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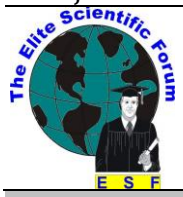

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RESEARCH ARTICLE

Biodiversity and Faunistic Studies of the Family Pyralidae (Lepidoptera) from Pothwar Region, Punjab, Pakistan

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ABSTRACT

Snout moths (Lepidoptera: Pyralidae) are economic pests of agricultural crops and forest plantations. To explore new species via taxonomic identification, 127 specimens of moths were collected from different areas of Pothwar region of Pakistan including Chakwal, Attock, Jhelum and Rawalpindi districts during 2009-2010. The characters of the specimens were identified at species level by using Hampson's key and other taxonomic resources. All of these species new to Pyralid moth fauna of Pothwar region namely: *Galleria mellonella* Linnaeus., *Achroia grisella* Fabricius., *Corcyra cephalonica* Staint., *Chilo simplex* Butler., *Scirpophaga auriflua* Zeller., *S. chrysorrhoa* Zeller., *Leucinodes orbonalis* Guenee., *Zinckenia fascialis* Cramer and *Cnaphalocrocis medinalis* Guenee. are reported for the first time from Pothwar region. To understand the biodiversity of moths, distribution of the species were also studied for each district of Pothwar region. The distribution pattern of *Corcyra cephalonica* (42), *Leucinodes orbonalis* (18), *Scirpophaga auriflua* (10) and *Scirpophaga chrysorrhoa* (9), *Chilo simplex* (6), *Zinckenia fascialis* (7), *Cnaphalocrocis medinalis* (10), *Galleria mellonella* (24) and *Achroia grisella* (1) was observed. Dichotomous keys have been built for low to higher taxa. Photography of important taxonomic characters are also provided.

INTRODUCTION

The family Pyralidae belongs to superfamily Pyraloidea and constitutes an important group of insects in Lepidoptera order (Kristensen, 2003). There are about 5,000 identified species of family Pyralidae belonging to five major subfamilies namely Pyralinae, Phycitinae, Epipaschiinae, Galleriinae and Chrysauginae (Munroe and Solis, 1998; Triplehorn and Johnson, 2005). Most of the insect members are significantly important pests of agricultural crops and forest trees (Hill, 1983; Wagner et al., 2008). The monophyly of the Pyralidae is supported by the closed bullae tympani (Solis, 2007); the forewings are elongate and or triangular with cubitus appearing four branched and the hind wing usually broad. Veins R_3 and R_4 in forewing completely merged or stalked at their base, uncus arms in the male genitalia (Kapoor, 1985; Solis, 2007).

The larvae of family Pyralidae have a body that is cylindrical in shape and pointed at each end. In normal position, the larvae have five pairs of abdominal prolegs. The body length of mature caterpillars is 8 to 40 mm (Maier et.al., 2004). Within Lepidoptera life history of Pyralid moths is very much diverse. Most species pass their larval period by feeding internally or externally on plants as leaf rollers, leaf miners, borers, root and seed feeders (Schulze and Fiedler, 2003). Pyralid adults are small, delicate and often dull colored snout with projected labial palpi (Ambrose, 2004; Triplehorn and Johnson, 2005).

Pyralidae includes some most important insect pests are yellow stem borer (*Scirpophaga incertulus* Walker), stalk borer (*Chilo auricilia* Dudgeon), shoot borer (*Chiloinfuscatellus* Snellen) and top borer (*Scirpophaga nivella* Febricius) (Dale, 1994; Neupane, 1990; Sallam and Allsopp, 2008). Furthermore, the rice leaf folders *Cnaphalocrocis medinalis* and *Marasmia* spp are major pests of rice crop in Asia (Khan et al., 2012. Indian meal moth (*Plodia interpunctella* Hubner), almond moth (*Cadra cautella* Walker) and wax moths (*Galleria mellonella* Linnaeus) are the important pests of the fruit trees (Campos-Figueroa, 2008; Solis, 2006). Larvae of

