RESEARCH ARTICLE Indian Journal of Agricultural Research, Volume 58 Issue 1: 170-174 (February 2024)

Biology and Incidence of the Jackfruit Bud Weevil *Ochyromera artocarpi* Marshall (Coleoptera: Curculionidae)

Soumya Kallekkattil[1,2], Aswatha Krishnamoorthy[1], Melally G. Venkatesha[3] 10.18805/IJARe.A-5653

ABSTRACT

Background: Jackfruit is one of the favourite fruit crops of the world owing to its taste and nutritional value and it is rightly called as the 'Poor man's food'. India is the second biggest producer of this fruit in the world; but commercial cultivation of jackfruit is still at a primitive stage in India. Besides a survey for the insect pests of the jackfruit in the earlier part of this century, there is no much research work has been carried out from India on jackfruit. Realizing an immediate need the present study was undertaken to generate more precise information about the biology of jackfruit bud weevil *Ochyromera artocarpi,* an important pest of jackfruit.

Methods: The biology and seasonal incidence of the jackfruit bud weevil, *Ochyromera artocarpi* (Coleoptera: Curculionidae) were studied in Indian Council of Agricultural Research - Indian Institute of Horticultural Research (ICAR - IIHR), Bengaluru (12°8′N; 77°35′E), India during 2013-2016.

Result: The male and female weevils completed their life cycle in 25.18±1.09 days and 26.14±1.12 days respectively with five larval instars. The mean incubation period of the egg was 3.90±0.20 days. The mean duration of development of larval stages, prepupa and pupa were 11.84±1.44, 3.10±0.07 and 7.30±0.50 days, respectively. The first and last instar (fifth) larva was 1.27±0.05 and 4.98±0.61 mm in length, respectively. The infestation of *O. artocarpi* was observed during December-April and reached its peak in March. Evaporation was positively correlated and precipitation was negatively correlated with *O. artocarpi* incidence. The results of this study will be helpful to develop IPM strategies against the weevil, which is a major pest of jackfruit.

Key words: *Artocarpus heterophyllus,* Damage symptoms, Incidence, Life history, *Ochyromera artocarpi.*

INTRODUCTION

Jackfruit (*Artocarpus heterophyllus* L) is a tropical fruit, recognized for its unique shape, size and flavour. It is rich in energy, dietary fibre, minerals, and vitamins and free from saturated fats or cholesterol (Dissanayaka, *et al*., 2019). This Asian tropical fruit belongs to the family of *Moraceae* (Sidhu, 2012).

India is the second-largest producer of jackfruits in the world and is considered as the motherland of jackfruit. In India, it has a wide distribution in Assam, Tripura, Bihar, Uttar Pradesh, the foothills of the Himalayas and south Indian states of Kerala, Tamil Nadu and Karnataka (Bailey, 1949). Despite having such a vast potential and usefulness jackfruit remains as an underutilized fruit. Insect pests are major biotic constraints for agriculture throughout India (Sidde Gowda and Gubbaiah, 2011). The jackfruit bud weevil, *Ochyromera artocarpi* Marshall (Curculionidae: Coleoptera) is a major pest of jackfruit. It is a small, active and greyish brown weevil. The small whitish grubs of *O. artocarpi* bore into tender flower buds and fruits and cause premature fruit drop. The greyish brown adult weevils nibble on jackfruit leaves (Butani, 1979). Ayyar (1940) reported *O. artocarpi* from north Malabar (Kerala, India) and Mysore (Karnataka, India) as a pest on jackfruit. Subramanian (1958) reported an outbreak of *O. artocarpi* in the Coimbatore region (Tamil nadu, India).

Although *O. artocarpi* has been reported as a severe jackfruit pest in India, no information is available on its detailed biology, seasonal incidence and extent of damage on jackfruit. Primarily, knowledge of biology and incidence of any pests is essential for the development of sustainable pest management practices (Niranjan and Neha, 2016). Hence, the present study was conducted to understand the detailed biology and seasonal incidence of *O. artocarpi,* which could be helpful to develop suitable pest management methods.

