Purakala
(UGC Care Journal)

ISSN:0971-2143
Vol-31-Issue-09-April-2020

Taxonomic Comparison of Fruit Piercing Moths from Genus *Eudocima* (Erebidae: Calpinae) Inhabiting Saptashrungi Garh, Vani, Nashik

Gurule Sachin Arjun
Department of Zoology
K.R.T. Arts, B.H. Commerce and A.M. Science College
Nashik-2

Rajput Jyoti Ayodhyaprasad
Department of Zoology
K.P.G. Arts, Commerce and Science College, Igatpuri, Dist- Nashik
rajputjyoti4444@gmail.com

Abstract

Taxonomic investigation has been made for different species of fruit piercing moth from genus Eudocima collected from Saptashrungi Garh, Vani, Nashik during August 2013 to February 2014 using light sheet and fruit baiting method. In the present study four species of Eudocima viz. E. maternal; E. phalonia; E. homaena and E. salaminia were studied wherein there is marked sexual dimorphism has been noticed mostly in forewing pattern. The wing venations of all the species are super-imposable with one another concluding characteristic venation pattern for genus Eudocima. There is marked variation observed in male genitalia of different species; which typical for particular species ensuring reproductive isolation. Ovipositor lobes in female genitalia slightly rectangular covered with dense setae. Ductus bursae short tubular sclerotized in E. materna, E. phalonia and E. salaminia while unsclerotized in E. homaena. The corpus bursae distended sac like uneven in shape with irregular corrugations.

ISSN:0971-2143
Vol-31-Issue-09-April-2020

Keywoards: *Eudocima*, Erebidae, Calpinae, Wing venation, Moth, Lepidoptera

Introduction:

Order Lepidoptera comprises the insects commonly known as butterflies, moths and skippers which includes most fascinating insect group. Of which moths can be differentiated from butterflies and skippers due to their nocturnal habit, presence of pectinate, bipectinate, lamellate and filiform antennae and possession of unique spine like structure supporting their hind wings. Many moth species are having reputation of pest of agricultural, forest, ornamental plants and some are known to pierce the fruits cause economic damage. Fruit trees are susceptible to attacks of numerous lepidopteran larvae such as leaf miners, flower Webbers, flower, fruit, bud, bark, stem borers etc. is well non fact throughout the world. Moreover the role of adult lepidopteran species that damages the fruits was unknown until 1869, when Thozet a French botanist observed for the first time *Eudocima (=Othreis) fullonia* moths sucking juice from ripe orange fruits at Rockhampton in Australia. Unlike most other moths, many adult noctuid moth species viz. *E. fullonia* uses their proboscis specially adapted to puncture fleshy fruit and sucking the juice (Bänziger 1982). Thus, Stebbing (1903) and Lefroy and Howlett (1909) reported fruit piercing moths from India for the first time (Baptist, 1944). Also the less frequently occurring fruit piercing moths *viz.*, *Othreis salaminia* and *Rhytia hypermnestra* reported by Swamiappan (2001). Even though these moths cause serious damage to tropical and subtropical fruits, very little research has been done in India especially on their species complex. Fruit piercing moth attained importance and significance as pests in various countries according to the development and degree of introduced fruit cultivation, particularly of citrus and pomegranate. Among the fruit piercers, the genus *Eudocima (=Othreis)* are by far the most harmful, causing widespread damage in tropical and subtropical countries. In India, four species of *Eudocima (=Othreis) viz*., *Othreis fullonia*, *Othreis materna*, *Othreis homaena* and *Othreis cajeta* were recorded as prominent fruit piercer and they are considered as very serious pest on citrus, guava, pomegranate, grapes, fig, sapota, mango, papaya and tomato (Hampson, 1894; Susainathan, 1924a; Ayyar, 1944; Ramkumar, *et al.* 2010). Hampson (1894) was described 9 species of fruit piercing moth in Indian region viz. *Eudocima (=Ophideres) salaminia, O. ancilla, O. fullonica (=fullonia), O. materna, O. Aurantia, O. tyrannus, O. hypermnestra, O. cocalus and O. discrepans* in Fauna of British India.

