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MORPHOMETRICS STUDY OF BANANA PSEUDOSTEM WEEVIL, *ODOIPORUS LONGICOLLIS*

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ABSTRACT

Banana (*Musa paradisiaca* L.) is considered as one the major tropical fruit in India with high yield potential. Although it is infested by many insect pests, banana pseudostem weevil (*Odoiporus longicollis*) is one the major pest of banana, responsible for reducing the yield of banana in India. Present study was conducted to study the morphometric of *Odoiporus longicollis* collected from banana field of horticultural garden, Bihar Agricultural University, Sabour, Bhagalpur. *O. lingicollis* eggs are slender in shape with length and width 2.18 ± 0.10mm, 1.05 ± 0.04mm, respectively while the length of 1st, 2nd, 3rd, 4th and 5th instars grubs of *O. lingicollis* was 3.32 ± 0.34mm, 6.53 ± 0.32mm, 9.75 ± 0.31 mm, 11.82 ± 0.27 mm, 18.60 ± 1.20 mm and 10.30 ± 1.14 mm, respectively and the width of 1st, 2nd, 3rd, 4th and 5th instars grubs of *O. lingicollis* was 1.21 ± 0.13mm, 1.69 ± 0.21 mm, 2.43 ± 0.30 mm, 3.50 ± 0.26 mm, 5.62 ± 0.60 mm and 5.40 ± 0.42 mm respectively. The male is slightly shorter than the female with the length and width of adult male was 14.60 ± 0.89 mm and 4.36 ± 0.71 mm, respectively while of female was 14.80 ± 1.79 mm and 5.24 ± 0.53 mm respectively.

Keywords **:** *Odoiporus longicollis*, *Musa paradisiaca,* morphometrics, male, female.

Introduction

Banana is botanically known as '*Musa paradisiaca'*. It is originated from tropical region of South – East Asia. It ranks 4th and the most important crop in the world (Samson *et al*. 2004) followed by rice, wheat and milk products (Chadha and Sahijram, 2000). India is the largest producer of banana in the world which contributes 25.58 % of the world production (FAO). After mango, it is India's second-largest tropical fruit crop. Banana is grown in an area of 884 thousand ha with a production of 30807.5 thousand tons per year. In Bihar, banana is grown in an area of 31.07 thousand ha with a production of 1396.39 thousand tons per year (Horticulture statistics division DAC&FW, 2018).

It is a well-known crop that supports the life of millions of people by generating additional income via its cultivation, processing, and marketing. Bananas are relatively cheapest and commonly available in most of the household with an excellent source of energy (104 cal/100 g). It is incredibly nutritious, enjoyed for its sweetness and taste, and cherished for its tender texture. It has high concentration of minerals i.e. potassium (Kyamuhungire *et al*., 2002), a good source of protein, and fairly rich in dietary fibre.

Banana is attacked by more than 200 species of insects and non-insect pests (Simmonds, 1966 and Singh, 1970). In India, there are more than 15 insect pests attack banana which include insects, mites and birds. Insect attack noticed from planting to harvesting at different stages of crop growth. Weevil borers are among the most damaging and critical insect pests because they not only harm the crop but also have an impact on the productivity and quality of the final product. Rhizome weevil, *Cosmopolites sordidus* and Pseudostem weevil, *Odoiporus longicollis* are the two most important weevil borers.

The banana pseudostem weevil is originated from South and South East Asia, which is also the centre of origin of the present-day bananas plant. This insect is found in India, China, Malaysia, Indonesia and Thailand and the key pest of bananas and plantains, posing a great threat to banana production in these countries (Valmayor *et al*., 1994). Pest density varies from field to field. The weevil prefers plantains and high land bananas, specially, 'Pome' types. Farms, where the weevils are not well managed will experience complete crop loss. This pest has been reported from all the banana growing states of India *viz*., Assam, West Bengal, Delhi, Bihar, Uttar Pradesh, Karnataka, Kerala, North East Hill States (Dutta and Maiti, 1972, Jayanthi and Varghese, 1999).

