

**BIODIVERSITY OF ANTS WITH SPECIAL REFERENCE TO APHID,
APHIS GOSSYPYII GLOVER ON EGG PLANT, SOLANUM
MELONGENA LOCAL VAR. BARAHMASIKA**

M. NONITA, C. MANMOHINI, T.K. SINGH AND R.K. RADHAKRISHORE
APHID RESEARCH LABORATORY, DEPARTMENT OF LIFE SCIENCES,
MANIPUR UNIVERSITY, CANCHIPUR -795 003, INDIA.
(e-mail : tksingh06@yahoo.co.in)

Studies on the biodiversity of ants tending on *A. gossypii* Glover were carried out on brinjal during 2000 and 2001. 19 species of aphidicolous ants under 8 genera belonging to 3 sub families were observed to be associated with the aphid indicating high ant-aphid mutualism on the host plant. Most of the species belonging to the sub family Myrmicinae (12 species) being followed by Dolichoderinae (4 species) and Formicinae (3 species) respectively. Among the aphid tending ants, *Tapinoma indicum* Forel was the predominant one. Moreover, the peak population of ants (31.33 and 5.55 ants/sample) were observed during April and it coincided with the period of maximum abundance of the aphids (228.02 and 168.07 aphid/sample) showing significant correlation between them ($r = 0.70; 0.86$). The ant incidence percentage as well as ant-aphid ratio were also worked out during the period of study.

Key words: Aphidicolous ants, *A. gossypii* Glover, mutualism, brinjal.

INTRODUCTION

Egg plant, *Solanum melongena* L. local var. "Barahmasika" is grown abundantly in Manipur and is consumed as a summer crop. It is infested by a number of insect pests, of which, the polyphagous aphid, *Aphis gossypii* Glover is considered to be an important pest of brinjal. In general, aphid have mutualistic association with ants (Togashi, 1987; Sudd, 1987) and this association increases the aphid population to a certain extent (El-Ziady, 1960). Among the aphids attended by ants, being a polyphagous species *A. gossypii* was found to be attended by a variety of ant species (Kurl & Chauhan, 1986).

In India, many aphidicolous ants have been reported by several workers (Misra & Behura, 1969; Kurl & Misra, 1980; Dutta *et al.*, 1982; Devi, 1990; Devi *et al.*, 2001; Bisht *et al.*, 2002). As there is little information about *A. gossypii* and its tending ants in terms of their occurrence and species composition on this host plant, Barahmasika, the present study were carried out for better understanding of their mutualistic relationship.

MATERIALS AND METHODS

The seasonal abundance of *A. gossypii* and its attending ants were studied on barahmasika for two subsequent crop seasons (2000 & 2001) in the experimental field of Life Sciences Department, Manipur University. The experimental plots were free from insecticidal application and normal agronomical practices were followed. Observations on the incidence of the pest and its tending ants were taken from 15 randomly selected plants at weekly interval. In the pre- flowering stage of the crop, the pest population was counted by selecting 3 leaves (upper, middle and lower leaves) per plant. At the later states of the plant growth, the population was drawn from two branches (each from upper, middle & lower leaves per branch) per plant. Besides, the aphidicolous ants were also collected along with the aphids from the host plants with a fine hair brush and