ISSN:0971-2143
Vol-31-Issue-09-April-2020

Material and Methods:

Fruit piercing moths from genus *Eudocima* was collected by light- trapping, fruit baiting and wine roaping methods from saptashrungi garh during August 2013 to February 2014. Attracted specimen were slayed using glass jar charged with ethyl acetate. Collected specimens brought to the laboratory and pinned using entomological pins. Pinned specimens were set using spreading board before rigor mortis sets in and were dried using electric oven at temperature of 40 to 55° C for about 48 to 72 hrs. Dried voucher specimens were labelled and stored in insect boxes and are deposited in departmental insect reference museum of K.T.H.M. College, Nashik for further taxonomic investigations. The dried specimens were photographed using Nikon SLR D3000 camera with wide angle micro-lens kit under bright sunlight. The specimens were examined using stereoscopic binocular microscope for their external characters and wing pattern. Identification of specimens has been done by following the identification keys (Hampson, 1894; Haruta, (1994a); Holloway, 2005; Kononenko *et al.* 2005; Gurule and Nikam, 2013; Gurule, 2013.

Figure 1: Fruit baiting to attract moths

Figure 2: Preserved specimens in insect boxes

Wing venation and external genitalia were studied to follow identification keys by the procedure given by Lee *et al.* 2013. The right pair of wings is separated from the body giving upward and downward jerk using blunt forceps and wet in 100% ethyl alcohol for a few seconds. Labelled pinned specimen were given the specimen number and duplicate label were kept accompanying the wings through the various steps of processing. The wings are placed in 20 % Ethyl alcohol and denuded with a camel hair brush of size 0 and 1 by gently brushing the

ISSN:0971-2143
Vol-31-Issue-09-April-2020

wing membrane from the wing base towards apex, alternating with gentle tamping of the membrane. Then wings are transferred to a watch glass and stained with 2% Eosin overnight and further cleared of scales in 70% Ethyl alcohol. The wings are dehydrated in 100 % Ethyl alcohol for 2-3 hours before slide mounting. Wing venation photographed using Nikon D3000 SLR camera.

The abdomen of dried specimens were detached from the body giving upward and downward jerk on the venter of end of abdomen using forceps and placed in 10% potassium hydroxide (KOH) overnight at room temperature. After digestion in KOH, the abdomen is transferred to a watch glass with distilled water and gently cleaned hairs and debris from the abdomen with a fine camel hair brush. The male genitalia are separated from the abdomen by tearing the inter-segmental membrane between the last abdominal segment and the genitalia. The phallus was removed from the genitalia by holding the base of the valvae using forceps.

For female genitalia the inter-segmental membrane between the 6^{th} and 7^{th} segment is cut, or torn apart using forceps, but ductus bursae kept intact. A small slit in the corpus bursae has been made and content was removed using hypodermic needle. The abdominal plate and genitalia were transferred to a watch glass in 100% Ethyl alcohol and quickly positioned and held in place with small chips of a glass slide. Genitalia are positioned with the valvae spread and held open by the glass chip and mounted in DPX on clean slide and labelled. Terminology of genitalia is used as given by Pierce, 1909. Prepared slide is photographed with digital microscope photographic unit. The species identification was confirmed by direct comparison with specimens available in collection department of Bombay Natural History Society (BNHS), Mumbai.

Result and Discussion:

The main characteristic of the family erebidae are palpi with the 2^{nd} joint more thickened; the scaling hairy; the tibiae very frequently spined, and the tarsal joints short. Forewing with vein M3 and CuA1 almost always anastomosing; hind wing is quadrifine with vein M2 fully developed and always from lower angle of discal cell arising from a point adjacent to M3; so that the cubital veins appear to branch into four veins giving typical quadrifine characteristic venation. The genus *Eudocima* placed in subfamily Calpinae and tribe calpini

ISSN:0971-2143
Vol-31-Issue-09-April-2020

characterized by moderate to large species with a characteristic forewing shape that has a strongly sinuous dorsal margin with a lobe between the antemedial and postmedial fasciae and a slight hook or falcation at the tornus. The postmedial is usually strongly oblique over at least its posterior half and intersects the dorsum between more or less centrallized two thirds. The tibiae are not spined. Moths from tribe calpini are known as fruit piercing moth with distinctly modified tongue, being robust, sharp, with erectile spines as barbs to facilitate the piercing of the tough skins of fruit.

