



POPULATION FLUCTUATIONS OF ROOT MEALY BUG, *Paraputo* sp. (HEMIPTERA: PSEUDOCOCCIDAE), – A DREADED PEST OF MULBERRY IN DARJEELING HILLS OF WEST BENGAL (INDIA)

Debojit Das*, H. Chatterjee¹, M.V. Santha Kumar, S.K. Mukhopadhyay, N.K. Das, A.K. Saha, B. B. Bindroo² and S. Nirmal Kumar

Central Sericultural Research and Training Institute, Berhampore, West Bengal - 742 101 (India)

¹Palli Siksha Bhavana, Viswa Bharati University, Santiniketan, West Bengal (India)

²Central Sericultural Research and Training Institute, Mysore, Karnataka - 570 008 (India)

*e-mail: debu42_das@rediffmail.com

(Received 1 July, 2013; accepted 5 December, 2013)

ABSTRACT

Root mealy bug *Paraputo* sp. (Hemiptera: Pseudococcidae) is the most dreaded pest of mulberry (*Morus* sp.), in Darjeeling hills of West Bengal (India). The pest incidence recorded at monthly intervals for three consecutive years revealed that the pest population was low in December-January, increased with rise in temperature and relative humidity upto rainy season (July-August) and then gradually declined. The peak population of 50.88-52.05 plant⁻¹ was in August. No significant variation was observed between the years in population fluctuations.

Key words: Darjeeling hills, mulberry, pest, population fluctuations, root mealy bug, silkworm

INTRODUCTION

Mulberry silk is produced by silkworm *Bombyx mori* L. which is monophagous on mulberry plant (*Morus* sp.). Of the two types of mulberry silkworm reared allover world, bivoltine silkworm cocoons are preferred over multivoltine on the basis of economic consideration, greater acceptability and higher market price. Rearing of bivoltine silkworms requires a specific climate, and in eastern India only Darjeeling hill climate favours mulberry rearing. Darjeeling is recognized as seed zone of high yielding (bivoltine) silkworm breeds which are utilized in the plains of West Bengal for producing hybrids.

Kalimpong in Darjeeling hills of West Bengal lies at an altitude of 910 m masl and in ancient period was a part of the 'silk road' leading to China. The area is endowed with temperate climate (temperature 6-32°C) and good annual precipitation (1600-2300 mm). Mulberry cultivation and rearing of bivoltine silkworm (*B. mori*) is done from April to September. However, infestation of root mealy bug {*Paraputo* sp.} has become a serious impediment in mulberry cultivation, thereby affecting cocoon production. The root mealy bug is viviparous and gives direct birth to nymphs on the proximal portion of main root. The young nymphs and adults suck the sap from root portion and bring down the vitality of plant. The site of feeding becomes the source of fungal infestation. This compound effect leads to the mortality of young plants in nurseries. In established gardens, the leaf yield is affected. The pest harbours in root zone adjoining the stump upto 20 cm depth, sucks sap and secretes honey dew that attracts fungal infection. Normal plant growth ceases, leaves become yellow and plant wilts (Mukhopadhyay *et al.*, 2010). Infestation is more on younger plants (3-10 years). Several alternative host plants of this pest have been recorded (Das *et al.*, 2004). Moreover, severe infestation by this pest leads to the death of cuttings and saplings *en masse* (Cox, 1978), greatly affects plant survival and

significantly reduces leaf yield of mature and aged plants (≥ 15 years). This has raised this insect to the status of major pest of mulberry in Darjeeling hills (West Bengal).

Mealy bugs are known as pests 'hard to kill' due to their polyphagous nature and this has forced the farmers to shift to other cash crops (Basu and Banerjee, 1965). Mealy bugs sometimes carry infectious diseases which in many instances have wiped out plantations of various crops (Hara *et al.*, 2001). Hence, ignoring this pest at this stage may lead to some unforeseen and paradoxical consequences in future. For any pest, prior to formulation of management strategies, its seasonal incidence and correlation with abiotic factors need to be established. Accordingly, the present study was taken up with the aim to assess yearly population fluctuations of root mealy bug, a dreaded pest of mulberry in Darjeeling hills of West Bengal (India).