The banana pseudostem weevil has a long-life span and many adults live for a year (Kumari *et al*., 2023). The sex ratio of adults encountered in banana gardens is 1:1.17 (male: female) (Dutt and Maiti, 1972). The sensory structures present on the rostrum of the weevils provide a key for sex differentiation (Nahif *et al*., 2000).

Morphometric techniques have been used to assist quantitative measurement and analysis of morphological variation in size and shape of the organisms. However, Life table study is very useful to analyse the key factors responsible for the mortality of the pest within population and it also helps in making pest management strategy.

Materials and Methods

To initiate the morphometrics of *O. longicollis* in laboratory, the total number of 50 adults specimens consisting of 25 male and 25 female were collected from the banana field of horticultural garden of Bihar Agricultural University, Sabour, Bhagalpur Bihar, India

Several characters were linearly measured using a stereo-zoom-microscope with an attached digital camera of Leica make and S9i model, calibrated to 0.01 mm and recorded to two decimal points. Total length (without snout), elytra length, elytra width, pronotum length, pronotum width, snout length, snout width, distance between eye, scape of antenna length, number of segments in antenna, procoxal distance, metacoxal distance, metacoxal distance, pygidium length, pygidium width, profemur length, protibial length, protarsus length, mesofemur length, mesotibia length, mesotarsus length, metafemur length, metatibia length, metatarsus length was measured with above said stereo-zoom-microscope available in Dept. of Entomology, Bihar Agricultural University, Sabour, Bhagalpur.

Results and Discussion

Morphometrics of *O. longicollis* was assessed in the laboratory of Department of Entomology, Bihar Agricultural University, Sabour, Bhagalpur, Bihar. India

Morphometric studies of different life stages of *O. longicollis*

Eggs

Eggs of *O. longicollis* were yellowish white cylindrical in shape with round ends, the size of eggs varied with an average length and width of 2.18 ± 0.10mm and 1.05 ± 0.04mm, respectively (Table 1). The present result is in agreement with Janakiraman (1998) who observed that the length and width of egg were 2.80 mm and 2.80 mm respectively.

Grub

Total five instars were observed in grub stages of *O. longicollis* (Table 1). The length and width of 1st instar of grub were 3.32 ± 0.34mm and 1.21 ± 0.13 mm, respectively, while the length and width of 2nd instar grub was 6.53 ± 0.32mm and 1.69 ± 0.21 mm, for 3rd instar 9.75 ± 0.31 mm and 2.43 ± 0.30, for 4th instar were 11.82 ± 0.27 mm and 3.50 ± 0.26 and for 5th instar it was 18.60 ± 1.20 mm and 5.62 ± 0.60 mm, respectively. The result recorded were found similar with the findings of Jayasree (1992) who reported that the body length and width of first instar larvae were 3.75 and 1.32 mm, second instar larvae 6.25 mm and 1.75 mm, third instar larvae 12.57 mm and 2.78 mm, fourth instar larvae 13.38 mm and 3.38 mm and the fifth instar larvae 18.41 mm and 4.95 mm, Janakiraman (1998) observed that mean length was 4.39, 6.65, 10.50, 15.47 and 19.96 mm for I, II, III, IV and V instars and the mean body width was 1.58, 2.32, 3.38, 4.43 and 5.89 mm for I, II, III, IV and V instars while the pupa varied with an average of 10.30 ± 1.14mm and 5.40 ± 0.42mm, respectively.

Pupa

It is obvious from the Table 1 that the length and width of pupa varied with an average of 10.30 ± 1.14 mm and 5.40 ± 0.42 mm, respectively (Table 1). Jayasree (1992) reported that the pupa without cocoon measured a mean length of 15.2mm and a width of 10.34 mm.

Adult

Newly emerged adult was brown in colour which later changed into black

Male

The observation recorded on adult male revealed that the length and width was 14.60 ± 0.89 mm and 4.36 ± 0.71 mm, respectively (Table 1).

Female

The data recorded on adult female revealed that length and width was 14.80 ± 1.79 mm and 5.24 ± 0.53 mm, respectively (Table 1). Janakiraman (1998) reported that the mean body length and width of male were 15 mm and 3.2 mm respectively and those of female were 16.4 mm and 3.7 mm respectively.

