. Ghosh) from *Salix babylonica*.

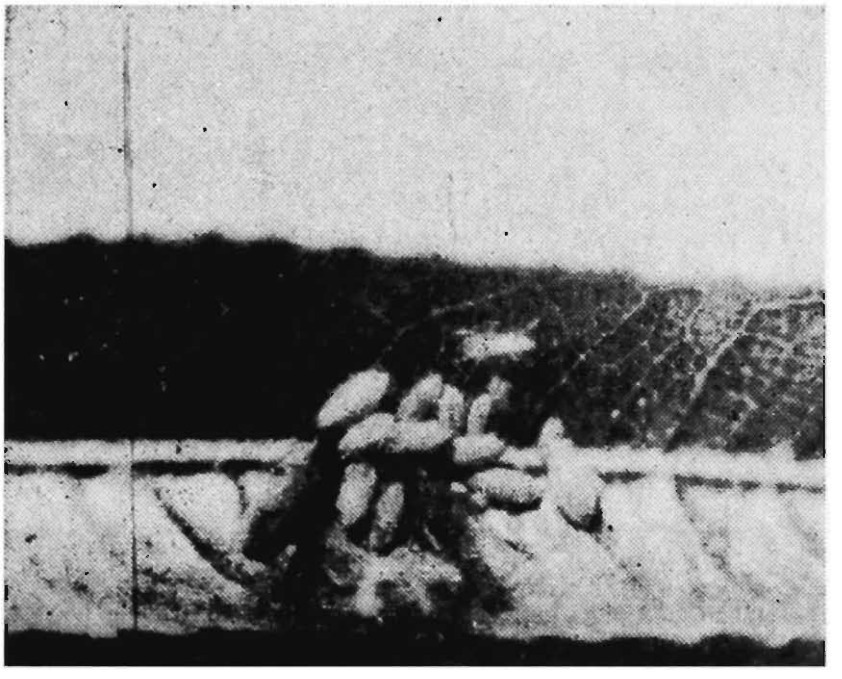
Hitherto unknown alate viviparous females and alate males are described below :

Alate viviparous female : Body 1.84-2.04 mm long and 0.67-0.83 mm wide. Head brown, almost smooth, with flat frons ; dorsum with 6 pairs of hairs including 1 pair on frontal sinus, with acuminate apices ; longest hair on vertex 12-14 μm long and 0.42-0.50 times the basal diameter of antennal segment III. Antennae brown, 0.54-0.62 times the body ; segment I with 5 hairs, segment II slightly scabrous ventrally, segment III with 19-29 round, distinctly protuberant secondary rhinaria distributed over the length except for basal 0.10 portion ; longest hair on segment III 7-12 μm long and 0·25-0·42 times the basal diameter of the segment ; processus terminalis 1.31-1.64 times the base of segment VI and 0.44-0.47 times the antennal segment III. Ultimate rostral segment 0·86-0·91 times the second joint of hind tarsus and without secondary hairs. Abdominal dorsum

sparsely spinulose, tergites 1, 6, 7 and 8 with separate brown spinopleural bands, tergites 2-5 with a fused spinopleural brown patch, marginal patch separately developed on tergites 2-7 ; dorsal hairs short, 4-6 per segment on anterior tergites, with acuminate apices, longest one on anterior tergites 9-12 μm long and 0·33-0.42 times the basal diameter of segment III ; tergite 7 with 2-4 hairs, longest one 9-14 μm long and 0·31-0.50 times the mentioned diameter. Siphunculi brown, narrow at basal 0.40 portion and rest distinctly clavate, poorly imbricated, 0.15-0.16 times the body, 1.85-2.14 times as long as cauda, 9.50-13.0 times its basal width, 4.75-6.17 times its maximum width and 9.25-13.0 times its apical width. Supracaudal process on 8th tergite 0.22-0.26 times the cauda and 1.0-1.67 times its basal width. Cauda with 5-6 hairs. Venter uniformly spinulose. Legs brown ; femora and tibiae sparsely spinulose on distal part ; tarsi imbricated. Other characters as in apterous viviparous female.