[1]ICAR-Indian Institute of Horticultural Research, Hesseraghatta Lake post, Bengaluru-560 089, Karnataka, India.
[2]Department of Zoology and Genetics, Jyoti Nivas College Autonomous, Bengaluru-560 095, Karnataka, India.
[3]Department of Zoology, Bangalore University, Bengaluru-560 056, Karnataka, India.

Corresponding Author: Melally G. Venkatesha, Department of Zoology, Bangalore University, Bengaluru-560 056, Karnataka, India. Email: venkatmelally@gmail.com

How to cite this article: Kallekkattil, S., Krishnamoorthy, A. and Venkatesha, M.G. (2024). Biology and Incidence of the Jackfruit Bud Weevil *Ochyromera artocarpi* Marshall (Coleoptera: Curculionidae). Indian Journal of Agricultural Research. 58(1): 170-174. doi: 10.18805/IJARe.A-5653.

Submitted: 14-07-2020 **Accepted:** 09-11-2020 **Online:** 16-01-2021

MATERIALS AND METHODS

Initially, *O. artocarpi* was cultured in the laboratory by collecting larvae of this pest present in jackfruits from the plantation of Indian Council of Agricultural Research-Indian

Institute of Horticultural Research (ICAR - IIHR), Bengaluru (12°8′N; 77°35′E), India. The field-collected larvae of *O. artocarpi* were reared in the laboratory on young jackfruits. Adults of *O. artocarpi* emerged in the laboratory were allowed to mate in a nylon mating cage (15×15×15 cm) and provided jackfruit leaves as food. Gravid females of *O. artocarpi* were provided young jackfruits for egg deposition in the same cage. Young jackfruits containing fresh eggs of *O. artocarpi* were kept individually in plastic boxes (10×10×10 cm) and covered with the muslin cloth. Freshly hatched larvae of *O. artocarpi* were allowed to develop on the infested jackfruits in the same plastic boxes until they reached the adult stage.

Morphology and life cycle

The rearing boxes were examined daily for exuviae and head capsules to confirm the moulting of larvae. The egg, larval, prepupal and pupal developmental period and the number of instars in their life cycle were recorded. The egg, each larval instar, prepupa, pupa and an adult were measured using a calibrated eyepiece micrometre under a stereo zoom microscope. External morphology of the egg, each larval instar, prepupa, pupa and adult was recorded.

Pest incidence

Jackfruit orchards were selected at ICAR - IIHR, Bengaluru, India. The orchard I, II and III comprised 150, 120 and 50 jackfruit trees, respectively. Standard agronomic practices, *i.e*. weeding, irrigation and fertilization were carried out in all orchards. The trees were never sprayed with any chemical pesticides. Surveys were conducted once a week in the orchards during June 2013-December 2015. A total number of 50, 40 and 20 plants were randomly selected from jackfruit orchard I, II and III, respectively for recording the incidence of *O. artocarpi* throughout the year. Adults of *O. artocarpi* present on the 36 randomly selected branches/ tree (12 each from the upper, middle and lower canopies) were counted, and the average population was calculated. Weather parameters *viz*, maximum and minimum temperature (°C), precipitation (mm), evaporation (mm), morning and evening relative humidity (%RH) and wind speed (km/h) were recorded at weekly intervals at the study area from the weather station located in ICAR-IIHR farm during the study period.

RESULTS AND DISCUSSION

Morphology

Eggs were yellowish-white and elliptical shaped (Fig 1a). The embryo was visible through the translucent eggshell. There were five larval instars. The length and width of the egg and larval instars are given in Table 1.

The translucent empty eggshell showed a small opening on its tip after egg hatching (Fig 1b and c). First instar larva was whitish with reddish-brown on the dorsal side. The body was linear in shape with a short brown head capsule. Second instar larva similar to first instar larva but body turned into a light cream colour with dark brown head capsule (Fig 1d). Body of the third instar larva was light brownish-white with a dark brown head capsule (Fig 1d).

Fourth instar larva was similar to the third instar, but the brownish colour completely disappeared and the larva became white- the head capsule dark brown with well-developed mandibles. Fifth instar larva was stouter than earlier instars. The full-grown larva slightly curved and 'C' shaped with dirty white colour (Fig 1d). The prepupal larva stopped feeding, shrunk and became stout (Fig 1e, f and g). The prepupa turned into a milky white pupa inside the young jackfruit. The prepupa with wing pads has an eye like black spots on either side of the snout (Fig 1 h and i). The length and width of the prepupa and pupa are given in Table 1.

