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Bioecology of the mango inflorescence caterpillar, *Perixera illepidaria* Guenée and record of its feeding on mango fruits

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ABSTRACT: Studies were conducted to understand the effect of weather parameters on the semilooper caterpillar, *Perixera illepidaria* Guenee (Lepidoptera: Geometridae), at ICAR Indian Institute of Horticultural Research, Bengaluru using three varieties of mango *viz*., Alphonso, *Totapuri* and *Banganapalli* from June 2015 to July 2016. *Perixera illepidaria* completed 3-4 generations from pre bloom to early fruit set. The adult moth laid eggs on mango flowers. The larval and pupal periods took 8-9 days and 5-7 days respectively, pupation normally takes place on flowers. The population of the insect was positively correlated with number of inflorescence buds (r= 0.39), the models $y = 0.24x + 1.27$ linear and $y = 0.01x^2 - 0.09x + 1.80$ quadratic showed 55 – 64 % of variation in insect population and negatively correlated with minimum temperature (r= -0.39) and model $y = -1.26x + 27.16$ linear, explained about 43% in Alphonso. In case of *Totapuri*, population of insect was negatively correlated with wind speed (r= -0.46) the model $y = -2.75x + 13.48$ linear and $y = 0.92x^2 - 10.00x + 27.02$ quadratic showed 59-63 % of variation in insect population and in *Banganapalli*, it was positively correlated with inflorescence bud (r= 0.62) and the two models $y = 0.18x + 1.81$ linear, $y = -0.01x^2 + 0.48x + 0.88$, quadratic showed 52-68% of variation in insect population.. Due to the probable availability of synchronous flower and favourable weather in 2021, *P. illepidaria* shifted from inflorescence to fruits and caused huge damage in different regions of south India. Hence it is necessary to take immediate field trials to find out an effective management**.**

Keywords: Bioecology, semilooper, *Perixera illepidaria,* mango, inflorescence*,* fruit damage

INTRODUCTION

Mango is the most important fruit crop of India. It has an area of 2.2 million hectares with the production of 19,687 million metric tons and average productivity stands at 8.7 million tons per hectare (Anonymous, 2020). The country has potential to increase the mango productivity, However insects pest are one among the several obstructers for its growth. Studies of various lepidopterans on mango ecosystem were done by various workers such as on mango inflorescence caterpillars (Verghese and Kamala Jayanthi, 1999; Kannan *et al.,* 2002; Kamala Jayanthi, *et al.*, 2018), *Orthaga exvinacea* (Lakshmi *et al.,* 2011; Kavita *et al.,* 2005; Rafeequ and Ranjini, 2011), *Dudua aprobola* (Soumya *et al.,* 2017) *Citripestis eutraphera* (Kamala Jayanti *et al.,* 2014; Soumya *et al.,* 2016), *Chlumetia transversa* (Verghese and Sudha Devi, 1998; Soumya *et al.,* 2017) and *Acrocercops syngramma* (Soumya *et al.,* 2017). Semilooper caterpillar, *Perixera illepidaria* Guenée (Lepidoptera: Geometridae) new to the mango ecosystem, was recorded and its biology was studied (Soumya *et al.,* 2019). It was first reported on litchi crop in Bihar in 2013 (Kumar *et al.,* 2014). *Perixera illepidaria* an emerging pest on mango, mainly infests mango inflorescence but was recently reported also damaging fruit (Anonymous, 2021). The present study was undertaken to know the relationship between biotic (mango phenology) and abiotic factors on the mango inflorescence caterpillar *P. illepidaria*. Further developing models may predict the population of the pest and management strategies can be taken well before its spread.

MATERIALS AND METHODS

The infestation of *P. illepidaria* was observed in the mango orchard of the Indian Institute of Horticultural Research (IIHR), Hessaraghatta, Bengaluru, India, from July 2015 to June 2016 on the mango varieties *viz.,* Alphonso, *Totapuri* and *Banganapalli*. The orchards were sampled once a week for *P. illepidaria*. Ten randomly selected mango trees in each variety. Infestation by the Lepiodpteran on each tree was observed by recording the number of infested inflorescence in each direction (north, east, south and west). Further studies on biology were conducted at ICAR-Indian Institute of Horticultural Research, Bengaluru and ICAR-National Bureau of Agricultural Insect Resources, Bengaluru. The caterpillars were reared and adults were identified by Dr. P. R. Shashank, ICAR-Indian Agricultural Research Institute, New Delhi. Identification of the lepidopteran was also confirmed through molecular means and sequence was submitted to Barcode of Life Database (BOLD) with its accession number (KU695907) (Soumya, 2019).