Measurements of one specimen in mm : Body length 2.01, width 0.82 ; antenna 1·08, antennal segments III : IV : V : VI 0.38 : 0.16 : 0.14 : (0.13+0.17) ; u.r.s. 0.10 ; h.t.2 0.11 ; siphunculus 0.30 ; cauda 0.14.

Alate male : Body 1.74-1.96 mm long and 0.58-0.74 mm wide. Head ventrally slightly scabrous with poorly developed lateral frontal tubercles ; dorsum with 5 pairs of hairs including 1 pair on frontal sinus with acuminate apices, longest hair on vertex 12-14 μm long and 0.38-0.43 times the basal diameter of antennal segment III. Antennae 0.64-0.76 times the body ; segment III with 40-46 round protuberant secondary rhinaria, segments IV, V and VI with 4-9, 5-8 and 1-2 similar rhinaria ; processus terminalis 1.11-1.31 times the base of segment VI and 0.30-0.36 times the antennal segment III. Ultimate rostral segment 0.91-0.93 times the second joint of hind tarsus. Abdomen dorsally spinulose, tergites 1-8 with separte brown spinopleural sclerotic bands, marginal sclerites separately developed on tergites 2-7 ; longest dorsal hair on anterior tergites 12-14 μm long and 0.36-0.46 times the basal



Sexual colony of *C. indica* on the leaf of S. *babylonica*.

diameter of segment III ; those on 7th and 8th tergites 14-16 μm and 23-25 μm long, and 0.43-0.62 times and 0.77-0.85 times the mentioned diameter respectively. Siphunculi 0.15-0.16 times the body, 2.0-2.47 times as long as cauda, 9.0-12.67 times its basal width, 5.14-5.33 times its maximum width and 10.67-12.33 times its apical width. Supracaudal process indistinct. Male genitalia having aedaegus with 2 claspers at its base. Venter uniformly spinulose. Other characters as in alate viviparous female.

Measurements of one specimen in mm : Body length 1.74, width 0.58 ; antenna 1.31 ; antennal segments III : IV : V : VI 0.53 : 0.21 : 0.17 : (0.13+0.16) ; u. r. s. 0.11 ; h.t. 2 0.12 ; siphunculus 0.26 ; cauda 0.13.

BIOLOGY

(i) Materials and Methods

Two plants of weeping willow (*S. babylonica*) in a garden at Joshimath were selected for biological observations. Ten sample leaves collected at random were observed fortnightly during spring to winter of 1983 and 1984. The aphid samples were collected in 70% alcohol and taken to the laboratory for sorting of morphs. As and when necessary, aphids were processed for microscopical studies.

During the full tenure of the study, meteorological informations were collected using maximum and minimum thermometer, dry and wet bulb hygrometer and rain gauge.

(ii) Observations

(a) *Seasonal activities :* With the sprouting of flowering buds and subsequently leaf buds towards the end of January in *S. babylonica,* the overwintered eggs of *C. indica* start hatching into fundatrices which we, however, could not collect. In contrast to *S. tetrasperma* which is the primary host of *C. aegopodii* (Scopoli), bud sprouting in *S. babylonica* occurs much earlier. Thus, the eggs of *C. indica* overwinter only for a short period, i. e., approximately 45 days.

Fundatrices after maturity give rise to apterous fundatrigeniae which either singly or in a group infest an emerging leaf, usually at the base of its dorsal surface. Later on, the general tendency of this aphid is found to infest the dorsal side of the apical most leaves of the long branches. When apical leaves grow older, the aphids migrate to the immediate tender leaves because of their greater succulence, The apterous fundatrigeniae develop within 10-11 days. The number of youngs produced by a fundatrigena ranges from 25-32, which are laid for a period of 12-14 days with daily rate of 0-4 nymphs. Alate viviparae first appear in small number in the 3rd generation. Alate production here is related to the spreading of colony rather than to crowding, since the population never tend to reach a high level. The occurrence of low alate morphs was also observed by Rabasse and Brunel (1977) for *C. aegopodii*.

