



Occurrence of *Chrysodeixis chalcites* (Esper) (Lepidoptera: Noctuidae: Plusiinae) on soybean in Rajasthan, India

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ABSTRACT: Among the defoliator insect pests of soybean, the semiloopers and caterpillars of Noctuidae cause considerable damage that often has a significant influence on the yield. The semiloopers were active from August to October, 2015 on soybean and their population reached the peak in the 1st week of September (37th SMW) with mean population of 7.33 larvae/plant. Among the species of *Chrysodeixis*, *C. includens* and *C. chalcites* were observed, of which, *C. chalcites* has been reported infesting soybean from Rajasthan. The description of the species has been presented in the paper with suitable photographs and diagrams. © 2017 Association for Advancement of Entomology

KEY WORDS: Lepidoptera, Noctuidae, *Chrysodeixis chalcites*, Soybean

INTRODUCTION

The insects included under the family Noctuidae are of universal distribution and exhibit immense variety in size, shape and coloration as imago, but are differentiated from other families by their neurulation. The plants belonging to Mimosaceae, Malvaceae, Euphorbiaceae, Poaceae, Anacardiaceae, Leguminosae, Myrtaceae, Apocynaceae, Verbenaceae, Coniferae and Moraceae are frequently infested by noctuids (Kirti and Dar, 2013). The semilooper subfamily Plusiinae was erected by Boisduval (1829) that is moderately large and taxonomically compact amongst the Noctuidae. The moths are distributed worldwide except in the Antarctic (Zahiri and Fibiger, 2008) and represented by approximately 500 species worldwide (Ronkay *et al.*, 2008). A list of 21 species under Plusiinae as part of Noctuidae is listed from India (Ronkay, 1986; 1987 and Ronkay *et al.*, 2008; 2010).

Shashanka and Singh (2014) have reported 25 genera with 59 species under subfamily Plusiinae and 5 species of the genus *Chrysodeixis* from India.

Soybean is a major oilseed crop in India and is grown in the states of Madhya Pradesh, Maharashtra, Karnataka, Uttar Pradesh, Rajasthan, Tamil Nadu, Andhra Pradesh and Uttarakhand. About 275 insect species have been recorded infesting soybean in India; among these, defoliators and sap-sucking insects are the major constraints to soybean production (Raju *et al.*, 2013). One of the more important semilooper pests is the twin-spot moth - *Chrysodeixis chalcites* (Esper, 1789) (Lepidoptera: Noctuidae: Plusiinae), a polyphagous and polyvoltine insect species that feeds on more than 30 different plant species, including fodder crops, vegetables, fruit trees and ornamental plants in the field and greenhouse. It is native to the Mediterranean and tropical regions (Rashid *et al.*,

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1971; Murillo *et al.*, 2013). This insect is a serious pest of greenhouse crops in Europe (Cabello *et al.*, 1996; Vanoers *et al.*, 2004). It has been reported in India from Ludhiana (Punjab) on sunflower (Singh and Singh, 1998; Singh *et al.*, 2003); Bangalore (Karnataka) on ornamental plants (Narayanan, 2003); Jabalpur (Madhya Pradesh) in light trap collections (Verma and Vaishampayan, 1983) and also reported on NBAIR, database, crop pest index (Soybean); however, there are no records of damage to soybean by this pest from Rajasthan.

MATERIALS AND METHODS

A field experiment on Bio-ecological Management of Major Insect Pests of Soybean was undertaken at the Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif*, 2015. Soybean variety JS-335, recommended for the zone, was sown in plots of size 4m x 3m maintaining 30 cm row to row and 10 cm plant to plant spacing and replicated six times. The populations of major insect pests including semiloopers were recorded from five randomly selected and tagged plants in each replication. The semiloopers were dislodged from the plants by gently shaking and collected on a white sheet kept underneath the plant. All the observations were taken during early hours of the day (6 to 8 am) on a weekly basis. The prevailing abiotic conditions of the atmosphere were recorded from the meteorological observatory of the farm to work out the correlation coefficients between the pest populations and the abiotic factors of the environment (Gomez and Gomez, 2010).

Field collected healthy larvae of the semiloopers were individually reared in glass containers (500ml capacity) in the laboratory to obtain adult moths for which fresh leaves of soybean from the field were provided daily till the larvae entered into the pupal stage. A two centimeter layer of sterilized sand was provided for proper pupation. Adults of different species of semiloopers emerged *viz.*, *Trichoplusia ni* (Hubner) including species of the genus *Chrysodeixis*.

