

HELIOTHIS SPECIES LEPIDOPTERA : NOCTUIDAE IN PAPUA AND NEW GUINEA

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ABSTRACT

Hosts, pest status, natural controls (pathogens and predators) and records of H. armigera and H. assulta are given; and H. rubescens and also the Armyworm Pseudaletia separata are recorded. Classification of the group, keys to the adults and larvae of local species, and control with insecticides are included. This paper deals more particularly with the Highland areas.

INTRODUCTION.

THIS group of pests is cosmopolitan and larval attack on maize, cotton, tobacco and tomatoes is a constant problem. Certain other crops are attacked less persistently. Little work has been done in New Guinea but results of research in Australia have been published in papers on tomatoes by Common (1948), cotton by Passlow (1959) and linseed by Passlow and others (1960). Sloan (1945) dealt with migration and Smith and Saunders (1961) with control on tobacco. Kirkpatrick (1961) recorded species distributions and hosts, and in a second paper (1961a) described the various stages of the Queensland species. Common (1953) examined the taxonomic and pest status of the group in Australia. A world study was presented by Hardwick (1965). In this paper a group of species previously included in *Heliothis* was removed to a new genus *Helicoverpa*. This has not met with general acceptance by all authorities and is used here as a sub-genus.

In New Guinea *H. armigera conferta* may be a serious pest of maize, tomatoes, soya beans and tobacco. Under Highland conditions in most seasons a pathogenic fungus is the most effective natural agent of control. *H. assulta assulta* has a more restricted host range and the favoured hosts are tobacco and cape gooseberry. Control of this species is also assisted by a pathogenic fungus.

CLASSIFICATION.

The subfamily Heliothidinae consists of a group of species poorly distinguished from those of Noctuidae. Larvae of the Heliothidinae have the characteristic habit of feeding on the flowers and fruits of the host plant, the moths commonly frequenting the flowers of the same plant. Hardwick (1965) summarises the knowledge of the group.

The major genera of the Heliothidinae are *Schinia*, *Heliothis*, and *Helicoverpa*.

Schinia is concentrated in western North America where particular species are adapted to specific food plants, and restricted by the distribution of these plants — (Hardwick, 1958).

Heliothis is well represented in the Old and New Worlds, with one intermediate and less specialised species *H. (Thalpophila) rubescens* Walker in Australia.

The genus *Helicoverpa* includes the least specialised *Heliothis armigera* Hubner and species closely related to it. This group of species is characterised by laying larger numbers of smaller eggs on a wider range of food plants and a tendency of the moths to fly longer distances than is the case with remaining *Heliothis* species.

The seventeen species placed in *Helicoverpa*, along with their five subspecies, may be divided into five groups.

The *armigera* group extends from southern Europe and Africa to New Zealand. The one main species has two forms, one of which, *H. (H.) armigera conferta* (Walk.), is found

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in the region east to south of the Celebes Islands, the limit of the distribution being New Zealand.

The *zea* group extends over all except the colder regions of the globe. The species *H. assulta* (Guenee) has a range from India and Japan to Australia and Fiji.

The monospecific *punctigera* group of Australia is related to the *gelotopoeon* group with four species in the Americas.

Two species in the Hawaiian Islands constitute the fifth group.

IDENTIFICATION.

Egg.

The egg is yellow, 'bun-shaped', and has numerous vertical ribs. Eggs are usually placed singly on buds or growing points.

Larva.

The basic colour is green and this may be marked by a diffuse brown or reddish pattern. Small larvae are often relatively dark. The body is covered with scattered short bristles (setae), each on a dark coloured base (tubercle). This gives the larva a characteristic 'rough' appearance.

Larvae may be distinguished as follows:

1. Vertical diameter of spiracle (breathing pore) on segment 7 (behind last pair of abdominal legs) larger than or occasionally equal to that of the seta—bearing tubercle above it *H. armigera*.
Vertical diameter of spiracle much less than that of the tubercle ($\times 0.6$ — $\times 0.8$). 2
2. Pigment of tubercle brown to dark brown. *H. assulta*.
Pigment black. *H. rubescens*.
(Based on characters used by Kirkpatrick 1961a.)

Pupa.

The pupa is brown and usually found loose in soil or in plant debris on the ground. Characteristic features are few but are described by Kirkpatrick (1961a).

Adult.

The general colour of moths varies from yellowish grey to orange-brown or reddish brown, with varying degrees of fine black or

dark markings. The hind wings are usually pale at the base, often with dark vein lines, and dark towards the terminal margin.

Differentiation of species is difficult, particularly with old or faded specimens. The following key will be satisfactory with the majority of specimens.

Heliothis armigera is illustrated in Plate I. Moths may be distinguished as follows:

1. Pale diffuse spot in the terminal fascia of the hind wing. 2
No pale diffuse spot. *H. rubescens*.
2. Basal area of hind wing yellow or orange, with greyish suffusion. *H. assulta*.
Basal area of hind wing whitish, with grey or greyish brown suffusion. *H. armigera*.