By the end of October with lowering of temperature, alate viviparous females lay pinkish nymphs which develop into apterous oviparae, while other alate viviparae lay greenish ones giving rise to alate males (Plate 1). Number of alate males is lower than that of oviparae, which may be due to the fact that one male can mate with more than one ovipara. Mating continues for about 3 minutes. After about 8-9 days, the fertilised ovipara lays 3-4 pinkish, elongatedly oval eggs, measuring about 0.7-0.8 mm in length and 0.4 mm in maximum width. Egg laying continues for 1-2 days and the ovipara dies after 6-7 days of egglaying. Males live for about 14 days. Eggs are left at this stage on the buds for overwintering.

(b) *Population pattern and composition* : The building up of population of *C. indica* on *S. babylonica* is initiated by the hatching of overwintered eggs into fundatrices but become established by the progeny of the latter during March in 1983 (Fig. 1) and February in 1984 (Fig. 2) depending on the arrival of spring. In both the years, study could be started only from the middle of February. It is found that aphid population attains a peak during April in both the

years, followed by a slow decline and maintains a low level throughout the summer and monsoon months. Again with the development of sexuals, population shows another low peak in November and subsequently declines in December. It should be mentioned here that as the infestation gradually spreads towards the tender apical leaves, it never becomes so high as to cause malformations.