The genus *Eudocima* is characterized by leaf-mimicking forewings and flash yellow or orange coloured hind wings. This yellow or orange is generally interrupted by a black border over much of the anterior-part of the wing, with a large black lunule which may sometimes reduce to one or more spots; set sub-marginally in the remaining spaces; certainly this is simply distinguishing feature for the genus. Fore wing vein R not anastomoses with Sc; Rs1 from middle of dorsal margin discal cell; Rs1, Rs2, Rs3, Rs4 are anastomosing and stalked; M1 from upper angle of discal cell; M2, M3 and CuA1 stalked, M2 from lower angle of discal cell; CuA2 originate from middle of ventral margin of discal cell. Anal vein runs downwards along the ventral basal lobe and then slightly curved upwards reaching tornus. Hind wings with wing coupling apparatus frenulum arising from the humeral angle near base of costa which is held in place on underside of forewing by a retinaculum. Vein R anastomosing from Sc; vein M1 from upper angle while M2 well defined as other veins and arise from lower angle of discal cell arising from a point adjacent to M3; so that the cubital veins appear to branch into four veins giving typical quadrifine characteristic venation; M2, M3 and CuA1 stalked; CuA2 arising just above from middle of discal cell. Anal vein straight and distinct. In male genitilia uncus is pointed with robust

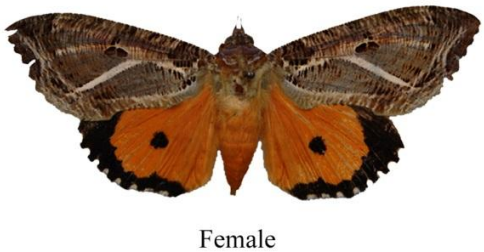
ISSN:0971-2143
Vol-31-Issue-09-April-2020

base in *E. materna*; robust with a slight scaphium in *E. phalonia*; short and acute in *E. homaena*. Acrotergite appears as dom over uncus in *E. homaena* and *E. phalonia* where as it is broad at the base of uncus in *E. materna*. Tegumen is longer than vinculum. The valves are with highly sclerotized margins and marginal thickening around the central lacuna; but with processes from thickened area in *E. Phalonia* & *E. Homaena* that lacks in *E. materna.* Juxta is hard plate divided dorsally in centre with dorsal division distinctly bifurcated which is short in *E. homaena* longest in *E. phalonia* and intermediate in *E. materna.* Female genitilia, ovipositor lobes in female genitalia slightly rectangular covered with dense setae. Ductus bursae short tubular sclerotized in *E. materna, E. phalonia* and *E. salaminia* while unsclerotized in *E. homaena.* All species shows corpus bursae distended sac like uneven in shape with irregular corrugations.

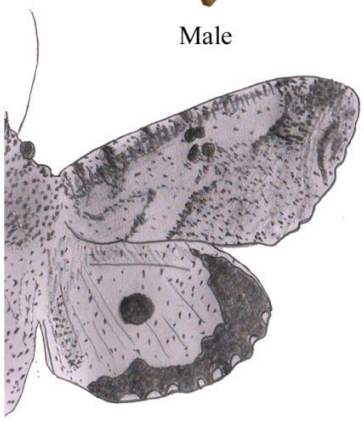
ISSN:0971-2143
Vol-31-Issue-09-April-2020

