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Morphometric measurement of hog plum leaf beetle *Podontia 14-punctata* (Chrysomelidae: Coleoptera)

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Abstract
The objective of this article is to find out the morphometric measurement of Hog Plum Leaf Beetle *Podontia 14-punctata* (Chrysomelidae: Coleoptera). The result showed that the mean length and breadth of the 1st, 2nd, 3rd, 4th instars larvae were 1.93, 10.02, 12.0, 20.42 mm and 0.99, 1.48, 3.41, 6.55 mm respectively and the weight were 4.367, 24.695, 75.282, 315.7 mg respectively. The average length breadth and weight of male pupae were 12.7, 6.90 mm and 1.75 g, respectively and female pupae were 14.5, 8.5 mm and 2.272 g, respectively. The average length of antenna of male and female were 7.1 and 8.05 mm, respectively. The length of 3rd legs or long leg of male and female beetle was 12.0 and 13.1mm, respectively. The length of fore wing (elytra) and hind wing in male were 11.6 and 18.0 mm and female were 13.1 and 21.5 mm, respectively. The average length and breadth of abdomen of male and female were 9.2, 7.05 mm and 11.1 and 7.6 mm respectively. The length of head of male and female were 5.0 and 5.6 mm, respectively.

Keywords: Morphometric measurement, larvae and beetle

Introduction
The hog plum (*Spondias mangifera* L.) is a popular subtropical fruit, locally known as "Amra". It grows in Bangladesh but good quality 'Amra" is cultivated commercially in Barishal district and the fruit is consumed mostly in green stage and is also used as pickle, chattni, murbba etc. (Ahmed, 1969). It is grown throughout the tropics (Maniruzzaman, 1988; Verheij and Coronel, 1991, Ahmed, 1969). The fourteen spotted leaf beetle, *Podontia quatodecimpunctata* (Chrysomelidae: Coleoptera) is distributed through South East Asia. It feeds on the hog plum (*Spondias mangifera* L.) *S. dulcis* and *Ficas elestica* (Husain and Ahmed, 1977; Howlader, 1993) [7], It is the most destructive pest of hog plum not only Bangladesh but also in India (Lefroy, 1971) [9]. It is grown throughout the tropics (Maniruzzaman, 1988; Verheij and Coronel, 1991). It is reported to be used as fodder in different parts of India like Asham, Madhya prodesh, Punjab and Uttar Pradesh (Singh, 1982) [15]. *Podontia 14-punctata* (*P. quatodecimpunctata*) is an voracious leaf eating insect of hog plum sometimes causing total defoliation.The fourteen spotted leaf beetle, *Podontia quatodecimpunctata* belongs to the family Chrysomelidae under the order of Coleoptera is distributed throughout South East Asia and feeds on *S. mangifera* Wild of the hog plum tree. The hog plum leaf beetle is a serious pest of the hog plum. Both adult and larva are voracious leaf feeder. As a result, of their attack, the tree becomes completely defoliated. It is reported that in Bangladesh, the beetles appear in April, abundant during July to September and disappear in October. The peak period of defoliation is August and September (Beeson, 1941; Baksha, 1997) [4, 2]. The damage due to the pest is severe during the period when the tree is in full foliage (Mondol, 1975) [10]. The insect causes damage about 96% of the levees of hog plum. Average infestation of the leaves is 50%, the beetles completely defoliate the tree and cause stunting of the growth of the three eventually reduces fruit size and yield. During off season the insect pupate in the soil in hibernating condition. All four larval stages retain a fecal coat, possibly mimicking bird dropping (Barlow, 1900; Stebbing, 1914; Baksha, 1997) [3, 16, 2]. However, morphometric measurement provides information about the amount of insecticide, types of insecticide and spray method. So, the present work was undertaken to study the morphological measurement of this pest (Rono *et al*, 2008) [12]. There are many works on the life history traits and food consumption on many insect pest such as morphometric measurement of lady beetle *Micraspis discolor* F (Chowdhury *et al*., 2008) [5], morphometric measurement of six spotted lady beetle

Menochilus sexmaculatus (Fab.) (Islam *et al*., 2007) [8]; morphometric measurement of lemon butterfly *Papilio demoleus* L. morphometric measurement of mango defoliator *Cricula trifenestrata* F. (Rono *et al*., 2008) [12]. But from the review of literatures, it was found that there very limited information about morphometric measurement of hog plum leaf beetle, *P. quatodecimpunctata*. For this reason**,** the objective of this article is to find out the morphometric measurement of Hog Plum Leaf Beetle *Podontia 14-punctata* (Chrysomelidae: Coleoptera), which is very much necessary for the management of this pest. Consequently, the objective of this article is to find out the morphometric measurement of Hog Plum Leaf Beetle *Podontia 14-punctata* (Chrysomelidae: Coleoptera).

