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Taxonomic Studies on the Lepidopteran Caterpillars Associated with Vegetables in Guntur District

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ABSTRACT

Different Lepidopteran larvae were collected from various places from Guntur district on vegetables. The larvae were brought to the laboratory reared, preserved and identified. The larvae *viz., Spodoptera litura* (Fabricius), *Earias vittella* (Fabricius), *Plusia peponis* Fabricius, *Leucinodes orbonalis* Guenee, *Palpita indica* (Saunders), *Isocentris opheltesalis* Walker, *Sphenarches caffer* (Zeller), *Eupterote mollifera* Walker and *Plutella xylostella* (Linnaeus) were identified and described based on the morphological characters and chaetotaxy of thoracic and abdominal segments especially 3rd abdominal segment and arrangement of crochets on the ventral prolegs. For easy identification of these larvae a taxonomic key was prepared with the help of line diagrams of thoracic and abdominal segments.

Key words : Lepidopteran Caterpillars,Taxonomy, Vegetables

Vegetables are important nutritional requirement of human beings as these foods not only meet the quantitative needs to some extent but also supply vitamins and minerals which improve the quality of the diet and maintain health. India is the second largest producer of vegetables in the world with a production of 101.43 million tonnes with an average productivity of 15.1 t ha^{-1}. In Andhra Pradesh, the area grown under vegetable crops is 2.58 lakh hectares with a production of 38.6 lakh tonnes with an average productivity of 14.9 t ha^{-1}(The Hindu Survey of Indian Agriculture, 2008 and Statistical Abstract Andhra Pradesh, 2008).

The vegetable crop ecosystems are infested by a number of lepidopteran pests. Majority of the lepidopteran pests causes economic damage and mainly feed on roots, foliage, stem, buds and blossoms. The identification of these pests in the larval stage is difficult when compared to the adult stage. An accurate identification of pest species damaging the crop should be known for effective pest management practices, as most of practices are species specific. Hence, the taxonomic studies of the larvae of lepidoptera is necessary in order to identify the lepidopteran pests at larval stage under field conditions.

MATERIAL AND METHODS

The larvae belonging to the order lepidoptera infesting vegetable crop ecosystems were collected from different places in Guntur district. The collected larvae were brought to the laboratory and transferred to rearing jars. The jars were covered with muslin cloth and the larvae were fed daily until they reach the final instar with their respective host plants. A few final instar larvae were killed in K.A.A.D mixture (kerosene-1 part, 95 per cent ethyl alcohol-7 parts, glacial acetic acid – 2 parts and dioxan – 1 part) as advocated by Peterson (1948).

The caterpillars were allowed for thirty minutes to four hours depending on nature and size of larvae and then transferred to 95 per cent ethyl alcohol for long time preservation. The specimens which were preserved in 95 per cent ethyl alcohol were given a dorsoventral cut with the help of a sharp blade. The specimens were kept in 10 per cent potassium hydroxide for overnight. The specimens were rinsed with water and were retained in different grades of alcohol *viz.*, 50, 70 and 95 per cent alcohols successively for about 10-15 minutes to facilitate dehydration. The specimens were transferred into clove oil for 10-15 minutes for clearing. Finally a phenol + xylol mixture in the ratio of 1:1 was used to retain the specimens until the permanent slides were prepared with Canada balsam.

The specimens were kept on glass slides with few drops of mounting media, Canada balsam and oriented in a required direction with the help of needles. A cover slip was placed on the slide gently. The mounted slides were kept on a levelled surface at room temperature for 24-36 hours for drying. Later, the specimen code number and name of the part of the specimen was written on the mounted slide. The line diagrams of thorax and abdominal segments of the caterpillars were drawn with the help of drawing attachment with Olympus Trinocular Research Microscope.

Nine caterpillars belonging to different families, collected in vegetable crop ecosystem are listed below.