Plate 1 : Taxonomic key characters of *Eudocima materna* Linnaeus, 1767

Male

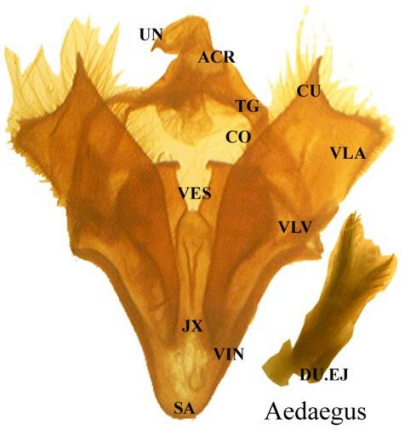


Female



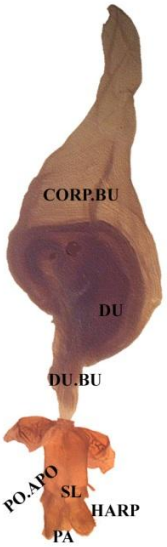
Wing pattern in male

Wing pattern in female

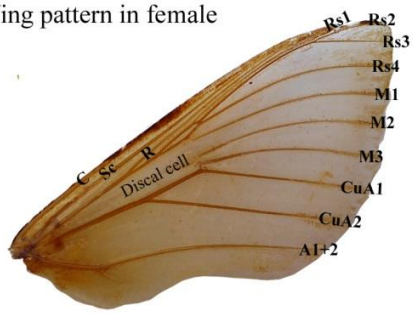


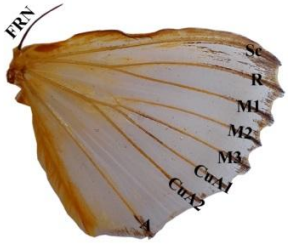
Aedaegus

Male Genitalia



Female Genitalia





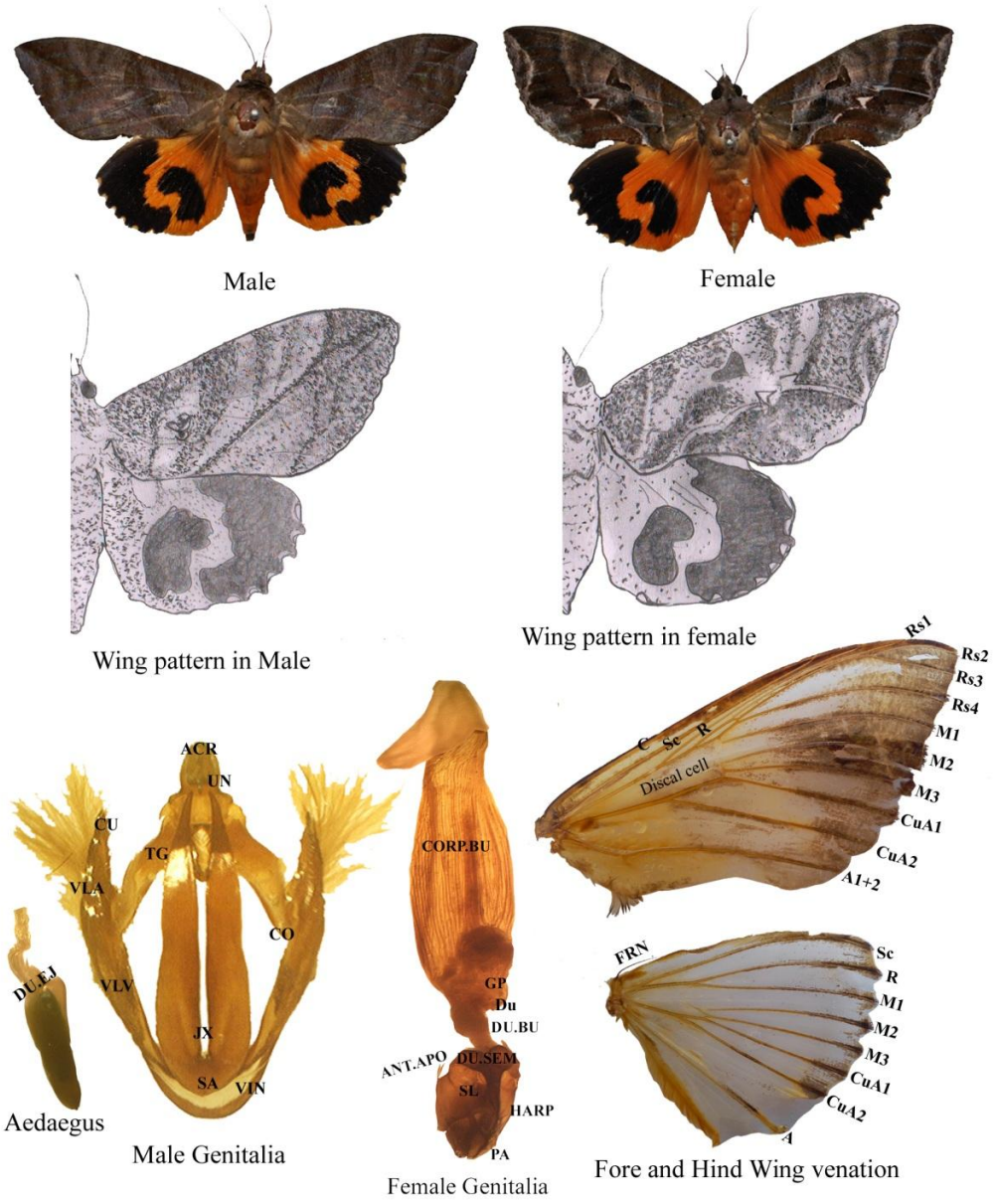
Fore and Hind Wing Venation

Abbreviations :

UN : Uncus	ACR : Acrotergite	TG : Tegumen
CU : Cucullus	CO : Costa	VLA : Valvula
VLV : Valva	VES : Vesica	VIN : Vinculum
JX : Juxta	SA : Saccus	Du.EJ : Ejaculatory duct
DU : Ductus	CORP.BU: Corpus bursae	DU.BU : Ductus bursae
SL : Sacclus	HARP : Harpe	PA : Papilla analis
PO.APO : Posterior Apophysis		
C : Costa	Sc : Subcosta	R : Redial
