

Taxonomic Notes on the Diamondback Moth

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Abstract

A taxonomic account is given of *Plutella xylostella*, a serious pest of crucifers worldwide. The paper lists various changes in the nomenclature from the initial description of this insect by Linnaeus in 1758. A detailed account of morphological characters of mature larva, pupa, and adult is given along with description of a closely related species, *Caunaca sera*, which also feeds on crucifers. Distinguishing characters of *P. xylostella* and *C. sera* are described.

Introduction

Plutella xylostella (Linnaeus 1758)

- Plutella Tinea xylostella* Linnaeus 1758, Syst. Nat. ed.:538.
Cerostoma maculipennis Curtis 1832, Brit. Entomol. Pl. 420 (expl. p 2).
Plutella cruciferarum Zeller 1843, Stett. Entomol. Ztg., 4:281.
Plutella brassicella Fitch 1856, Rep. Nox. Inst. New York, 1:170.
Plutella limbipennella Clemens 1860, Proc. Acad. Nat. Sci. Philad., 12:6.
Plutella mollipedella Clemens 1860, Proc. Acad. Nat. Sci. Philad., 12:6.
Gelechia cicarella Rondani 1876, Bull. Soc. Entomol. Ital., 8:20.
Tinea galeatella Mabilie 1888, Miss. Sci. Cap. Horn, 6:34.
Cerostoma dubiosella Beutenmuller 1839, Can. Entomol., 21:27.

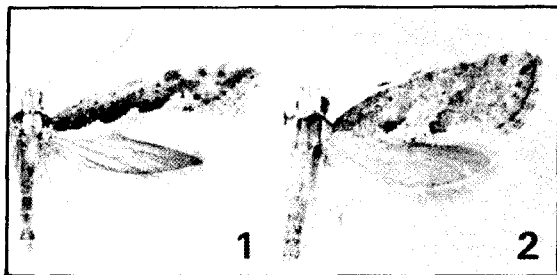
Much confusion in the nomenclature existed between the *Lonicera*-feeder and the smaller species feeding on various cruciferous plants until Zeller in 1843 restricted the Linnean name *xylostella* to the *Lonicera*-feeder, and called the smaller species *cruciferarum* Zeller. In 1897 Walsingham and Durrant pointed out that *Plutella cruciferarum* Zeller is a junior synonym of *Cerostoma maculipennis* Curtis, 1932. Consequently, the diamondback moth (DBM) had appeared in the literature as *Plutella maculipennis* Curtis.

In 1966, Bradley pointed out that the specific name *xylostella* is valid and has a priority over *maculipennis*. Some workers made objections to this. In 1970, Wolff proposed that the International Commission on Zoological Nomenclature (ICZN) should place on the Official List of Names in Zoology the name *xylostella* Linnaeus, 1758 (with the application for the use the plenary powers to designate a neotype for *Phalaena Tinea xylostella* Linnaeus, 1758), and that the name *maculipennis* published in the combination *Plutella maculipennis* Curtis, 1832, should be placed on the Official List of Specific Names in Zoology. Pelham-Clinton in 1970 supported Wolff's proposal, because the DBM, at that time known as *Plutella maculipennis* Curtis, was a widespread pest and extensive published literature listed it under that name.

Wolff's proposal, however, was refused by the ICZN (Opinion 1002) in 1973, and the specific name *xylostella* Linnaeus, 1758, as published in the combination *Phalaena Tinea xylostella*, was placed on the Official List of Specific Names in Zoology with the Name Number 2506.