Male and female genitalic dissections were prepared following Clarke (1941). All slide

preparations were examined under the stereozoom binoculars. Wing length measurements were taken from the center of the auxiliary area to the apex of the forewing. Digital photographs of specimens and their body parts were taken with the help of Stemi 2000 C Stereozoom Binoculars of Carl Zeiss make. The software installed in the binoculars used for linear measurements was Axio Vision L.E. 4.8; besides, the graph paper method was also employed. The identification of specimens was carried out using the key of Olivares (1992), Passoa (1995), Passoa (2009) and Kirti and Dar (2013). Taxonomic glossary of genitalia in lepidopteran insects (Klots, 1970) was also used.

RESULTS AND DISCUSSION

Incidence of semiloopers in soybean

The semiloopers were active from August to October, 2015 on soybean and, as presented in Table (1), the larval numbers were significant from 1st week of August (33th SMW) with mean population of 1.67 larvae/plant. The population increased gradually and reached the peak in the 1st week of September (37th SMW) with mean population of 7.33 larvae/plant. At the peak period of activity, the mean atmospheric temperature was 26.48° C, the mean relative humidity 67.14 per cent and there was no rainfall during three to four weeks; thereafter, the population declined gradually and reached to a minimum level of 0.33 larvae/plant during 2nd week of October (42nd SMW). The occurrence of *C. chalcites* on soybean has been reported from Spain (Avidov and Harpaz 1969; Amate *et al.* 1998); Zimbabwe (Taylor 1980) and in northern Italy (Zandigiacomo 1990). Rashid *et al.* (1971) and Harakly and Farag (1975) observed the maximum population of *C. chalcites* larvae from August to October on tomato at the optimal temperature of 25°C.

Chrysodeixis chalcites (Esper, 1789)

Materials examined (6 Specimens, 4 ♂ & 2 ♀): India: Rajasthan, Udaipur; 2. VIII. 2015, Coll. A. K. Meena (RCA, Udaipur); 8. IX. 2015, Coll. A. K. Meena (RCA, Udaipur); 7. X. 2015, Coll. A. K.

