TAXONOMIC STUDIES ON THE VEGETABLE PEST OF GENUS *PLUTELLA* SCHRÄNK (PLUTELLIDAE: LEPIDOPTERA) FROM NORTHWESTERN INDIA

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web supplement

ABSTRACT

Taxonomic studies of Plutella xylostella *Linnaeus from northwestern India was made based on the structural details of wing venation and external genitalia.*

KEYWORDS

Genitalia, India, Lepidoptera, Plutellidae, Plutella

ABBREVIATIONS

IA+2A - Vein representing fused first and second anal vein; 3A - Third anal vein; CuA_1 - First anterior cubital vein; CuA_2 - Second anterior cubital vein; CuP - Posterior cubital vein; FRI - Forest Research Institute; M_1 - First medial vein; M_2 - Second medial vein; M_3 - Third medial vein; PUP - Punjabi University, Patiala; R - First radial vein; R_1 - Second radial vein; R_2 - Third radial vein; R_3 - Fourth radial vein; R_4 - Fifth radial vein; R_5 - Radial sector; Sc - subcostal vein; $Sc+R_1$ - Stalk of subcostal and first radial vein; UHF - University of Horticulture and Forestry.

Plutella xylostella Linnaeus (commonly known as Diamond back moth) (Family Plutellidae) is one of the major pests of the cruciferous crops, though its main hosts are cauliflower and cabbage. On world basis, this genus *Plutella* Schränk is reported by over forty species with *P. xylostella* Linnaeus being the only one to be recorded from South-East Asia (Robinson *et al.,* 1994). We have collected and examined 134 males and 55 females specimen from four states -- Jammu & Kashmir, Himachal Pradesh, Punjab and Uttranchal representing northwestern Siwaliks. Besides re-examination of the adult morphology, wing venation, male and female genitalia have been studied in detail to improve the diagnosis of the genus.

MATERIALS AND METHODS

The Plutellid specimens collected with the help of light traps from four states were processed as per methodology discussed by Lindquist (1956), Tagestad (1974), Zimmerman (1978), Mikkola (1986), and, Landry and Landry (1994). The methodology involved killing (using tetracholoroethane), pinning and preservation (well fumigated wooden boxes) of adult specimens and stored in the Lepidoptera Laboratory, Department of Zoology, Punjabi University, Patiala. The standard techniques given by Zimmerman (1978) and Robinson (1976) were followed for wings preparation and genitalia dissection respectively. To write the taxonomic descriptions on various morphological characters, wing venation (Zimmerman, 1978; Park, 1995; Hodges, 1998) and external genitalia (Klots, 1970) were followed. For naming of various veins, Comstock-Needham system discussed by Miller (1970) was adopted. All illustrations were made by using a camera lucida attached to a stereoscopic light microscope (Nikon SMZ-10, Japan). All the specimens were photographed prior to dissection.

OBSERVATIONS

Family Plutellidae

Plutellidae Guenée, 1845, *Annls Soc. Ent. Fr.,* (2)3: 339 (as Plutellidi)
Type genus: *Plutella,* Schränk 1802, *Fauna Boica,* 2(2): 169.

Genus: *Plutella* Schränk

Plutella Schränk, 1802, *Fauna Boica,* 2(2): 169.
Anadetia Hübner, [1825], *Verz. Bekannt. Schmett.*: 405.
Euota Hübner, [1825], *Verz. Bekannt. Schmett.*: 408.
Cerostoma Latreille, [1802] sensu Stephens, 1834*, Illust. Br. Ent* (Haust.) 4: 341
Creagria Sodoffsky, 1837, *Bull. Soc. Imp. Nat. Moscou* 1837 (6): 94
Type species: *Phalaena xylostella* Linnaeus, 1758, *Syst. Nat.* (Edn. 10), 1: 538, by monotypy.

Diagnosis

Head covered with somewhat errect scales; labial palpus long, upturned, second segment with tuft of long scales, third segment acute; antenna long, filiform, about $^3/_{4^{th}}$ length of valvae; forewing characterised by a series of pale diamonds formed down its "back" by the overlapped pale markings on the dorsum when the moth is at rest; vein R_4 to costa, R_5 to termen, medial veins free, CuA_1 and CuA_2 free, CuP vestigial; hindwing with Rs to costa, M_1+M_2 stalked, CuA_1 and CuA_2 free; male genitalia with uncus less sclerotized; socii absent; gnathos with two curved lobes; saccus present; valvae foot shaped, sclerotized except middle; aedeagus ankylosed, basally with lobes, vesica lacking cornutus; female genitalia characteristic anterior apophyses apically thin, long, broader at base; signum small or large, kite-shaped, surrounding sclerotized.