S. No.	Common Name	Scientific name	Family	Host plants
1	Tobacco caterpillar	*Spodoptera litura* (Fabricius)	Noctuidae	Bhendi, Cotton, Tobacco, Sunflower Chilli, Greengram Blackgram, Cowpea Soybean, Castor
2	Bhendi fruit borer	*Earias vittella* (Fabricius)	Noctuidae	Bhendi, Cotton
3	Snakegourd semilooper	*Plusia peponis* (Fabricius)	Noctuidae	Snakegourd
4	Brinjal shoot and fruit borer	*Leucinodes orbonalis* (Guenee)	Pyralidae	Brinjal
5	Pumpkin caterpillar	*Palpita indica* (Saunders)	Pyralidae	Pumpkin, Cucumber
6	Spinach caterpillar	*Isocentris opheltesalis* (Walker)	Pyralidae	Spinach
7	Bottlegourd plumemoth	*Sphenarches caffer* (Zeller)	Pterophoridae	Bottlegourd
8	Moringa hairy caterpillar	*Eupterote mollifera* (Walker)	Eupterotidae	Moringa
9	Diamond back moth	*Plutella xylostella* (Linnaeus)	Yponomeutidae	Cauliflower, Cabbage, Mustard

RESULTS AND DISCUSSION

Key to the lepidopteran caterpillars associated with vegetable crop ecosystems

A key for distinguishing the following lepidopteran larvae associated with vegetable crops was prepared for easy and accurate identification. The key is mainly based on different characters *viz.*, colour of larvae, armature on the body, chaetotaxy of prothorax and 3rd abdominal segment and the arrangement of crochets.

1. The thoracic and abdominal segments with long numerous hairs without any definite setal arrangement. Head without horn like processes. Each abdominal segment with a pair of verruca with long hairs or setae on black dorsal area; crochets uniordinal mesopenellipse. (Fig 13 & 14)
… *Eupterote mollifera* Walker Fy: Eupterotidae
- The thoracic and abdominal segments with short, definite number of hairs with definite setal arrangement ……2

2. Crochets on abdominal prolegs are arranged in multiserial circle; larva full green in color. (Fig 17 and 18)
… *Plutella xylostella* (Linnaeus) Fy: Yponomeutidae
- Crochets on abdominal prolegs are not arranged in multiserial circle ……3