Rs : Redial sector	M : Median	CuA : Cubitus anterior

ISSN:0971-2143
Vol-31-Issue-09-April-2020

Plate 2 : Taxonomic key characters of *Eudocima phalonia* Linnaeus, 1763



Abbreviations :

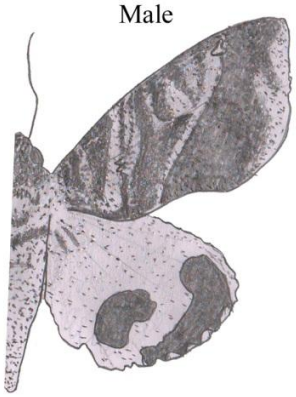
UN : Uncus	ACR : Acrotergite	TG : Tegumen
CU : Cucullus	CO : Costa	VLA : Valvula
VLV : Valva	VES : Vesica	VIN : Vinculum
JX : Juxta	SA : Saccus	Du.EJ : Ejaculatory duct
DU : Ductus	CORP.BU: Corpus bursae	DU.BU : Ductus bursae
SL : Sacclus	HARP : Harpe	PA : Papilla analis
ANT.APO : Anterior Apophysis		PO.APO : Posterior Apophysis
C : Costa	Sc : Subcosta	R : Redial
Rs : Redial sector	M : Median	CuA : Cubitus anterior
A : Anal	FRN : Frenulum	

ISSN:0971-2143
Vol-31-Issue-09-April-2020

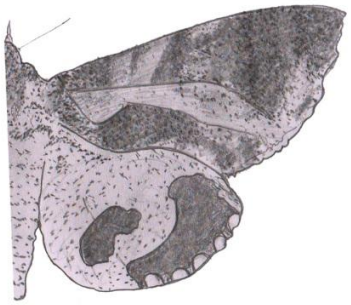
Plate 3 : Taxonomic key characters of *Eudocima homaena* Hubner, 1823