Plutella xylostella Linnaeus

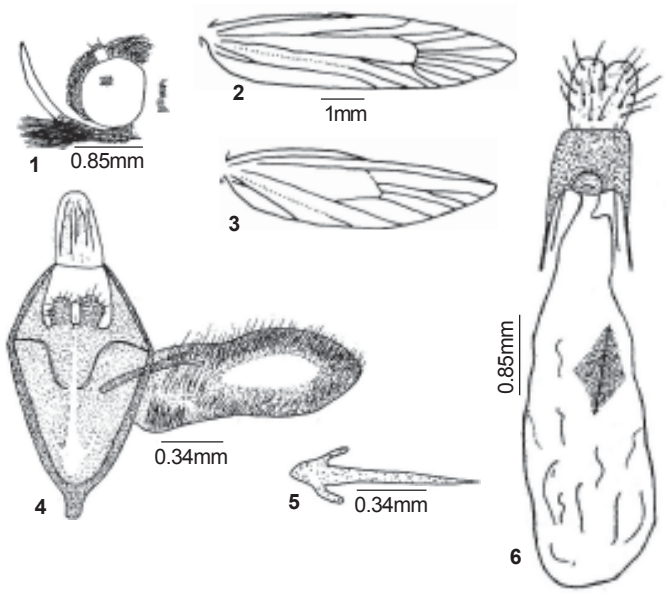
Plutella xylostella Linnaeus, 1758, *Syst. Nat.* (Edn. 10) 1: 538.
(Images 1-4[w], Figs. 1-6)

Material examined

Four males, one female, 2.iii.1998; three males, 8.iii.1998; three males, one female, 19.iii.1998; five males, two females, 5.iv.1998; three males, two females, 7.iv.1998; three males, 11.ii.1999; two males, two females, 23.ii.1999; seven males, two females,

[w] see Images 1-4 in the web supplement at www.zoosprint.org

Manuscript 1322; Received 27 January 2005; Revised received 14 May 2005; Finally accepted 02 June 2005; Date of publication 21 June 2005



Figures 1-6.* Plutella xylostella *Linnaeus
1 - Labial palpus; 2 - Forewing venation; 3 - Hindwing venation; 4 - Male genitalia: ventral view; 5 - Aedeagus; 6 - Female genitalia: ventral view

8.iii.1999; four males, two females, 15.iii.1999; three males, 23.iii.1999; seven males, three females, 29.iii. 1999; seven males, two females, 6.iv.1999; two males, 1.viii.1999; two males, 17.x.1999; two males, 10.iii.2000; three males, two females, 14.iii.2000; four males, two females, 21.iii.2000; three males, three females, 24.ii.2000; three males, 27.iiiv.2000; three males, one female, 9.iv.2000; two males, one female, 2.v.2000, PUP, Dist. Patiala, Punjab, 250m; two males, 3.iv.1999; ten males, 23.iv.1999; seven males, seventeen females, 25.iv.1999; two males, 5.iv. 2000; one male, 17.iv.2000; five males, 18.iv.2000; eight males, three females, 20.iv.2000, FRI Dehradun, Dist. Dehradun, Uttaranchal, 700m; two males, 18.v.1999; three males, 19.v.1999; four males, three females, 4.iv.2000, UHF Nauni, Dist. Solan, Himachal Pradesh, 1360m; three males, two females, 6.iv.2000, Dharmpur, Dist. Solan, Himachal Pradesh, 1500m; two males, 12.iv.1999; two males, one female, 13.iv.1999; two males, 5.ix.1999, Renuka Lake, Dist. Sirmour, Himachal Pradesh, 740m; five males, three females, 9.xi.2001, Jammu University Campus, Dist. Jammu, Jammu & Kashmir, 350m (coll. P.C Pathania).

Distribution

India, Myanmar and Sri Lanka (Fletcher, 1921), world-wide including India (Vishwanath & Agarwal, 1982; Prasad *et al.,* 1983; ICAR, 1987; Velusamy *et al.,* 2000; David, 2001; Atwal & Dhaliwal, 2002), cosmopolitan (Butani & Jotwani, 1984; Butani, 1987); Europe, Asia, Africa, Western Hemisphere, Oceania (CPC, 2001).