DISTRIBUTION AND HOST RECORDS.

- A. *Heliothis (Helicoverpa) armigera* *conferata* Hubner. The common names are as follows: corn earworm, tomato grub, tobacco bud worm.

Zea mays L. MAIZE

Papua: Boroko, Port Moresby—15. VI. '56 (6).

14-mile farm, Port Moresby—13. III. '58 (2).

Erave, Southern Highlands District—18. X. '60 (1).

New Guinea: Aiyura (3)—20. I. '58; 11. VII. '58; on cobs with heavy population of *Pseudaletia separata* (Wlk) 22. VII. '58; 22. XI. '58; 23. VII. '59 with *P. separata* (1). Kainantu, Eastern Highlands District (5,100 ft.)—5. XI. '54 (2). Goroka, E.H., (5,100 ft.)—10. X. '51 (1).

West New Guinea: Kota Nica—12. VII. '57; 2. VIII. '57 (4).

Lycopersicum esculentum Mill. TOMATO

Papua: Erave, S.H.D. (3,600 ft.)—18. X. '60 (1).

New Guinea: Aiyura—29. IV. '58; 28. V. '58; 1. XII. '58; 30. XI. '60; 23. XII. '60 (1).

Brassica oleracea L. CABBAGE

New Guinea: Aiyura—24. III. '58 (1).

Pisum sativum L. GARDEN PEA



Plate I.—Corn Earworm Moth. *Heliothis armigera* Hubner.

New Guinea: Aiyura—1. XI. '57; 27. V. '58; 1. VI. '58; 18. XI. '60; 21. XII. '60; 10. I. '61 (1).

Glycine Soja max Merr. SOYA BEAN

New Guinea: Aiyura—1. XI. '61; 10. I. '62 (1).

West New Guinea: Kota Nica—3. IX. '57 (4).

Phaseolus spp. BEANS

West New Guinea: Kota Nica—15. VII. '57; 9. IX. '57; 12. XII. '57 (4).

Cajanus cajan PIGEON PEA

New Guinea: Aiyura—29. III. '58 (1).

Gossypium hirsutum COTTON

New Guinea: Erap, Morobe District—10. V. '60 (5).

Dianthus caryophyllus L. CARNATION
New Guinea: Kainantu, E.H.D.—20. XII. '54 (1).

Nicotiana tabacum L. TOBACCO
Papua: Sogeri Plateau, 1,500 ft. 1. II. '63 (2).

Theobroma cacao L. CACAO
West New Guinea: Kota Nica—1. XII. '57 (4).

Ambanz (Manokwari) '60 (4).
Dun (1964) records this species as a pest of pods.

Coffea arabica COFFEE
Recorded as a host (2) in both the Eastern and Western Highlands; and at Wau, 23. VII. '63 (2).

Dumbleton (1954) refers to a cyclostyled report by Mr. G. S. Dun in which maize, tomatoes, tobacco, lettuce, cacao, taro

(*Alocasia* and *Colocasia*), and rice are listed as hosts of *H. armigera*. Dun (1955) refers further to this species as a pest of horticultural crops, and Szent-Ivany (1961) quotes the cacao record.

Other Records: Light and field collections.

Papua: Mageri, Sogeri Plateau, Port Moresby (1,600 ft.)—August, (7).

New Guinea: Wau, Morobe Highlands 3,400 (ft).—7. IX. '58, (2).

Wantoat, Sarawaket Mts. (4,000 ft.)—September (7).

Aiyura—19. V. '58; 7. X. '58, (light) (1).

Goroka, E.H.—23. V. '58, (light) (1); 28. VI. '55, (light) (2).

Daulo Pass—September (8,000 ft.); October (6,500 ft.), (7).

Bainyik, Maprik, Sepik District—October, (7).

Gazelle Peninsula, New Britain—October and November, (7).

Lubuana Ptn., East coast, New Ireland—August, (2).

These records suggest that this species is seasonal in Highland areas, there being a lull in activity early in the year and again in August and September. At Aiyura the insect was very common in 1958, and again in late 1960, 1961 and early 1962. Damage was most severe on tomatoes, legumes, and maize in that order.

Records for the Lowlands suggest less activity in the hot wet part of the year.

B. *Heliothis (Helicoverpa) assulta assulta* (Guenee): Cape gooseberry budworm.

Physalis peruviana L. CAPE GOOSEBERRY.

New Guinea: Aiyura—14. III. '58; 12. VII. '58, (1).

Nicotiana tabacum L. TOBACCO

Papua: Sogeri Plateau, 1. II. '63. (2).

Other Records: Light and field collections.

