



## Original article

# First record and taxonomic description of the genus *Thysanoplusia* (Fabricius) (Lepidoptera: Noctuidae: Plusiinae) from Pakistan

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## ABSTRACT

Species belonging to genus, *Thysanoplusia* Fabricius of the subfamily Plusiinae which are polyphagous in nature and pest of vegetables, foods, legumes, fodder, fruits, ornamental plants and cotton crops. Samples were collected from different localities of district Bahawalpur. For collection, comprehensive and comparative surveys were carried out during 2017–18 on taxonomic account of species of the genus *Thysanoplusia* Fabricius and resulted identified one species *Thysanoplusia orichalcea* (Fabricius) first time from Pakistan. Morphological characters viz., vertex, frons, labial palpi, antennae, compound eyes, ocelli, proboscis, wing venation, male and female genital characteristics were used for the identification and classification. Dichotomous keys and photographs are also provided. There is hardly any substantial research work on taxonomic studies of subfamily Plusiinae Pakistan. So to fill this gap the present proposal was designed to study the diversity of Noctuid moths from Pakistan and very fruitful results have been obtained.

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## 1. Introduction

Lepidoptera is the 2nd largest order of insect after Coleoptera which comprises moths and butterflies. Almost all kinds of cultivated plants have one or two pests belong to order Lepidoptera.

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Adult stage of both moths and butterflies are mostly beneficial insects as pollinators of many plants that take the nectars with the help of siphoning type proboscis. The immatures usually have chewing mouthparts that are suitable for feeding on almost all parts of the plant (Krenn, 2010) and they are defoliators and/or miners of delicious plant tissues. Among these, defoliators are the most inclusively fall down in subfamily Plusiinae (Lepidoptera: Noctuidae). Members of this subfamily are robust, small-medium sized, usually with a basic characteristic metallic speck in the middle of the forewing (Twinkle et al., 2018). Their caterpillars, known as semi-loopers, larval forms loopers and leaf feeders, they are also major pest of some economically important crops as the immature feed on numerous herbaceous plants, including crops such as soybean, potato and sunflower Bhat and Ahangar (2018).

The subfamily Plusiinae was established first time by Boisduval (1829) with type genus *Plusia* (Ochsenheimer, 1816). This subfamily is moderately large and taxonomically important. Plusiines comprises almost 500 species throughout the world (Ronkay et al., 2008), of which 59 species under 25 genera and 3 tribes have been reported from India (Shashank and Longjam, 2014). The genus *Thysanoplusia* was erected by Ichinose (1973). This genus is very vast and diverse in nature. Species *Thysanoplusia orichalcea* (Fabricius) is also known as soybean looper. It is a polyphagous in nature and serious pest of vegetable crops that are cultivated in Indonesia, from where it spread to South Asia, Europe, Africa, India, New Zealand and Australia. The species *T. orichalcea* was firstly identified by Fabricius in 1775, *Noctua orichalcea* as type species from India. A number of taxonomic changes gave rise to many genus synonyms as *Plusia*, *Diachrysia* and *Thysanoplusia* (C.A.B., 1977). Species synonyms viz, *Noctua aurifera* Hubner, *N. orychalcea* Hubner and *Phalaena chrysitina* Martin (Poole, 1989). The *T. orichalcea* has been frequently studied under numerous synonyms like *Thysanoplusia* (Hill et al., 1987), *Diachrysia* (Turner, 1978), *Diachrysia* (Taylor, 1980, 1978), *Plusia* (Jack, 1941; Evans, 1952; Caswell, 1962; Rose, 1963; Schmutterer, 1969; Singh and Singh, 1977; Dhuri and Singh, 1983; FaTeiro and Singh, 1985; Sardana and Verma 1986; Singh and Singh, 1987; Hill and Waller, 1988; Bhardwaj and Panwar, 1990) and *Phytometra* (Evans, 1952). The recorded common names are several (C.A.B., 1977), but semi-looper is used as a common name (Singh and Taylor, 1978; Taylor, 1980; Sardana and Verma, 1986; Hutchison, 1988; Hill and Waller, 1988). Jagbir et al. (2014) also studied the taxonomy of *T. orichalcea*. Jagbir and Charan (2015) identified one species of the genus *Thysanoplusia* on the base of genitalia.

In the present manuscript, *T. orichalcea* species was collected and identified in detail on the base of male genitalia for the first time. Genital characters gives species specific characters for the identification of all type of moths to fulfill the gap of taxonomic study of family Noctuidae from Pakistan.