MATERIALS AND METHODS

Population build up of the pest was studied at a fixed site in the farm of Regional Sericultural Research Station, Kalimpong, Darjeeling (West Bengal) on 10 year old plantations of mulberry cv. BC₂59, recommended for hill region with standard package of practices, except plant protection measures. The data was collected from 15 randomly selected plants in an area of 200 m² at 15 days interval for three years (2004-2007). The population count was taken by gently removing the soil around the root zone of each plant, upto a depth of 20 cm. Each time population was recorded from separate plants as the removal of soil from the basal region of same plant was observed to adversely affect plant health and colony of the pest negatively, leading to abnormal and erratic population variation of the pest (Barrión and Litsinger, 1978). The collected data was subjected to statistical analysis by determining the level of significance of pest infestation.

RESULTS AND DISCUSSION

The pest population was low during December-January. The population increased with increase in temperature and humidity. The pest population increased upto rainy season (July-August) and thereafter gradually declined (Table 1). The pest was at very low ebb during the month of January when temperature was 9-17°C and relative humidity (RH) 69-78%. In this month root mealy bug population varied from 0.49 to 0.95 plant⁻¹ with a mean population of 0.77. Peak population of 50.88-52.05 plant⁻¹ was observed in August (Fig. 1) when temperature was 19-27°C and RH 84-94%. However, from September onwards, with the fall in temperature, relative humidity (temp.: 17-26°C and

Table 1: Mean monthly incidence of root mealy bug (No. plant⁻¹) during different years

Month	2004-2005	2005-2006	2006-2007	Mean
Jan.	0.928	0.497	0.956	0.778
Feb.	0.719	1.531	0.929	1.033
Mar.	3.179	3.097	4.098	3.444
Apr.	5.672	7.102	6.760	6.497
May	11.445	12.533	12.529	12.163
June	16.295	17.363	15.933	16.525
July	29.183	28.059	29.051	28.762
August	52.054	51.820	50.888	51.586
September	38.253	33.377	38.068	36.530
October	13.169	14.385	13.818	13.786
November	2.515	2.162	2.610	2.425
December	0.972	0.200	1.094	0.683
Mean	10.239	10.058	10.655	
CD _{0.05} :	Month (M) = 0.175; Year (Y) = ns; M x Y = 0.303			

RH 80-88%) and soil moisture, the pest population declined. During December when temperature was 11-20°C and RH 70-76% the pest population varied between 0.20 and 1.09 with mean population of 0.79 plant⁻¹. No significant variation was observed between the years in the population fluctuations. This indicated regular occurrence in severe form every year. However, pest population was significantly affected by the climatological conditions of months and years. This is in conformity with the findings of Sittigul *et al.* (2000) who reported that root mealy bug population in *Longan* sp. is influenced by the atmospheric temperature and soil moisture as well as by the ant population which act as carriers. A sizeable pest population was observed between June and October when new plantation programmes are taken up by the stakeholders and autumn crop rearing commences, the produce of which has strategic importance as they would be utilized as bivoltine parents for producing multivoltine x bivoltine hybrids in the plains of West Bengal during November. Hence, plant protection measures have to be adopted for the effective management of this polyphagous pest (Baker, 1978).