Head

The data in Table 2 showed that the length and width snout of male weevil was 4.54 ± 0.53 mm and 0.68 ± 0.10 mm and for female it was 4.93 ± 0.92 mm and 0.69 ± 0.12 mm, respectively while the distance between eyes of a male was 0.32 ± 0.08 and for female it was 0.36 ± 0.09 mm (Table 2).

Antennae

The result presented in Table 2 showed that the scape length of antenna of male and female was 1.55 ± 0.23mm and 1.70 ± 0.32mm, respectively with having 5 segments in each flagellum and the antenna was geniculate type or like elbow shape. The result recorded were similar with the findings of Jayanthi *et al.*, 2020, who reported that the antennae of male and female weevil within the species were morphologically similar but vary in size.

Thorax

The observation recorded for the length and width of male pronotum was 4.24 ± 0.61mm and 4.84 ± 0.59 mm and for female it was 4.84 ± 0.59 mm and 3.58 ± 0.48 mm, while the procoxal distance of male and female was 0.37± 0.07 mm and 0.42 ± 0.10 mm, mesocoxal distance 1.21 ± 0.21 mm and 1.48 ± 0.17 mm and metacoxal distance it was 1.89 ± 0.53 mm and 1.96 ± 0.25 mm, respectively (Table 2).

Pygidium

The data on pygidium reflected that the length and width of pygidium of male was 3.45 ± 0.52mm and 2.33 ± 0.48mm and for female it was 3.05 ± 0.21mm and 2.04 ± 0.17mm respectively. (Table 2).

Leg

The data recorded on legs reflected that the length of profemur, protibia, protarsus, mesofemur, mesotibia, mesotarsus, metafemur, metatibia and metatarsus of male was 3.15 ± 0.07mm, 2.75 ± 0.07mm, 2.30 ± 0.10mm, 3.05± 0.07mm, 2.65 ± 0.07mm, 2.27 ± 0.06mm, 3.10 ± 0.14mm, 2.70 ± 0.14mm and 2.23 ± 0.06mm, respectively while the length of profemur, protibia, protarsus, mesofemur, mesotibia, mesotarsus, metafemur, metatibia and metatarsus of female was 3.20 ± 0.10 mm, 2.93 ± 0.12 mm, 2.50 ± 0.14 mm, 3.10 ± 0.10 mm, 2.80 ± 0.10 mm, 2.35 ± 0.21 mm, 3.15 ± 0.10 mm, 2.77 ± 0.06 mm and 2.25 ± 0.07 mm, respectively (Table 2).

Elytra

The data presented in Table 2 reflected that the length and width of elytra of a male was 7.00 ± 0.71 mm and 5.00 ± 0.71 mm and for female it was 7.20 ± 0.84 mm and 5.30 ± 0.45 mm, respectively.

Table 1: Morphometric studies of different life stages of *O. longicollis*.

Life Stage	Length (mm) Mean ± SD	Width (mm) Mean ± SD
Egg	2.18 ± 0.10	1.05 ± 0.04
Grub		
1st Instar	3.32 ± 0.34	1.21 ± 0.13
2nd Instar	6.53 ± 0.32	1.69 ± 0.21
3rd Instar	9.75 ± 0.31	2.43 ± 0.30
4th Instar	11.82 ± 0.27	3.50 ± 0.26
5th Instar	18.60 ± 1.20	5.62 ± 0.60
Pupa	10.30 ± 1.14	5.40 ± 0.42
Adult		
Male	14.60 ± 0.89	4.36 ± 0.71
Female	14.80 ± 1.79	5.24 ± 0.53