various species of family Pyralidae destroy the cones of pine trees (Turgeon et al., 1994; Whitehouse et al., 2011). Numerous moth species belonging to different families are morphologically similar to each other. Moths are nocturnal and remain inactive during day time (Maier, 2004). Several of these notorious species remain unfamiliar to entomologists in terms of their check and distinctiveness due to the fact that these are minor and less damaging species. Besides, even the most damaging and well known species like *Scipophaga nivella* in rice and top borer, *Scirpophaga excerptalis* in sugarcane had often been confused. For example, males of the *Scirpophaga incertulus* bear a resemblance to the males of *S. gilviberbis* and *S. nivella* while females of these species are easily distinguishable. Likewise, more morphologically similar species still need to be recognized by taxonomic studies. Other than Hampson work on the Pyralidae moths, there are no reports available on the diversity and distribution pattern of the snout moths from Pothwar region. Therefore, the present investigation have been undertaken to study the taxonomic identification of the poorly known species of Pyralidae moths and their distribution pattern in Pothwar region.

MATERIALS AND METHODS

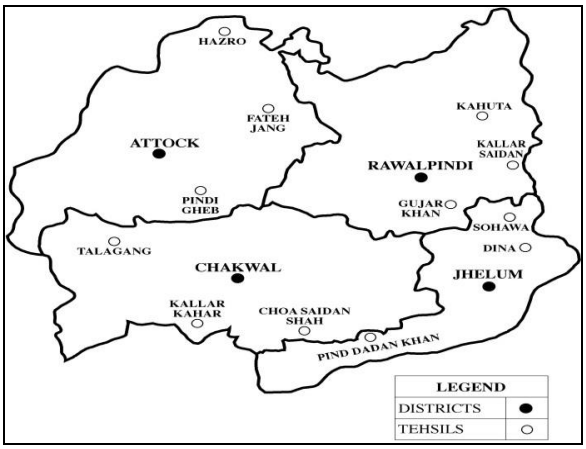

Fig. 4: Map showing different localities of Pothwar region from where Pyralidae moths were collected (Khan et. al, 2012).

In order to explore the fauna of Pyralid moth (Pyralidae: Lepidoptera) the proposed research was conducted during the year 2009-2010. A total 127 specimens were collected from the following localities of Pothwar region. Valid names for the captured specimens, their synonyms, description of habitat, body lengths and sex ratio of collected specimens with dates of collection are also provided. Dichotomous keys have been built for lower and higher texa. Coloured images of important taxonomic characters are also provided.

District Rawalpindi

i. Rawalpindi ii. Kahuta iii. Kallar Saidan iv. Gujar Khan

District Attock

i. Hazro ii. Fateh Jhang iii. Pindi Gheb iv. Jhand

District Jhelum

i. Jhelum ii. Dina iii. Sohawa iv. Pind Dadan Khan

District Chakwal

i. Chakwal ii. Chua Saidan Shah iii. Talagang iv. Kallar Kahar

Collection and Preservation

Moths were collected by using aerial nets, light traps and hand picking at night time. Data was collected after 24 hours. The specimens were collected on daily bases during March to October. Collected specimens were transferred in killing jars containing potassium cyanide. After half an hour, the dead specimens were placed in wet butter paper in petri dish for soften the body parts especially the wings than these specimen stretched and pinned properly and preserved in wooden boxes along with tags which have a complete information about the specimen. Coopex powder and mounted naphthalene balls were used to protect the specimens from ants and other predators.

Wing venation

To study the wing venation of the collected specimens, wings were washed out according to method described by (Triplehorn and Johnson, 2005).

Wings were removed carefully to avoid the breakage or tearing. After removal, the wings were dipped in 95 % alcohol and 10 % hydrochloric acid, respectively, in order to make them wet. Then wings were cleaned by bleach (a mixture of 5o% sodium chloride and 50% sodium hypochlorite) and rinsed with distilled water to remove the traces of bleaches. Cleaned wings were mounted on slide and preserved properly for further taxonomic studies.

