Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(3): 247-251

Received: 07-03-2017
Accepted: 08-04-2017

Muddasar
Department of Entomology, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot, Karnataka, India

Venkateshalu
Department of Entomology, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot, Karnataka, India

Correspondence
Muddasar
Department of Entomology, College of Horticulture, Bagalkot, University of Horticultural Sciences, Bagalkot, Karnataka, India

Faunistic studies on the genus *Xanthodes* (Lepidoptera: Noctuidae: Bagisarinae) associated with Bhendi ecosystem of Karnataka

Muddasar and Venkateshalu

Abstract
Faunistic studies of the genus *Xanthodes* Fabricius were carried out during 2014-15. During this study two species were documented from the genus i.e. *X. albago* and *X. transversa*, which were collected and reared on their respective host plants. The morphological characters and external genitalic attributes were studied in detail and supplemented with photographs.

Keywords: Taxonomic, *Xanthodes,* genitalia, species, Noctuidae

Introduction
The productivity in vegetables is low due to many biotic factors like insect pests, diseases and abiotic stresses. Among various constraints for low productivity in vegetables, the infestation and loss caused by insect pests is one of the main contributory factors. Among the insect pests, caterpillars belonging to family Noctuidae of order Lepidoptera are of great economic importance. Larvae of these noctuid moths are polyphagous and feed on different kind of vegetables, grasses, cereals, weeds, flowers and fruit crops. Many of these caterpillars cause serious damage to foliage, growing shoots and stem and to economic parts like flower buds, flower, fruit or seed. The noctuid caterpillars are eruciform and are called by different names like cutworms, borers, defoliators or semiloopers based on their feeding habits.
The information pertaining to fauna and complexity of noctuids occurring on major vegetables and their identification at adult and larval stages is in infant stage. So, the studies especially in Karnataka, one of the major vegetable growing states of India have greater field applicability in horticulture in general and entomology in particular. Therefore, keeping these points in view the present investigation on "Faunistic studies the genus *Xanthodes* (Lepidoptera: Noctuidae: Bagisarinae) associated with Bhendi ecosystem of Karnataka" was under taken to study the diversity, morphological and genital characters,

Materials and methods
The present investigation was undertaken at Department of Entomology, College of Horticulture (COH) Bagalkot during 2015-16. The detailed material and methods during the course of study is presented below

Collection of immatures and rearing: The larvae were collected along with their host plants and were brought to laboratory for further rearing to adults at the Department of Entomology, COH, Bagalkot. The larval cultures were transferred to rearing cages of size 20×20×20 cm along with its host and were maintained in the laboratory by providing fresh shoots until they reached pupal stage. The immature stages collected from the field were reared in the laboratory as described by Bhumannavar and Viraktamath (2001) [1].

Collection of adults by using light traps: Light source of 200 watt mercury vapour lamp was used with white cloth background in the vegetable fields at Udyanagiri COH, Bagalkot. A white cloth of 10 ft. x 6 ft. was hung between two vertical poles with lamp at the centre. The moths which were attracted to light trap were collected. The emerged adults in the laboratory or collected from light were killed by using ethyl acetate, pinned through thorax using stainless anticorrosive insect pins (No. 3, 4). The insects were mounted on mounting boards, or on a thermacol, the antenna and wings were stretched properly in order to facilitate identification.

The specimens collected were identified to generic and species level based on the keys developed by Hampson in the Moths volumes of the Fauna of India

Morphological characters, venation of both fore and hind wing, and genitalia were recorded in detail for each species using standard procedures given by Blanchard and Knudson (1981) [2]. Genitalia of adults (male and female) were dissected using the technique described by Clark (1941) [3], Sivasankaran *et al.* (2011) [18] Sekhon (2013) [16] and Singh (2014) [17] with little modification. Dried and preserved adult insects were used for the dissection of genitalia.

Result and Discussion

During this study two species were documented and studied the morphological and genital characters. The members of the subfamily Bagisarinae were diagnosed by long palpi, porrect, met by a short and sharp frontal tuft, the 3rd joint prominent and antenna simple. Thorax and abdomen smoothly scaled without tuft of hairs, forewing with the termen non crenulate (Hampson, 1894) [6, 7].

The above study clearly indicated that there were some variations with respect to both morphological as well as genital characters. In the current study, all the above discussed variations were used for classifying the collected specimens upto families, sub-families, genera and species level. These variations were also used to prepare illustrated keys for easy identification. The present study corroborates with the findings of Kirti *et al.*, (2014) [11] who developed the identification keys for the subfamilies of Noctuidae by using morphological and genital characters.

