

Incidence of Leaf Eating Beetle *Podontia quatuordecimpunctata* L. on Greater Hog plum (*Spondias dulcis* Forst.) in Gangetic Plains of West Bengal

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ABSTRACT: Greater hog plum (*Spondias dulcis*) or 'biliti amra', a minor fruit crop belongs to plant family Anacardiaceae. Besides, weather based population monitoring is necessary to forewarn the probable population build up of a specific pest for a region. Keeping the views in mind an experiment was conducted to study the pattern of incidence of one of its major pest, the chrysomelid leaf beetle (*Podontia quatuordecimpunctata* L.) in an unsprayed orchard located in the Gangetic plains of West Bengal during summer and kharif seasons. The experiment reveals that the leaf damage is done by both the adult and grub stages of the beetle. The beetle was noticed to occur on the crop from April to August along with two peak periods of infestation (1st week of June and 2nd week of July). The study reveals non-significant correlation between the pest population and the meteorological parameters taken into consideration.

Keywords: Incidence, *Podontia quatuordecimpunctata*, *Spondias dulcis*, Weather parameters.

INTRODUCTION

Though West Bengal is very rich in fruit diversity, few of them have given importance for cultivation and production and they are considered as major fruit crops. Variety of minor fruits having very high nutritive and medicinal value is also grown in this region. Hog plum is one of the important underutilized minor fruit of West Bengal with low appreciation. The fruit crop belongs to the genus *Spondias* and comes under the family Anacardiaceae. Though the primary place of its origin is Indo-Malaysian region from where it was spread in new and old world tropical areas (Morton, 1987), earlier report suggested that the crop was cultivated in sub-Himalayan regions, Maharashtra, Andhra Pradesh and the western peninsula comprising the forests which are deciduous to semi-evergreen in nature (Tandon and Rastogi 1976). Other important cultivating regions of this crop are Andaman and Nicobar Islands (Mukhopadhyay *et al.*, 2002), Kerala (Sreedharan, 2004), West Bengal (Hasan and Das 2005). There are two cultivated species of hog plum present across the India viz. *Spondias pinnata* (Syn. *Spondias mangifera*) which is commonly known as Indian hog plum or locally 'amra' whereas the other species *Spondias dulcis* is particularly localized as greater hog plum or 'biliti amra' (Das *et al.*, 2019). Fruits of greater hog plum are comparatively larger, oval to round shape and sweeter than Indian hog plum for which its demand is more in West Bengal than Indian hog plum. Unripe green fruits and sometimes leaves are used as vegetables and ripe fruits are consumed as fruits. The green fruits are commonly used to prepare pickle, chutney, morabba etc. (Ahmad,

1969). One hundred gram of edible fruit can provide 157.30 Kcal energy, 12.40 % carbohydrate, 0.50-0.80 % protein, 8.05-10.54 % sugar and 0.28-1.79 % fat. It also contains minerals like calcium (56 mg), phosphorus (67 mg), iron (0.9 mg) and vitamins like Thiamine (0.05 mg), Riboflavin (0.2 mg), Vitamin A (205 IU) and Ascorbic acid (42 mg). The fruit crop also has important medicinal value as it provides relief from bacillary dysentery, tuberculosis, scurvy, rickets and other complex illnesses. It is also known for reducing serum cholesterol, high blood pressure and provides protection against tumor formation (Bhuiyan, 2012). Besides the lack of appreciation there are several reasons for low production and productivity of hog plum fruits; one of them is various pests like birds, monkeys and insect pests. Amongst the insect pests, the major one is chrysomelid foliage feeder *Podontia quatuordecimpunctata* (Linnaeus, 1767) which comes under order Coleoptera, family Chrysomelidae and sub-family Alticinae. Adults and grubs both are the main damaging stages and voraciously feed on hog plum foliage (Beeson, 1941; Ahmad, 1969; Mondal, 1975; Sarder and Mondal 1983). During the peak infestation time its damage results in complete foliage loss as well as growth retardation and reduced quality and quantity of fruit (Mondal, 1975). Under heavy infestation the grubs also feed the older leaves, tender plant parts and green barks (Howlader, 1993). Previous studies reported that the pest can cause 50% to 96% defoliation which may result in total fall of trees (Uddin and Khan 2015; Asaduzzaman *et al.*, 2018; Akata *et al.*, 2021). Therefore, to know about its population dynamics is very much crucial for integrated management. Wide use of synthetic insecticides for controlling the insect pests