Description

Adult (Figures 1, 3-5)



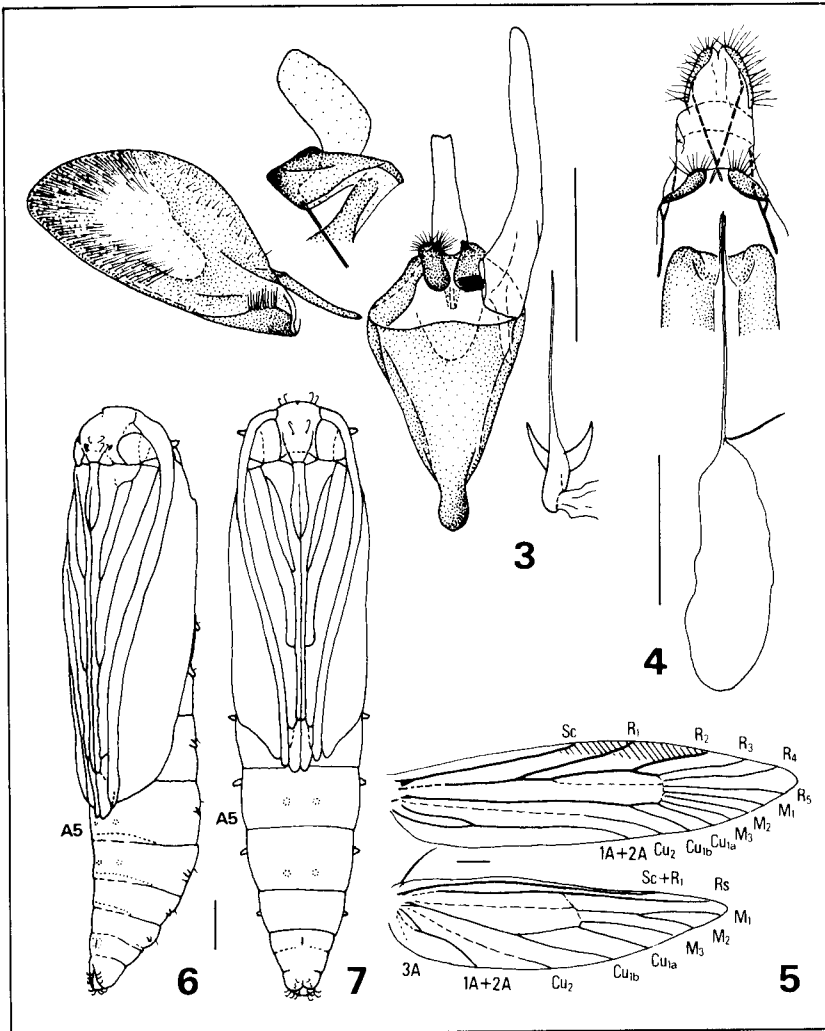
Figures 1-2.
Adults: 1. *Plutella xylostella*, male, and
2. *Caunaca sera*, female

In both males and females wing expanse is 12-15 mm. Venation as in Figure 5. Forewing, in males, with upper (costal 2/3) light fuscous, sometimes partially ochre-tinged, sometimes mixed with whitish scales, and flecked with scanty small blackish dots or spots; lower (dorsal) 1/3 pale ochreous-white, the upper edge being nearly white and thrice sinuate upwards, margined broadly with dark brown or black-brown; in females, light ochreous or light grey-ochreous; the contrast not so pronounced between upper and lower portions in coloration, but the markings, so far as traceable, like those of the male. Genitalia: in male as shown in Figure 3; aedeagus extremely slender in apical 5/8 and strongly bulbous basally, with distinct flanges on each side at basal 1/4. Female genitalia as in Figure 4; antrum weakly sclerotized, long, extremely slender; ductus bursae membranous, as wide as and much longer than antrum.