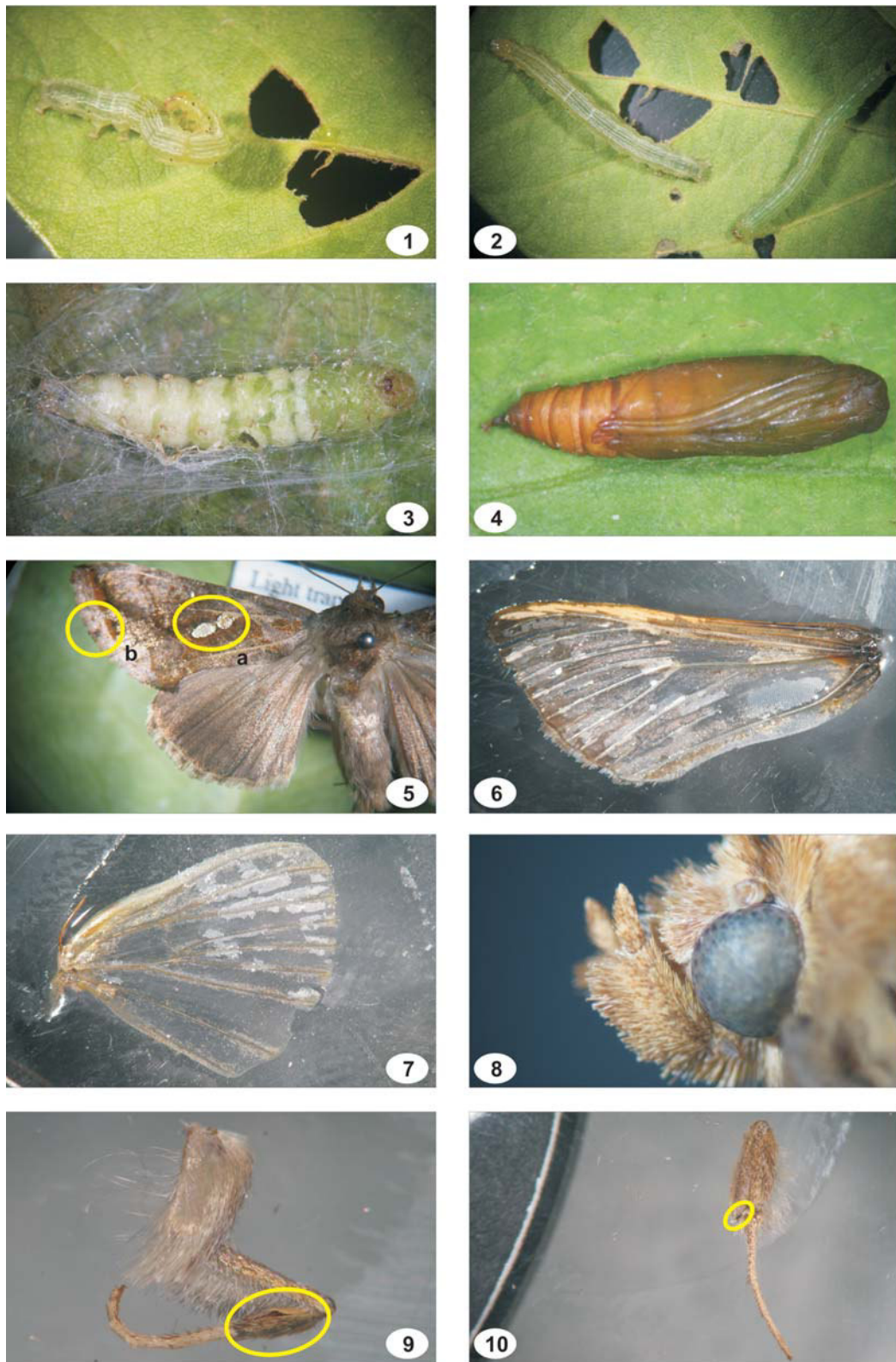


PLATE-I: *Chrysodeixis chalcites* (Esper) Male 1-10: 2. Field incidence; 3. Pre-pupa; 4. Pupa; 5. Adult; 6. Fore wing details; 7. Hind wing; 8. Labial palpi; 9. Foreleg; 10. Middle leg (Spurs)

