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NEW DISTRIBUTIONAL RECORD OF *LEUCANIA PALAESTINAE* (LEPIDOPTERA: NOCTUIDAE: HADENINAE): FROM PUNJAB, PAKISTAN

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ABSTRACT

An inclusive and comparative taxonomic account of one species of genus *Leucania* Ochsenheimer *viz*. *Leucania palaestinae* (Noctuidae: Lepidoptera) is provided herewith. Area was surveyed and collection of *Leucania palaestinae* was made from the selected area using light traps. This species was described with special reference to the species head, veins of both wings, appendages, male and female external genitalia attributes. Keys to the species of genus *Leucania* collected from district Muzaffargarh along with its spatial distributional map for all species is provided. Morphological characters have been illustrated with the help of photographs. This species has been reported for the first time from district Muzaffargarh, Punjab, Pakistan.

Key words. New record, *Leucania palaestinae,* genitalia, Muzaffargarh, Punjab

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INTRODUCTION

Noctuid's are well-known for their significant role of predation, pollination pest aptitudes and established one of the well-studied insect groups. Incredible degree of disparity is observed in all the developing stages among the group. Members of family Noctuidae are economically important, as the immature of several species but a variety of horticultural and agronomic crops. Caterpillars may damage any part of the plant such as roots, shoot, foliage and fruits. All types of cultivated crops have almost one or two insect pest belonging to this family. (Kristensen *et al.*, 2007). The larvae of this family deteriorate agricultural crops as well as forest plants by mastication, but adult moths are anthophilous along with well-developed and dentate tip like proboscis, which uses for piercing the peel and flesh of ripened fruits for sucking the juices. The damaging portion of fruit can easily become infected by other microbial pathogens that spoiled the fruits to drop out prematurity (Krenn, 2010). Noctuidae Family is the largest family of moths and it has 29 subfamilies throughout the world, among these subfamilies, Hadeninae has great economic importance. (Speidel *et al.*, 1996). Subfamily Hadeninae is further alienated into six tribes i.e. Glottucini Hadenin, Eriopygini, Leuceniini, Hadenin, Hadenin and Tholerini (Kitching and Rawlings, 1999). Mostly Noctuids moths are morphologically similar but actually, they are dissimilar from one another. These species also have an attraction towards artificial lights and this behavior is significant for moth's collection during the night by a light trap. (Fayle *et al*., 2007).

Historically, moth's cataloguing was extremely unhinged because numerous authors categorized the Noctuid's moth only base on simple morphological characteristics (Zahiri *et al.,* 2012). The preliminary morphological classification was started with one or two simple characters i.e. wing patterns, color and antennae (Covell, 1984). Afterward the genital structure was identified as a highly significant and more tenacious taxonomic character as compare to color pattern variation, wing venations, and type of antenna (Mutanen *et al*., 2005). Genitalic attributes of Noctuid moths provide the enormous and massive source of deviation than other simple morphological characters (Varga and Ronkay, 2013).

Genus *Leucania* Ochsenheimer, 1816 is a most imperative Noctuid's genus, comprises almost 350 identified species globally, about one-third of which occur in the new world. (Poole, 1989). Although the catalogue of family Noctuidae (Poole, 1989) is the mostlatest taxonomic platform for genus *Leucania* throughout the world. This genus was first time described by Ochsenheimerin, 1816 and identified the *Phalaena comma* Linnaeus as a type species, then (Hampson,1894) studied this genus systematically and identified forty-seven species from different zones of India and Britain. (Franclemont, 1951) described a species *viz, Psedaletia adultera* first time from North America. (Sugi, 1963) identified two different species like *L. striata* Leech and *L. insecuta* Walker from China. (Sekhon, 2013) examined and separated the two species i.e. *L. venalba* Moore and *L. albicosta* Swinhoe of the genus *Leucania* from India. These species were identified based on genitalia. (Mudasir, 2013) described a new species *L. palaestinae* Staudinger by the systematic study of male and female

genital attributes from Himalaya Kashmir. Three species like *L. rivorum, N. multistria,* and *L. pampa* were identified on the base of genitalia from Brazil (Diego *et al.*, 2019). The main objective of this study is to clarify the taxonomic identity of the family Noctuidae from district Muzaffargarh, Punjab, Pakistan. *L. palaestinae* species has been reported from district Muzaffargarh and dealt with taxonomic update. Wing venation and genitalic characters of new recorded species have been elaborated and key is furnished for inter-specific discrimination.

MATERIALS AND METHODS

Different collection sites were selected for Noctuid's collection several comprehensive surveys were conducted from different zones of district Muzaffargarh from April 2016 to September 2017. Forty specimens of *L. palaestinae* species were netted by using the light trap.