at present has resulted in development of resistance and resurgence of the pest against insecticides, the minor pest becomes major ones and the natural enemy population in the ecosystem reduces (Thomas and Waage 1996). Further, rainfall among the weather variables is more associated with plant growth and production. It affects the intensity and quality of other weather variables. Heavy rainfall favors plant pests and disease attack (Sharma *et al.*, 2021). Time has come to make interest in various cultural practices for reducing the pest population below the economic threshold level. Hence, the present experiment was formulated to study the seasonal fluctuations of this foliage feeder and to know about the effect of various weather parameters on its incidence.

MATERIALS AND METHODS

The present investigation was carried out in a greater hog plum orchard located at Manikpara, Krishnanagar (23.41° N, 88.4767° E), Nadia under Gangetic plains of West Bengal during both summer and *kharif* seasons of 2022. For studying the pest incidence five trees were selected randomly. After that the pest population (total number of grubs and adults) was recorded from the compound leaves located at central point of the east sided canopy occupying 1 m² area using the quadrat method (Khan, 2016). First observation was taken at 16th Standard Meteorological Week (2nd week of April) from its first appearance and it was continued up to the month of August till the disappearance of the beetles. During the study period no insecticidal spray was applied in the orchard. After recording the total pest population across the season, the mean population was worked out and used for statistical analysis. Weekly data regarding prevailing weather conditions like maximum temperature, minimum temperature, morning RH, evening RH and rainfall recorded at the meteorological observatory located in Krishnanagar (Anon., 2008) were retrieved (Anon., 2022). Afterwards, the weather data was correlated with the pest population using Microsoft Excel 2010. For different weather parameters *viz.* maximum temperature (T_{max}), minimum temperature (T_{min}), morning relative humidity (RH_{mor}) and evening relative humidity (RH_{eve}), mean values of previous seven days were used except rainfall where the sum of previous seven days was used.

RESULTS AND DISCUSSION

The beetles (chrysomelid foliage feeder, *Podontia quatuordecimpunctata* L.) were considerably stout with large pronotum and elytra was yellowish orange in colour. Lower portion of the body, head and other appendages like legs, antennae were more yellowish in color. The beetles were observed with characteristic 14 irregular black spots on the elytra (Plate 1), hence also named as *Podontia 14-decimpunctata* (Pramanik and Basu 1973). Beetles were sluggish in nature and didn't take flight instantly upon disturbance and represented themselves being dead. Grubs were yellow in color with black head capsule and black tubercles were distributed on dorsal side of the body (Plate 2) and

having three pairs of black thoracic leg. Threads of faces with some liquid substance were distributed all over the body which made them appearing like bird excreta which helps them hiding from predators (Plate 3). The beetles were also observed laying elongated eggs in batches on the leaf rachis, tender twigs which were yellowish in colour during the time of egg laying (Plate 4), while the eggs became whitish in colour after some time (Plate 5). Young first instar larvae were observed feeding on small, very tender, and just emerged out leaves and auxillary buds (Plate 6). *Podontia* itself is a broad genus comprises approximately 14 Asian species inhabiting the regions spreading from Indonesia to Indo-China; among which one species was also found from Northern Australia (Baly, 1865; Heikertinger and Csiki, 1940). The concerned species was found to be distributed among the South East Asian countries like Peninsular Malaysia, India, Nepal, Myanmar, Thailand, Laos, Cambodia (Romantsov and Medvedev 2015). Maulik (1926) first reported this beetle from India after that Pramanik and Basu (1973) described its incidence with detailed life history. This pest was reported by several scientists from greater hog plum *Spondias dulcis* (Corbett and Yusope 1921; Maulik, 1926; Bose, 1953; Scherer, 1973; Pramanik and Basu 1973; Mohamedsaid, 1989; Singh and Misra 1989; Baksha, 1997; Medvedev, 1999) from India as well as outside of India. The beetle is also called 'kadondong beetle' or alternatively 'kedongdong beetle' (Corbett and Yusope 1921). Occurrence of this beetle was previously reported from Bangladesh from the wild form of hog plum *Spondias mangiferae* (Husain and Ahmad 1977; Howlader, 1993). Grubs covering themselves with faecal matter just to mimic bird dropping were formerly reported by several workers (Barlow, 1900; Stebbing, 1914; Baksha, 1997; Deka and Kalita 2002). The observed characteristic features of egg are supported by the findings of Singh and Misra (1989) while the larval characteristics are in agreement with the report published by Deka and Kalita (2002).

