Acarologia is proudly non-profit, with no page charges and free open access

Please help us maintain this system by encouraging your institutes to subscribe to the print version of the journal and by sending us your high quality research on the Acari.

Subscriptions: Year 2018 (Volume 58): 380 €
http://www1.montpellier.inra.fr/CBGP/acarologia/subscribe.php

Previous volumes (2010-2016): 250 € / year (4 issues)
Acarologia, CBGP, CS 30016, 34988 MONTFERRIER-sur-LEZ Cedex, France

The digitalization of Acarologia papers prior to 2000 was supported by Agropolis Fondation under the reference ID 1500-024 through the « Investissements d’avenir » programme (Labex Agro: ANR-10-LABX-0001-01)

Acarologia is under free license and distributed under the terms of the Creative Commons-BY-NC-ND which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original author and source are credited.
POPULATION DYNAMICS AND DIURNAL ACTIVITY OF ACALITUS HIBISCI MONDAL AND CHAKRABARTI (ACARI: ERIOPHYOIDEA)

BY Saswati CHAKRABARTI & Samiran CHAKRABARTI

(Accepted December 2004)

POPULATION DYNAMICS DIURNAL ACTIVITY ACALITUS HIBISCI HIBISCUS VITIFOLIUS ACARI ERIOPHYOIDEA

SUMMARY: Studies on the seasonal abundance of Acalitus hibisci Mondal & Chakrabarti on Hibiscus vitifolius indicate that the variation in the population of the mites is positively correlated with different abiotic factors, such as, temperature, relative humidity and rainfall. It has been found that the population of mites during winter months is 5 times less than that in the summer months. Mite movement during daytime is the least during noon i.e. from 12.30 hrs to 13.30 hrs while number of mites coming out of the gall shows a notable increase during morning. A slight increase in activity was also found during afternoon in some months.

RÉSUMÉ : L’abondance sisonnière de Acalitus hibisci Mondal & Chakrabarti sur Hibiscus vitifolius montre que la variation des populations des acariens est corrélée positivement à plusieurs facteurs abiotiques dont la température, l’humidité relative et les précipitations. Ces populations sont 5 fois moins nombreuses en hiver qu’en été. Les déplacements sont moindres à la mi-journée de 12h30 et 13h30 alors que le nombre d’acariens quittant les galles s’élève notablement le matin. Une augmentation légère de l’activité a été décelée l’après-midi certains mois.

INTRODUCTION

Acalitus hibisci Mondal & Chakrabarti 1982 is a pouch gall forming mite on the leaves of Hibiscus vitifolius, a tropical wild shrub. Ghosh (1983) studied the anatomy of the gall of Hibiscus vitifolius. The relationship of temperature, relative humidity and rainfall with the population of this mite has not been studied yet.

Host plant developmental phases are correlated with herbivory and a slight anatomical or biochemical change of host plant may bring a significant effect on herbivores. Simultaneously, plant developmental stages are also greatly dependent on seasonal changes. So, seasonal variations have profound effect on herbivore population (Das & Gupta, 1991; Naidu & Channabasavanna, 1989; Rice & Weinberger, 1981). Flamm & Coulson (1988) found that abiotic and biotic factors of the environment affect population level performance of herbivores.

So far literature was studied, it was found that interrelationship of population dynamics of gall for-
ming eriophyid mites with seasonal variation still requires detailed investigation. In the present study, population dynamics of *Acalitus hibisci*, a gall forming eriophyid mite producing leaf galls on *Hibiscus vitifolius*, in relation to weather variation viz. temperature, relative humidity and rainfall have been noted. Daily inward and outward movement of these mites from the gall was also recorded to indicate their diurnal activities.

**Material and Methods**

Populations of *A. hibisci* were studied on naturally growing *H. vitifolius* plants under field conditions. Plants were maintained and kept under observation to study variation in mite population in relation to the environmental changes in different months of the year as well as the daily movement of mites outside the gall. Population density of *A. hibisci* was estimated by taking 5 leaves at random from different plants from a population of 20 individual plants fortnightly in every month starting from January 1998 to December 1999 *i.e.* for two consecutive years. Leaves containing galls were examined under stereo-binocular microscope to assess the total number of mites including larvae, nymphs and adults per gall. Temperature, relative humidity and rainfall of each month were shown from the meteorological data (Table 1) recorded by Agro-Meteorology Department, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal, India, that is located very close to the place of experiments. To record the daily movement of the mites including larvae, nymphs and adults outside galls, 5 leaves at random were collected from the above mentioned plant population at one hour intervals, starting from 7.30 hrs to 17.30 hrs in different months on 27th day. Readings for five random samples were recorded. The collected leaves were examined under a stereo binocular microscope to locate and note the total number of mites moving outside gall.