## 2. Materials and methods

The noctuid specimens were captured by light trap (250 W, 160 W and 250 W) that were fixed at different localities i.e., Uch sharif, Hasilpur, Khairpur, Tamewali, Ahmed pur, Lal suhara, Yazman and Khanqah sharif of district Bahawalpur, Pakistan. Noctuid moths were collected from mentioned localities during 2017 and 2018.

The collected specimens were killed in poison jar of potassium cyanide without damaging the body scales. Body appendages such as antenna, legs and fore and hind wings were spread using the stretching board. Moths were pinned with entomological pins and preserved properly in air tight wooden boxes along with detail description like collector name, locality, habitat and collector name. Abdomen was cut from the body and dipped in 10% KOH solution for one night (Robinson, 1976). Abdomen was dissected very carefully with the use of fine forceps under stereomicroscope (Meiji EMZ-5TR). Genitalia was washed in distal water and 50%, 60% and 70% solution of ethanol for 15 to 20 min for clearing of the genital parts and finally washed with glycerol. Permanent mounting of the wings and genitalia was done on glass slides with help of Canada balsam. The identification of these samples was done with the help of relevant and published literature (Hampson, 1895).

The genitalia were studied following the methodology of Robinson (1976), Klots (1970) and Kitching (2003). For photographs, genitalia were placed on a glass slide with a cover slip. Photographs were taken with a digital camera mounted on (Meiji Techno) stereo zoom microscope by using a Canon SX60 digital

camera. Measurement of all body parts along with genitalia were also done as shown in Table 1.

## 3. Results

### Diagnostic feature of genus *Thysanoplusia*

Members of the genus *Thysanoplusia* vary in color and are marked with median whitish silvery color. Different body parts like head is rough and anterior parts of frons are twisted. Vertex is inverted and palpi have large 2nd and 3rd segments than the basal segments. Moderate size proboscis and hairy and glabrous eyes. Antenna of the male are ciliated. Fore wings are larger than hind wing while anterior margins are sinuate and crenulated but rounded apical sub angles of the apical margin. Anterior and apical margins of the hind wings are sinuated. Middle tibia have wanted spines but spines clothed the posterior tibia. Ductus bursae of the female genitalia bag like.

### Diagnostic feature of *Thysanoplusia orichalcea*

**Head:** Head is brownish in color and concealed with compact brown hairs. A light brown medial line present on patagia.

**Thorax:** crests of this region have yellowish brown color and also fringed with brownish hairs. Thoracic crests have yellowish brown color. Pectus are yellowish white in color. Fore wings are light brown color decorated with a golden color and reniform is located at angle of the cell but hind wings are yellowish brown color, terminal area and veins of hind wing are decorated with dark brown color.

**Abdomen:** small brown hairs are present. Abdominal crests have yellowish brown tips and lateral anal of the male covered with small and brown tuft of hairs (Fig. 2A–C).

### Male genitalia of *T. orichalcea*

Uncus consistently narrows and curved along with needle like or ponted tip. Scaphium is long and well-developed. Tegumen is narrow and short than uncus in length. Valva is tapered and band like at the base but gradually broadening towards the caudal. Spines are present on cucullus area. Harp absent. Vinculum is thin, extended and highly sclerotized. Saccus of the genitalia is broad and cylindrical with rounded tip. Juxta is wide and candle flame like and well define (Fig. 2D). Aedeagus long cylindrical and inflated at base with almost short ejaculatory ductus that enter near the base while numerous spines like cornuties are present on distal end and proximal portion tubular (Fig. 2E).

### Material examined of *T. orichalcea*

Punjab: Bahawalpur: Uch sharif, 02 ♂♂, 08.viii.2017, Hasilpur, 02 ♂♂, 22.ix.2018. Khairpur, 03 ♂♂, 02.ix.2017, Tamewali, 02 ♂♂, 21.vii.2018. Ahmedpur, 01 ♂♂, 14.ix.2017, Lal sunhara, 03 ♂♂, 26.

**Table 1**  
Measurement of different body parts (mm) and Standard Error (SE) of the species *Thysanoplusia orichalcea*.

Characters	% Measurements (mm) of 16 Specimens of <i>T. orichalcea</i> ± SE
Wingspan	36 ± 0.719
Antenna	17 ± 0.428
Aedeagus	7.0 ± 0.387
Valva	6.5 ± 0.258
Saccus	2.0 ± 0.242
Tegumen	2.5 ± 0.204
Uncus	3.0 ± 0.241
Juxta	1.0 ± 0.102

vi.2017, Yazman, 01 ♂, 13.x.2017 and from Khanqah Sharif 02 ♂♂, 13.x.2018. Muhammad Sajjad.