Biology: Pupa (Image 1), Larva (Image 2).

Male and female (Images 3 & 4)

Alar expanse: 10-14mm. Vertex and frons covered with somewhat erect, creamish-brown scales; labial palpus moderately long, upturned, second segment covered with creamish-fuscous tuft of long scales, third segment acute, creamish-fuscous (Fig. 1); antennae long, filiform, with white and fuscous band alternatively, about $^{3}/_{4}^{th}$ length of forewing; thorax creamish-brown at middle, sides fuscous in colour; forewing elongate, fuscous brown scaled, pale creamish-brown markings at base to tornus, costa slightly convex, apex acute, termen convex, tornus poorly defined, anal margin convex, termen with cilia grey; hindwing grey scaled, costa convex from base to middle then almost straight, distally convex, apex acute, termen oblique, tornus convex, anal margin convex, termen and anal margin with cilia grey in colour; prothoracic and mesothoracic legs creamish-black in colour, metathoracic leg creamish in colour.

Wing venation: (Figs. 2 & 3)

Forewing with Sc ending slightly below middle of costa, R_1 arising slightly below middle of discal cell, R_1 curved at ending, R_1, R_2, R_3 free, R_2, R_3 parallel, R_3 arising at upper angle of discal cell, R_4 to costa, R_5 to termen, M_1, M_2, M_3 free, parallel, M_1 arising at middle of discocellular, M_1 nearer to R_5 than M_2, M_3 and CuA_1 arising at lower angle of cell, CuA_1 and CuA_2 free, CuA_1 curved at middle, CuA_2 arising at 4/5th of discal cell, CuP vestigial, visible at $^{1}/_{4}^{th}$ distally, 1A+2A forked at base; hindwing with $Sc+R_1$ ending near middle of costa, Rs to costa, straight, arising at upper angle of cell, M_1+M_2 stalked, arising at middle of discocellular, M_3 free, near to M_2 than CuA_1, CuA_1, CuA_2 free, CuA_1 arising at lower angle of cell, CuA_2 arising at $^{2}/_{3}^{rd}$ of discal cell, CuP vestigial, visible at ending, 1A+2A small forked at base.

Male genitalia (Figs. 4 & 5)

Uncus not sclerotized; socii absent; gnathos with two curved lobes, small, sparsely setose, joint with tegumen; tegumen small, somewhat arched; juxta weak and thin; vinculum long and broad, Ushaped; saccus small, rounded apex; valvae symmetrical, foot-shaped, well sclerotized except at middle, inner margin densely setose, costal margin slightly convex, with a long arm at base, directed posteriorly, sacculus margin concave apically, convex basally with bunch of spine near base, cucullus margin strongly convex dorsally, apex rounded, convex ventrally; aedeagus small, ankylosed, broader at base then gradually narrowed, pointed at apex, two small lobes near base; vesica without cornutus.

Female genitalia (Fig. 6)

Papillae anales large and broad, sparsely setose; anterior apophyses small, broader at base, apically thin, posterior apophyses long and thin, longer than the length of anterior apophyses; ostium bursae small opening, side sclerotized, centrally placed; ductus bursae very small, somewhat broad; corpus bursae long and broad, broader distally then gradually narrowed upto base; signum small, kite-shaped, moderately sclerotized.

Larval host plant: Cabbage, cauliflower, raddish, mustard and cruciferous plants (Fletcher, 1921).

Remarks

Bradley (1966) designated a lectotype of the species, *Phalaena xylostella* Linnaeus, 1758 and in view of this *P. xylostella* was placed on the official list of specific names in zoology (No. 2506). While giving a key to the Philippine genera of the family Plutellidae, Diakonoff (1967) has stressed that the genus, *Plutella* Schrank can be distinguished on the basis of the veins M_1 and R_3 (Figs. 2, 3) of the forewing, which are always present and separate. It can be characterised by the series of pale diamonds formed down its back by the overlapped pale markings on the forewing dorsum, when the moth is at rest. The second segment of the labial palpi is conspicous due to the presence of a porrect tuft of very long scales on it.

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Acknowledgements

We are grateful to the Ministry of Environment and Forests (GOI), New Delhi for funding the project on taxonomy of Microlepidoptera. The authors are also thankful to Dr. K.T. Park (Korea) and Dr. G.S. Robinson, (N.H.M.), London for sending much needed literature.