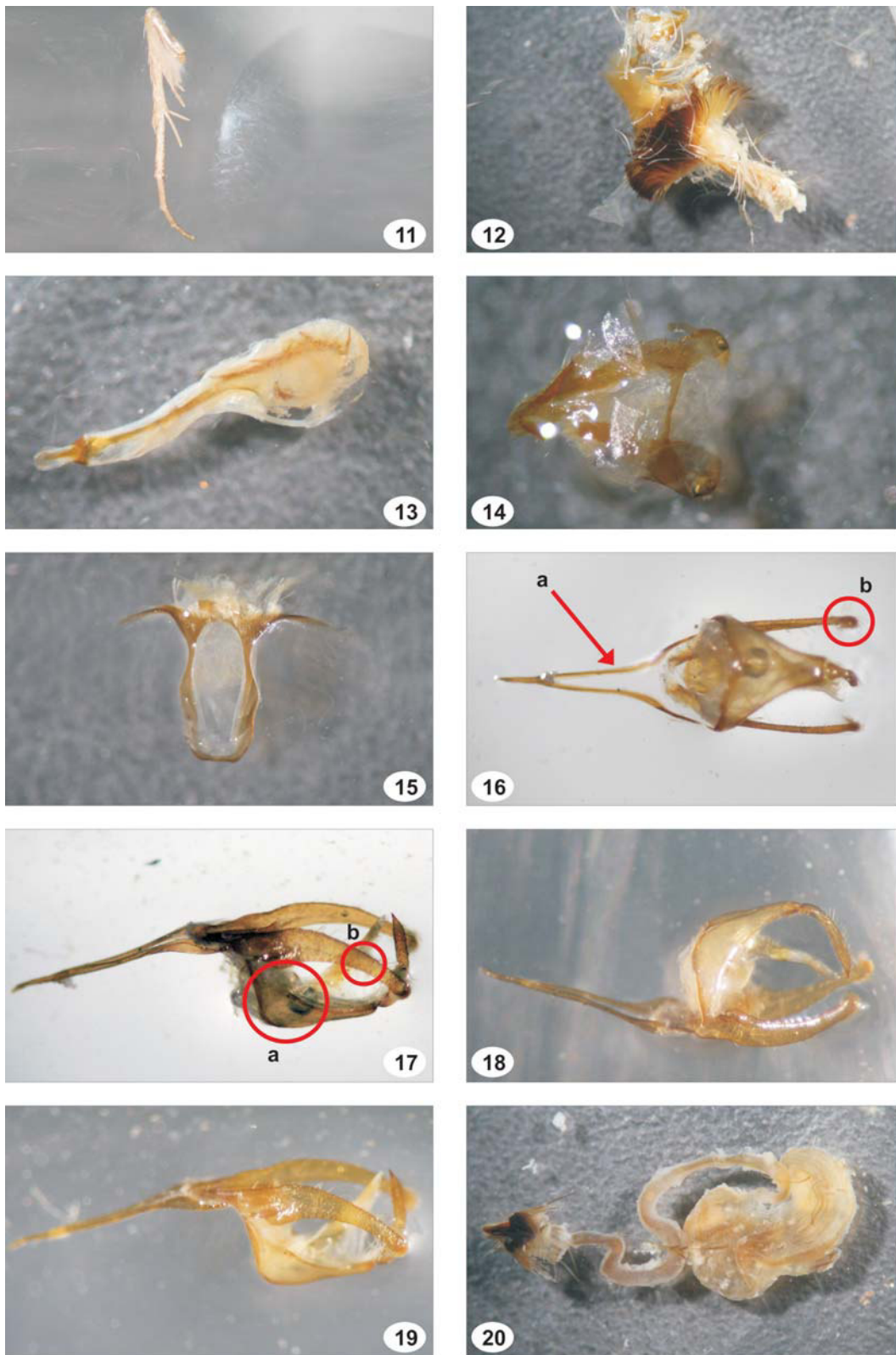


PLATE-II: *Chrysodeixis chalcites* (Esper) Male 11-20: 11. Hind leg; 12. Genitalia; 13. Aedeagus; 14-15. Sclerites of modified abdominal segment VIII; 16-19. Genitalia; 16. Dorsal view; 17. Lateral view; 20. Female genitalia

Table 1. Seasonal incidence of semiloopers in soybean during *kharif*, 2015

SMW	Mean		Total Rainfall (mm)	Semilooper (Larvae/plant)
	Atm. Temp. (° C)	RH (%)		
33	27.11	71.07	0	1.67
34	27.26	83.07	14.10	2.00
35	26.93	75.43	1	2.33
36	27.10	69.79	0	5.67
37	26.48	67.14	0	7.33
38	26.74	61.14	0	6.00
39	29.70	60.79	3.50	5.67
40	24.84	76.86	2.40	2.33
41	25.94	48.36	0	1.67
42	26.91	44.79	0	0.33
Coefficient of correlation (r) between population and Atm. Temp.				0.29
Coefficient of correlation (r) between population and RH				0.11
Coefficient of correlation (r) between population and Total Rainfall				-0.18

Meena (RCA, Udaipur); 9. X. 2015, Coll. A. K. Meena (RCA, Udaipur) (1); 11. X. 2015, Coll. A. K. Meena (RCA, Udaipur).

Description (Plate - I and II):

Early instar larvae are leaf skeletonizers, as they eat only a portion of the leaf to form an irregular network of minute clear areas. Later instars eat the entire leaf, at most leaving the midrib, or other veins (Fig. 1, 2); the mature larvae stop feeding and enter a prepupal stage on soybean leaves and later they pupated in the soil provided (Fig. 3, 4). The thorax and/or abdomen of the adult moth have tuft of scales; they rest with the wings folded over their back in a tent like arrangement.

Forewing: The forewings are with a silver marking often shapes like a “Y, V, solid dot or boot.” which are oval and sub equal in size (Fig. 5 a). A few specimens may show a bronze-colored forewing, but the twin spots are always present. On the forewing, a small black dot near the margin of the wing on vein M_2 (sometimes rubbed off) can be seen (Fig. 5 b).

Hindwing: hind wing ground color brown-gray, darker towards the margin, with dark gray veins and a pale-tan short fringe.

The key taxonomic character of Noctuidae venation of the hind wings, where $Sc + R_1$ is separated from R_5 and is connected with discal cell at the base, has been shown (Fig. 7). Front and hind wing dissimilar in venation (Fig. 6-7). The labial palpi are of moderate dimensions, more or less upturned, with the second segment densely scaled, the third generally short; and eyes without hairs (Fig. 8). Another identifying feature is number of tibial spurs i.e. 0-2-4 (foreleg-middleleg-hindleg) and epiphysis present in foreleg (Fig. 9-11).

Male genitalia: The soybean semiloopers are often confused although the male genitalia are very different. Male of *C. chalcites* have tufts of pale long scales on the sides of the abdomen and black long scales on the apex, genitalia and abdominal segment VIII, ventral (Fig. 12). Aedeagus with cornuti, elongated and its posterior apex globose, three times than the rest (Fig. 13). Sclerites from modified abdominal segment VIII, with black scales removed (Fig. 14-15). Genitalia, dorsal view, saccus elongated sub equal in length to the valve and V shaped, apex more acute (Fig. 16-19); saccus longer than valva (Fig. 16, a). The genitalia are characterized by valva without claspers or claws, valva (Lateral view, Fig. 17, b) elongate and wider at base than towards the apex, with tight groups of setae at the apical margin (Fig. 16, b); tegumen oval with lateral arms triangle-like in shape (Fig. 17, a). Uncus elongated, basal third curved; apex straight with a curved, dark spine (Lateral view of genitalia, Fig. 18-19).

Female genitalia: No differences in the constant features were observed in the female genitalia among the species. The bursa copulatrix usually lacks a well defined signum but is often generally scobinate (Fig. 20 General view of female genitalia).

Measurements: Wing expansion 40 ♂, 41 ♀ mm, the forewing length is 17 ♂ and 17.5 ♀ mm in moth.

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