The mean data of *P. illepidaria* were subjected to correlation analysis with abiotic factors (maximum and minimum temperature, morning and evening relative humidity, wind speed and rainfall) and crop phenology (inflorescence). The means of the weather parameter except rainfall prior to the observation were calculated whereas cumulative rainfall, prior to the week was calculated (Kamala Jayanthi *et al.,* 2014). The correlation coefficient 'r' were tested for significance at p=0.05 to associate relationship between the factors. The factors showing significant relation at p=0.05 were further subjected to linear and non linear models using scatter plot and trend line analysis and were then subjected to multiple regression.

RESULTS AND DISCUSSION

Bioecological studies revealed that adult moth (Fig. 1a) lays eggs on flowers of mango. The larval (Fig. 1c) and pupal (Fig. 1d) periods took 8-9 days and 5-7 days respectively. Pupation normally takes place on flowers and it was noticed that between the flowering seasons of pre bloom to early fruit set there will be at least 3 to 4 generations. The larva has a characteristic loop while moving (Fig. 1b).

It was found that the population of the insect was positively correlated (r= 0.39) with inflorescence buds (Fig. 2) while minimum temperature was negatively correlated (r= -0.39) (Table 1, Fig. 3) in case of Alphonso. Whenever the synchronous flowering occured it favored the multiplication of the pest and the model $y = 0.24x + 1.27$ linear and $y = 0.01x^2 - 0.09x + 1.80$ quadratic model (Fig. 2 & 3) showed 55 – 64 % of insect population explained by percentage of new inflorescence buds and model $y = -1.26x + 27.16$ linear explained about 43% by minimum temperature. In case of *Totapuri*, population of the insect was negatively correlated with wind speed (r= -0.46) (Table 1) and the model $y = -2.75x + 13.48$ linear and $y = 0.92x^2 - 10.00x + 27.02$ quadratic (Fig. 4) showed 59-63 % of variation in insect population. In *Banganapalli*, number of *P. illepidaria* had no significant relationship with abiotic factors and significant positive correlation with crop phenology stages namely inflorescence bud (r = 0.62) (Table 1) and the two models $y = 0.18x + 1.81$ linear, $y = -0.01x^2 + 0.48x + 0.88$, quadratic (Fig. 5) showed 52-68% of variation in insect population.

Climate change and insect lifecycles are crucial in the context of economically important insects on crops (Karuppaiah and *Sujayanand*, 2012; Sable and Rana, 2016). The lepidopterans occurring on mango are no exceptions and are bound to be influenced by weather parameters. These also affect the phenology of the plants

Table 1. Correlation coefficient (r) of *P. illepidaria* with abiotic factors and crop phenology in mango, (cv. Alphonso)

Parameter	Correlation coefficient (r) of *P. illepidaria*		
	Alphonso	***Totapuri***	***Banganapalli***
Inflorescence bud (%)	**0.39***	0.16	**0.62***
Bloom (%)	0.15	0.35	0.22
Full bloom (%)	-0.09	-0.12	-0.28
Maximum temperature (^{0}C)	-0.21	-0.16	-0.31
Minimum temperature (^{0}C)	**-0.39***	-0.01	-0.08
Morning relative humidity (%)	0.15	0.13	0.25
Evening relative humidity (%)	-0.29	-0.03	-0.07
Wind speed (km/hr)	-0.03	**-0.46***	-0.27
Rainfall (mm)	0.14	-0.13	0.07