Mature larva (Figures 8-17)

Average length 10 mm. Head capsule (Figure 8) pale ochreous to pale greenish-ochreous, or sometimes pale brown, mottled with brownish and black-brown spots; eyespot black. Body green, sometimes tinged with pale yellow; rarely pale yellow, pale pinkish-yellow or pale grey (for example, when the larva feeds on whitish inner leaf of the cabbage, the body color fades into paleness); pinacula somewhat paler; prothoracic shield and anal shield a little paler than ground-color, and scattered with small pale brown and brown markings; thoracic legs ochreous, with pale brown claws; peritreme of spiracles ochreous; most setae stout and black. Head (Figure 8) with part of frontoclypeal apotome enclosed by adfrontal sutures extending about 3/4 of distance to vertical triangle; ocelli IV closer to III than to V (Figure 9). Mandibles as shown in Figure 11, labrum as in Figure 10. Ventral prolegs (Figure 17) elongate, and twice as long as wide; crochets uniorbital, gradually smaller laterally and arranged in a circle, being usually 10 to 13 in number. Anal prolegs with about eight or nine crochets in a semi-circle. Spiracles are round; that of 8th abdominal segment distinctly larger than that of 7th (approximately 4:3) and as large as that of prothorax.

Chaetotaxy (Figures 8-10, 12-16) Cranial setae as in Figures 8-9. AFa not found. Prothorax as in Figure 12; VI separated from coxa. Mesothorax with SD1 very slender and shorter than SD2. Metathorax setose like mesothorax. Abdomen as shown in Figures 14-16; D1 above level of D2; SD2 separated from pinaculum of SD1; SV group unisetose on 8th and 9th, bisetose on 1st and 7th, and trisetose on 2nd-6th segments; SD1 of 9th segment very slender. Anal shield as in Figure 16.



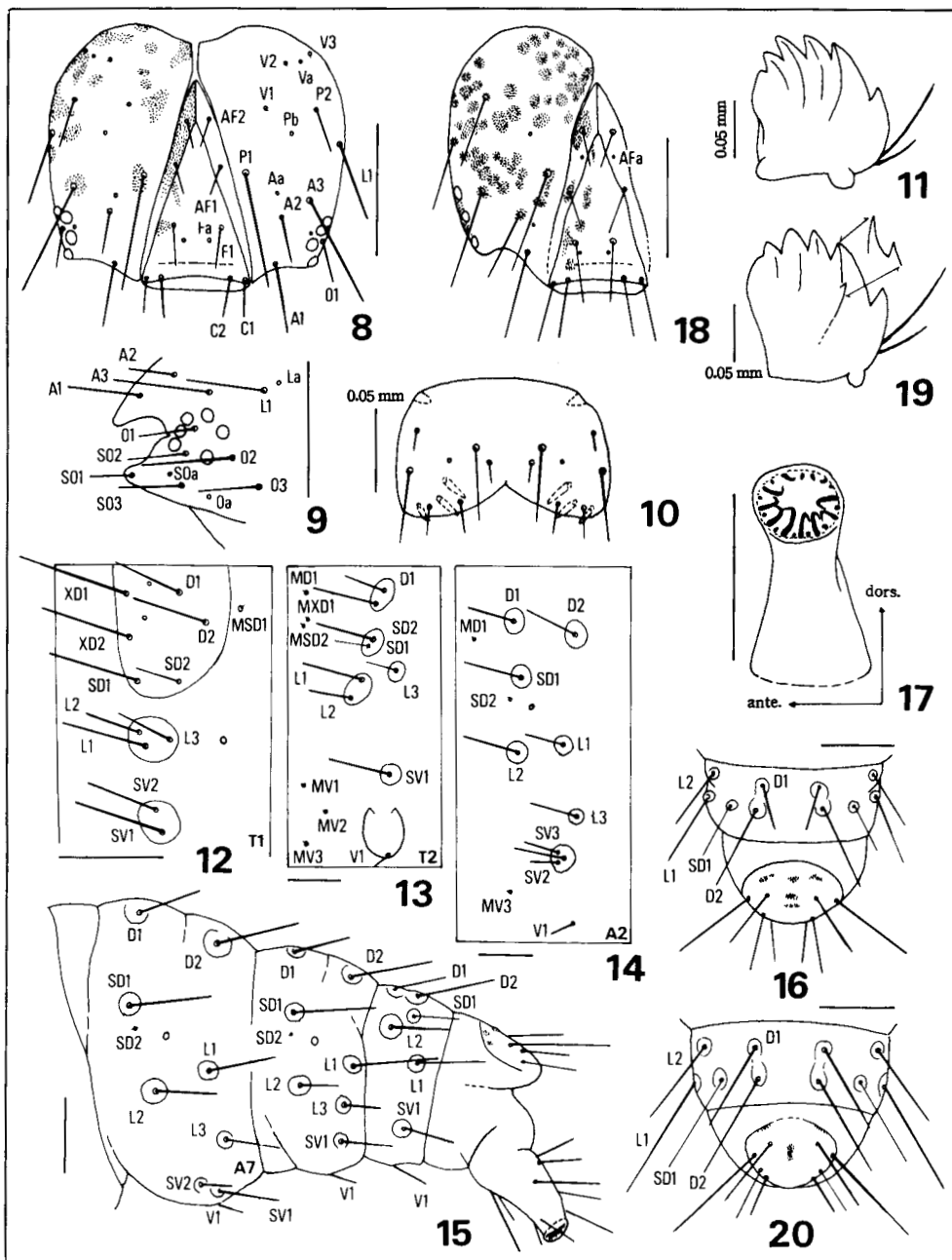
Figures 3-7. Adults (3-5) and pupae (6-7): 3. *Plutella xylostella*, male genitalia, 4. female genitalia, 5. male, wings, 6. male, ventro-lateral aspect; 7. *Caunaca sera*, female, ventral aspect. (scale = 0.5 mm)