Table 2: Morphometric study of adult *O. longicollis.*

Sr. No.	Particulars	Male	Female
		Mean ± SD	Mean ± SD
1	Total body length	14.60 ± 0.89	14.80 ± 1.79
2	Snout length	4.54 ± 0.53	4.93 ± 0.92
3	Snout width	0.68 ± 0.10	0.69 ± 0.12
4	Distance between eye	0.32 ± 0.08	0.36 ± 0.09
5	Scape of antenna length	1.55 ± 0.23	1.70 ± 0.32
6	Number of segments in antenna	5	5
7	Pronotum length	4.24 ± 0.61	4.84 ± 0.59
8	Pronotum width	3.31 ± 0.47	3.58 ± 0.48
9	Procoxal distance	0.37± 0.07	0.42 ± 0.10
10	Mesocoxal distance	1.21 ± 0.21	1.48 ± 0.17
11	Metacoxal distance	1.89 ± 0.53	1.96 ± 0.25
12	Pygidium length	3.45 ± 0.52	3.05 ± 0.21
13	Pygidium width	2.33 ± 0.48	2.04 ± 0.17
14	Profemur length	3.15 ± 0.07	3.20 ± 0.10
15	Protibial length	2.75 ± 0.07	2.93 ± 0.12
16	Protarsus length	2.30 ± 0.10	2.50 ± 0.14
17	Mesofemur length	3.05± 0.07	3.10 ± 0.10
18	Mesotibial length	2.65 ± 0.07	2.80 ± 0.10
19	Mesotarsus length	2.27 ± 0.06	2.35 ± 0.21
20	Metafemur length	3.10 ± 0.14	3.15 ± 0.10
22	Metatibial length	2.70 ± 0.14	2.77 ± 0.06
23	Metatarsus length	2.23 ± 0.06	2.25 ± 0.07
24	Elytra length	7.00 ± 0.71	7.20 ± 0.84
25	Elytra width	5.00 ± 0.71	5.30 ± 0.45

Fig.1. Different life stages of *O. longicollis* (A)Egg, (B)Grubs, (C)Pupa, (D) Cocoon and (E)Adult

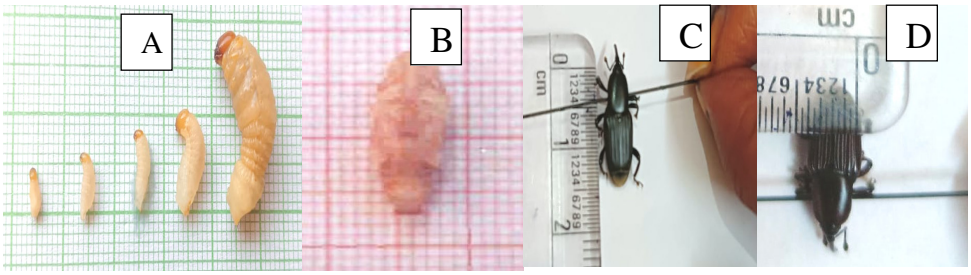

Fig. 2 : Measurement of different life stages of *O. longicollis* (A) Length and width of grubs of instars, (B) Length and width of pupa, (C) Length of adult and (D) Width of adult