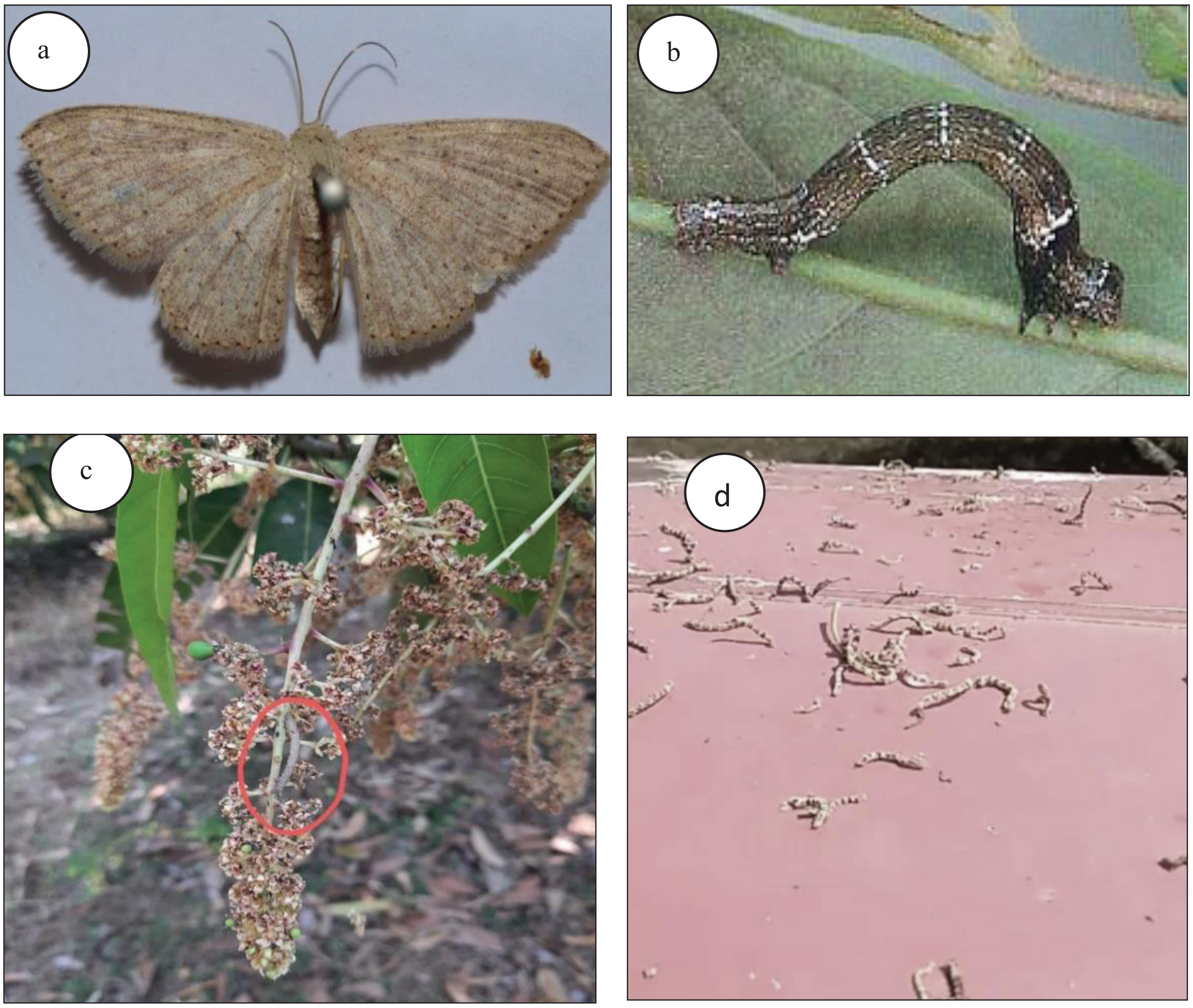

Fig 1. a, Adult of *P. illepidaria* ; b, Larva of *P. illepidaria;* c, Larva on the inflorescence d, Dead loopers collected on a rug, post chemical spray; (Photos c – d sent by farmers)

and in turn have bearing on insect dynamics (Soumya, 2019). Unlimited availability of synchronous flower buds was the reason for flared multiplication of insects. Using inflorescence bud as a predictor is a good idea in management and give room and time for management intervention. Usually mango flowers asynchronously and staggered (Kishore, *et. al.,* 2015) over a period of 3 – 4 weeks giving less scope for peaks in insect numbers. The mango phenology especially vegetative flushing, cycles of flowering, and also fruiting are triggered by changes in weather parameters (Delgado *et al.,* 2011). Thus changes in abiotic factors also influences the incidences of insects. Lepidopterans are known to be highly sensitive to weather changes especially temperature (Kocsis and Hufnagel, 2011).

During the flowering season farmers normally give a spray of imidacloprid to control hoppers. This apparently does not affect *P. illepidaria*. Other co-occurring minor caterpillars like *Dudua aprobola* Meyrick, *Euproctis fraterna* (Moore), *Nanaguna* sp., and *Chlumetia transversa* Walker (Verghese and Kamala Jayanthi, 1999; Kamala Jayanthi, *et al.*, 2018) etc., were found to be negatively associated with *P. illepidaria* in a chi-square analysis (Soumya, 2019). They are all still found to be minor pests only.