Adults were small blackish-brown beetles with a white mark on the prothorax and elytra. Adults were sluggish before feeding and occasionally fly in a horizontal plane. The adult female and male measured 3.78±0.91 and 3.60±0.72 mm in length and 1.5±0.05 and 1.37±0.12 mm in width. The body length and width between sexes was not significantly different (t = 1.3, P>0.05 and t = 1.4, P>0.05).

The *Ochyromera* genus belongs to the tribe Ochyromerini of the subfamily Tychiinae (Morimoto, 1962; Clark *et al.,* 1977) or Curculioninae according to the recent classifications (Kuschel, 1995; Zherichen and Egorov, 1990), includes about 30 species from the Oriental and

Table 1: Measurements of immature stages of *O. artocarpi.*

Stages	n	Measurements of immature stages		Duration of development (days)	
		Length (mm) Mean (±SD)	Width (mm) Mean(±SD)	Mean±SD	Range
Egg	25	0.45±0.03	0.25±0.05	3.9 0±0.20	3.70-4.10
I instar	25	1.27±0.05	0.57±0.05	2.50±0.10	2.40-2.60
II instar	25	2.43±0.55	0.96±0.07	2.20±0.20	2.00-2.40
III instar	25	3.72±0.60	1.61±0.10	2.34±0.24	2.10-2.58
IV instar	25	4.78±0.65	1.64±0.10	2.8 0±0.40	2.40-3.32
V instar	25	4.98±0.61	1.78±0.09	2.00±0.50	1.50-2.50
Prepupa	25	3.69±0.50	1.89±0.06	3.1 0±0. 07	2.40-3.80
Pupa	25	4.1±0.81	1.93±0.06	7.30±0.50	6.79-7.54

Far East part of the Palaearctic Regions. Weevils of *Ochyromera* genus are abundant in the mountain area of warm to the subtropical region in South-east Asia. They have a wide range of host plants belong to Annonaceae, Caesalpiniaceae, Clusiaceae, Ebenaceae, Ericaceae, Euphorbiaceae, Illiciaceae, Lauraceae, Moraceae, Magaoliaceae, Oleaceae, Rubiaceae, Sapotaceae, Theaceae and Pinaceae (Kalshoven, 1956; Kojima *et al*., 1998; Oberpreiler, 1993; Kojimo and Morimoto, 1996). The weevils are known to feed on various parts of plants, i.e. seeds, fruits, flowers and leaves and pupate in the soil in leaf-mining species, *i.e*. *O. miwai,* or inside seed or fruit in fruit-eating weevils, *O. suturulis, O. ligustri* and *O. artocarpi* (Kojima and Morimoto, 1996)

Many *Ochyromera* species have been recorded as pests all over the world (Warner, 1961). However, the biology of the weevils is inadequately known. The egg of *O. artocarpi* is oval with a smooth surface and colour ranges from white to cream as reported in the sweet potato weevil *Cylas formicarius* (Martin and Minoru, 1954; Cockerham, 1954). Butani (1993) also reported that the egg of *O. artocarpi* is oval and pale yellow. The oviposition behaviour of *O. artocarpi* is similar to that of *C. formicarius,* which lays eggs singly within the cavity on a fruit (Martin and Minoru, 1954).