In the graph results indicates that abundance of the *T. orichalcea* was recorded at Khairpur and Yazman because in these localities mostly land are cultivated with vegetables and brassica crops but lowest numbers were collected from Tamiwali and Ahmed pur where most of the land is cultivated with rice crop. Another reason is the sand dunes located at Khairpur and Yazman that increase the temperature which might help in the abundance *T. orichalcea* (Fig. 1).

**Sexual dimorphism:** Unknown

**Habitat**

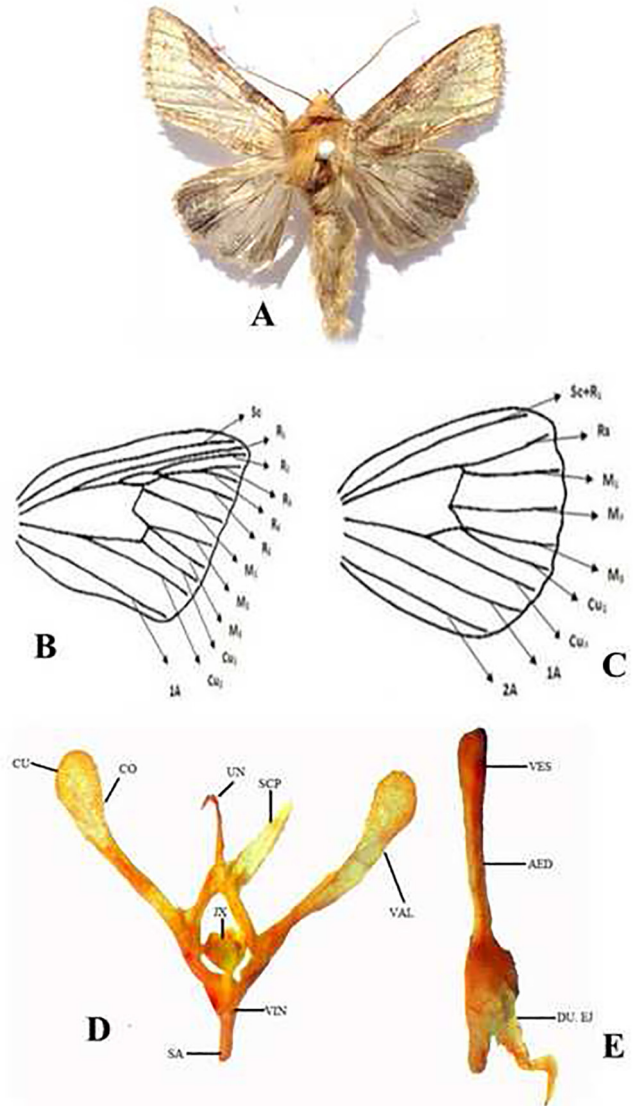
This genus was distributed in farmland, gardens, ravines (barancos), herb edges and residential areas in warm regions of the District Bahawalpur. Altitude 237.2 km2 and latitude 29° 25' m 5.0448" N and 71° 40' 14.4660" E.

**Host plants of *T. orichalcea***

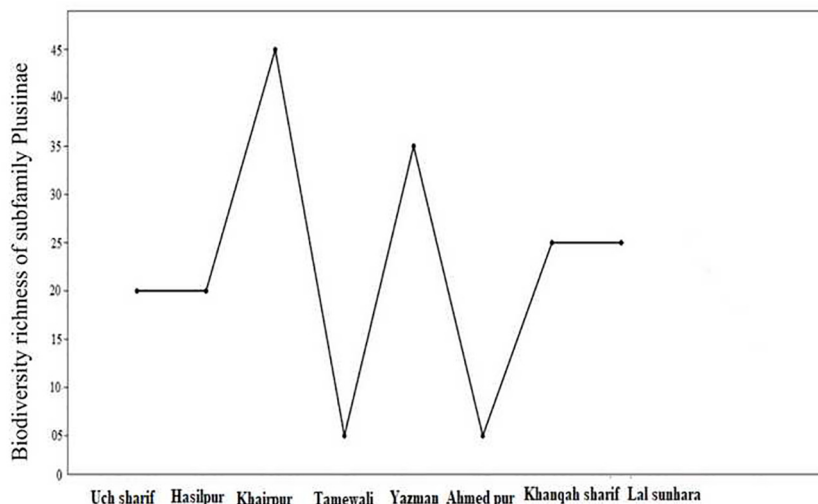
Adults of *T. orichalcea* are polyphagous pest that has several primary and secondary host and wide host spectrum. This is vital factor for the better chance to survive during evolutionary strategies (Tables 2 and 3). In phytophagous insects, female first locate a suitable site for mating and male also under pressure to locate the suitable host where female might be present to mate and oviposit on a suitable plant that has good nutritional and safer for the development of the offspring's.