Selected localities of District Muzaffargarh: Different localities including Ruhelanwali, Ali Pur, Kot Addu, Jatoi, Khan Garh and Musoshah were selected for the collection noctuid moths.

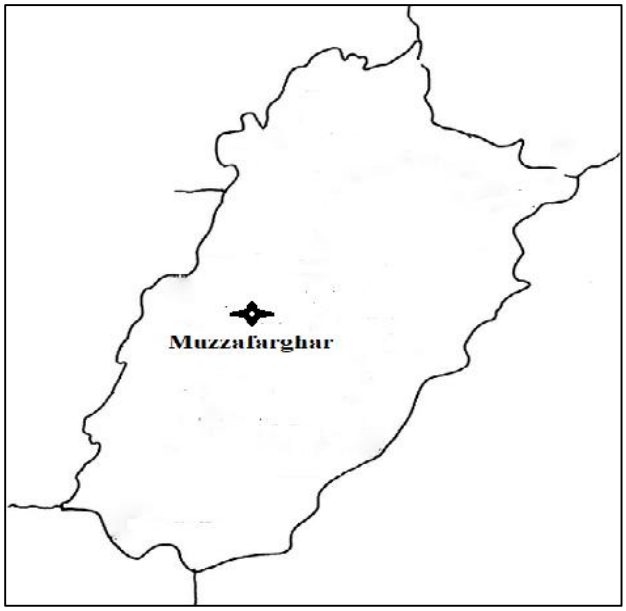

Figure 1. Map of District Muzaffargarh

Collection and Conservation: Adult moths of family Noctuidae were collected with the help of light traps (160 W and 250 W) that were installed in different localities i.e., Ruhelanwali, Ali Pur, Kot Addu, Jatoi, Khan Garh and Musoshah of district Muzaffargarh. Data was collected after 24hours (Sarwar *et al.,* 2020). Collected samples were slew in Potassium cyanide without spoiling the body scales. Deceased samples were putted as sandwich in wet butter paper for 2-3 hours for softening body parts like wings, legs, and antenna. Body appendages such as legs, wings and antenna were spread on the stretching board and preserve properly into the airtight wooden box. The tags with complete detail about specimens were also fixed. Phenyl tablets and Coopex powder were used for the preservation of collected moths from ants, lizards, and other predators. (Sajjad *et al.,* 2020)

Examination of genitalia and wings venation: To study the wing venations, both (Hind & Fore) wings were separated from the moth body by agile upward jerk. These wings were scraped by dipping into 70% alcohol up to 1 to 2minutes and then shifted into solution of sodium hypochlorite (NaOCl) for 20 minutes and then washed for 2 to 3 times by distal water. For genitalia study of male and female moths, the routine procedures were adopted usually used by (Sajjad *et al*., 2020: Sarwar *et al.,* 2020). Specimen abdomens were removed from the moth body and soaked in 10% solution of Potassium Hydroxide (KOH) in test tubes heated for 5–10 minutes. Dissection of abdomen was done by using fine needles and forceps under stereomicroscope (Meiji EMZ-5TR). Genitalia was removed and washed in distilled water 2 to 3 times to eliminate the KOH residues and subsequently immersed into 50, 60, and 70% ethanol for 15 to 20 minutes to clear all the parts of genitalia. The genitalia were examined under a stereoscopic microscope MEJI, Photography of the analytical features of the Noctuid moth and genitalia was done by a digital camera (HD 1500 T Meiji)

Description: All collected specimens were identified and classified into their respective biological hierarchy based on both morphological as well as genital characteristics with the help of books, published literature (Noctuid's Taxonomy), identification keys, internet sources, and taxonomic experts. Dichotomous keys have also been provided. Photography of diagnostic characteristics was also made.

RESULTS AND DISCUSSION

Diagnostic characters of *Leucania* genus: The wingspan of adult moths is varying up to 34- 44mm in size. Forewings are mostly dark grey color along with pale brown veins. Hind wings are lighter in color but the apex is gray. Well-developed proboscis and diagonally upturned palpi. Dense scales present on the 2nd segment of palpi but the 3rd segment is without scale, shorter and depressed. Both eyes are densely hairy, in male moth antenna lightly ciliated. The head of this genus is not intensely retracted into the thorax, head, and thorax consistently covered with grey hairs but the thorax is fully scaled. A tuft of hairs is present on basal segments of the abdomen that are whitish and brownish. Small hairs are on the tibia and tarsi. (Dar, 2014).

