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EFFECT OF TEMPERATURE ON THE GALL FORMATION AND ON THE SURVIVALITY OF ADULT *POUROPSYLLA TUBERCULATA* (HOMOPTERA : PSYLLIDAE), A GALLINACEOUS INSECT ON *ALSTONIA SCHOLARIS* (APOCYNACEAE)

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Temperature is the most important abiotic factor affecting development and reproduction of insects. *Pauropsylla tuberculata* forms pouch galls on the leaves of *Alstonia scholaris*. It is observed that increase in temperature has direct influence on population built up of *P. tuberculata* and gall formation. During field study, it was observed that maximum galls are formed in August to October, when temperature (19^{0}C to 32^{0}C) and relative humidity (55 to 93%) remain suitable for the growth and development of *P. tuberculata*. Minimum infestation occurs from March to June due to increase in temperature up to 40^{0}C and decrease in relative humidity (13 to 48%). Hence, increase in temperature up to 30^{0}C enhance population built up of *P. tuberculata* and further increase in temperature up to 40^{0}C decrease reproduction and survivality. These data were confirmed by laboratory experimental observations.

Key words : Temperature, gall formation, psyllid, *Pouropysylla tubercalata*, *Alstonia scholaris*.

INTRODUCTION

Alstonia scholaris, the host plant of the gall maker *Pauropsylla tuberculata* (Homoptera: Psyllidae) , belongs to family Apocynaceae. *A. scholaris* is a tree of great economic value to mankind. Its pharmacological values range from antimalarial to anticancer activities. It is a popular remedy in India for the treatment of various types of disorders in both the ayurvedic and folklore system of medicine (Nadkarni, 1976). *A. scholaris* is also a beautiful ornamental tree, planted in gardens for ornament and often cultivated as an avenue tree. Now a day, it is preferred as roadside plant in cities as it is highly affected to pollutants. However, gall caused by *Pauropsylla tuberculata* on the leaves of this highly prized tree adversely affect the looks and its economic value. Galls on the leaves of *A. scholaris* are scattered irregularly in large number on the leaf surface and sometimes covers the petiole, infloresence and stem as well. The shape of galls are semi globose, globose, conical and glabrous. The color of young galls are pale green and trun yellowish green on maturity.

P. tuberculata is a gallinaceous insect belongs to order Hemiptera, suborder Homoptera and family Psyllidae. Psyllid or 'jumping plant lice" are small phytophagous, phloem feeding and highly host specific sucking insects, induces galls on the leaves of higher vascular plants(Mani, 1964; Hodkinson, 1984; Burckhardt, 2005; Yang *et al.*, 2007). Gall forming insect may affect host plant photosynthetic rates in a more complex way than chewing insects (Fay *et al.*, 1993; Crawley, 1997; Larson, 1998; Fay & Throop, 2005); since, gall-makers do not remove photosynthetic tissue.The present study deals with the effect of temperature on the gall formation and survivality of *P. tuberculata,* which will help in devising a suitable control measure of this psyllid.

MATERIALS AND METHODS

Studies were made in field as well as in Entomology Research Laboratory, M.S. college, Saharanpur (U.P.). Different plants were randomly selected from the field area. Infested leaves plucked from the tree during different months of the year. Infestation percentage, number of galls, number of adults, temperature and humidity data were also recorded. For recording the effect of different temperature levels on survivality of adults in laboratory condition, two days old adults were kept in hurricane lamp glass chimneys, covered at top by fine muslin clothes placed in a petridish. Tender twig of *A. scholaris* having five to seven leaves were also placed in the chimneys as food for adults. The basal part of the twig was dipped in water in a vial. These chimneys were kept in temperature and humidity control cabinet at 70 ± 5% R.H. level. These were subjected to various temperature levels *viz.*, 0, 5, 10, 15, 20, 25, 35, 40^{0}C to note the survival of the adults. The data are recorded in Table II.

RESULTS AND DISCUSSION

It has been observed that number of gall on the leaves increases gradually with increase in temperature up to an optimum; above this, further increase in temperature cause a fall in the number of gall. The reason for this could be, as temperature increase above the optimum level, insect (*P. tuberculata*) would not be able to perform physiological functions such as reproduction, development and mortality. A controlled laboratory study also provide valuable information about the relationship between temperature, gall formation and survivality of adults of *P. tuberculata.*

Temperature is an important environmental variable that affects the rate of psyllid development, reproduction, mortality, survivality and subsequently its population. Increase in field temperature has direct effect on gall formation and population build up of *P. tuberculata.* It has been concluded from the data of field observations that maximum number of galls occurred during August to October at temperature ranging

Table 1 : Relationship between temperature and gall formation on the leaves of *A. scholaris* by *P. tuberculata* during the year 2010.

Months	Average temperature (^{0}C)	Average no. of galls per leaf
January	13.72	22
February	17.08	25
March	23.49	38
April	28.08	21
May	30.01	19
June	29.62	14
July	30.46	78
August	28.58	108
September	28.40	120
October	23.38	118
November	18.87	56
December	15.62	30

(Average has been taken of 50 observations)

Table II : Effect of different temperature levels on the survivality of *P. tuberculata* in laboratory.

Sex of adults	Longevity of adults at different temperature							
	0^0C	5^0C	10^0C	15^0C	25^0C	30^0C	35^0C	40^0C
Male	-	4hrs	4days	6days	9days	9days	8days	2hrs
Female	-	6hrs	6days	7days	10days	10days	9days	3hrs

from 19^0C to 32^0C and R.H. 55 to 93%. Minimum number of gall occurred from March to June at temperature ranging from 15^0C to 40^0C and R.H. 13 to 48%. Table I clearly depicts the relationship between gall formation and temperature.

From the experimental data it has been concluded that the survival period decrease with the increase in temperature. Both the sexes do not survive at 0^0C which is the lower lethal temperature level for the adults of *P. tuberculata.* At 5^0C, the male survived for 4hrs and female for 6hrs. Exposure to 10^0C and 15^0C resulted, 4 and 6 days survivality for male respectively, while female survived for 6 and 7 days respectively at the same temperature levels. Further increase in temperature, 25^0C to 30^0C, resulted in longevity periods of 9 days for male and 10 days for female. At 35^0C, male psyllid lived for 8 days and female for 9 days. At 40^0C, the shortest life span was recorded; the male survived only 2 hrs and 3 hrs for female. 40^0C temperature was upper lethal temperature, which affects the physiology and survival of adult *P. tuberculata.* 35^0C temperature is also not observed suitable for the survival of either sex for longer exposure. Table II shows the relationship between temperature and longevity of each sex. Longevity increases with the increase in temperature up to 30^0C and thereafter it decreases with increase in temperature up to 35^0C. Maximum survivality of both the sexes was recorded at 30^0C and minimum at 0^0C and 40^0C only in hours. Thus, experiment described above clearly evaluated that temperature has direct effect on the survivality of the adults *P.tuberculata.*

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