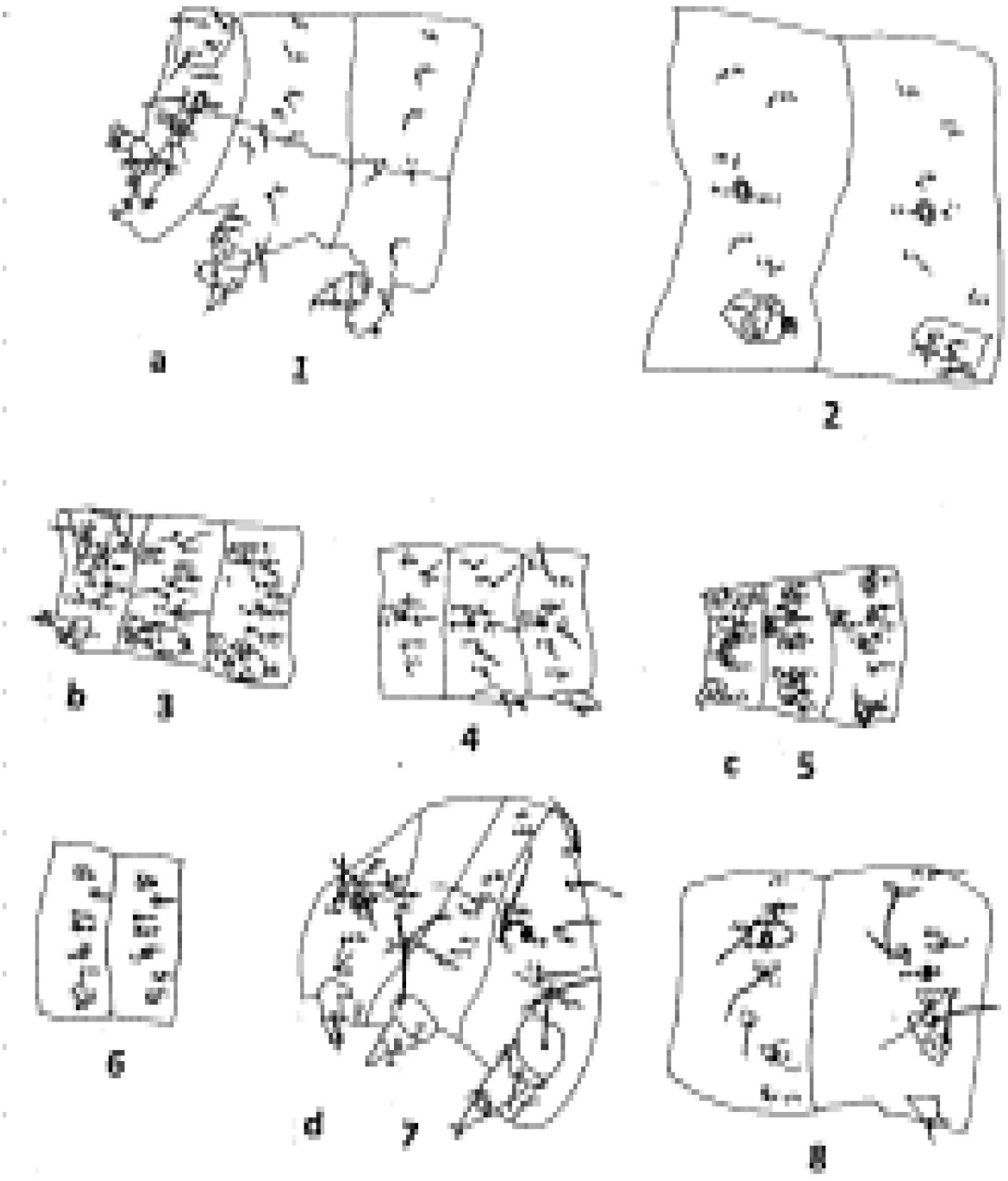
3. Crochets on abdominal prolegs are biordinal mesoseries; Caterpillar is yellowish green with white longitudinal lines and black tubercles with thin hairs arising on them (Fig 7 and 8) *Plusia peponis* Fabricius Fy:Noctuidae
- Crochets on abdominal prolegs are uniordinal mesoseries or penellipse or complete circle or biordinal or triordinal mesopenellipse ……..4

4. Crochets on abdominal prolegs are uniordinal mesoseries ……5
- Crochets on abdominal prolegs are biordinal or triordinal mesopenellipse 6