The beetles were first observed in the month of April (2nd week) *i.e.* when the trees were full of green foliage with lower intensity (Plate 7). The pest incidence was coincided with the new flashes of leaves just after commencement of summer season. With the emergence of new leaves the pest population increased and reached its highest occurrence (2-3 adults + 4-5 grubs per compound leaves enumerated as pest population of 4.2 m²) during first week of June *i.e.* 23rd Standard Meteorological Week (SMW) (Table 1, Fig. 1). It inflicted heavy damage keeping the rachis intact and all the leaflets were devoured leaving only the midrib (Plate 8). It was observed that the pest population declined with the loss of foliage but afterwards when the plant again produced new flashes of leaves, incidence of the pest occurred on the tree and reached its second peak (5.6 no. m²) during the second week of July *i.e.* 28th SMW. The pest continued to feeding on hog plum leaves till the fourth week of August. All the instars of grub and adult beetle were observed feeding on the leaves. The larval instars were found to be covered with their own faecal matter. Feeding injury of

the beetles made the hog plum trees almost devoid of foliage that resulted in reduced photosynthesis by the trees and as a consequence plant growth was observed to be hampered (Plate 9). Correlation studies revealed that none of the weather parameters taken into consideration had significant effect on the pest population (Fig. 2). However, both maximum and minimum temperature showed positive correlation with the pest population whereas pest population was negatively correlated with morning and evening RH and rainfall. Some workers reported the peak period of the incidence of this particular pest is August and September though they occurred on hog plum from June to September with high amplitude of incidence during July and disappeared during October when foliage become yellow and started dropping (Beeson,

1941; Baksha, 1997) that partially supported the present finding. Some study also revealed that these beetles inflict heavy damage to the fruit trees from March to August and completed two generations in this period (Mondal, 1975) which is in agreement with the present. The present outcome also lends support from earlier findings of Beeson (1941); Ahmed (1969); Mondal (1975); Sarder and Mondal (1983) who also reported that both the adult beetle and larvae feed on the foliage of the concerned fruit crop. Our results are partially supported by the findings of Rahaman *et al.* (2022) who reported that temperature has significant positive effect and humidity has non-significant positive effect on pest population while rainfall showed non-significant negative correlation with the adult and grub population of the beetle.

Table 1: Incidence of *Podontia quatuordecimpunctata* on hogplum along with prevailing weather conditions.

Standard Meteorological Week (SMW)	Month & Week	Mean pest (both adult and grub) population m ⁻²	T _{max} (°C)	T _{min} (°C)	RH _{mor} (%)	RH _{eve} (%)	Rainfall (mm)
16	April (II)	1.5	37.00	28.00	87.00	63.00	0.00
17	April (III)	2.75	36.57	27.42	87.14	67.00	9.40
18	April (IV)	1.4	39.00	28.14	88.57	57.28	0.00
19	May (I)	2.4	33.60	23.00	85.67	67.17	41.40
20	May (II)	2.8	34.29	26.14	88.57	69.29	13.30
21	May (III)	3.2	35.29	26.43	88.00	72.00	30.40
22	May (IV)	3.4	35.43	25.14	86.43	62.43	34.30
23	June (I)	4.2	38.13	27.75	87.00	65.25	5.70
24	June (II)	4	39.71	28.43	87.00	68.29	0.10
25	June (III)	1.8	40.71	28.86	89.57	74.29	9.60
26	June (IV)	0.8	34.57	26.29	91.14	80.14	7.40
27	July (I)	0.2	34.71	27.14	94.14	82.14	6.50
28	July (II)	5.6	36.00	27.28	94.42	77.17	0.10
29	July (III)	4.8	36.86	27.00	94.71	84.57	0.70
30	July (IV)	3.6	36.00	27.57	93.86	79.43	1.50
31	August (I)	2.65	34.43	26.57	94.29	82.29	5.20
32	August (II)	2.8	35.00	26.75	94.25	81.38	25.90
33	August (III)	2	32.43	26.14	96.57	86.43	14.30
34	August (IV)	0.4	33.86	26.71	92.57	79.57	14.20