Life cycle

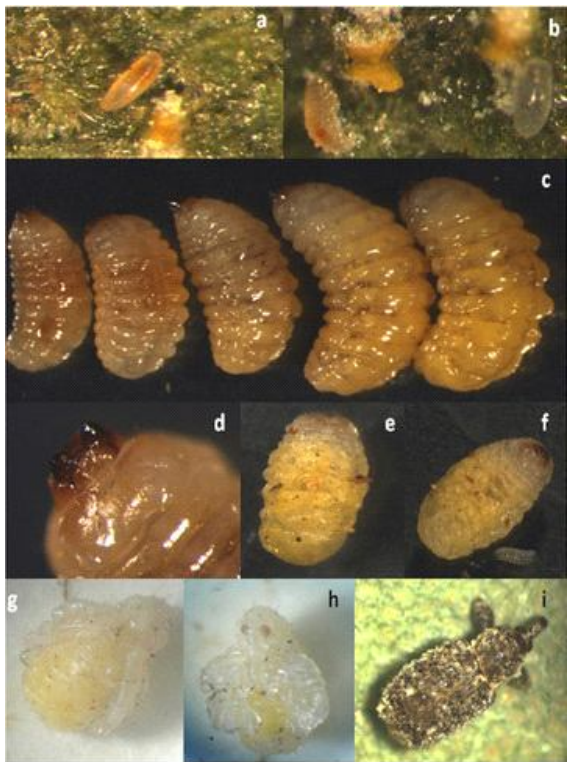
The developmental period of egg, four larval instars, prepupa and pupa of *O. artocarpi* is presented in Table 2. The total developmental period of larval instars including prepupa and pupa was 9.04±1.51 days. The male and female *O. artocarpi* completed their life cycle in 25.18±1.09 and 26.14±1.12 days under laboratory conditions.

The gravid females of *Ochyromera artocarpi* made small cavities on young jackfruits and laid eggs in them singly (Fig 2 a). The larva after hatching scraped in the outer part of the fruit. The early-stage larvae were found feeding in the pericarp region of the fruit. The full-grown larvae made damage more in-depth in the endocarp portion of the fruits (Fig 2 b and c). The freshly eclosed adult weevils fed in the pericarp region of the fruits. Adult weevils emerged from the dried fallen fruits by making small circular holes (Fig 2 f).

Table 2: Relationship between *O. artocarpi* population and abiotic factors.

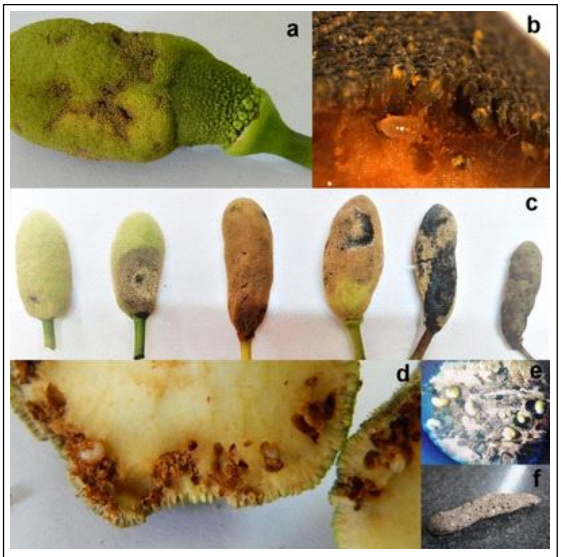
Variable	Correlation coefficient Y (r) value
Maximum temperature	0.35
Minimum temperature	-0.3
Morning relative humidity	-0.39
Evening relative humidity	-0.21
Evaporation	0.70*
Wind speed	-0.22
Rainfall	-0.63*

*Significant at the 0.01 level.



a) Egg, b) Freshly hatched larva with egg case, c) Larval instars, d) Anterior portion of larva, e) Prepupa (dorsal side), f) Prepupa (ventral side), g) Pupa (dorsal side), h) Pupa (ventral side), i) Adult.

Fig 1: Life stages of *Ochyromera artocarpi*.



a) Damaged fruit, b) Early instar larva entering into the pericarp of fruit, c) Different stages of pest damage on young fruits, d) and e) Later larval instars feeding on the endocarp of fruit f) Fallen dried fruit showing adult exit holes.

Fig 2: Damage symptoms of *Ochyromera artocarpi* on jackfruit.