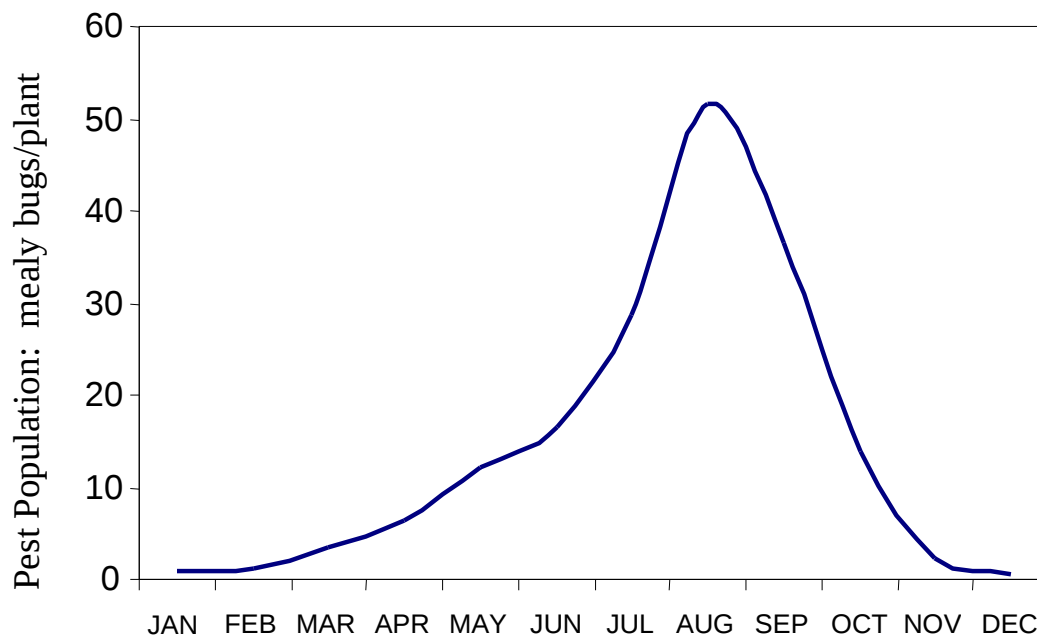


Fig. 1: Month-wise population fluctuations of the root mealy bug

A female root mealy bug was observed to lay 29-36 nymphs. Time taken to complete life cycle by a male root mealy bug was 18-27 days while for a female it was 21-56 days, the period being inversely proportional with temperature, but directly correlated with relative humidity.

The use of synthetic pesticides in sericulture is banned in Darjeeling. A botanical product (5% neem oil) (Azadirachtin @ 1500 ppm), with a safe period of 15 days and economically viable as one time application, was found effective in controlling this dreaded pest of mulberry in the region, with a suppression level of 72-80%. The low population of 5-10 mealy bug (nymphs and adults) plant⁻¹ is sufficient to cause severe mortality in the nurseries. Hence, in the nurseries the population has to be regularly monitored from the 1st week of March. If the population reaches to 5-10 mealy bugs plant⁻¹, the application of neem oil has to be initiated as precautionary measure. However, in established mulberry gardens whenever the population (nymphs and adults) reaches 10-15 plant⁻¹, application of neem oil is essentially required (Biswas *et al.*, 2002). The stakeholders and extension functionaries should always plan botanical application at least 15 days prior to silkworm brushing schedule in order to avoid residual hazards that lead to mortality of tender worms.

Acknowledgement: Authors are thankful to Shri P.W. Sherpa for providing technical assistance during the study period.

REFERENCES

- Baker, J.R. (ed.) 1978. *Insects and Related Pests of Flowers and Foliage Plants*. North Carolina Agricultural Extension Service, AG-136, Raleigh, USA.
- Barrion, A.T. and Litsinger, J.A. 1978. *Brevennia rehi* (Lindinger) is the valid name for rice mealy bug. *International Rice Research Newsletter*, 3(5): 15.
- Basu, A.C. and Banerjee, S.N. 1965. The control of *Ripersia oryzae* Green, a mealybug of paddy plant in West Bengal. *Journal of Economic Entomology*, 58:621-623.
- Biswas, S., Das, D., Chattopadhyay, S., Das, S.K. and Mondal, K. 2002. Root mealy bug (*Paraputo* sp.) of mulberry in Darjeeling hills – its severity, biology and control. *Sericologia*, 42: 39-48.
- Cox, J.M. 1978. Revision of the *Rhizoecus* species (Homoptera: Pseudococcidae) known from New Zealand. *New Zealand Journal of Zoology*, 5: 623-638.
- Das, D., Biswas, S., Sarkar, S., Das, S.K. and Chakrabarti, S. 2004. Population dynamics of the root mealy bug (*Paraputo* sp.) of mulberry in the hills of Darjeeling. *Sericologia*, 44: 95-100.
- Mukhopadhyay, S.K., Das, D., Santha Kumar, M.V., Das, N.K., Mondal, K. and Bajpai, A.K. 2010. Weather-based forewarning of root mealy bug, *Paraputo* sp. (Pseudococcidae: Hemiptera), in mulberry of Kalimpong hills. *The Journal of Plant Protection Sciences*, 2: 85-87.
- Sittigul, C., Visitpanich, J., Chanbang, Y. and Zang, M. 2000. Preliminary observation on the association of ant species, ground mealy bugs and bolete mushrooms with sudden death of Longan. *A NeT Newsletter*, B: 21-24.