N.B.: T_{max} = maximum temperature; T_{min} = minimum temperature; RH_{mor} = morning relative humidity; RH_{eve} = evening relative humidity

Table 2: Correlation coefficient (r) between mean population of *Podontia quatuordecimpunctata* and weather parameters.

	Mean pest population	T _{max} (°C)	T _{min} (°C)	RH _{mor} (%)	RH _{eve} (%)	Rainfall
Mean pest population	1					
T _{max} (°C)	0.239*	1				
T _{min} (°C)	0.048	0.745	1			
RH _{mor} (%)	-0.012	-0.391	0.099	1		
RH _{eve} (%)	-0.049	-0.469	-0.054	0.894	1	
Rainfall	-0.083	-0.463	-0.790	-0.306	-0.119	1

*Significance at 5% probability; N.B.: T_{max} = maximum temperature; T_{min} = minimum temperature; RH_{mor} = morning relative humidity; RH_{eve} = evening relative humidity

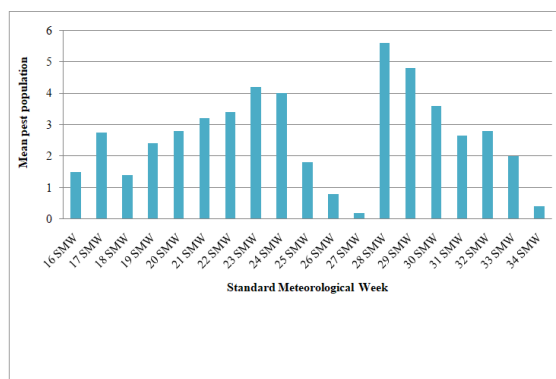


Fig. 1. Population fluctuation of *Podontia quatuordecimpunctata* on hog plum.