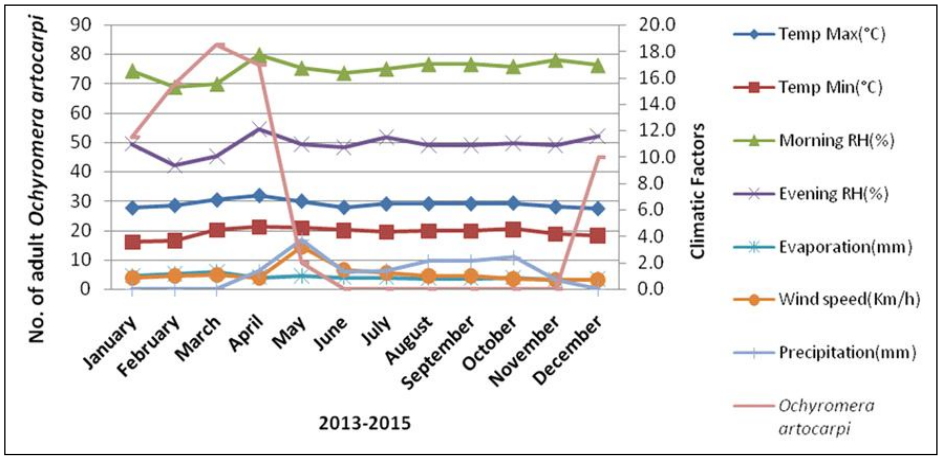


Fig 3: Incidence of *Ochyromera artocarpi* in relation to climatic factors at ICAR-IIHR jackfruit orchards during 2013-2015.

The larva *O. artocarpi* is of the typical curculionid form as reported in the mango nut weevil *Sternochetus mangiferae* (Fabricius) (Robert and Thomas, 2016; Pinese and Holmes, 2005). They are crescent-shaped, cylindrical, white, legless grubs. Older larval instars are compact and C-shaped. *Ochyromera artocarpi* completed its life cycle with five larval stages, as reported by Subramanian (1958). The total larval period, including prepupa of *O. artocarpi* lasted for 9.04±1.51 days, whereas Subramanian (1958) reported that the larvae complete its development and pupate in 14-15 days. The variation in larval duration may be due to the effect of host plants and local climatic factors. Damage of *O. artocarpi* on young fruits was similar to the reports of Subramanian (1958) and Butani (1979). The adult weevils found to feed externally, singly or in groups, on the fruit as reported by Butani (1993). The body measurement of adult female and male was almost similar to *O. sonepheti* (Hiroaki Kojima, 2011).

Seasonal incidence

Populations of *O. artocarpi* fluctuated during different months of a year. The initial infestation of *O. artocarpi* was observed in December coinciding with the onset of fruit set, and infestation further increased from January and reached its peak in March, and fully declined in April. The population of *O. artocarpi* was positively correlated with evaporation (r= 0.70) and negatively correlated with precipitation (r= -0.63) (Table 3). The small whitish grubs of *O. artocarpi* bore into tender flower buds and fruits during November to April. Affected buds and fruits fall prematurely. Adults sometimes found nibbling on leaves and feeding on the outer portion of immature fruits during March.

The population fluctuations of jackfruit bud weevil were closely associated with the weather parameters. The incidence was similar during all the three years (November - May), with a peak density in March (Fig 3). As of now, so far no information is available on the seasonal incidence of *O. artocarpi* on jackfruit and also on the genus *Ochyromera* in general in India and elsewhere. Our study provided a detailed life history and incidence of *O. artocarpi* first time, and this information could be useful to develop an effective weevil management programme.

CONCLUSION

Experiment results revealed that the male and female *O. artocarpi* completed their life cycle in 25.18±1.09 days and 26.14±1.12 days, respectively on jackfruit. There were five larval instars in its life cycle. Different life stages *viz*, larval stages, prepupa and pupa completed in 11.84 ± 1.44, 3.10±0.07 and 7.30±0.50 days, respectively. The infestation of *O. artocarpi* was observed during December-April and reached its peak in March.

ACKNOWLEDGEMENT

The authors are thankful to the Director, ICAR-Indian Institute of Horticultural Research, for providing necessary facilities.

Conflict of interest

All authors declare that they have no conflict of interest.

REFERENCES

Ayyar, T.V.R (1940). Handbook of Economic Entomology for South India. Government Press, Madras, India. Pp 319.

Bailey, L.H. (1949). The Standard Encyclopedia of Horticulture. Mac Millan Co. Ltd., New York. Pp 401-402.

Butani, D.K. (1993). Mango Pest Problems. Periodical Expert Book Agency, New Delhi. Pp 290.

Butani, D.K. (1979). Insect pests of fruit crops and their control: Jackfruit. Pesticides. 12(11): 36-44.