Wing venation was studied according to (Hampson, 1896) and other available literature using stereoscope Leica, 4X. The specimens were further confirmed morphologically by comparing with housed collection of Pyralid moths at National Insect Museum and National Agricultural Research Centre Islamabad. The collection was deposited in Biosystematics Laboratory, Department of Entomology, PMAS-Arid Agriculture University Rawalpindi. Identification was done up to species level with the help of already published literatures, books, monograph and internet sources. Photography of adults, wings and dichotomous keys were also provided.

RESULTS AND DISCUSSION

Family Pyralidae

Members of this family are called as snout moths because their labial palpi are projected forward.

Diagnostic characteristics of this family are: Maxillary palpi and proboscis developed; Forewing with vein 1*a* usually free sometimes forming a branch with 1*b*; Vein 5 from near lower angle of cell or nearer 4 than 6. Hind wing with vein 5 usually from near lower angle of cell; 8 anastomosing with 7 beyond the end of cell; Vein 1 *a*, *b*, *c* present; Frenulum developed.

Identification of 9 species in 8 genera belonging to 4 subfamilies of family Pyralidae has been described as fellow

Key to the subfamilies of Pyralidae in Pothwar Region

1. Wings often relatively narrow, gray in color. Ocelli absent. Hind wing with median nervure pectinated on upper side……..……... 2
- Wings often ground, brownish or blackish, with four white cross lines. Ocelli present. Hind wing with median nervure not pectinated on upper side…..…..… 3
2. Maxillary palpi small, but distinct, upturned, scaling different in species. Retinaculum elongate, bar-shaped. ……..……..……....Galleriinae
-Maxillary palpi small and triangularly scaled …… ……..……...…..……..Crambinae
3. Proboscis absent…….…...……Schoenobinae
- Proboscis present.....……..Pyraustinae

1. Subfamily Galleriinae (Zeller, 1848)

Key to Genera of Galleriinae

1. Four veins arising from median nervure of hind wing, Outer margin of forewing angled ……*Galleria* (Fabricius, 1798)
- Three veins arising from median nervure of hind wing, Outer margin of forewing not angled……..……...2
2. Hind wing with closeddiscal cell, Vein 8 present, frenulum with single spine….. *Achroia* (Hubner, 1819)
- Hind wing with opendiscal cell, Vein 8 absent, frenulum with double spine ……*Corcyra* (Rogonot, 1885)

1. **Genus *Galleria* (Fabricius, 1798)**
1. ***Galleria mellonella* (Linnaeus, 1758)**

Adult 15-18 mm**,** Head, thorax and abdomen yellowish brown. Palpi of male minute and in female are long, extending beyond the short frontal tuft Antennae simple in male with a tuft of basal joint; Forewing grey Fore wing 12-15 mm; Hind wing 8-10 mm; Inner area ochreous; variegated with purple and black; a ridge of raised rough scales below the cell; Outer margin of forewing angled; Hind wing fuscous brown; base and inner area paler or almost wholly pale; Frenulum present. (Fig 1A-B).

Type

This species was collected on light near bee hives.

Biomaterial examined

Kallar Saidan: 5(2♂ + 3♀), 30-vii-2010. Rawalpindi: 8(5♂ + 3♀), 27-vi-2010. Kallar Kahar: 6(3♂ + 1♀), 7-iv-2009. Chakwal: 5(2♂ + 3♀), 22-iv-2009.

Remarks

Judging from the published description of *Galleria mellonella*given by Hampson (1896) this species is distinct on the basis of outer margin of forewing angled.

2. **Genus *Achroia Achroia grisella* (Fabricius,1798)**

Adult 12 mm, uniform grey-brown, the head yellow. Palpi minute and porrect; maxillary palpi minute. Antennae minutely serrate. Forewing short and rounded, male with a glandular fold fringed with hair at base of costa below. Vein 3 from near angle of cell, vein 11 absent. Fore wing 9-11 mm, Hind wing 6-9 mm, Hind wing with the apex acute. Vein 2 from close to angle of cell. Frenulum present in the form of short hair (Fig 2A-B).