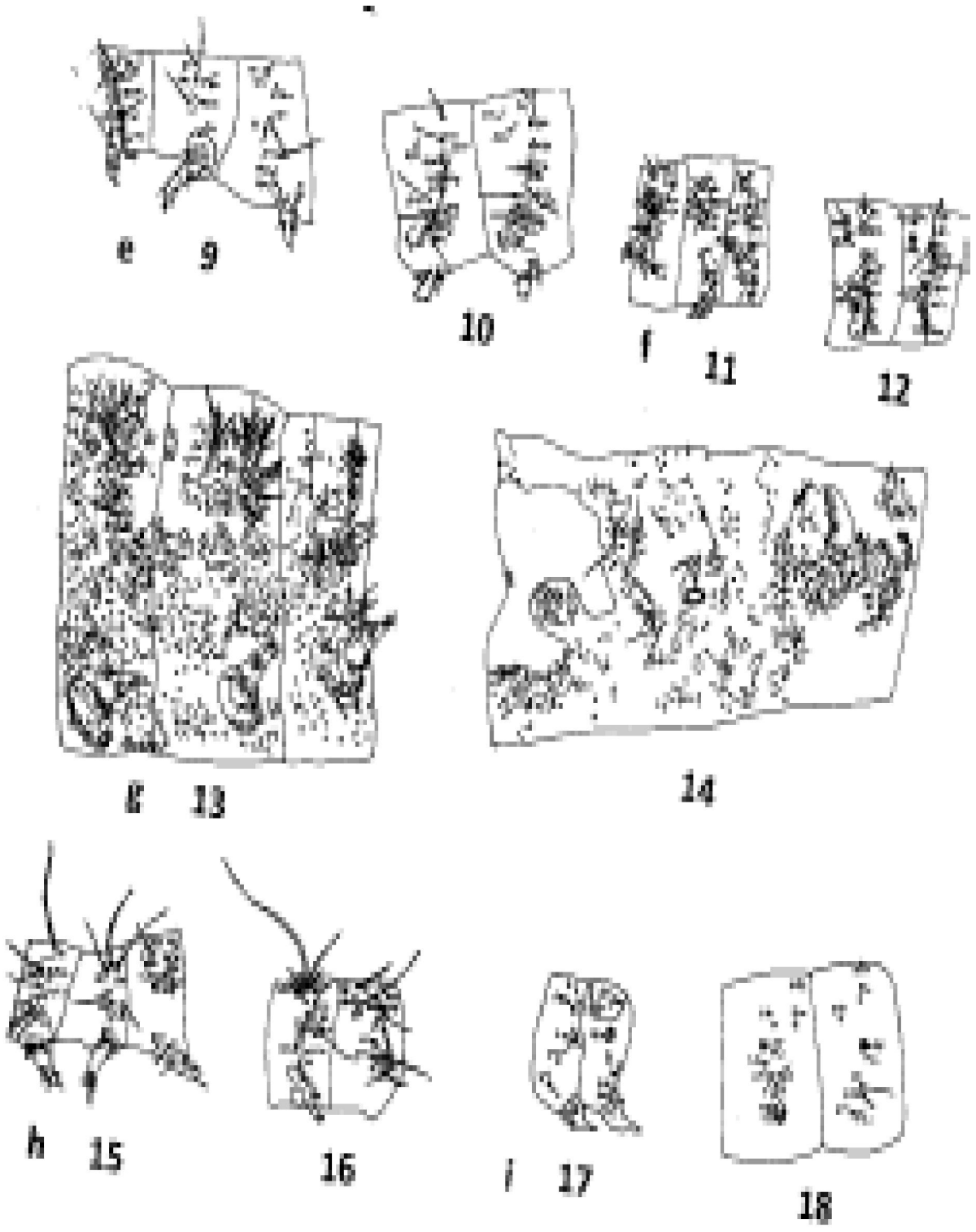
5. Caterpillar is chocolate brown with a longitudinal white stripe and orange maculae all over body and few setae raised on pinaculae. (Fig 3 and 4)
… *Earias vittella* (Fabricius) Fy: Noctuidae
- Caterpillar is stout, cylindrical, brownish with dorsal, subdorsal spiracular stripes of different colour. (Fig 1 and2)
… *Spodoptera litura* (Fabricius) Fy: Noctuidae

6. Crochets on abdominal prolegs are uniordinal mesopenellipse; Caterpillar is greenish brown with spines radiating all over the body from tubercles. Subdorsal setae SD1 and SD2 are present in prothoracic shield.(Fig 15 and 16)
…*Sphenarches caffer* (Zeller) Fy:Pterophoridae
- Crochets arranged in biordinal or triordinal mesopenellipse ……. 7

7. Crochets arranged in biordinal mesopenellipse. Caterpillar is yellowish green with four black spots on the thorax. (Fig 11 and12)
... *Isocentris opheltesalis* Walker Fy: Pyralidae
- Crochets on abdominal prolegs are triordinal mesopenellipse ……..8



Cheatotaxy of a) *Spodoptera litura* (Fabricius) 1. Thorax 2. Abdomen *b) Earias vittella* (Fabricius) 3. Thorax 4. Abdomen *c) Leucinodes orbonalis* Guenee 5. Thorax 6. Abdomen *d)Plusia peponis* Fabricius 7. Thorax 8. Abdomen