The genus, *Xanthodes* can be distinguished by R_2, R_3 stalk and R_4, R_5 stalk (Hampson, 1894) [6, 7].

1a. Post spiracular hood medially angulated, tarsal segments apically with multiple rows of setae; fore wing with R_4 stalked away from the base of R_5 (Fig. 1); hind wings cross vein indistinct.....*Xanthodes transversa*

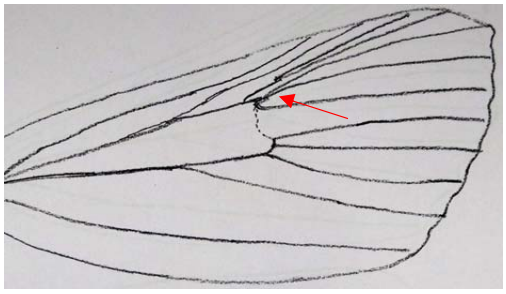

Fig 1

1b. Post spiracular hood medially concave, tarsal segments apically without multiple rows of setae; fore wing with R_4 stalked at the base of R_5 (Fig. 2); hind wings with cross vein distinct……..……..*Xanthodes albago*

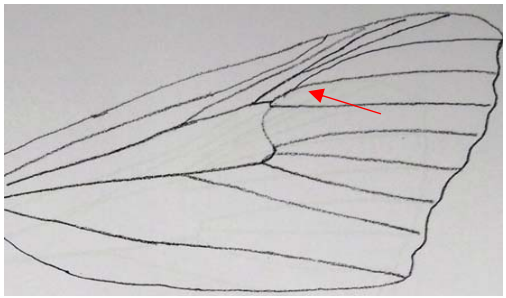

Fig 2

1. *Xanthodes albago* Fabricius, 1794 (Plate 1.)

Head whitish, thorax and fore wing bright canary yellow. Abdomen ochreous. Fore wing with an oblique waved ante medial line. Reniform oval, ochreous centre with a brown outline often obsolete, post medial line from costal margin encompasses the reniform spot. Post medial line highly excursed beyond the cell and angled towards the inner margin, the sub marginal lines, inner line angled below the costa, large diffused triangular patch extending over the whole of outer area, its apex running up to costa at post medial line. Sub terminal costal spot small, terminal margin dentate and blackish. Hind wing iridescent white, sometimes suffused with brownish or ochreous or only the apical area is brownish or ochreous. Females with a large brown terminal patch which extends towards the base of wing (Plate 1).

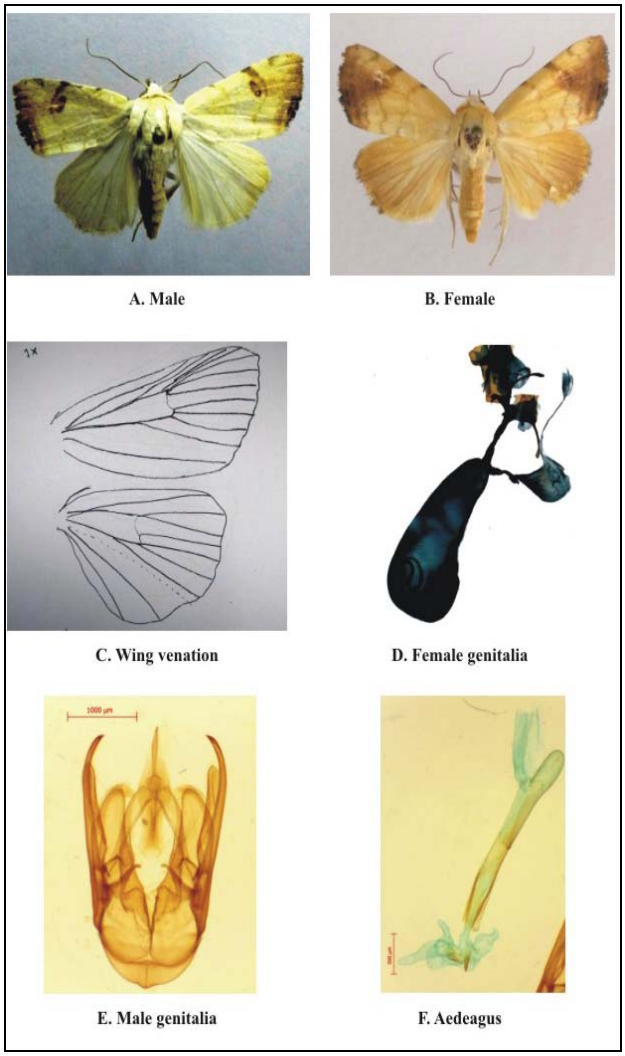

Plate 1: *Xanthodes albago* (Fabricius, 1794)

Head: vertex relatively rough, scales extended and pointed over frons, frons rough. Labial palp moderate size, upright with smooth and piliform scales. Proboscis tip strongly spinose and sclerotised. Antenna wider than frons and cilia prominent in males.