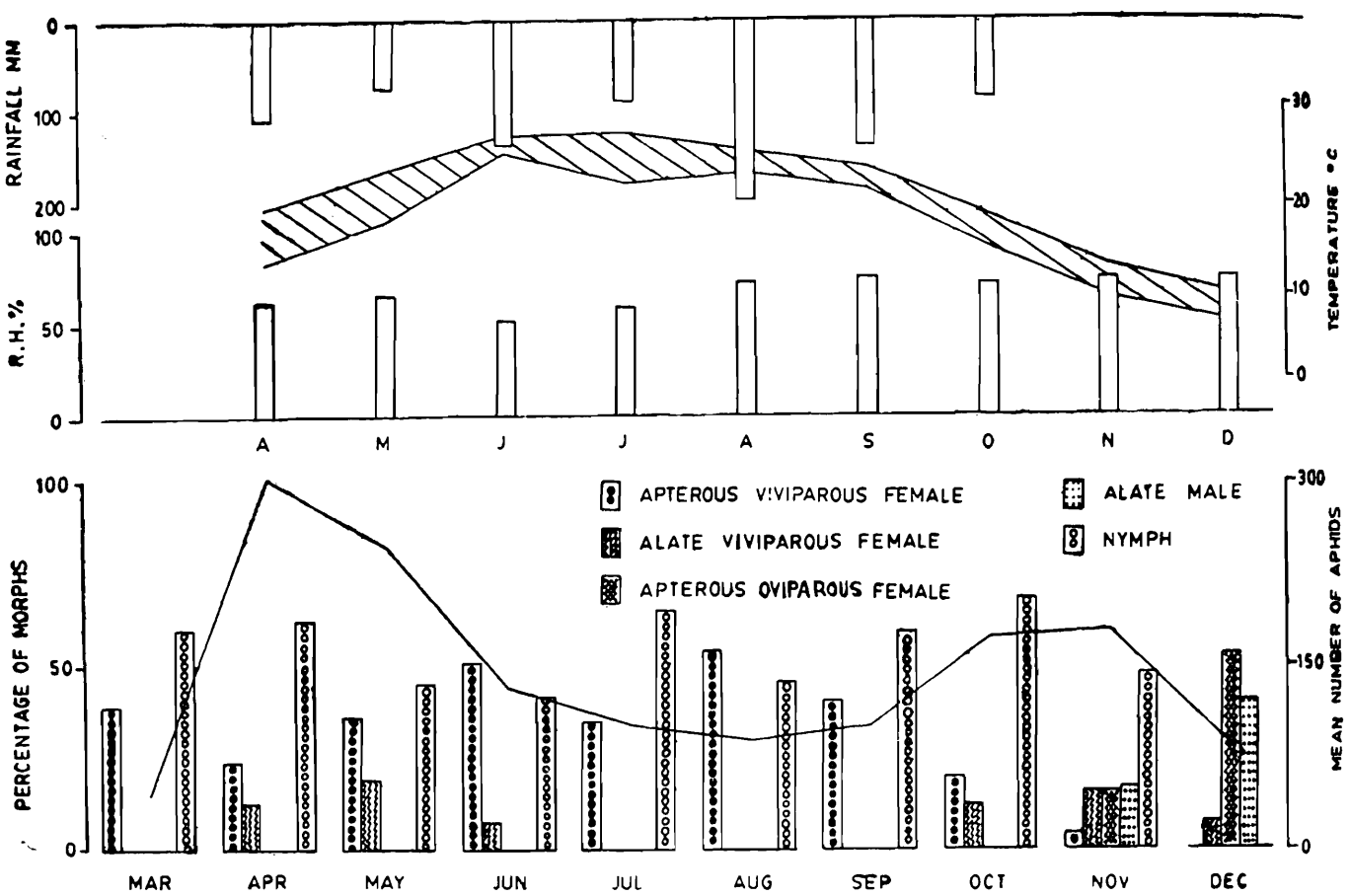


Fig. 1. Incidence pattern and morph composition of *C. indica* on *S. babylonica* in 1983.

From the available morphs (Figs. 1 and 2) a substantial change in the composition of alatoid and apteroid morphs is observed during different phases of aphid population growth. It is interesting to note that the nymphs almost always form the bulk of the population. The alate morphs are always low (7.06-19.28% in 1983 and 6.56-20.00% in 1984) with two phases, one during spring-summer and another daring autumn with a off-period during monsoon. Incidence of apterous morphs in 1984 maintains a more or less stable condition till

arrival of autumn, while it is somewhat fluctuating in 1983 and declines from October onwards in both the years. Apterous oviparous female and alate male appear during November and decline in December.