Cheatotaxy of e) *Palpita indica* (Saunders) 9. Thorax 10. Abdomen *f) Isocentris opheltesalis* Walker 11. Thorax 12. Abdomen *g) Eupterote mollifera* Walker 13. Thorax 14. Abdomen *h) Sphenarches caffer* (Zeller) 15. Thorax 16. Abdomen *i) ilutella xylostella* (Linnaeus) 17. Thorax 18. Abdomen

8. Larva is yellowish green with a pair of narrow longitudinal white streaks along the mid dorsal line. (Fig 9 and 10)

… *Palpita indica* (Saunders) Fy:Pyralidae

Larva is pinkish in colour with sparsely distributed hairs on the body. Subdorsal seta SD1 and lateral seta L1 only present in prothorax. (Fig 5 and 6)

… *Leucinodes orbonalis* Guenee Fy: Pyralidae

Spodoptera litura (Fabricius) caterpillar is stout, cylindrical and brownish with dorsal, subdorsal, sub-spiracular and supra-spiracular stripes of different colours. *Earias vittella* (Fabricius) caterpillar is chocolate brown with a longitudinal white stripe on the dorsal side and orange maculae all over the body and a few setae raised on pinaculae. In *S. litura* and *E. vittella* prothorax consists of prothoracic shield which extends upto the margin of XD2. The caterpillar of *Plusia peponis* (Fabricius) is yellowish green with white longitudinal lines and black tubercles with thin hairs arising on them. Whereas, in *P. peponis,* prothoracic shield extends upto the ventral margin of SD2. In all these three caterpillars dorsal, anterior dorsal, lateral, subventral, micrscopic setae are present. In *P. peponis* microscopic setae are absent unlike in other caterpillars. In mesothorax of all the three caterpillars dorsal, subdorsal, lateral and ventral setae are distinct. But in *P. peponis* dorsal setae D1 and D2, subventral seta SV1 and ventral seta V1 are prominent. The third abdominal segment also possess variation in the setal arrangement which is used as a supplement to the external morphological features for easy identification. Peterson (1948) explained that the family Noctuidae bears uniordinal (rarely biordinal) crochets arranged in a mesoseries. Issac and Rao (1941), Bretherton *et al.* (1983), Ahola (1986) and Chakravorty and Mandal (1989) studied the chaetotaxy of different lepidopteran larvae belonging to the family noctuidae and provided a key based on the external morphological features and chaetotaxy.

Leucinodes orbonalis Guenee larvae are light pinkish in colour with sparsely distributed hairs on warts on the body. The caterpillar of *Palpita indica* (Saunders) is yellowish green with a pair of narrow longitudinal white streaks along the mid dorsal line**.** *Isocentris opheltesalis* Walker, caterpillar is yellowish green in colour with four black spots on the thorax. *L. orbonalis* and *P. indica* belong to the same family Pyralidae and possess certain common characters like presence of three different lengths of crochets (Triordinal) on the abdominal prolegs. But in *I. opheltesalis,* the crochets on the abdominal prolegs are arranged in biordinal mesopenellpse. Peterson (1948) explained the arrangement of crochets, they may bear uniserial biordinal (rarely uniordinal) and occasionally triordinal crochets. Issac and Rao (1941), Peterson (1948), Allyson (1977a), Allyson (1977b), Chu and Cutkomp (1992) and Moyal and Tran (1992) studied the chaetotaxy of different lepidpteran larvae belonging to the family, pyralidae and provided key based on the external morphological features, chaetotaxy and arrangement of crochets.

Sphenarches caffer (Zeller) caterpillar is greenish brown with spines radiating all over the body from tubercles. The crochets on abdominal prolegs are uniordinal mesopenellipse. *Eupterote mollifera* (Walker) caterpillar is brownish with thin long hairs on the body. On prothroax and mesothorax numerous setae are present. On 3rd abdominal segment a pair of verrucae with long hairs or setae on black dorsal area. These setae are numerous and difficult to describe. The crochets on the abdominal prolegs are unirodinal mesopenellipse. *Plutella xylostella* (Linnaeus) caterpillar is greenish with short hairs on the body. Crochets on abdominal prolegs are arranged in multiserial circle.

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