Male

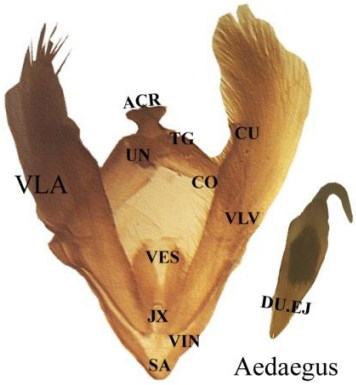
Female



Wing pattern in male



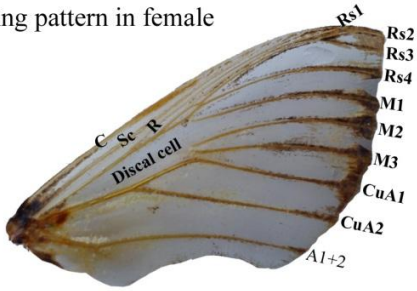
Wing pattern in female

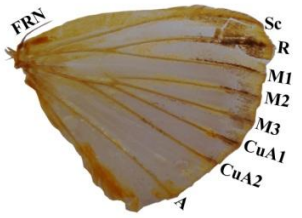


Aedaegus

Male Genitalia

Female Genitalia





Fore and Hind Wing Venation

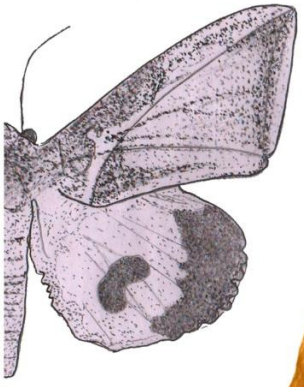
Abbreviations :

UN : Uncus	ACR : Acrotergite	TG : Tegumen
CU : Cucullus	CO : Costa	VLA : Valvula
VLV : Valva	VES : Vesica	VIN : Vinculum
JX : Juxta	SA : Saccus	Du.EJ : Ejaculatory duct
CORP.BU : Corpus bursae	DU.BU : Ductus bursae	SL : Sacclus
HARP : Harpe	C : Costa	ANT.APO : Apophysis Anterioris
Sc : Subcosta	R : Redial	Rs : Redial sector
M : Median	CuA : Cubitus anterior	A : Anal
FRN : Frenulum		

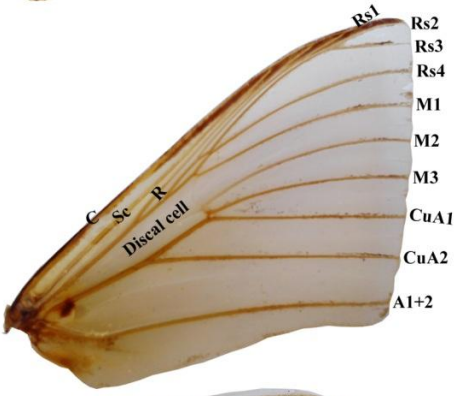
ISSN:0971-2143
Vol-31-Issue-09-April-2020

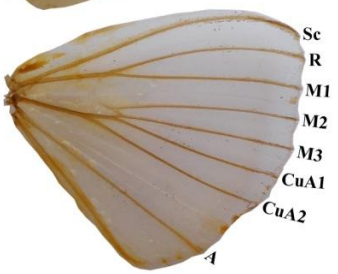
Plate 4 : Taxonomic key characters of *Eudocima salaminia* Cramer 1777

Female

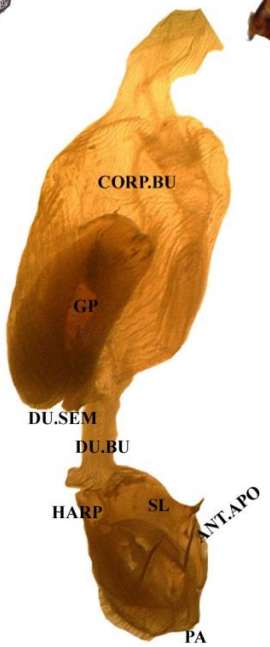


Wing pattern in Female





Fore and Hind Wing Venation



Female Genitalia

Abbreviations :

GP : Genital plate	CORP.BU : Corpus bursae	SL : Sacclus
DU.BU : Ductus bursae	DU.SEM : Ductus Seminalis	HARP : Harpe
PA : Papilla analis	ANT.APO : Apophysis Anterioris	
C : Costa	Sc : Subcosta	R : Redial
Rs : Redial sector	CuA : Cubitus anterior	M : Median
A : Anal		

ISSN:0971-2143
Vol-31-Issue-09-April-2020

References:

Ayyar, T. V. R., (1944). Notes on some fruit sucking moths of the Deccan. *Indian Journal of Entomology*, 5(I & II): 29-33 pp.