Type

This species was collected on light near bee hives.

Biomaterial Examined

Rawalpindi: 1♂, 27-vi-2009.

Remarks

This species is very close to already known species of *Achroia grisella* given by Hampson (1896) but differ from the following characters, Apex of acute fore wing and hind wing is short and round.

3. Genus *Corcyra* (Rogonot, 1885)

4. *Corcyra cephalonica* (Stainton, 1866)

Measurement

Adult 10-12 mm. Head and thorax very pale brown, sometimes whitish or darker brown. Antennae whitish brown, basal joint with some darker brown scales. Abdomen and legs pale brown. Fore wings very pale brown, the veins more or less indicated by darker brown scaling, except along the dorsum which remains of the pale ground color. Fore wing 12mm, Hind wing 9 mm. Hind wing with open discal cell, vein 8 absent. Frenullum in the form of double spine. Cilia with a slightly paler line at their base (Fig 3A-B).

Type

This species was collected on light in the stored products.

Material Examined

Rawalpindi: 5(3♂ + 2♀), 15-viii-2009. Hazro: 6(4♂ + 1♀), 21-vii-2010. Pind dadan khan: 3(1♂ + 2♀), 13-viii-2010. Jhelum: 6♂, 16-viii-2010. Dina: 4♀, 15-viii-2010. Gujar khan: 6(4♂ + 2♀), 18- vii 2010. Chakwal: 4(2♂ + 2♀), 06-viii-2010. Talagang: 8♂, 07-viii-2010:

Remarks

This species is very close to already known species of *Corcyra cephalonica* given by Chittenden (1919) but differ from the following characters. This specie is distinct on the basis of open discal cell of hind wing and frenulum with double spine.

2. Subfamily Crambinae

5. Genus *Chilo* (Zincken, 1817)

6. *Chilo simplex* (Butler, 1877)

Measurement

Adult 14-18 mm. yellowish brown head and thorax. Proboscis absent. Palpiporrect, covered with rough hair

and extending two to three times length of head. Antennae minutely serrate. Fore wing 12-14 mm, Hind wing 7-9 mm, fore wing with apex rectangular in male, somewhat acute and produced in female. Fore wing of male has a highly curved transverse line of short dark brown streaks, yellowish patch in the end of cell. Female with some diffused fuscous from apex to lower angle of cell (Fig 4A-B).

Type

This specie was collected on light in the maize crop.

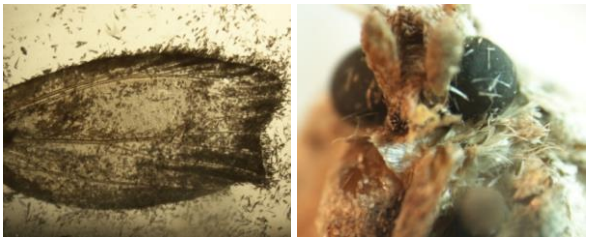

Fig. 1(A-B): Forewing and maxillary palpi of *Galleria mellonella* not triangularly

Fig. 2(A- B): Forewing of *Achroia grisella* with rounded appearance and hind wing with acute outer margin

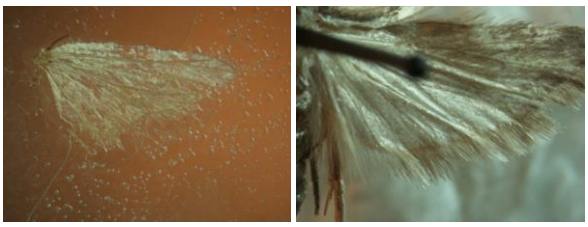

Fig. 3(A-B): Hind wing of *Corcyra cephalonica* with open discal cell and double frenulum and showing pale brown cilia

Fig. 4(A-B): Labial palpi of *Chilo simplex* porrect, covered with hair and extending two to three times length of head and fore wing apex somewhat produced

Material Examined

Kahuta: 2♂, 23-v-2010. Jhelum: 4 (3♂ + 1♀), 7-v-2010.