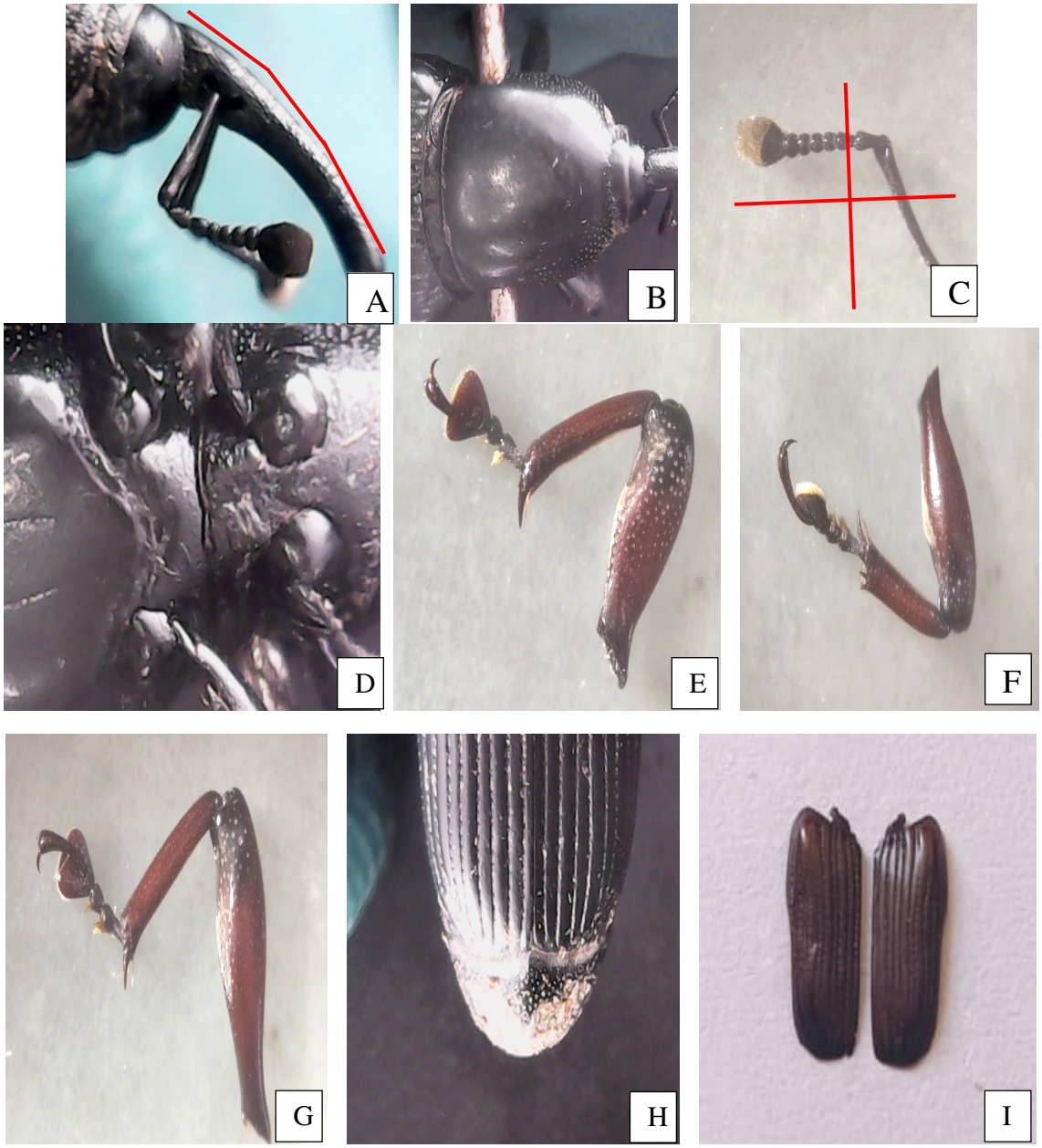

Fig. 3: Morphometric study of adult *O. longicollis*,(A) Snout (length),(B) Antenna, (C) Pronotum(length and width),(D) Distance between meso and meta coxa,(E) Proleg, (F) Mesoleg,(G) Metaleg,(H) Pygidium (length and width) and (I) Elytra

Conclusions

O. lingicollis eggs are slender in shape with length and width 2.18 ± 0.10mm, 1.05 ± 0.04mm, respectively while the length of 1st, 2nd, 3rd, 4th and 5th instars grubs of *O. lingicollis* was 3.32 ± 0.34mm, 6.53 ± 0.32mm, 9.75 ± 0.31 mm, 11.82 ± 0.27 mm, 18.60 ± 1.20 mm and 10.30 ± 1.14 mm, respectively and the width of 1st, 2nd, 3rd, 4th and 5th instars grubs of *O. lingicollis* was1.21 ± 0.13mm, 1.69 ± 0.21 mm, 2.43 ± 0.30 mm, 3.50 ± 0.26 mm, 5.62 ± 0.60 mm and 5.40 ± 0.42 mm respectively. The male is slightly shorter than the female with the length and width of adult male was 14.60 ± 0.89 mm and 4.36 ± 0.71 mm, respectively while of female was 14.80 ± 1.79 mm and 5.24 ± 0.53 mm respectively. Morphometric studies of *Odoiporus longicollis* provide basic knowledge for accurate identification, ecological understanding, population monitoring, and development of eco-friendly management strategies. They form a critical scientific base for designing region-specific IPM modules, particularly in major banana-growing regions.

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