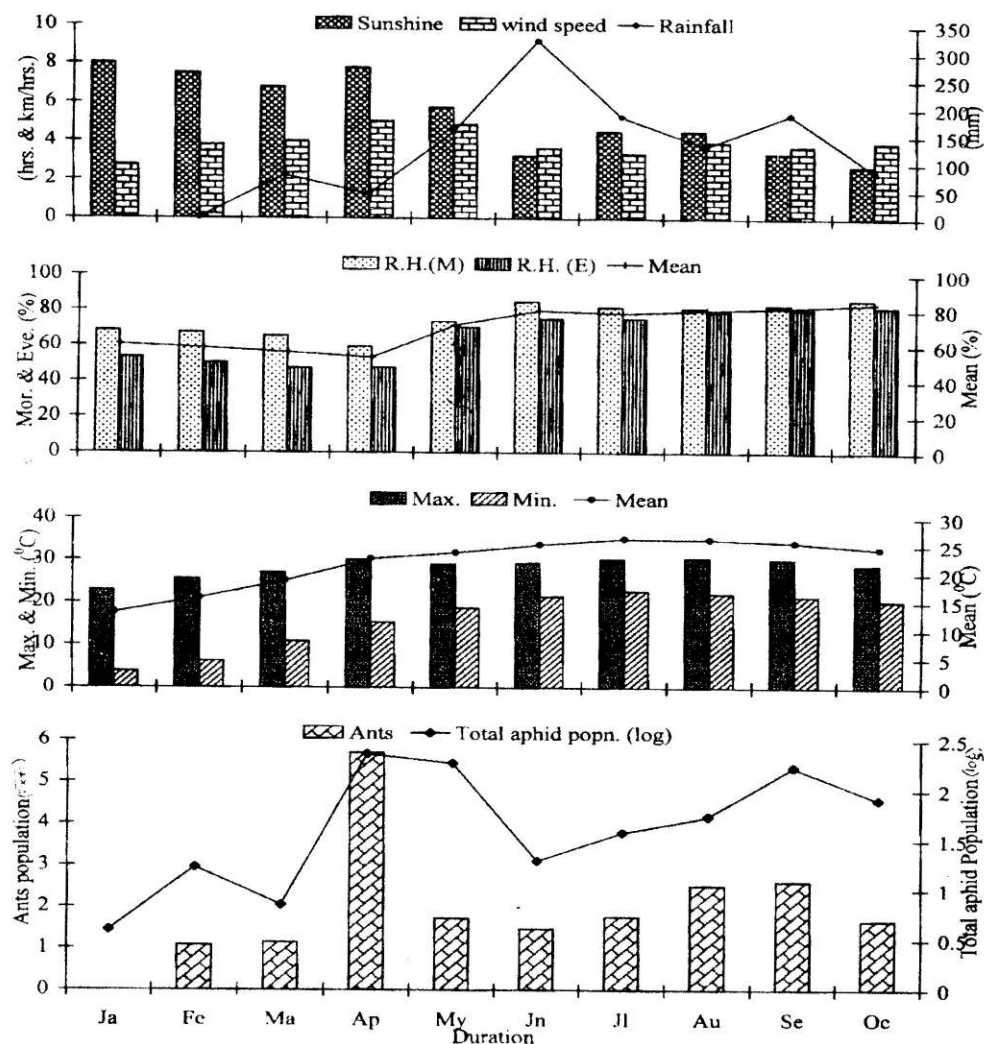


Fig. 1 : Seasonal abundance *A. gossypii* in relation to ant and abiotic factors on *S. melongena* local var. Barahmasika (2000).

brought to the laboratory and preserved in 70% alcohol in small vials (4 x 1 cm.) for identification.

RESULTS AND DISCUSSION

Studies on the ants attending *A. gossypii* on brinjal were carried out in terms of their occurrence for a period of two years (2000 & 2001). The tending ants were observed during the months of January to October and the frequency of their population density showed remarkable variation in different months of the years (Figs. 1 & 2).