Remarks

Corcyra cephalonica given by (Chittenden, 1919). The porrect, longer palpi and rectangular apex of fore wing in male.

3. Subfamily Schoenobinae

5. Genus *Scirpophaga*

Key to Species of Scirpophaga

1. Pure white, anal tuft orange or brownish in female……...……. *auriflua* (Zeller, 1863).
-Pale or golden yellow, anal tuft greyish brown ……..chrysorrhoa (Zeller, 1863).

V. *Scirpophaga auriflua* (Zeller, 1863)

Measurement

Adult 12-18 mm, pure white in color. Head with the frons white, palpi porrect and extending once to twice the length of head; antennae of male minutely ciliated or serrated. Thorax upper side whitish. Abdomen of female large and with longorange colored anal tuft. Legs generally white. Wings white, long and narrow. Hind wing with frenulum double spine (Fig 5A-B).

Type

This species was collected on light in the sugarcane crop.

Biomaterial examined

Rawalpindi: 2♀, 30-vii-2010. Attock: 4♀, 11-iv-2009. Hassan Abdal: 4♀, 15-vi-2010.

Remarks

This species is very close to already known species of *Scirpophaga auriflua* by (Hampson, 1896) but differ from the following characters; This species has pure white color and brown or orange anal tuft**.**

VI. *Scirpophaga chrysorrhoa* (Zeller, 1863)

Measurement

Adult 8-12 mm. Pale golden yellow in color. Thorax upper side whitish. Abdomen of female large and with grayish brown anal tuft. Abdomen long and ochreous. Wings golden yellow, long and narrow. Fore wing with vein 3 from before angle of cell; 4, 5 from cell. Hind wing with vein 3 from near angle of cell. Hind wing with frenulum double spine (Fig 6A-B).

Type

This species was collected on light in the grass fields.

Biomaterial examined

Rawalpindi: 4♀, 30-viii-2009. PindiGheb: 2♀, 11-vi-2010. Hassan Abdal: 3♀, 15-vi-2010.

Remarks

This species is very close to already known species of *Scirpophaga chrysorrhoa* given by (Hampson, 1896) but differ from the following characters, Its golden yellow color and greyish brown anal tuft.

4. Subfamily pyraustinae (Meyrick, 1890)

Key to Genera of Pyraustinae

1. Antennae annulated, Veins 4, 5 of the hind wing well separated……..*Leucinodes* (Guenee, 1854)

- Antennae not annulated, Veins 4, 5 of the hind wing not separated…….…….…….…….…….2
2. Third joint of palpi long, naked and pointed, Frons rounded.....*Zinckenia* (Zeller, 1852)
- Third joint of palpi short and blunt, Frons not rounded.……...… *Cnaphalocrocis* (Guenee, 1854)

6. Genus *Leucinodes* (Guenee, 1854)

VII. *Leucinodes orbonalis* (Guenee, 1854)

Measurement

Adult 11-13 mm. Body white, the head and thorax flecked with black and brown. Antennae not thickened and somewhat annulated. Base of fore wing brownish yellow or rusty brown followed by an incomplete undulating black line. Discocellulars of hind wing highly angled. Hind wing with black speck at upper angel of cell and spot at lower angel (Fig 7A-B).

Type

This species was collected on light in the brinjal crop.

Biomaterial Examined

Rawalpindi: 5(4♂ + 1♀), 22-vi-2010. KallarSyedan: 5(4♂ + 1♀), 18-v-2010. Hazro: 3♂, 20-iv-2010. Choa Saidan Shah: 3♂, 7-iv-2010. Gujar Khan: 2♂, 23-viii-2010.