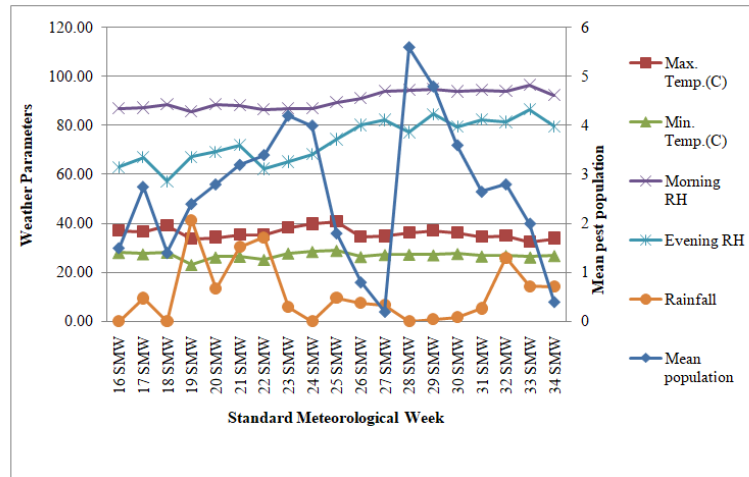
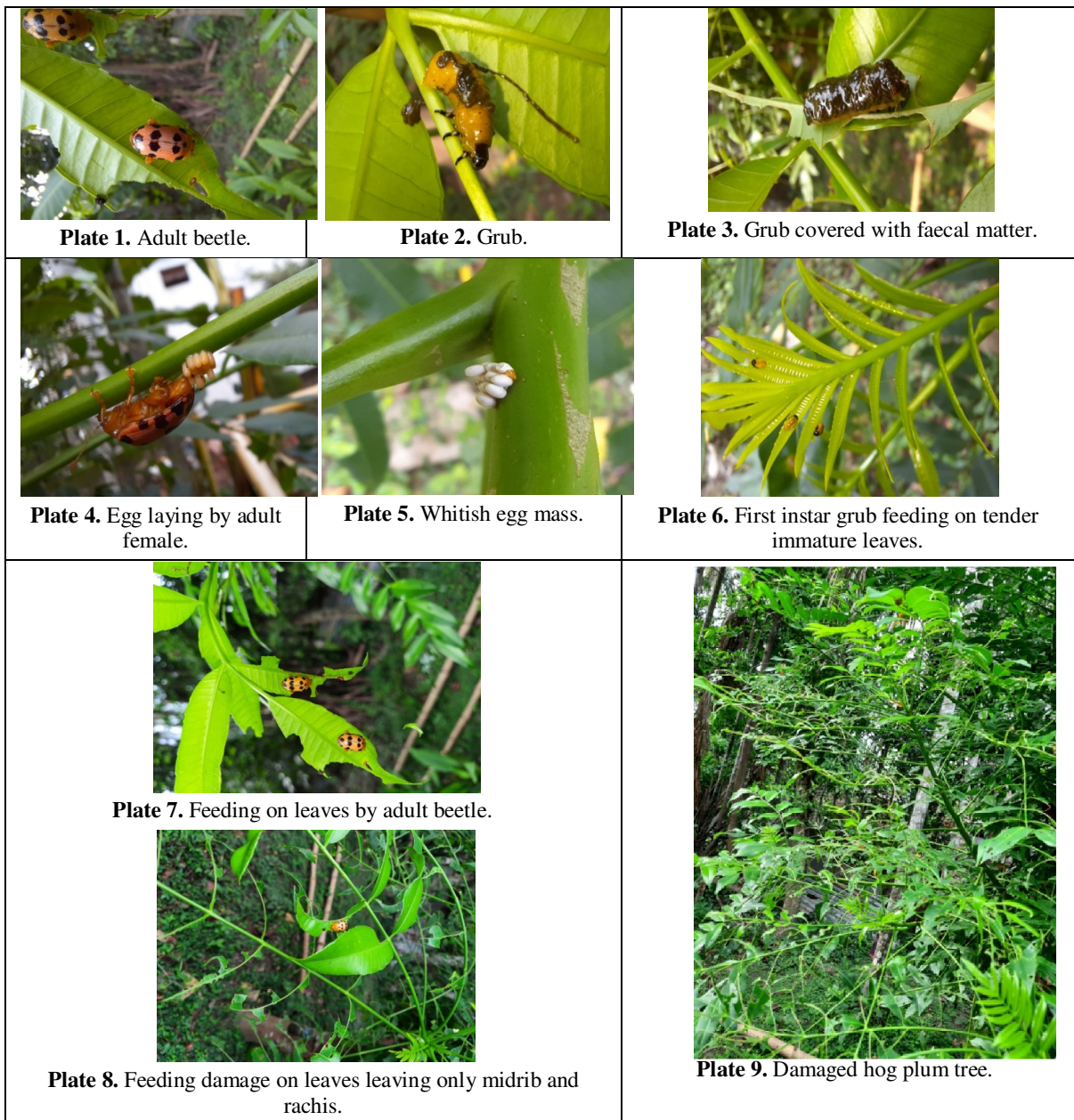


Fig. 2. Incidence pattern of *Podontia quatuordecimpunctata* on hogplum along with prevailing weather conditions.



CONCLUSION

The investigation concludes that chrysomelid foliage feeder (*Podontia quatuordecimpunctata* L.) is one of the major insect pests of greater hog plum in the Gangetic plains of West Bengal. Both the adult and grub stages of the insect are responsible for foliage damage. The beetle occurs in the orchard from April to August having two peak periods of infestation (first week of June and second week of July). The study also reveals non-significant association between the weather factors and pest population. The present finding may act as a stepping stone to develop weather based pest monitoring system of this minor but important fruit crop in future.

FUTURE SCOPE

Hog plum growing areas can be identified and selected across the state as well as across the country and detailed study can be made on bio-ecological aspects of this pest. Weather based population monitoring is needed to forewarn the probable population build-up of the pest for the concerned region for which a continuous study of minimum 10 years is needed. Eco-friendly and economically sound management tactic should be developed based on available resources and tactics which is also very much lacking for this fruit crop.

Conflict of Interest. None.

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