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Insect pests of cotton in the Ord River irrigation area

Cover Page Footnote
I am indebted to Mr. C. F. H. Jenkins for advice throughout the project and to Dr. K. H. L. Key, Mr. I. F. B. Common and Mr. T. G. Campbell, for a number of pest identifications listed in this article.
COTTON is grown in the Ord Valley of north Western Australia, mainly as an annual, irrigated crop during the hot summer months of the "wet season". It is usually planted in November-December and harvested March-May.

This period of growth corresponds closely to that of maximum insect activity.

Detailed entomological investigations, commenced at Kimberley Research Station during the 1959-60 wet season, have shown that cotton is liable to attack from a large number and variety of insect and mite pests. Some of these are general feeders which attack other crop and weed plants, while others are more specific, attacking only members of the family Malvaceae, the family of plants to which cotton belongs.

With its succulent leaves and highly nutritious fruiting parts, cotton is a most attractive food for insects. Stems, leaves, squares (buds), flowers, bolls (fruit) and seeds are readily attacked as they become available. The plant can replace lost leaves and squares to a certain extent but destruction of the maturing bolls is an irreplaceable loss and protection from pests is most important at this stage.

Although over 20 different cotton pests have so far been recorded in the Ord Irrigation Area, investigations have shown that on the basis of incidence of attack, degree of damage and ease or difficulty of control, only six of these can be considered major ones.

The pests are described below roughly in order of decreasing importance at the present time. The relative status of the various pests could change in the future.

The list is arranged according to "wet season" conditions, but if cotton is also to be grown during the "dry season," then changes in pest status would also occur—for example, red spider and the loopers would be of greater and lesser importance respectively.

Fortunately the list does not include the Mexican boll weevil, *Anthonomus grandis* Boh., a major cotton pest which has been excluded from Australia by strict quarantine measures.

**MAJOR PESTS**

**Tobacco Cluster Grub**

*Prodenia litura* (F).

This pest, also known as the cotton leaf-worm, Egyptian cotton worm and cotton cutworm, is recorded from many of the cotton growing areas of the world, with the notable exception of U.S.A. It is the most serious pest of cotton in Egypt, and is at present in the same category in the Ord River area.

Although noted in the Ord River area many years earlier, *Prodenia* was first recorded causing significant damage to cotton on Kimberley Research Station during the 1956-57 wet season. However, it was not until the latter part of the 1960-61 season, that serious damage was recorded. Considerable damage was experienced throughout the following two wet seasons, causing experiments on cotton to be seriously affected.

During the past two seasons it has been very difficult to control this pest with certain insecticides and resistance, particularly to the chlorinated hydrocarbon types, has been suspected; this question is being investigated at the present time.

**Description**

The moth of this Noctuid has a wing span of about 1½ in. The forewings are greyish-brown, marked with a complicated pattern.
of whitish bands and streaks and with blue-grey areas near the tip and base. The hind wings are pearly-white with a dark brown line just inside their rear margins.

The eggs are usually laid in clusters on the undersides of the leaves. Some clusters have been found to contain over 2,000 eggs; the average number is about 400. The egg mass is usually covered with fine brown scales from the abdomen of the female. Individual eggs are almost spherical in shape, longitudinally ribbed and pearly green or light brown in colour, later turning dark grey.

The newly-hatched larva is greyish-green with a conspicuous black head and appears somewhat hairy. In the later instars, the general colour may be grey, green, creamy, brown, pinkish or black and the typical black, half-moon or triangular shaped markings along the back of the larva usually become much more obvious. A yellow or orange-coloured line can often be seen along each side of the dorsal line.

The presence of a pair of black marks, sometimes fused, about one quarter of the way along the back from the head and another smaller pair at a slightly shorter distance from the opposite end of the larva, also assist in distinguishing Prodenia from other caterpillars found on cotton.

The fully-grown larva is almost 2 in. long. The pupa is chestnut-brown in colour, shiny in appearance and about ¾ in. long and ¼ in. in diameter.

Life History, Habits and Damage

The eggs hatch in from two to four days. The newly-hatched larvae swarm over the leaf and attack the surface tissues, bringing about partial or complete skeletonisation of the leaf. The effect thus produced is an early, reliable sign of Prodenia infestation.

Later, the larvae eat right through the leaf. For the first few days the larvae remain clustered together but then gradually disperse by crawling, the use of silken threads and other means, over the whole plant.

The leaves are voraciously attacked, giving the plants a very ragged appearance. Squares, flowers and young bolls are also readily attacked, the floral part being particularly favoured.