Fig. 5(A-B): Orange anal tuft of female of *Scirpophaga auriflua.* Labial porrect, third joint down curved and Frons black and rounded

Fig. 6(A-B): Greyish brown anal tuft of female of *Scirpophaga chrysorrhoa,* with Brown and rounded frons

Fig. 7 (A-B): Annulated antennae of *Leucinodes orbonalis.* Wings base of forewing rusty brown, black and brown patches on both wings

Remarks

This species is very close to already known species of *Leucinodes orbonalis* given by Hampson (1896) but differ from the following characters, Its rusty brown fore wing base, black and brown patches on both wings, annulated antennae and hind wing with discocelluler highly angled.

7. Genus *Zinckenia* (Zeller, 1852)

VIII. *Zinckenia fascialis* (Cramer 1782)

Measurement

Adult 8-10 mm. Dark brown body colour; abdomen brown with white rings; antennae smooth or simple; palpi upturned, third joint long and naked; frons rounded. No transverse anterior lines in the fore wing, a black edged white patch present not reaching the costa. Hind wing with patch more regular and wider and only slightly tapering to inner margin. (Fig 8A-C)

Type

This species was collected on light in the grass fields.

Biomaterial Examined

Attock: 2♂, 28-vii-2010. Pinddadan Khan: 3♂, 24 -vii-2010. Dina: 2♂, 25-vii-2010.

Remarks

This species is very close to already known species of *Zinckenia fascialis* given by Hampson (1896) but differ from the following characters, It's long, naked and pointed third joint of palpi, white patches on both wings and rounded frons.

8. Genus *Cnaphalocrocis* (Guenee, 1854)

IX. *Cnaphalocrocis medinalis* (Guenee 1854)

Measurement

Adult 8-10 mm. Yellowish brown body; head and collar dark brown; palpi upturned, lower side white and upper side yellow; flat and oblique frons; antennae annulated; abdomen yellow and ringed with white and black to the extremity. The anal tuft black with white strips. Fore wing with a depression of membrane in the middle of costa with tuft of hair on upper side. Hind wing yellow with outer area dark brown. Discal cell short in hind wing. Long cilia present on outer margin of hind wing (Fig 9A-C).

Type

This specie was collected on light in the grass fields.

Biomaterial Examined

Rawalpindi: 3♂, 10-viii-2010. Kahuta: 2♂, 12-viii-2010. Hazro: 2♂, 18-viii-2010. Fatehjang: 3♂, 19 -viii-2010.

Remarks

This species is very close to already known species of *Cnaphalocrocis medinalis* given by Hampson (1896) but differ in the following characters, its black anal tuft with white strips, depression of wing membrane and flat and oblique frons.

Fig. 8(A-C): Labial palpi of *Zinckenia fascialis*, third joint long, naked and acuminate, with Simple antennae and wings with white patches

Fig. 9(A-C): Labial palpi of *Cnaphalocrocis medinalis* white below and third joint short.Abdomen ringed with white and yellow towards extremity and anal tuft black with a white strip. Fore wing depression of membrane between subcostal and medial veins.

Table 1: Distribution of various species of Pyralidae moths in Pothwar Region.

Area	Attock	Chakwal	Rawalpindi	Jhelum
Name of species				
Galleria mellonella	0	11	13	0
Achroia grisella	0	0	1	0
Corcyra cephalonica	6	12	11	13
Chilo simplex	0	0	2	4
Scirpophaga auriflua	8	0	2	0
Scirpophaga chrysorrhoa	5	0	4	0
Leucinodes orbonalis	3	3	12	0
Zinckenia fascialis	2	0	0	5
Cnaphalocrocis mdinalis	5	0	5	0

Conclusion

This family is very diverse for our crops and vegetables and immature of this family causes a huge loss to our economy, but there is no research work has been done on the taxonomy of this family from this region. In the present research the taxonomic study of family pyralidae was done for the first time from this region.

Authors' contributions

All authors contributed equally in finalizing this manuscript.

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