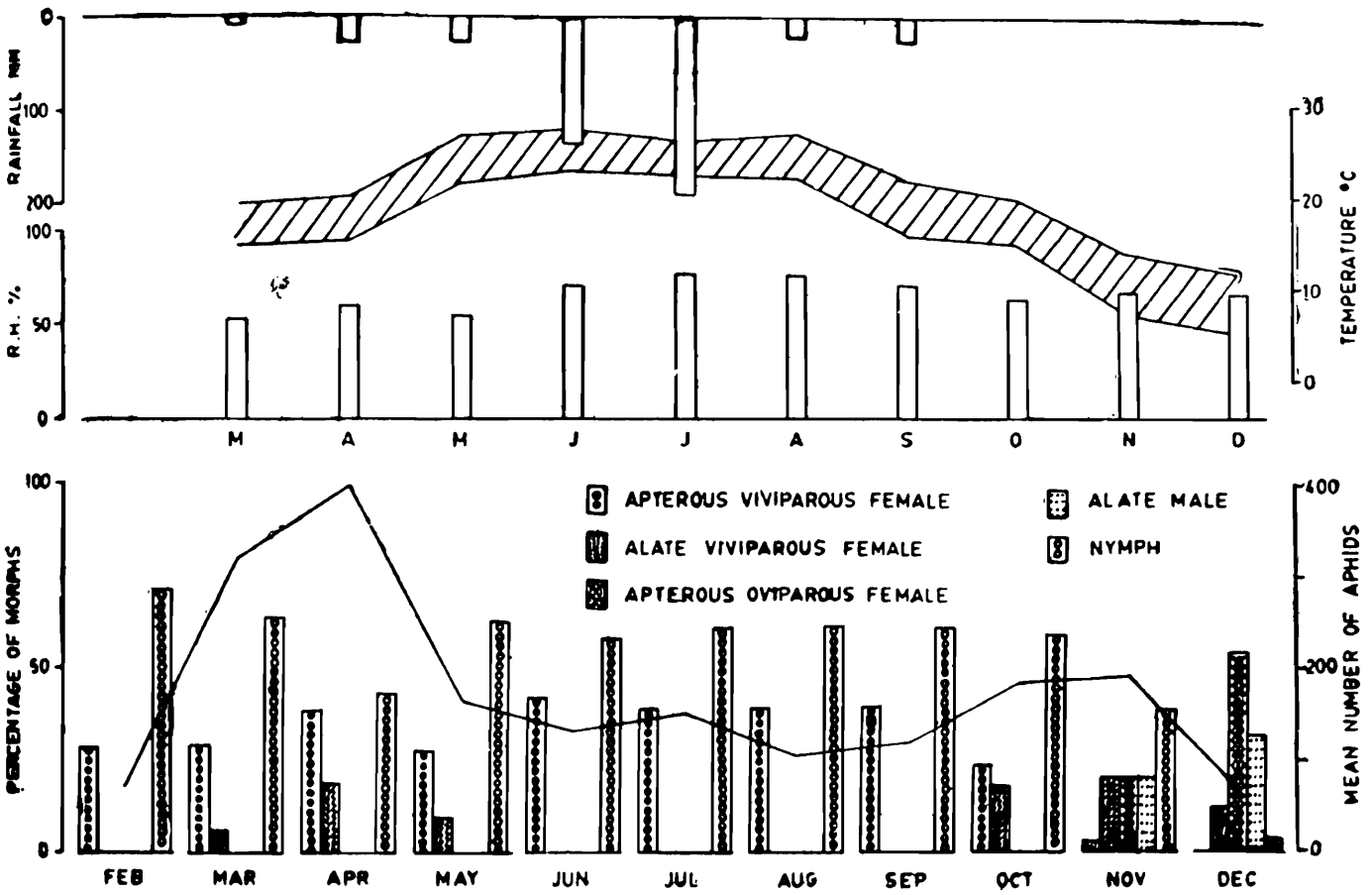


Fig. 2. Incidence pattern and morph composition of *C. indica* on *S. babylonica* in 1984.

(c) *Natural enemies* : In early spring, *Adalia tetraspilota* (Hope), *Coccinella septempunctata* L. and *Harmonia* (*Leis*) *dimidiata* (F.) are found to predate on this aphid, but from summer onwards *Oenopia sauzeti* Muls., *Menochilus sexmaculatus* F. and *Platynaspis* sp. seem to be abundant coccinellid predators. Surprisingly none of the above species are found to breed on this aphid. The only syrphid maggot collected is *Metasyrphus confrater* (Wied.).

DISCUSSION

C. indica, an endemic aphid to India, leads a holocyclic, autoecious life on weeping willow. This species differs from *C. aegopodi* (Scopoli), also commonly occurring in that

area, in the host-alternation since the latter species shows a heteroecious mode of life(Ghosh *et al.*, 1986). However, its infestation could never reach at the levels which can damage the weeping willow. High temperature and rainfall can affect its population build up in summer and monsoon, when we obtained a low level of population. Production of alate morphs is always low and completely absent in monsoon months. In aphid, alate production depends on population density (Hille Ris Lambers, 1966) and unsuitable condition of host plants through continuous exploitation of the plant sap by the aphids (Way, 1973). But in *C. indica,* summer production of alate seems to be necessary for dispersion to all available uninfested tender leaves, whereas winter alates account for the production of sexuals.

Predators appear to have some impact on the population decline in summer as most of the coccinellids are noted to be quite active in spring and summer after the termination of their hibernation quarters.

Summary

The present paper provides a taxonomic description of so far unknown alate viviparous female and alate male morphs of *Cavariella indica* Maity and Chakrabarti. Biological activites, morph composition and natural enemies of this aphid in Garhwal range of north west Himalaya have also been discussed.

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