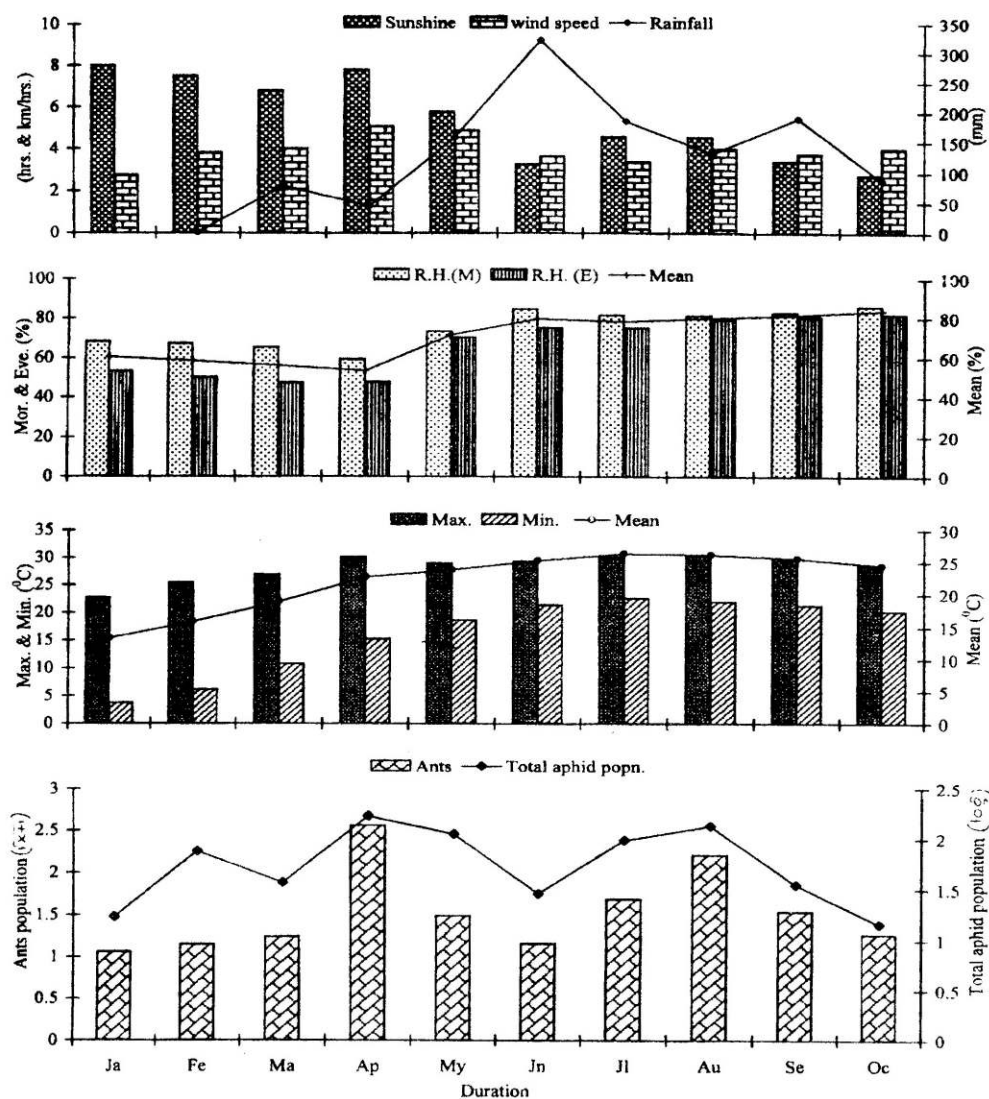


Fig. 2 : Seasonal abundance *A. gossypii* in relation to ant and abiotic factors on *S. melongena* local var. Barahmasika (2001)..

Species composition of aphidocolous ants

During the present observation, as many as 19 species of ants were collected from the colonies of *A. gossypii* and their period of activity is shown in Table I. Of these, *P. dives* and *T. indicum* were encountered more frequently than the other species. The species composition and seasonal occurrence of ants showed almost similar trend during two consecutive cropping seasons (2000 & 2001). 19 aphidocolous ants belonging to 8 genera under 3 sub families viz. Myrmicinae, Dolichoderinae and Formicinae were recorded

Table I : List of ant species attending *A. gossypii* and their period of activity (2000 & 2001).

| Ant species | Sub family | Period of activity |
|--------------------------------------|----------------|------------------------|
| <i>Polyrhachis dives</i> Smith | Formicinae | Feb. - Sept. |
| <i>Camponotus</i> sp. A | Formicinae | June, Sept. |
| <i>Camponotus</i> sp. B | Formicinae | Jan., Aug.-Sept. |
| <i>Iridomyrmex anceps</i> Roger | Dolichoderinae | May-June, Sept. |
| <i>I. glaber</i> Mayer | Dolichoderinae | Feb., May-June |
| <i>Trapinoma indicum</i> Forel | Dolichoderinae | April-Oct. |
| <i>T. melanocephalum</i> Fabr. | Dolichoderinae | March-May, July |
| <i>Tetramorium christiei</i> Forel | Myrmicinae | July |
| <i>T. curtulum</i> Emery | Myrmicinae | March-April, July |
| <i>T. guineense</i> Fabr. | Myrmicinae | May, Sept.-Oct. |
| <i>T. bicarinatum</i> Nyl | Myrmicinae | May, Sept. |
| <i>Triglyphothrix musculus</i> Forel | Myrmicinae | September |
| <i>Phidole</i> sp. | Myrmicinae | February |
| <i>Phidole binghami</i> Forel | Myrmicinae | April-June |
| <i>Monomorium</i> sp. A | Myrmicinae | Feb., May, July, Sept. |
| <i>Monomorium</i> sp. B | Myrmicinae | March |
| <i>Monomorium minutum</i> Mayer | Myrmicinae | July |
| <i>M. floricola</i> Jerd. | Myrmicinae | Feb., May-July, Oct. |
| <i>M. pharaonis</i> Linn. | Myrmicinae | April-May |

Table II : Seasonal distribution of aphidicolous ants with *A. gossypii* on Barahmasika.

| | Jan | | Feb | | Mar | | Apr | | May | | Jun | | Jul | | Aug | | Sept | | Oct | | Total | |
|-----|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|------|---|-----|---|-------|----|
| | G | S | G | S | G | S | G | S | G | S | G | S | G | S | G | S | G | S | G | S | G | S |
| I | - | - | 1 | 3 | 2 | 2 | 2 | 3 | 2 | 6 | 2 | 4 | 1 | 3 | - | - | 3 | 4 | 2 | 2 | 4 | 12 |
| II | - | - | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 4 | 1 | 3 | 1 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 4 |
| III | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | - | - | 2 | 3 |

I : Myrmicinae; II : Dolichoderinae; III : Formicinae; G : Genetic; S : Species.