Pupa (Figure 6)

Length 5-6 mm, about four times as big as the width. At first pinkish-white to pinkish-yellow, or sometimes green, with blackish subdorsal and subspiracular lines; ground-color later changing to brown. Structure as shown in Figure 6; abdomen with neither teeth nor spines on dorsal surface. Tenth abdominal segment with hooked setae.

Related Species

The adults of *P. xylostella* are not confused with any other pluteiid species by the coloration, and are characterized by the peculiarly shaped aedeagus and the extremely slender antrum and ductus bursae.



Figures 8-20. Mature larva, *Plutella xylostella* (8-17): 8. head dorsal aspect; 9. ocellar region; 10. labrum, dorsal aspect; 11. left mandible; 12. prothorax; 13. mesothorax; 14. 2nd abdominal segment; 15. 7th-10th abdominal segments, lateral aspect; 16. 9th and 10th abdominal segments, dorsal aspect; 17. 3rd abdominal segment, left, ventral proleg, mesal aspect. Mature larva, *Caunaca sera* (18-20): 18. head, dorsal aspect; 19. left mandible; 20. 9th and 10th abdominal segments, dorsal aspect. (scale = 0.25 mm, unless stated otherwise)

Plutella porrectella (L) and some species of *Caunaca*¹ (which is allied to *Plutella*) are associated with cruciferous plants in Europe; *P. porrectella* on *Hesperis*, *C. seniella* (Zetterstedt) on *Arabis* and *Sisymbrium*, *C. annulatella* (Curtis) on *Cochlearia* and *Cheiranthus*, and *C. incarnatella* (Steude) on *Sisymbrium*. However, the larvae of these species do not attack cultivated cruciferous vegetables belonging to *Brassica* and *Raphanus*. *P. xylostella* can be easily distinguished from them in both adult and immature stages.

Caunaca sera (Meyrick), occurring in Japan, Taiwan, Vietnam, Indonesia, India, Sri Lanka, Australia, and New Zealand, is a pest of cruciferous vegetables (Fletcher 1933, Moriuti 1977). The larva of *C. sera* prefers to feed on brown mustard (*Brassica juncea* Czern et Coss var *integrifolia* Sinskaia), but also feeds on rape (*B. napus* L), cauliflower, cabbage, Chinese cabbage, and radish in Japan; turnip (*B. rapa* L) was recorded as one of the hosts of this pest in India (Fletcher 1933). *C. sera* is also associated with many wild cruciferous plants.