**Light trap records**

Adult abundance was evaluated with the help of light traps and during the period of research population density of *T. orichalcea* remains low until the middle of March but peak abundance recorded from April to June at district Bahawalpur. Data indicates that population density of the pest increased with the increase of temperature. Because from environmental factors, temperature is considered one of the main key role player from abiotic factors that affecting the growth and development like body size, generation time and voltinism. Changing environmental temperature of district Bahawalpur effects the life cycle, reproduction of longevity of insects. Larval stages are hypersensitive to the temperature and other biotic factors and they are constantly in under pressure



**Fig. 2.** *Thysanoplusia orichalcea*. ♂ (A) Adult dorsal view (B) Forewing (C) Hind wing (D) Genitalia (E) Aedeagus.



**Fig. 1.** Specimens of subfamily Plusiinae captured by light traps at different localities of district Bahawalpur, Pakistan.

**Table 2**  
Primary host plants of *T. orichalcea* (Hill et al., 1987).

Primary host	
Local name	Scientific name
Mustard, Turnips, Rape (canola)	<i>Brassica juncea</i> / <i>Brassica rapa</i> / <i>Brassica napus</i>
Spinach	<i>Spinacia oleracea</i>
Ornamental gourd, Squash	<i>Cucurbita</i> spp
Cotton	<i>Gossypium</i> spp

**Table 3**  
Secondary host plants of *T. orichalcea* (Hill et al., 1987).

Secondary host			
Local name	Scientific name	Local name	Scientific name
Celery, Celeriac	<i>Apium</i> spp.	Lucerne	<i>Medicago sativa</i>
Carrot	<i>Daucus carota</i>	Clover	<i>Trifolium</i> spp.
Parsley	<i>Petroselinum crispum</i>	Chickpea	<i>Cicer arietinum</i>
Milkweed	<i>Asclepias</i> spp.	Soyabean	<i>Glycine max</i>
Sunflower	<i>Helianthus annuus</i>	Okra	<i>Abelmoschus esculentus</i>
Lettuce	<i>Lactuca</i> spp.	Groundnut	<i>Arachis hypogaea</i>
Daisy	<i>Chrysanthemum</i> spp.	Sweet pea	<i>Lathyrus odoratus</i>
Sugar beet	<i>Beta vulgaris</i>	Pea	<i>Pisum sativum</i>
Sweet potato	<i>Ipomoea batatas</i>	Strawberry	<i>Fragaria</i> spp.
Melon	<i>Cucumis melo</i>	Roses	<i>Rosa</i> spp.
Ornamental gourd, Squash, Pumpkin, Cucumber	<i>Cucurbita</i> spp.	Oranges	<i>Citrus</i> spp.
Watermelon	<i>Citrullus lanatus</i>	Potato	<i>Solanum tuberosum</i>
Beans	<i>Phaseolus</i> spp.	Tomato	<i>Lycopersicon esculentum</i>
Eggplant	<i>Solanum melongena</i>	Tobacco	<i>Nicotiana</i> spp.

to complete their immature stages as soon as possible and reached adult stage and research area has warm climate that favor the development of the pests and also help in the spread in different location of the Bahawalpur. Due to this reason it is reported from almost all mention localities and in these localities brassica and cotton are mostly cultivated that are the suitable host plant of *T. orichalcea*. From the supporting data that showed from trapping it was captured during February that the indication of its first progeny start from last year hibernating colony.

#### Site selection

During the summer of 2017 to 2018 different sites were visited as a host of *T. orichalcea* field crops, vegetable markets, orchards and home gardens. Analysis the captured data and categorized the host into two groups according to their relative abundance.

#### Distribution of *T. orichalcea*

*Thysanoplusia orichalcea* was widely distributed throughout the district Bahawalpur and assemble the moths from selected localities such as Uch sharif, Hasilpur, Khairpur, Tamewali, Ahmedpur, Lal sunhara, Yazman and Khanqah Sharif. In the collection all were the male but female not found during the survey.

#### 4. Discussion

Species of *T. orichalcea* was reported from district Bahawalpur from different major host and secondary host plants. Most of the

area of this district is under cotton and brassica crops and some localities have cultivated with vegetable crops. Due to the suitable ecological conditions insect pests are easily established and cause huge losses to many cash crops. Its distribution and spread of the surrounding areas is very easy due to exchange of the commodities from the markets. Its proper identification and classification is compulsory for the development of IPM strategy to control this destructive pest and sustain the agricultural outcomes. Taxonomic Study of insects play a key role in managing the insect pest of our cash crops because after correct identification we can control the diverse insect pest with in limited resources. This is base line for future Taxonomists.

#### 5. Data availability statement

Data relevant to this manuscript available and will be provided on request by the corresponding author.

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