Materials and Methods

The study on morphology of hog plum leaf beetle, *Podontia quatodecimpunctata* were done in the laboratory of Entomology of Hajee Mohammad Danesh Science & Technology University, Dinajpur, Bangladesh from May to August, 2017. The mean monthly temperature was 30±2^{0}C and relative humidity 80±5%.

A culture of hog plum leaf beetle, *Podontia* 14-punctata was established in the laboratory in order to supply necessary insects for the experiment. For this purpose, some males and females of P. 14-punctata were collected from the hog plum plant of Hajee Mohammad Danesh Science and Technology University, Dinajpur campus. These beetles were sexed and paired in petridishes (6.0 x1.0 cm) for egg laying. The bottom of the petridishes was covered with blotting paper (Whitman filter paper no 1). Leaf of hog plum collected daily from the unsprayed plant and supplied as food. After hatching of eggs, the grubs were transferred to several medium sized petridishes (11cm diameter) and reared on hog plum leaf till adult emerged. Different parameters about morphometric measurements of egg, grub, pupa and adult were taken based on 10 individuals. For the measurement of length and breadth of the eggs oculomicroscope (oculomicrometer) were used. The length and breadth of different grub instars, pupa and adult beetles were measured with the help of ordinary millimeter scale. The experiments were conducted using Completely Randomized Design (CRD) with 10 replications. The data were analyzed statistically. The medium mature leaves were supplied by making small pieces with the help of a sharp scissor. The foliage consumed by larva and adult were recorded daily in terms of area and weight basis by subtracting leaf area and weight before and after consumption by placing leaves in an electronic automatic area meter (Model L-13,000, LI-COR, Nebraska. USA) and Mettlers Digital Balance (Model-MR 220. No. 971373), respectively until death. The length and breadth of egg, different larval instars, pupa and adult beetles with their thorax, abdomen, leg, antenna and wing were measured with the help of ordinary millimeter scale.

$$P = \frac{P' - C}{100 - C} \times 10$$

Where,

P= Percentage of corrected mortality

P'= Observed mortality (%)

C= Mortality (%) at control.

Results and Discussion

The results of morphometric measurement of different stages of Hog Plum Leaf Beetle *Podontia 14-punctata* (Chrysomelidae: Coleoptera) are harmonically presented in different figures and are presented below:

Morphometric measurement Eggs

The mean length and breadth of the eggs were 1.67±0.21 mm and 0.73±0.15 mm, respectively (Fig.1). The weight of the each egg was 1.89±0.94 mg. Baksha (1997) [2] reported that the eggs same insect was bright yellow in colour and oval in shape being 2±0.2 mm in length and 0.6±0.1 mm in breadth. Singh and Misra (1989) [14] observed that the eggs were bright yellow in colour, oval in shape and rounded at both ends with 2 mm in length and 0.6 mm in breadth. The findings of the study are in close proximity with the aforesaid researchers.

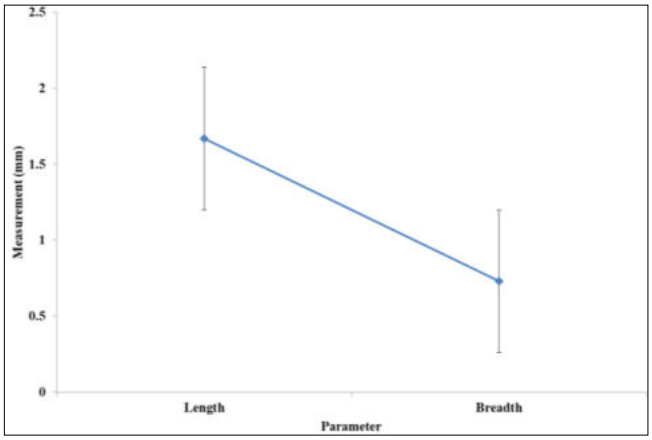

Fig 1: Morphometric measurement (mean±SE) of eggs of *P. quatodecimpunctata*

Morphometric measurement Larvae

Morphometric measurement was made for body length, breadth and weight of the larvae and was presented in the (Fig 2). The larvae hatched from the small, round and yellow egg. During hatching the larvae come out from the egg by making an irregular hole through the upper end of egg shell. Larvae were soft bodied, dirty yellow or yellowish brown with a black head and legs, elongated somewhat flattened and covered with minute spiny structure. There were three ocelli on either side of the head and the mandibles were sickle shaped. Three pairs of legs were long and slender. The results highlighted that the newly emerged larvae measured from 1.8 to 2.1 mm with an average of 1.93±0.03 mm in length and the breadth which varied from 0.9 to 1.2 mm with an average 0.99±0.03 mm. The weight of newly hatched larvae was varied from 4.0 to 4.6 mg with an average of 4.37±0.07 mg.