The larvae of *C. sera* coexist with those of *P. xylostella* on the host plants. *C. sera* is easily distinguished from *P. xylostella* on the basis of the following taxonomic characters.

***Caunaca sera* (Meyrick 1896)**

***Plutella sera* Meyrick 1886, Trans. N. Z. Inst. 18:178.**

Adult (Figure 2) Wing expanse 10-14 mm. This species is easily distinguishable from *P. xylostella* by the much broader wings (cf Figures 1 and 2). The genitalia are distinctly different from those of *P. xylostella*.

Mature Larva (Figures 18-20) Average length 10 mm. Head with numerous blackish-brown dots, some of which touch together (cf. Figures 8 and 18); mandible with a small retinaculum on inner surface (cf. Figures 11 and 19). Body green or somewhat tinged with yellow, with a slender red or pale red dorsal, subdorsal, supraspiracular, subspiracular, and basal lines, all of which are interrupted and connected by fine lines of same color extending dorsoventrally; in *P. xylostella* the lines are absent; prothoracic shield with a black brown or nearly black postero-ventral mark, which is absent in *P. xylostella*. Ventral prolegs with a mesal penellipse (an incomplete circle) of about 10 crochets in *C. sera*, but with a complete circle of crochets in *P. xylostella*. Chaetotaxy is very similar to that of *P. xylostella*; cranial puncture AFa present in *C. sera*, but absent in *P. xylostella* (cf Figures 8 and 18).

Pupa (Figure 7) Very similar to that of *P. xylostella* in appearance and structure, differing primarily by the clypeus which is provided with a pair of hooked setae in *C. sera* but with three pairs in *P. xylostella*; further, the maxilla is always shorter than the mid leg in *C. sera* but the former usually slightly longer than the latter in *P. xylostella*.

Ecological notes The lifecycle is not well known, but seems to be similar to that of *P. xylostella*. The larva feeds on the leaf of above mentioned crucifers, making shot-holes all over the foliage. Pupation takes place in an open net-like white cocoon usually on the underside of leaf, and the larval skin is thrown out the open end of the cocoon, as in the case of *P. xylostella*.

¹ According to Bradley (1972), *Caunaca* Wallengren, 1880, is synonym of *Rhigognostis* Staudinger, 1857.

Literature Cited

- Bradley, J. D. 1966. Some changes in the nomenclature of British Lepidoptera, Part 4, Microlepidoptera. *Entomol. Gaz.* 17:213-235.
- Bradley, J. D. 1972. Yponomeutidae. *In* A Check List of British Insects, Second Edition (revised). Handbooks for the Identification of British Insects. 11:12-14. Royal Entomological Society of London, London, UK.
- Fletcher, T. B. 1933. Life histories of Indian Microlepidoptera (second series), Cosmopterygidae to Neopseustidae. *Sci. Monogr.* 4, Imperial Council of Agricultural Research, Delhi.
- ICZN. 1973. International Council of Zoological Nomenclature, Opinion 1002. *Phalaena Tinea xylostella*, Linnaeus, 1758: Refusal to use plenary powers to designate a neotype. *Bull. Zool. Nomencl.* 30:86-87.
- Moriuti, S. 1977. Fauna Japonica, Yponomeutidae s. lat. (Insecta:Lepidoptera). Keigaku Publishing Company, Tokyo. 327 pp.
- Pelham-Clinton, E. C. 1970. Comments on the proposal by Niels L. Wolff to designate a neotype of *Phalaena xylostella* Linnaeus, 1758. *Bull. Zool. Nomencl.* 27:130.
- Walsingham, L. and J. H. Durrant. 1897. The diamondback moth: *Plutella cruciferarum*, Z. (1843), a synonym of *Cerostoma maculipennis*, Crt. (1832). *Entomol. Mon. Mag.* 33:173-175.
- Wolff, N. L. 1970. *Plutella Tinea xylostella* Linnaeus, 1758 (Insecta,Lepidoptera): Designation of a neotype under the plenary powers. *Bull. Zool. Nomencl.* 37:60-62.