Papua: Port Moresby (Newtown)—12. XII. '55 (light). (2); 9. V. '57, (light) March. (7).

Brown River, P.M.—August, (7).

Bisianumu, Sogeri Plateau (1,600 ft.)—July. (7).

Kokoda, Northern Dist.—June to August. (7).

Ekeikei—March and April. (7).

New Guinea: Wau, Morobe Dist. (4,000 ft.)—September. (7).

Oomsis (near Lae)—August. (7).

Aiyura—18. I. '59 (1); March, July, and December. (7).

Okapa, E.H.D. (6,000 ft.)—October. (7).

Goroka, E.H.D. (5,100 ft.)—23. V. '58. (7).

Mandi (near Wewak), Sepik Dist.—October. (7).

Bainyik, Sepik Dist. (1,000 ft.)—October. (7).

Keravat, New Britain—27. XI. '54 (light) (2).

West New Guinea: Kota Nica—June and September. (7).

H. a. assulta has been collected most frequently from May to August under lowland conditions, while the relatively small number of captures in highland areas have been well distributed throughout the year.

There is an indication that this is the more common species in lowland areas and it is much less common than *H. armigera* at higher elevations, probably as a result of its much narrower host range.

C. *Heliothis (Thalophila) rubescens* Walker: Indian weed caterpillar.

A single specimen has been collected.

New Guinea: Goroka, Eastern Highlands District, 5,100 ft.,—23. C. '58, at light, Col. J. H. Barrett.

Previous records are from Australia where the only known host plant is *Sigesbeckia orientalis* L. Indian Weed: (Kirkpatrick 1961).

FOOTNOTE:

- (1) Author's records
- (5) Col. A. Catley
- (3) Highlands Agricultural Experiment Station, Aiyura, Eastern Highlands. (5,400 ft.)
- (4) R. T. Simon-Thomas (1962)
- (5) Coll. A. Catley
- (6) Published in error as *H. assulta* Szent-Ivany (1956) (pers. com.)
- (7) Records from Hardwick (1965).

V. CONTROL.

Natural Agents.

(a) *A pathogenic fungus* identified as *Nomuraea* (= *Spicaria*) *prasina* Maubl. has been responsible for heavy field mortality of larvae.

An infected larva is illustrated in a previous paper—(Plate XXIII : Barrett 1966), and the fungus is incorrectly titled Green Muscardine Fungus *Metarrhizium anisopliae* Metsch.

It appears responsible for the relative scarcity of insects in the wet conditions of early spring over the summer period, and also for the variations in larval populations from season to season. The type of incidence suggests that an area may become 'saturated' with spores which remain viable and may retard infestation of the following crop in that area. This is provided that weather conditions are suitable for the fungus when populations again begin to develop.

During periods of fungus activity in the field the loss of larvae brought into the laboratory was of the order of 95 per cent. There was undoubtedly some cross infection in the laboratory but segregation of larvae, sterilisation of glassware and other precautions, reduced the mortality rate of late stage field collected larvae by only a small percentage.

With the onset of the condition larvae become sluggish and then comatose, darken in colour, and under damp conditions the body will become covered by the growth of a white fungal mycelium. Over a few days this changes to an olive green colour and the fungal surface then becomes powdery. This is due to the maturation of the millions of spores which have developed. (Plate XXIII : Barrett 1966)).

(b) *Predators* Two pentatomid bugs are active against the larvae. *Amyotea* sp. is oval in outline, half an inch long, and dark brown and orange in colour. *Platynopus melacanthus* Boisd. is of a mottled brown colour, slightly smaller, and has a spike on each 'shoulder' : (Plates XXI and XXII : Barrett 1966). These bugs paralyse the larva, and liquefy and suck out the body contents.

(c) *Egg losses* are normally heavy but agents are not known. Ants may be responsible, along with a nabid bug.

(d) *Parasites* have not been recorded.

Chemical Control.

Over the years a range of materials have been tested in various countries, but DDT remains the most effective. It is relatively cheap and of reasonably low toxicity to humans. In the Highlands where chemicals have been little used 0.1 per cent. concentration in water, preferably made up from an emulsifiable concentrate, is effective against *H. armigera*. The higher concentration 0.2 per cent. may be necessary to control *H. assulta* on tobacco.

When sprays are applied mechanically a rate of 0.5 to 1 pounds per acre in as little as 15 gallons of water has been found effective.

Under Territory conditions where natural agents are important in control, applications of insecticide should only be made as a last resort and should not be repeated unless reinfestation occurs. This policy will produce the least possible interference with predators and will reduce the chances of the development of a mite problem.

On soya beans, where vigorous growth will produce a closed canopy of leaves, heavy populations of larvae may be present but have little effect on the yield provided that no appreciable break in the canopy results from their feeding. In small areas in village gardens the shaking of plants, followed by the destruction of fallen larvae, is a feasible control measure.

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