The length of the 2nd instars larvae ranged from 8.4 -11.00 mm with an average of 10.02±0.27 mm in length and from 1.4 to 1.6 mm with an average of 1.48±0.02 mm in breadth. The weight of 2nd instars larvae was varied from 24.13 to 25.2 mg with an average of 24.7±0.1 mg. After completing of second moulting the third instars larvae came out leaving the exuviae's. At this instars, morphologically they were similar to that of 2nd instars but differed in size and shape. Third instars larvae were elongated and more active than previous instars. The body size of the 3rd instars larvae measured 11.45 to 12.4 mm with an average of 12.0±0.1 mm in length and from 3.3 to 3.5 mm with an average of

3.41±0.02 mm in breadth. Also the weight of 3rd instars larvae was recorded as 75.28±0.14 mg.

After third moulting, the 4th instars larvae came out and looks like 3rd instars larvae. They were yellow greenish in colour, elongated, slightly broader in size and shape. The body segments were quite distinct. They body length of the 4th instars larvae was measured from 18.5 to 22.4 mm within an average of 20.46±0.58 mm in length and from 5.8 to 7.2 mm with an average 6.55±0.15 mm in breadth. The weight of 4th instar larvae was varied from 280 to 347 mg with an average of 315.7±7.31 mg.

Baksha (1997) [2] revealed that the mature larval instars of *P. quatodecimpunctata* was greenish in colour and 21.9±2.7 mm to 25.7±2.1 mm in length and 7.5±1.4 mm to 8.3±1.6 mm in width. Sardar and Mondal (1983) [13] reported that 4th larval instars of this beetle having accumulation of black shiny excreta over the dorsal side of the body. On an average, the 1st, 2nd, 3rd and 4th instars were measured as 3.5, 9.9, 15.6 and 25.5 mm in length, corresponding head width being 0.7, 2.4, 2.9 and 3.9 mm.

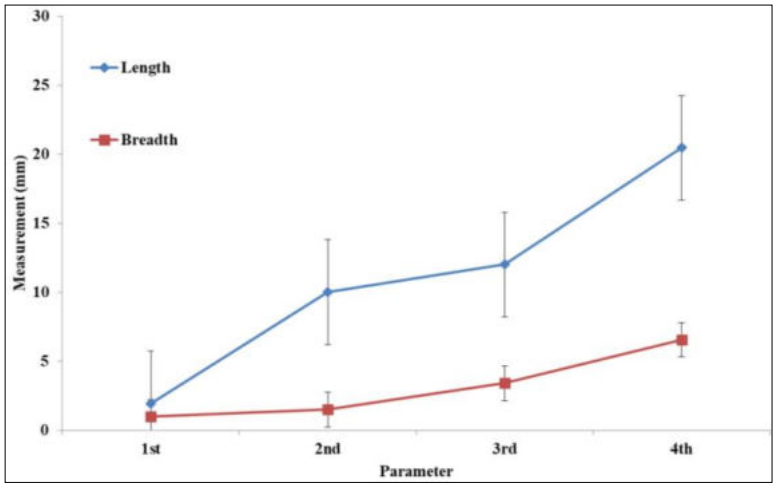

Fig 2: Morphometric measurement (mean±SE) of larvae of *P. quatodecimpunctata*

Morphometric measurement Pupae

The pupa was the ultimate transformation of pre-pupa. The pupa was non-feeding stage and chiefly a quiescent one. The pupal cell was found in the soil at a depth of 1 to 2 cm. The male pupa was smaller than the female. The length and breadth of the male pupa ranged from 12 to 13 mm and 6.5 to 7.5 mm with an average 12.7±0.15 mm and 6.95±0.89 mm respectively. The weight of male pupa was an average of 1.75±0.04 g (Fig 3).

The length and breadth of the female pupa ranged from 14 to 15 mm and 8 to 9 mm with an average of 14.5±0.13 mm and 8.5±0.13 mm respectively. The weight of female pupa was an average of 2.27±0.04 g.

Sardar and Mondal (1983) [13] reported that the male pupa was smaller than the female pupa measured, respectively 9.5 and 13.3 mm in length and 3.1 and 3.4 mm in head width.