Thorax: Tympanum with post spiracular hood normal. Spiracle not visible and anteriorly directed. Fore tibia dorso ventrally flat with lateral extended piliform scale tuft. Mid tibial spur long more than 2/3rd of basitarsus. Hind tibia medially tufted. Terminal tarsal setae more than two.

Wing span: 30-32 mm

Fore wing: without areole R_2, and R_3 stalked emerges before upper angle and stalked for less than 1/4th of R2. R4 and R5 stalked. Only M_1 arises from upper angle. M_2 close to lower angle. M_3 from lower angle. CuA_1 from below the lower angle. CuA_2 away from the middle of the cell. Cross vein indistinct. R_1 and CuA_2 at equidistance from the discal cell

Hind wing: Sc and Rs anastomosed at the base forming a fork. M_2 present away from middle of the cell but not, close to the lower angle. Cross vein distinct, lower angle slightly forward then the upper angle. CuA_2 away from the middle of the cell.

Abdomen: roughly scaled and with one abdominal dorsal brush.

Male genitalia: uncus short, straight, sclerotised medium with a bulbous base, sparsely setose with setae at the base, Tegumen inverted V-shaped, membranous and both the arms narrow with a tube like process between the arms. Vinculum small membranous, arms fused and U-shaped. Vulva well developed, equal the length of tegumen, sclerotised and bears harpe at base with a spine like process. Sacculus developed into a long Claspers sclerotised and distinct, ends with a sharp spine like towards the apex. Cuculus pointed separated by a small notch, setose. Juxta membranous inverted W-shaped. Transtilla membranous. Transtilla, sacculus and tegumen fused basally and form two distinct plates
Aedeagus tubular narrow and elongate bulbous at base, vesica membranous with a single cornuti.

Female genitalia: Corpus bursae elongate balloon like, broader at the apex and narrow at the base, twice the length of ductus bursae. Ductus seminalis sac like arises between the junction of corpus and ductus bursae, tubular and slightly sclerotised. Anterior apophyses shorter than the posterior with a spatulate apex. Posterior apophyses pointed and needle like. Papilla analis slightly sclerotised, setose with macro and micro setae.

Larval characters: Grown up larva are greyish black with a black line present in mid dorsal region along the length of body with a series of black spots on either side of mid dorsal line. Ventral side of body is yellowish green colour laterally with a broad greyish white band and black spots surrounded by a yellow margin on all the abdominal sternites. A series of black prominent spots are present laterally with a prominent seta at centre. Dorsal and latero-ventral region bears white setae. Thoracic legs are black and abdominal prolegs greyish white on 5th and 6th sternite. Head poorly separated from thorax and is greyish yellow with black spots (Fig.3).

Fig 3: *Xanthodes albago*

Material examined: INDIA: Karnataka: Mudigere, 3 ♂, 20. x. 2014, collected from light, Prasanna, R. Y., RHREC (Kumbapur), Dharwada 03. xi. 2015, reared on okra, Muddasar; Bagalkot, COHB, 1♀ 10. viii. 2015, light trap, Venkateshalu.

2. *Xanthodes transversa* Guenee, 1852 (Plate 1.)

Fore wing right canary yellow with prominent medial streak extending from base to terminal area, vertex and thorax reddish brown, with reddish longitudinal line.
Fore wing ante and post medial line highly angulated rufous and waved sometimes, a large rufous triangular patch occupying the whole outer area and sometimes produced backward along the median nervure to base or occasionally obsolete, apical and sub-apical lines join rufous patch a black sub apical speck prominent. Hind wing slightly suffused with reddish brown, outer margin rufous (Plate 2).