Infestation of squares results in these parts becoming “flared”—that is the bracteoles are spread outwards, away from the bud. A similar effect is produced however, following attack by other caterpillar pests and such squares are invariably shed.

The larger, more mature bolls, although extensively scarred on the outside, are only occasionally entered and then initially by the more mature larvae. Many larvae can be found sheltering and feeding inside the involucre of bracts surrounding the flower buds, also within the flowers; this habit greatly increases the difficulty of control by insecticides.

The larvae also spend considerable time, particularly during the heat of the day,
Prodenia litura
The tobacco cluster grub

Earias huegeli
Rough bollworm

Pectinophora gossypiella
Pink bollworm

Heliothis punctigera
Climbing cutworm

Anomis planalis
Cotton looper

Cosmophila flava
Cotton semi-looper
low down on the plants and on the ground where they shelter in cracks of the soil and beneath fallen plant material, moving up the plants again in the evening to continue their feeding.

Stems and petioles are chewed and bored by the larvae, resulting in the "felling" of foliage and fruit. Roots and germinating seeds may also be damaged and seedlings and young plants may be cut off at ground level in a typical cutworm manner.

At certain times, mass migrations of *Prodenia* larvae off the cotton plants have been observed. Numerous larvae of all sizes can then be seen moving around on the ground below and away from the crop in typical armyworm fashion.

This phenomenon has also occurred with an infestation on safflower and may be due to a crowding effect or reduced palatability of the maturing plant.

The pest is active throughout the year but activity declines considerably during the cooler weather of the dry season.

The larval stage occupies some two to three weeks under wet season conditions, passing through six instars. Pupation occurs within a cell in the soil, usually directly below the plants, for a period of from eight to 11 days. Thus egg to moth cycle takes three to five weeks during the summer months but the duration of all stages is increased considerably during the cooler dry season period. In Egypt, for example, the cycle may occupy up to four months during the winter. Several generations of the pest occur throughout the year in the Ord Area.

**Host Plants**

*Prodenia* larvae are extremely polyphagous. The list of the host plants so far recorded in the area is too long to include here, but a very extensive range of crop, pasture, vegetable, ornamental and weed species is attacked in varying degrees. The depredations by the larvae, however, are mainly confined to the broad-leaved types although monocotyledons such as maize, sweet corn, oats and wheat have been attacked.

Natural enemies of *Prodenia* include a predatory bug, *Oechalia consocialis* (Bois.); a parasitic Tachinid fly and a polyhedrosis virus disease, all of which attack the larval stages.

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**Rough Bollworm**

*Earias huegeli* Rog.

A related species, known as the spotted bollworm, *Earias fabia* (Stoll), is also found attacking cotton in the Ord Area, but is of minor importance.

**Description**

The moth of this pest measures 3/4 in. across the outstretched wings. The forewings are marked with a wedgeshaped area which extends from the base of each wing to the tip; there are also three broken lines across each wing. These markings may be green or straw-coloured, green being the usual coloration during the wet season and straw-coloured during the drier weather. The hindwings are silvery-grey with a brownish suffusion at the margins.

The pupa is dark-brown and is about 3/8 in. long with somewhat rounded ends. It is enclosed within a whitish, buff or brown coloured felt-like cocoon, the shape of which resembles an upturned boat.

**Life History and Damage**

The eggs are laid, usually singly, on most parts of the plant but the terminal shoots, buds and bolls are preferred. Under wet season conditions they hatch in three to five days and the larvae soon start feeding on these parts.

Rough bollworm larvae characteristically bore into the buds and bolls and eat out the contents either completely or partly; in the latter case, consequent fungal infection may complete the destruction of the part. Several larvae may infest the same boll. Considerable damage is also caused by the habit of the larvae boring in the stem, often down through the terminal bud but also through the nodes.

The main stem growing point is quite often attacked, resulting in the collapse and death of the upper few inches of stem and leaves; these wilted or dead terminals
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Rough bollworm larvae in cotton boll. The fully-grown larva is about 3 in. long and is mottled with yellow, brown and grey markings. The body has a rough appearance which gives this pest its name.

are usually the first sign of rough bollworm infestation, although attack by other cotton pests such as grasshoppers and *Prodenia* larvae can give a similar effect. The boring activity of the rough bollworm larvae results in undesirable excessive vegetative growth and malformation of the cotton plant.