Bänziger, H., (1982). Fruit-piercing moths (Lep.,Noctuidae) in Thailand: A general survey and some new perspectives. Mitteilungen der Schweizerischen Entomologischen Gesellschaft 55: 210-240 pp.

Baptist, B. A., (1944). The fruit-piercing moth (*Othreisfullonica*L.) with special reference to its economic importance. *Indian Journal of Entomology*, 6:1-13 pp.

Gurule, S.A. and Nikam, S.M., (2013). The moths (Lepidoptera: Heterocera) of northern Maharashtra: a preliminary checklist. *Journal of Threatened Taxa* 5(12): 4693–4713pp; http://dx.doi.org/10.11609/JoTT.o2555.4693-713

Gurule, S.A., (2013). Taxonomic study of Moths (Lepidoptera: Heterocera) from north Maharashtra, India. *Ph.D. thesis submitted to Savitribai Phule Pune University, Pune*. 1-250 pp.

Hampson, G. F., (1894). The fauna of British India indicating Ceylon and Burma, Moths volume 2. Taylor and Francis, London, 558-563 pp.

Haruta, T., (ed.), (1994). Noctuidae: Catocalinae and Ophiderinae. In Haruta, T. (ed.) Moths of Nepal, part 3 *Tinea* 14, (Suppl. 2): 140-153 pp.

Holloway, J.D., (2005). Moths of Borneo. Parts 15 &16, Noctuidae: Catocalinae. *Malayan Nature Journal*, 58 (1–4), 1–529 pp.

Kononenko, V.S., & Pinratana, Bro., A., (2005). Moths of Thailand Vol. 3. Noctuidae: an illustrated catalogue of the Noctuidae (Insecta, Lepidoptera) in Thailand: Part 1: Subfamilies Herminiinae, Rivulinae, Hypeninae, Catocalinae, Aganainae, Euteliinae, Stictopterinae, Plusiinae, Pantheinae,

ISSN:0971-2143
Vol-31-Issue-09-April-2020

Acronictinae and Agaristinae. Brothers of St Gabriel in Thailand, 2-261 pp. 44 plates.

Lee, S. and Brown, R.L., (2013). Preparing dissections and slide mounts of moths including wing venation, genitalia and whole bodies. Online version accessed on 10 July 2013. http://mississippientomologicalmuseum.org.msstate.edu/Researchtaxapages/CactusMoths/Methodology.html

Lefroy, H. M. and Howlett, F. M., (1909). Indian Insect life. Calcutta and C. thacker, Spink. 786 pp.

Pierce, F.N., (1909). The Genitalia of the Noctuidae of the Lepidoptera of British Islands : An account of the morphology of the male clasping organs. Liverpool, A.W. Duncan, South John Street, 1-83 pp., 32 plates.

Ramkumar, J., Swamiappan, M., Raguraman, S. and Sadasakthi, A., (2010). Species diversity and seasonal abundance of fruit piercing moth cpmlex in Tamil Nadu. *Journal of Biopesticides*, 3(1) : 011-015 pp.

Stebbing, E. P., (1903). Indian Museum Notes, 5(3): 117-127 pp.

Susainathan, P., (1924a). Fruit-sucking moths of South India. Proc. 5th Entomol. Mtg. Pusa, 23-27 pp.

Swamiappan, M., (2001). Fruit piercing moths as emerging pests of fruit crops in India. Paper presented in national seminar on emerging trends in pests and diseases and their management held on October, 11- 13, 2001 at TNAU, Coimbatore. Abs. 9-10 pp.