Key of different species of the genus *Leucania*

1. Tegumens broader laterally …….2
-Tegumens slender laterally……5

2. Ductus bursae are short in female genitalia, curved dorsally and well sclerotized
***L. abdominalis* Hampson 1894**
-Ductus bursae of female genitalia is long and Straight…….3

3. Vesica longer in size along with bulky cornuti …...***L. punctosa* Tritschke 1825**
-Vesica short and more cornuti are present in two clusters…….4

4. Ductus bursae two and half times long as long as appendix bursae in female genitalia
***L. infatuns* Franclemont 1972**
-Ductus bursae is shorter in length, straight and sclerotized in female genitalia
***L. striata* Leech 1900**

5. Uncus larger and distally curved with thick and short hairs…..... ***L. substriata* Leech 1900**
-Uncus large tubular fringed with hairs below and middle sides…6

6. Centeral fragment of vinculum and saccus are abstemiously broad and large
…..... ***L. radiate* Bremer 1861**
-Saccus is abstemiously wide its dorsal and posterior portions are slightly bent……7

7. Antennae are minute ciliated, broad and dark color strips are present in forewing
……***L. diatrecta* Butler 1886**
-Antennae are simple thread like; forewings have greyish color scales ……....8

8. Hind wings mostly white in color, veins directed toward the outer margin of hind wings
……***L. loreyi* Duponchel 1827**
-Hind wings are pale yellow in color with dark and white stripes beneath the cell……9

9. Forewings veins margin are pale brown and extends from base of wings up to the discal spot….

***L. phragmitidicola* Guenee 1852**
-Forewings veins edges are dark brown which extended from the base of wings up to the discal spot……10

10. Hind wings mostly consistently covered with the pale brown scale
……***L. anteroclara* Smith 1902**
-Hind wings are whitish in color and few dark spots present on outer margin……....11

11. Black dots are present in short discal cell ……***L. lapidaria* Grote 1876**
-Two-minute dark spots occur in a moderate discal cell with …..…12

12. Uncus long and cylindrical in shape along with small hairs. Crona is without penicular hairs b ……***L. adjuata* Grote1874**
-The uncus is smaller, cylindrical, without hairs. Dense penicular hairs are present on Crona ……***L. palaestinae* Staudinger, 1897**

Morphological Features of *Leucania palaestinae* Staudinger, 1897: Both head and thorax are fringed with light grey hairs; Abdomen pale in color along with tuft of hairs; upturned palpi; long and simple antennae; whitish brown forewings and fringed with small fuscous; external margins of wings are greyish; veins and interspaces slightly streaked with brown. Some ochreous stripes are present at base; one streak present in the discal cell; anti-medial line and indistinct sub basal occurred; unclear orbicular claviform: an indistinct postmedial, submarginal. Hind wings whitish and dark brown veins are present; cilia are pale white along with black marginal line (Figure A).

Male genitalia of *Leucania palaestinae* Staudinger, 1897: The uncus is curled and shorter in size. Juxta is tapering towards the top just like pear-shaped and well sclerotized. Teguments narrow membranous and have eye-like spots. Valva broader, complicate, bifurcates apically and covered with tinny hairs. The ventral phase of the valva is deeply arched with a strong forked; large and curved ampulla; costa has a short triangular projection. Sacculus well-developed. Vinculum is a v-shaped; Saccus small; Aedeagus is a bulb-shaped; Thick spiculiform cornuti present in the vesica. Ductus ejaculatorious entered near the base (Figure B).

Female; not found

Materials examined: 22 specimens of *L. palaestinae* were captured by light trap from selected localities such as Kot Addu 06 ♂, 9. vii. 2016, Alipur on 02 ♂, 19. ix. 2016, Ruhelanwali, 05♂, 5. iii. 17 and Jatoi, 03 ♂, 02. ix. 2016, Khan Garh 02 ♂, 10. vi. 2016, Musoshah 04 ♂, 19. ix. 2016. Already defined species of this genus were also collected like, Moths of *L. lapidaria* were netted from Ali Pur14, ♂, 03. ix. 2017, Mahmood Kot, 8♂, 02. x. 2016 and Jatoi, 15♂, 07. ix. 2016. *L. adjuata* were captured from Alipur, 13♀, 04. v. 2017 and Jatoi, 17 ♀, 04. x .2016. Samples of *L. anterodara* from Jatoi, 12♂, 17. ix. 2016, Mahmood Kot, 07♀, 28. vii. 2016, Kot Addu, 16 ♀, 04. v. 2016 and Alipur 11 ♂, 22. iv .2016. Specimens of *L. phragmitidicola* from Kot Addu, 15 ♂, 28. viii. 2016, Ayub Iqbal Malik.