After passing through a number of instars during a period of two to three weeks, the fully grown larva pupates within a silken cocoon, often situated between the bracts and the boll. Pupation occupies from eight to 11 days.

Native host plants of this pest are plentiful in the area and one of these—*Hibiscus ficulneus* L. is particularly important.

Although present throughout the year, the rough bollworm appears to be particularly active during periods of dry weather.

Climbing Cutworm

*Heliothis punctigera* Wallengr.

This cosmopolitan pest is important because of its preference for the fruiting parts of the cotton plant. Although another species, *Heliothis armigera* (Hubn.) has also been recorded attacking cotton in this area, it has proved to be of minor importance only.

**Description**

The moth is a typical Noctuid, with a stout body and measuring about 1½ in. across the extended wings. The forewings are ochreous-coloured with rather indistinct and irregular markings. The hind wings are whitish with a broad black area around the hind margins.

The eggs are pearly-white and somewhat dome-shaped. The young larva is grey-white, slightly hairy and marked with black spots. In the later stages, the colour is most variable; although the general coloration is usually green, it may also be yellow, brown, pink or almost black. Light and dark bands typically extend along the length of the body. When fully mature, the larva is about 1½ in. long.

The pupa is dark brown and smooth in appearance.

**Life History and Damage**

The eggs, which are deposited singly on the fruiting parts or young foliage, hatch in two to five days and the young larvae commence eating the tender young foliage and buds. The later stages however prefer the fruiting parts, particularly bolls, which are often completely eaten out and more than one boll may be attacked by the same larva. As with certain other caterpillar pests of cotton, infestation of the buds by cutworm larvae usually results in “flared” squares and these damaged squares and young bolls are often shed.

The length of the larval stage varies with the temperature and food supply but is usually from two to three weeks. When mature the larva leaves the plant and pupates in the soil for a period of 10 to 14 days, at the completion of which the adult emerges and commences egg laying three or four days later. Thus, under favourable conditions, the life cycle occupies four to six weeks.

Larvae of this pest are also attacked by *Oechalia*, the Tachinid fly and the virus disease.
Pink Bollworm

*Pectinophora gossypiella* (Saund.)

This insect is one of the most widespread of all cotton pests, occurring in almost every cotton growing area of the world. In Queensland however, a different species, *Pectinophora scutigera* (Hold.) occurs.

The occurrence of pink bollworm in the Kimberley area of W.A. was first noted during the early 1920's when specimens were recorded from experimental cotton at Broome.

Although it has only been of minor importance in both the experimental cotton at Kimberley Research Station and the commercial crops at Kununurra during the past two wet seasons, it caused considerable damage in previous years. In the 1960-61 wet season, for example, it was estimated that in one damage assessment trial at Kimberley Research Station 75 per cent. of the yield loss could be attributed to this pest. Therefore, pink bollworm can be regarded as being potentially a very serious cotton pest in this area.

**Description**

The moth is small and inconspicuous, being only about $\frac{3}{8}$ in. long with wings folded and having a wing expanse of about $\frac{3}{8}$ in.

The forewings are greyish-brown, marked with patches of black and fringed at the outer margins with fine hair-like scales. The hind wings are silvery grey and have a dense fringe of hair-like scales along their hind margins.

The eggs are small, oval shaped and pearly greenish-white in colour when first laid, becoming more orange coloured later. The larva is a yellowish colour when newly-hatched, but lightens to a creamy white and in the later instars this ground colour is overlaid by transverse bands of pink which give the larva a general pink appearance, hence its name. The fully-grown larva reaches a length of about $\frac{3}{8}$ in.

The pupa is about $\frac{1}{8}$ in. long and $\frac{1}{4}$ in. diameter and is shiny brown in appearance.

**Life History and Damage**

The eggs may be deposited singly or in groups on the foliage or below the bracteoles of the buds and young bolls. The number of eggs laid by a moth may vary from 100 to 500.

Under favourable conditions, the eggs hatch in from three to five days and the young larvae immediately search around for a bud, flower or boll in which to feed; failure to find suitable food at this stage can result in heavy larval mortality.

If the larva burrows into a flower bud, the tips of the flower petals are often webbed, so that when the bud opens the flower has a "rosetted" appearance. This is one of the first signs of pink bollworm infestation.

Infested squares and flowers are usually shed, in which case the larva may complete its development within other fallen fruiting parts, or it may die. Larvae may also occasionally be seen feeding on the stamens or eating down into the ovary of an opened flower. Most damage however is caused to the bolls, the developing seeds (Continued on page 120)