Population of *Acalitus hibisci* per gall showed peaks during May to July in both the years *i.e.* 1998 and 1999. From the experimental data (Table 1) it is evident that there is no significant difference in variation of mite population in the two consecutive years studied (CD value 29.021). Table 1 shows that the

<table>
<thead>
<tr>
<th>Months</th>
<th>1998</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Av. temperature</td>
<td>Av. R. H.</td>
</tr>
<tr>
<td>J</td>
<td>32.8</td>
<td>16.13</td>
</tr>
<tr>
<td>F</td>
<td>40.2</td>
<td>21.5</td>
</tr>
<tr>
<td>M</td>
<td>59.2</td>
<td>25.48</td>
</tr>
<tr>
<td>A</td>
<td>53.8</td>
<td>29.8</td>
</tr>
<tr>
<td>M</td>
<td>130.6</td>
<td>27.55</td>
</tr>
<tr>
<td>J</td>
<td>106</td>
<td>30.33</td>
</tr>
<tr>
<td>J</td>
<td>112.3</td>
<td>30</td>
</tr>
<tr>
<td>A</td>
<td>90.2</td>
<td>29.33</td>
</tr>
<tr>
<td>S</td>
<td>72.8</td>
<td>28.63</td>
</tr>
<tr>
<td>O</td>
<td>50.6</td>
<td>29.68</td>
</tr>
<tr>
<td>N</td>
<td>42.5</td>
<td>23.13</td>
</tr>
<tr>
<td>D</td>
<td>35.8</td>
<td>20.03</td>
</tr>
<tr>
<td>SD +</td>
<td>33.182</td>
<td>4.718</td>
</tr>
</tbody>
</table>

C. D. value at 5% level: A x B = 29.021

Table 1: Population dynamics of mites/gall in relation to average temperature, average relative humidity and average rainfall in different months during 1998 & 1999.

**Results**

The mite *Acalitus hibisci* was found to form galls throughout the year on the leaves of *Hibiscus vitifolius*. During May to August infestation was highest. Population of *Acalitus hibisci* per gall showed peaks during May to July in both the years *i.e.* 1998 and 1999. From the experimental data (Table 1) it is evident that there is no significant difference in variation of mite population in the two consecutive years studied (CD value 29.021). Table 1 shows that the
population of the mite begins to increase from February and declines from August. The population size was least during December and January when the temperature was lowest (16.13-20 °C). The results were recorded at a fortnight interval and Table 1 illustrates the mean of 10 readings (at the end of each fortnight 5 readings from 5 different leaves were taken) recorded in a month.

![Graph 1](image1.png)

**Fig. 1.** Interaction between number of mites and 3 abiotic factors (1998).

The outward movement of the mites from the gall indicated their daily activity. **Fig. 3** illustrates the variation in number of mites coming out of galls during daytime throughout the year. Readings plotted in the graph were the mean of five random samplings. The period of study was from 7.30 hrs to 17.30 hrs during each day. Before 7.30 hrs and after 17.30 hrs, very few mites (less than 5) were found to move outwards from the gall except the period from May to June.

While observing daily activity with the help of a stereo-binocular microscope, the activity of these mites rises during the morning hours and least activity was exhibited during noon throughout the year **(Fig. 3)**. A slight rise in activity during evening hours was also evident in the graph.

**DISCUSSION**

There are many reports on the effect of abiotic factors on population dynamics of tetranychid mites (Van de Vrie et al., 1972; Takafuji, 1980; Goyal et al., 1984; Al-Booory & El-Haideri, 1986; Mallikarjunappa & Nageshchandra, 1989; Das & Gupta, 1991; Rat et al., 1991 and Kumari & Sadana, 1995). Several authors (Hollingsworth & Berry, 1982; Sharma & Kushwaha, 1984; Dubitzki & Gerson, 1987) also have reported similar works on tenuipalpid mites. In comparison with these data, there are very few reports available on eriophyid mites particularly gall forming eriophyids.