Clark, W.E., Whitehead, D.R. and Warner, R.E. (1977). Classification of the weevil subfamily ychiinae, with a new genus, new combination and new synonym in Lignyodini (Col., Curt.). Coleoptera Bulletin. 31(1): 1-18.

Cockerham, K.L., Deen, D.T., Christain, M.B. and Newsom, L.D. (1954). The biology of the sweet potato weevil. Technical Bulletin -Louisiana Agricultural Experiment Station. 383: 30.

Hiroaki Kojima (2011). Two new species of *Ochyromera* (Coleoptera, Curculionidae) associated with a coniferous tree, *Keteleeria evelyniana* (Pinaceae) from Laos. Elytra, Tokyo, New Series. 335(2): 335-341.

Dissanayaka, T.M.P.M., Gimhani, K.H.I. and Champa W.A.H. (2019). Evaluation of nutritional, Physico-chemical and sensory properties of jackfruit (*Artocarpus heterophyllus*) incorporated frozen yoghurt. International Journal of Scientific and Research Publications. 9(6): 627-633.

Kalshoven, L.G.E. (1956). Notes on the habits and ecology of Indonesian forest insects of minor importance III. Curculionidae. Entomologische Berichten. 16: 77-88.

Kojima, H., Morimoto, K. and Horikawa, M. (1998). Two new species of the genus Ochyromera (Coleoptera: Curculionidae) from Japan. Esakia, Fukuoka. 38: 113-122.

Kojimo, H. and Morimoto, K. (1996). The tribe Ochyromerini (Coleoptera, Curculionidae) of Japan. III. Genera with seven egments in the funicle and key to genera. Ibid. 64: 733-743.

Kuschel, G. (1995). A phylogenetic classification of Curculionoidea to families and sub-families. Memoirs of the Entomological Society of Washington. 14: 5-33.

Martin, S. and Minoru, T. (1954). The sweet potato weevils in Hawaii-Their biology and control. Technical Bulletin NO. 23. Hawaii Agricultural Experiment Station, University of Hawaii, Hawaii. pp 8-22.

Morimoto, K. (1962). Key to families, subfamilies, tribes and genera of the superfamily Curculionoidea of Japan excluding Scolytidae, Platypodidae and Cossoninae. Journal of Faculty Agricultural Kyushu University. 12: 21-66.

Niranjan, S. and Neha, G. (2016). ICT based decision support systems for Integrated Pest Management (IPM) in India: A review. Agricultural Reviews. 37(4): 309-316. doi: 10.18805/ag.v37i4.6461

Oberpreiler, R.G. (1993). New taxa of Ochyromerina from Africa; with comments on the subtribe and description of immature stages (Coleoptera: Curculionidae: Curculiononae: Tychiini). Africal journal of Zoology. 107: 217-252.

Pinese, B. and Holmes, R. (2005). Managing mango seed weevil. Horticulture and Forestry Science (online). Available: http://www.dpi.qld.gov.au.

Robert, E.W. and Thomas, R.F. (2016). Mango Seed Weevil, *Sternochetus mangiferae* (Fabricius) (Insecta: Coleoptera: Curculionidae). DPI Entomology Circular 93. Department of Entomology and Nematology, UF/IFAS Extension. University of Florida.

Sidhu, A.S. (2012). Jackfruit improvement in the Asia-Pacific Region - A status report, Asia-Pacific Association of Agricultural Research Institutions c/o FAO Regional Office for Asia and the Pacific Bangkok, Thailand. Pp 72-75.

Sidde Gowda, D.K. and Gubbaiah (2011). Insect pests of rice and their management in Karnataka state of India- A review. Agricultural Reviews. 32(1): 55-62.

Subramanian (1958). Letters to editor: On the occurrence and life cycle of jack weevil (*Ochyromera artocarpi* Marshall) at Coimbatore. Current Science. 27(6): 214.

Warner, R.E. (1961). The genus *Ochyromera* new to the western hemisphere, with a new species and additions to the Junk-Schenkling Coleopterorum Catalogus (Curculionidae: Prionomerinae, Endaeini). Coleopterists' Bulletin. 15: 121-124.

Zherichen, V.V. and Egorov, A.B. (1990). Weevils of the Far East USSR. Vladivostok. (in Russian). pp 164.