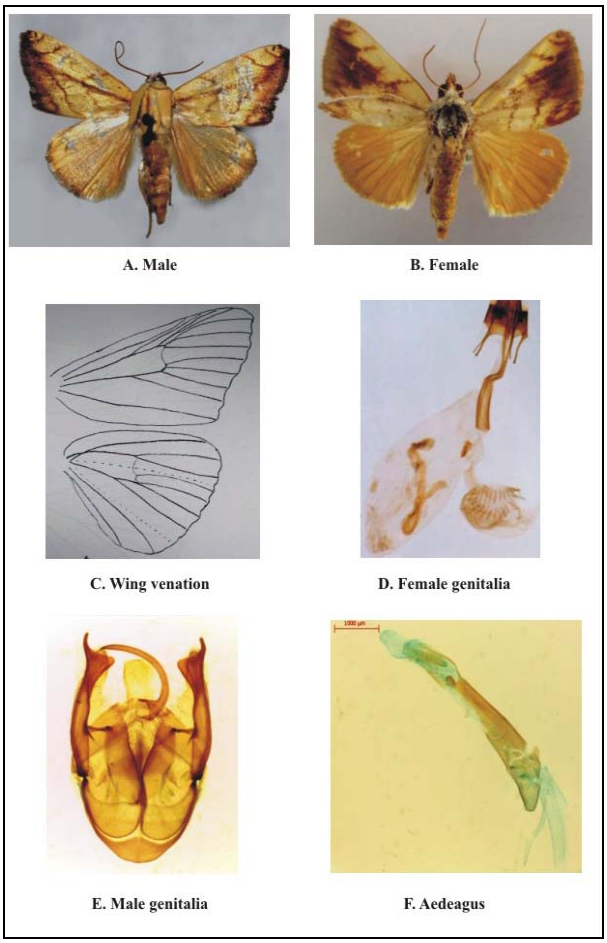

Plate 2: *Xanthodes transversa* (Guenee, 1852)

Head: vertex relatively rough, scales extended and pointed over frons, frons rough. Labial palp moderate size, upright with smooth and piliform scales, Proboscis strongly spinose and sclerotised. Antenna narrower than frons and cilia tufted in males.

Thorax: Tympanum with post spiracular hood posteriorly concave. Spiracle not visible and anteriorly directed. Tympanal sclerite smooth. Conjuctiva smooth. Fore tibia with lateral extended piliform scale tuft. Mid tibial spur long more than 2/3rd of basitarsus. Hind tibia medially and distally tufted with piliform scales and tarsal segments with multiple thin spines in between prominent three spines. Terminal tarsal setae more than two.

Wing span: 34-38 mm

Fore wing: without areole, R_2 and R_3 stalked for $1/3^{rd}$ of R_2 away from upper angle. R_4 and R_5 stalked for less than $1/4^{th}$ of the R_4 and emerge from upper angle of the cell, M_1 arises from upper angle. M_2 close to lower angle. M_3 from lower angle. CuA_1 from below the lower angle. CuA_2 away from the middle of the cell. Cross vein distinct. R_1 and CuA_2 at equidistance from the cell.

Hind wing: Sc and Rs anastomosed at the base forming a fork. M_2 present away from middle of cell, but not close to the lower angle. Cross vein indistinct at middle of the wing, lower angle slightly forwarded then the upper angle.

Abdomen: roughly scaled with one dorsal abdominal brush.

Male genitalia: uncus sclerotised long, curved, sickle shaped with apical spines, longer than the vinculum and tegumen. Pseudo uncus lobe like, membranous. Inverted V-shaped tegumen with both arms broad apically and separated widely at base. Vinculum small U-shaped. Saccus wanting. Vulva well developed sclerotised sparsely setose dorsally, well differentiated into parts. Basally vulva broad and meet broadly at base up to half of its length, vulva setose, apex of both vulvae ends with a thumb like process with a triangular base. Cucculus broad with a finger like process on outer margin. Juxta sclerotised, narrow at the base, bow shaped. Transtilla membranous. Transtilla, vulva, juxta fused and form two plate like structures in vinculum. Aedeagus elongated, slightly sclerotised without any spines. Vesica membranous, tube like and elongated.

Female genitalia: Corpus bursae elongate oval shaped, membranous twice as long as the ductus bursae. Ductus seminalis broad sac like with a sclerotised small spines in rows. Ostium bursae extended upto half the length of ductus bursae. Ductus bursae sclerotised and tubular. Anterior apophyses shorter than the posterior with spatulate apex whereas posterior apophyses with a pointed apex. Papilla analis triangular slightly sclerotised, setose with few micro and macro setae.

Larval characters: Fully grown up Larva is dark green with a distinct yellow band on mid dorsal portion along the length of body. Horse shoe shaped black colour spots on each sternite with a series of black colour spots dorsolateral. A narrow yellow stripe on lateral side of the body on which the spiracles are present. Black spots on latero ventral portion and horse shoe markings bear long setae. Last abdominal sternite with a reddish patch present dorsally (Fig.4).