Table III : Ant incidence percent and ant-aphid ratio of *A. gossypii* on brinjal, 2000 & 2001.

| Time | 2000 | | 2001 | |
|-----------|-------------------|-----------------|-------------------|-----------------|
| | Ant incidence (%) | Ant Aphid Ratio | Ant incidence (%) | Ant Aphid Ratio |
| January | 0.00 | 0.00 | 0.83 | 0.01 |
| February | 0.28 | 0.01 | 2.04 | 0.00 |
| March | 0.62 | 0.04 | 3.38 | 0.01 |
| April | 62.95 | 0.14 | 35.35 | 0.03 |
| May | 3.96 | 0.01 | 7.13 | 0.01 |
| June | 2.35 | 0.06 | 2.23 | 0.01 |
| July | 4.24 | 0.06 | 11.72 | 0.02 |
| August | 10.51 | 0.10 | 34.71 | 0.03 |
| September | 11.59 | 0.03 | 8.66 | 0.04 |
| October | 3.50 | 0.02 | 3.95 | 0.04 |

Table IV : Correlation of ant population with Aphid and abiotic factors.

| Period | Y vs X ₁ | Y vs X ₂ | Y vs X ₃ | Y vs X ₄ | Y vs X ₅ | Y vs X ₆ |
|----------------------------|--------------------------------|------------------------------|------------------------------|-----------------------------------|---------------------------------|---------------------------|
| 2000 | 0.570 | 0.152 | -0.087 | -0.140 | 0.392 | 0.860** |
| 2001 | 0.620 | 0.287 | -0.239 | -0.397 | 0.230 | 0.700** |
| Y- population of Ant | X ₁ = Wind speed | X ₂ = Sunshine | X ₃ = Rainfall | X ₄ = Rel. Humidity | X ₅ = Temperature | X ₆ = Aphid |

** : Significance at 1% level.

during the study. Myrmicinae contributed a maximum of 12 species under 4 genera being followed by Dolichoderinae and Formicinae consisting of 4 and 3 species under 2 genera each respectively. Shantibala *et al.* (1995) also observed maximum number of species of ants under the sub family Myrmicinae tending *Cervaphis quercus* on *Quercus serrata*.

Under the subfamily Myrmicinae the genera, viz. *Tetramorium*, *Triglyphothrix*, *Phidole* and *Monomorium* were represented by 4,1,2 and 4 species respectively. But in case of Dolichoderinae, 2 species each were recorded under the genera *Iridomyrmex* and *Tapinoma*. The genus *Polyrhachis* and *Triglyphothrix* belonging to the subfamily Formicinae and Myrmicinae respectively were represented by one species each. Among the aphid –tending ants, *T. indicum* was predominant in terms of density. However, the genus *Technomyrmex* was reported as the most abundant one in case of *C. quercus* on *Q. serrata* (Shantibala *et al.*, 1995).

Seasonal occurrence

During the present study, the pest appeared during January and its incidence extended up to October. The peak density (228.02 & 168.07 aphids/sample) was recorded during April in both the cropping seasons. Likewise, ant population was also recorded from January to October and their maximum abundance (31.33 & 5.55 ant/sample) was observed in April (Figs. 1 & 2), which coincided with the peak density of aphid. The present finding is in conformity with those of Devi (1990) and Shantibala *et al.* (1995). 12 species of aphidicolous ants of the subfamily Myrmicinae were found during February to October. The maximum incidence of ant was recorded during May and minimum was observed during March and October (Table II). Four members of the subfamily Dolichoderinae were recorded from February to October with the highest incidence during the month of May and the least in February. Shantibala *et al.*, (1995) also observed similar trend of occurrence of aphid tending ant. Under the subfamily, Formicinae, 3 species were recorded from January to September (Table II). Based on the seasonal occurrence of the aphid tending ants, the longest period of activity was that of the species *P. dives* and the second longest association was found with the species *T. indicum* (Table I). During the present study, the ant incidence percentage as well as ant - aphid ratio were also worked out. The maximum ant incidence percent (62.95 & 35.35%) was observed during the peak period of ant population (2000 & 2001). The highest value of ant- aphid ratio was observed during April in 2000 whereas, in 2001 the maximum ant aphid ratio was recorded in September and October (Table III). The mutual relationship of aphid and ant indicated high significant positive association (Table IV). The abiotic factors viz. average temperature, sunshine and wind speed showed non-significant positive correlation with the ant population (Table IV). Thus, it could be inferred that

effect would be of secondary importance in determining the density of varied ant species. This result is in conformity with that of Shantibala *et al.* (1995). However, in case of relative humidity and rainfall, negative association was recorded with the ant population. It indicated that the ant population was inversely proportional with that of the above mentioned abiotic parameters. Hence, the above results reveal that the activity of aphidocolous ant was found to be maximum when the aphid population attained peak on the host plant. Based on the data of the species composition of the ants, it could be inferred that subfamily Myrmicinae attended aphids in larger number being followed by Dolichoderinae and Formicinae.

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