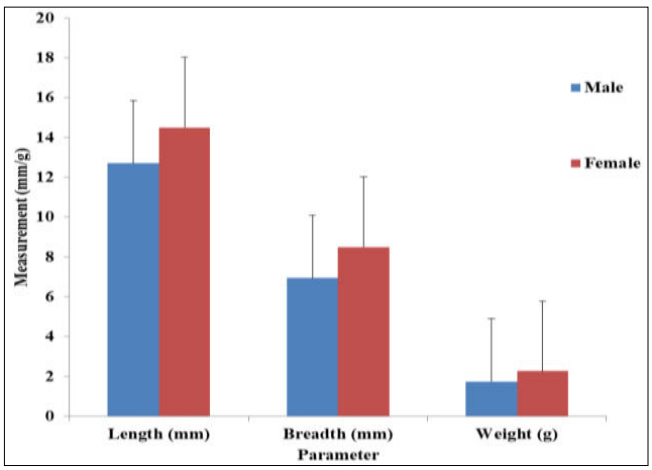

Fig. 3: Morphometric measurement (mean±SE) of pupa of *P. quatodecimpunctata*

Morphometric measurement of adult

The adult beetle emerged from the pupa, pushing its way out through the wall of the earthen cell. The beetle was red-orange with a metalic tint of 14 characteristic black spots on both elytra (Maxwell-Lefroy, 1971) [9]. The female was larger than the male. The average length and breadth of male were 13.05±0.12 mm and 6.9±0.06 mm and female those of were 15±0.012 mm and 9±0.12 mm, respectively. The weight of male and female were an average of 2.68±0.01 g and 2.86±0.01 g respectively. The mature beetle was brightly colored. The bodies of both sexes were oblong and somewhat tapering at the apex. The average length of the antenna for male and female were 7.1±0.07 mm and 8.05±0.05 mm, respectively. The average length of the foreleg mid leg and hind leg for male were 9.05±0.05 mm, 10.1±0.07 mm and 12.05±0.05 mm and for female were 10.05±0.05, 11.05±0.05 and 13.1±0.07 mm respectively. Beeson (1941)[4] reported that the halticine hog plum beetle is oblong, 1.27 to 1.69 cm, pink, the elytra with 6 black spots each and 2 black spots on the suture.

The average length of fore wing (elytra) and hind wing of male and female were 11.6±0.07 mm and 13.1±0.07 mm and hind wing were 18.05±0.13 and 21.5±0.22 mm, respectively. The average length of thorax (head) for male and female were 5±0.0 and 5.6±0.07 mm, respectively. Also the average length of abdomen for male and female were 9.2±0.05 mm, 11.1±0.07 mm and breadth were 7.05±0.05 mm, 7.6±0.07 mm, respectively. Sardar and Mondal (1983) [13] stated that the female beetle was slightly larger than the male. The average body length and head width was 14.0 mm and 5.4 mm in the male and 16.0 mm and 6.0 mm in the female (Fig 4).

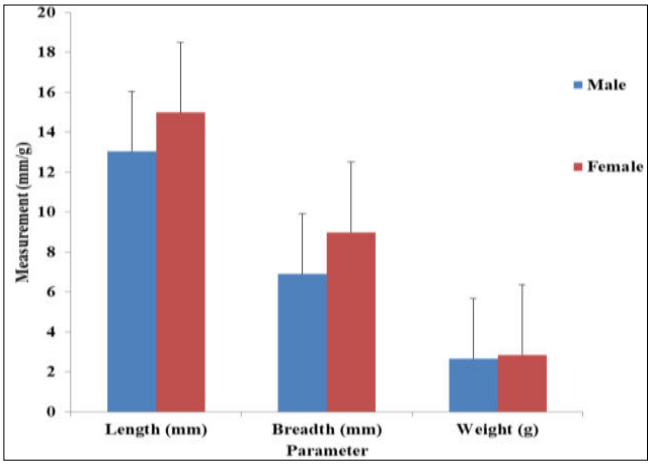

Fig 4: Morphometric measurement (mean±SE) of adult of *P. quatodecimpunctata*

Conclusion

The morphological measurement data shows that the average length, breadth and weight of eggs were 1.67 mm, 0.73 mm and 1.89 mg, respectively. The mean length and breadth of the 1st, 2nd, 3rd, 4th instars larvae were 1.93, 10.02, 12.0, 20.42 mm and 0.99, 1.48, 3.41, 6.55 mm, respectively and the weight were 4.367, 24.695, 75.282, 315.7 mg respectively. The average length and breadth of abdomen of male and female were 9.2, 7.05 mm and 11.1 and 7.6 mm, respectively.

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