In 1981, Abou-Awad in Egypt found that the population of *Eriophyes mangiferae* was affected with variation in temperature and relative humidity. He obtained a significant positive correlation of mite population with temperature. In 1989, Naidu & Channabasavanna working on *Eriophyes cymbopogonis* infesting citronella found that low temperature during winter months was not preferred by the mites and their population decreased during that period (state of plant not mentioned in the original reference). Das & Gupta (1991) observed similar phenomenon. Allen et al. (1994) found that eriophyid mites preferred moist weather. Schlisske (1981) reported that humidity plays a decisive role in population dynamics of *Aculus fockeui*. In western Norway, Hassain & Solhoy (1998) reported that highest numbers (936/leaf) of *Aculus schlechtendali*
on three different apple cultivars during middle of August. West Bengal, particularly the southern part of this state, is situated in the eastern part of tropical India, where monsoon as well as seasonal variation of climatic condition is very prominent. Day lengths in summer are more than 12 hrs varying from 12.07 hrs. (March) to 13.67 hrs. (June) and begin to decrease from September (12.39 hrs.). The shortest day length is usually in December (10.26 hrs). Hot sunny sultry summer (av. day temperature is 35°C, relative humidity 85%-90%) is followed by heavy rainfall during July and August (av. rainfall 6.8mm) after which a short-lived autumn appears (av. temperature 26°C, relative humidity 86.5%). Then winter prevails for about 6-7 weeks (av. temperature 20°C, relative humidity 73%). The present observations indicate that though in summer the population of mites per gall was highest (av. number 125.9 per gall)
and in winter their number came down (average 37.8
dergall), yet the curve never touched the zero and the
galls were also found to be produced throughout the
year. The activity of mites was found to be 5 times less
in winter than that in summer. Jeppson et al., (1962)
reported extreme arid condition might cause reduc-
tion in mite population. The correlation of rainfall
with mite populations was positively significant in the
present study. Solhoy et al., (1991) in Norway also
indicated that rainfall had no profound effect on
eriophyid mite population; though in other groups of
mites as in tetranychids continuous and heavy rainfall
was found to have harmful effect (Das, 1959; Osaka,
1965). In the present study rainfall and high
relative humidity both were found to affect mite
population and activity positively and such effects are
significant as it is evident from Fig. 1 and Fig. 2.

Clopton & Gold (1993) studied the activity of
Eutrombicula alfreddugesi, a trombiculid mite in a
forest edge ecosystem and found that their activity
was highest during afternoon hours between 15.30
hrs and 17.30 hrs in temperate climate. So far, there
was no such report on the diurnal activity of erio-
phyid gall mites in tropical climate. Fig. 3 shows that
the highest peak of activity of mites was at 9.30 hrs
during April and May (number of mites moving out-
side the gall being 46) when the population of
mites/gall was also highest (Table 1).

During noon (12 to 13.30 hrs), the movement of
mites outside gall was least. For the first six months
number of mites moving outside the galls ranged
from 4-6, but during later months (i.e. July- Decem-
ber), the number of mites outside galls during noon
ranges from 1-3.

Though there was always a slight rise in the after-
noon activity throughout the year, the afternoon
peaks were most prominent during February and
April (Fig. 2 & 3). During February highest after-
noon peak was at 17.30 hrs while in April it was at
15.30 hrs with number of mites moving outside being
22 and 27 in these two months respectively. During
May when mite population was highest (nos. of
mites/gall 125.9 to 130.6), there was no prominent
afternoon peak, although a slight rise in the number of
moving mites was recorded (16 mites/ leaf at 15.30
hrs) which was much less than that in April. This may
be due to high temperature in afternoon hours for
clear sunny sky in tropical summer (minimum tempe-
rate recorded at 5.30 am in the open field is 35°C).

Observations from the present study suggest that in
places of tropical eastern India, the gall mite Acalitus
hibisci exhibits the highest activity outside galls
during April and May, when most of the days are
clear and sunny but average relative humidity (68.6%-
and 82.75% respectively) and temperature (28.13°C
and 29.98°C respectively) are high. The present data
indicate that there may be a possibility of an upper
and a lower threshold in temperature affecting activi-
ety of mites.

Acknowledgements

The authors thank Dr. (Mrs.) Sibani Chakrabarti,
Department of Botany, B.K.C. College,
Kolkata 700 108 for suggestions and going through
the manuscript, and the Head, Department of Zo-
ology, University of Kalyani for laboratory facilities.

References

Abo Awad B.A., 1981. — Ecological and biological
studies on the mango bud mite, Eriophyes mangiferae
(Sayed), with description of immature stages (Eriophyoi-
Al-Ghroory I. & El-Haideri H. 1989. — Some ecological
aspects of the pomegranate false spider mite, Tenuipalpus
punicae (Acari: Tenuipalpidae) in Iraq. — In: Channa-
Basavanna G.P. & Viraktamath C.A. (Eds.). Progress
New Delhi, Bombay, Calcutta, 2, 73-79.
Citrus rust mite story: A modeling approach to a fruit-
mite-pathogen system. Pest management in the subtro-
pics. Biological control—a Florida perspective. — Inter-
cept, Ltd., U. K., 619-639.
Clopton R.E. & Gold R.E. 1993. — Distribution and
seasonal and diurnal activity patterns of Eutrombicula
alfrededugesi (Acari: Trombiculidae) in a forest edge eco-