Distribution: Iran. Egypt, Cyprus, Sicily, Greece, Israel, Turkey, Syria, Sinai, Iraq Jordan, and Turkmenistan, and India. (Salem, 2020)

Table 1. Measurement of different parts (mm) of genitalia of *Leucania palaestinae.*

Characters	*L. palaestinae*
Head	5
Antennae	13
Wingspan	29
Aedeagus	2
Valva	5
Saccus	0.2
Tegumen	1.2
Uncus	.5
Juxta	1.5

Comments: This species is widely distributed in district Muzaffargarh and most of the population is found in agricultural crops. Few specimens of this species during surveys were found from forest areas.

Remarks: The newly reported species is very similar to the already described species *viz, L. palaestinae*, but delimited by the following combination of the characters. (1) Uncus curved and short, (2) Juxta is Pear-shaped (3) Valva has lighter and trifling hairs, (4) Valva is narrow and short (5) Eyelike spot present in Tegumens.

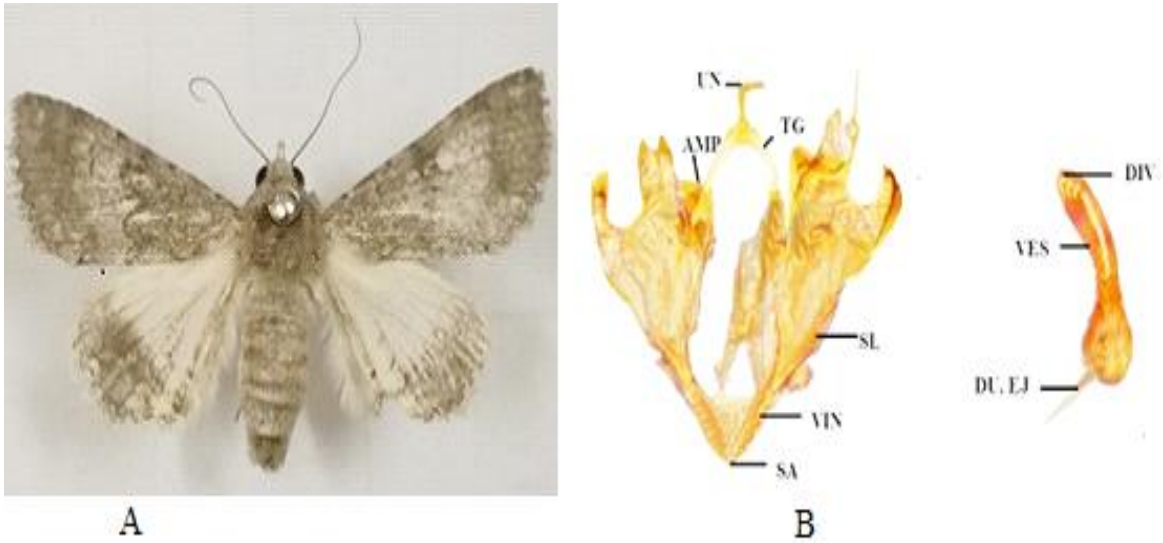

Figure2: (A) Adult *L. palaestinae* (B) Male genitalia

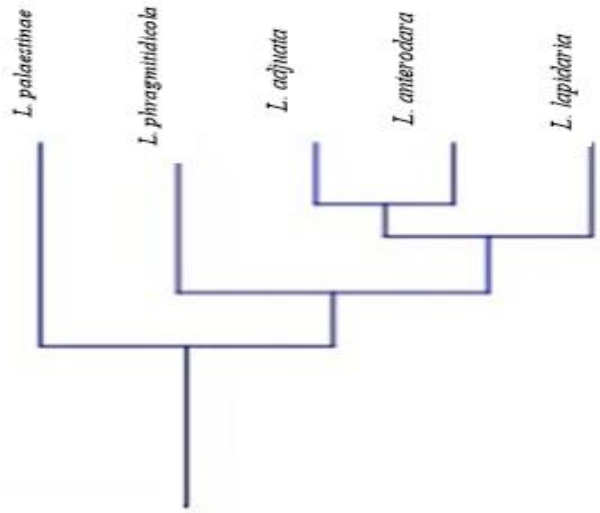

Figure 3. Dendrogram of different species of genus *Leucania*

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Author's Contribution: Zahid Mahmood Sarwar and Muhammad Binyameen design this study and helped in

species identification and classification. Ayub Iqbal Malik conducted this study and wrote the manuscript.

Declaration of interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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