Material examined: INDIA: Karnataka: Bagalkot, Haveli, 5 ♂, 25. x. 2015, reared on okra, Muddasar; Banidinni (Bagalkot), 23. xi. 2015, reared on okra, Muddasar; RHREC (Kumbapur), Dharwada 03. xi. 2015, reared on okra, Muddasar; KRCCHA, 03. xi. 2015, Reared on okra, Muddasar. Bagalkot, COHB, 1♀ 10. viii. 2015, light trap, Venkateshalu.

Fig 4: *Xanthodes transversa*

Acknowledgement
The authors are thankful to Dr. Shashank, Pathour, Scientist, Dept. of Entomology, IARI, New Delhi. for helping in identification and dissection of genitalia. The present study was carried out by host based collection, which helps in accurate identification of the pest and confirmation of its host. The morphological and genital characters of collected species were studied in detail and discussed here.

References

1. Bhumannavar BS, Viraktamath CA. Rearing techniques for three species of *Othreis* (Lepidoptera: Noctuidae) and their ectoparasitoid, *Euplectrus maternus* Bhatnagar (Hymenoptera: Eulophidae). Journal of Biological Control. 2001; 15(2):189-192.
2. Blanchard A, Knudson EC. A new species of *Ozamia ragonot* from Texas. Journal of the Lepidopterists Society. 1981; 35(3):233-235.
3. Clark GJF. The preparation of slides of the genitalia of Lepidoptera. Bulletin of Brooklyn Entomological Society. 1941; 36(4):149-169.
4. Ferguson DC. Review of the New World Bagisarinae with description of two new species from the southern United States (Noctuidae). Journal of the Lepidopterists Society. 1997; 51(4):344-357.
5. Hacker H. Additions to several revisions of Noctuid genera revised from 2001 to 2011, with descriptions of nine new species and three new subspecies from Africa, Arabian Peninsula and Iran, with faunistic Notes (Noctuoidea). Esperiana, Buchreihe zur

Entomologie. 2013; 18:199-220.
6. Hampson GF. Fauna of British India, Moths, 1894; 2: 160-609, 3: 1-107. Taylor and Francis Ltd., London.
7. Hampson G F. Fauna of British India, Moths, London, 2, 160-609, Taylor and Francis Ltd, 1894, 1-107.
8. Hampson GF. Fauna of British India Including Ceylon and Burma - Moths. 1892-1937, 1-5.
9. Holloway JD. The Moths of Borneo: Family Noctuidae, subfamily Catocalinae. Malayan Nature Journal. 2005; 58:1-529.
10. Kendrick RC. Moths (Insecta: Lepidoptera) of Hong Kong. Ph.D. thesis, The University of Hong Kong. 2002; xvi + 660, 1.
11. Kirti JS, Mudasir AD, Khan ZH. Keys for the identification and segregation of Noctuid subfamilies. Insect Environament. 2014; 19(3):176- 179.
12. Kitching IJ. An historical review of the higher classification of the Noctuidae (Lepidoptera). Bulletin of the British Museum (Natural History). 1984; 49:153-23
13. Kitching IJ, Rawlins JE, Noctuoidea. in Kristensen, N.P. Handbook of Zoology: Bd. 4. Arthropoda: Insecta. Teilbd. 35, Lepidoptera, Moths and Butterflies. 1999; 1:355-401.
14. Lafontaine JD, Fibiger M. Revised higher classification of the Noctuoidea (Lepidoptera). Canadian entomologist. 2006; 138:610-635.
15. Lafontaine JD, Schmidt BC. Annotated check list of the Noctuoidea (Insecta, Lepidoptera) of North America north of Mexico. Zookeys. 2010; 40:1-239.
16. Sekhon CK. Taxonomic significance of external genitalia in family Noctuidae (Noctuoidea: Lepidoptera). PhD (Dept. of Zoology and Environmental Science) Thesis, Punjab University 2013, 33-144.
17. Singh H. Genitalic studies of species *Craniophora fasciata* (Moore) (Noctuidae). International Journal of Advance Life Sciences. 2014; 7(4):593-596.
18. Sivasankaran K, Babu Thanadurai T, Ignacimuthu S. Studies on external genitalial morphology of subfamily Catocalinae (Lepidoptera: Noctuidae). Journal of Research in Biology. 2011; 8:631-642.