Recently in 2021 it was observed that caterpillar shifted from inflorescence to fruits (late flowering) in different regions like Ramanagara, Chikkaballapur, Kolar (Karnataka), Gudiyattum, Latteri, Vellore, North Arcot, Krishnagiri, Dharmapuri, and Salam (Tamil Nadu), and Chittoor (Andhra Pradesh) (Personal communication Dr. M Mohan, 2021). As a result of favourable climate and abundant resource (flower buds), the second and third generation of insects probably multiplied greatly and

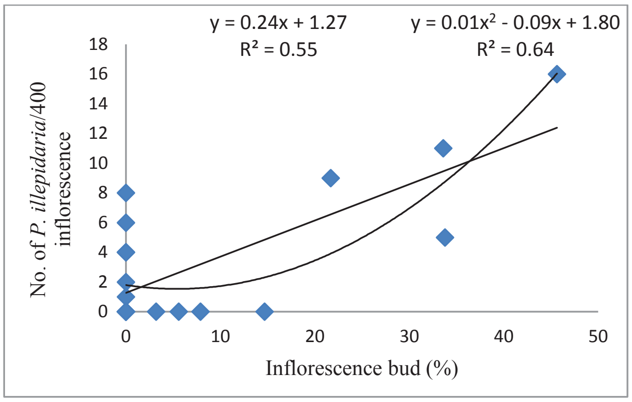

Fig. 2. Relationship of *P. illepidaria* with percent inflorescence bud in Alphonso

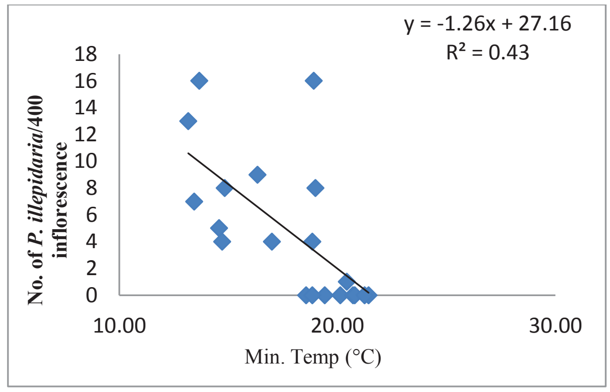

Fig. 3. Relationship of *P. illepidaria* with minimum temperature in Alphonso

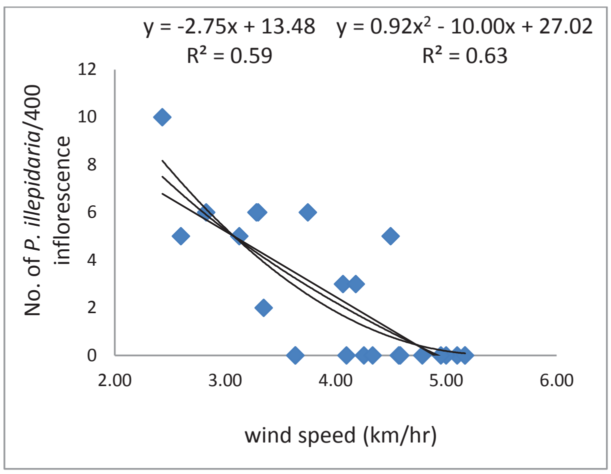

Fig. 4. Relationship of *P. illepidaria* with wind speed in *Totapuri*

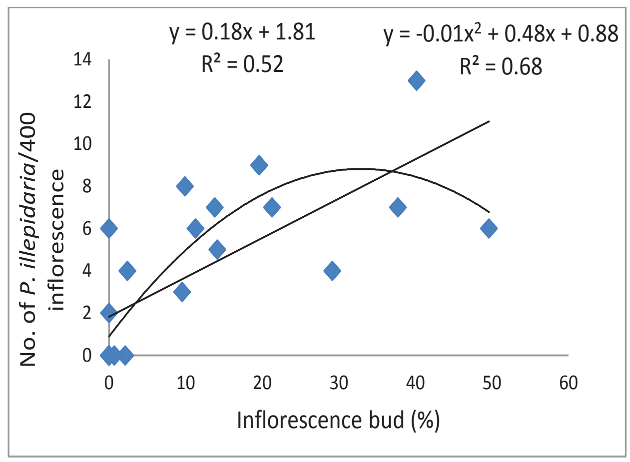

Fig. 5. Relationship of *P. illepidaria* with percent inflorescence bud in *Banganapalli*

started feeding on panicles which had already fruit set. Apart from the presence of looping caterpillars, the dried flowers and dropping of fruits were the main symptoms.

To alert the farmers, on the outbreak of the population and its severity was blogged. As a consequence of the attack of *P. illepidaria* farmers may lose 70-80% of the fruit crop. This will affect both internal market and export. It is suggested that immediate field trials be taken to find out the most effective management strategy. Growers and officials are advised to be vigilant to avert major loss to mango growers as the pest has propensity to spread to other areas of India and beyond.

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