

LARVAL IDENTIFICATION OF HELIOTHIS PUNCTIGERA AND HELIOTHIS ARMIGERA.M. Cahill,<sup>1</sup> C. Easton,<sup>2</sup> N. Forrester,<sup>1</sup> G. Goodver<sup>3</sup>INTRODUCTION

The adult stages of the two Heliothis species found most abundantly in the summer cropping areas of Australia (H. armigera and H. punctigera) are easily distinguishable and have been so for sometime. However the inability to distinguish the larval stages of these two species has hampered research on their ecology. For the past 5-10 years scientists studying H. armigera and H. punctigera have found that in the early larval stages cuticle pigmentation separated the species. More recently hair colour differences on the last instar larvae have proved successful for identification. Verification and refinement of these techniques is presented below.

METHODSSummer 1982-83

Heliothis larvae were collected from cotton and sunflower crops in north-western New South Wales from December 1982 until June 1983. These larvae were generally no smaller than second/third instar (5-10 mm) and often up to fifth instar (25 mm). The larvae were brought to the laboratory and reared in individual pots with artificial diet. Speciation was initially carried out on third-fourth instar larvae only. When the last instar technique was developed larvae were speciated at this stage also. The larvae were allowed to develop normally at 25°C through to adult emergence for final identification.

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Summer 1983-84

Heliothis eggs were collected from cotton crops throughout the Namoi, Gwydir and Macquarie Valleys in New South Wales and from the Queensland cotton areas Darling Downs, Lockyer Valley, Biloela and Emerald. These eggs were reared completely on artificial diet in individual containers. Species identification was made on third-fourth instar larvae and subsequently sixth instar. Adults were used to confirm the identification.

#### DESCRIPTION

These are usually six larval instars or moults in H. armigera and H. punctigera. The larvae can be speciated at two periods - third/fourth instar and sixth instar.

H. armigera larvae up to the fourth instar normally vary from a light caramel colour to very dark brown. Third and fourth instar larvae have a "saddle" which is a roughly triangular shaped, darkly pigmented area on the first and second abdominal segments around the dorsal hairs. (Fig 1).

H. punctigera do not have this "saddle" at the third and fourth instars.

Late instars of both H. armigera and H. punctigera exhibit an enormous range of colour and pigmentations - from yellow-green to dark green, to pink to very dark brown and may often change remarkably after moulting. The "saddle" marking is generally present in H. armigera in the later instars and rarely in H. punctigera.

The sixth instar larvae are easily distinguished by hair colour - H. armigera have white hairs while H. punctigera have black. In most cases all the dorsal and sub-dorsal hairs on H. armigera are white and on H. punctigera are black but always at least the two hairs immediately behind the cervical shield are characteristic. (Fig 1). In our verification we have found that these hair colour differences need to be confined to sixth instar larvae since earlier instars of H. armigera were not consistently white. The identifying criteria are summarized in table 1.

#### VERIFICATION

The results in Table II are for the 1982-83 data and show

- the numbers and stage at which the larvae were speciated and
- the adult identification.

Of the 443 larvae identified as either *H. armigera* or *H. punctigera* at the third-fourth instar, 430 were identified correctly and of 121 sixth instar larvae identified 119 were correct. This gave an overall success rate of 97%.

Table III shows the 1983-84 data. In this case all larvae were identified at third-fourth and subsequently sixth instars. From the egg collections with the larvae reared on uniform artificial diet, 1978 were correctly identified from 1981 reared (99.8% correct).

Table IV shows the various cotton growing areas and the numbers of adults eventually reared. These areas range from the Macquarie Valley (31° 31') in New South Wales to Emerald (23° 31') in Queensland and consequently cover a broad geographical and genetic base.

#### DISCUSSION

The increase in accuracy from the 1982-83 season to 1983-84 can be attributed to the different rearing methods. Larvae fed on natural diets (i.e. collected from the field) exhibit a wider range of colours and pigmentation than those reared completely on artificial diet. Previous workers have encountered problems with the "saddle" method of speciation. This can be explained by the fact that in most cases it was being extended beyond its limit i.e. when the larvae had developed past fourth instar.

Further uses of these techniques could include studies on species preference sites for egg laying, possible parasite/predator preferences and possible differential survival rates in various crops.

	<u>H. armigera</u>		<u>H. punctigera</u>	
	third/fourth instar	sixth instar	third/fourth instar	sixth instar
saddle	always	generally	never	rarely
hair colour	dark	white	dark	black

TABLE I.

Identification characteristics for Heliothis larvae

Identification at third/fourth instar	Identification at sixth instar	Moth Identification	Number reared.
H. armigera	-	H. armigera	113
H. punctigera	-	H. punctigera	237
H. armigera	H. armigera	H. armigera	53
H. punctigera	H. punctigera	H. punctigera	27
-	H. armigera	H. armigera	29
-	H. punctigera	H. punctigera	10
H. armigera	-	H. punctigera	10
H. punctigera	-	H. armigera	3
-	H. armigera	H. punctigera	1
-	H. punctigera	H. armigera	1

TABLE II

1982-83 Verification of larval identification.

Identification at third/fourth instar	Identification at sixth instar	Moth Identification	Number reared
H. armigera	H. armigera	H. armigera	409
H. punctigera	H. punctigera	H. punctigera	1569
H. punctigera	H. armigera	H. armigera	1
H. armigera	H. armigera	H. punctigera	1
H. punctigera	H. punctigera	H. armigera	1

TABLE III

1983-84 Verification of larval identification.

AREA	<u>H. armigera</u>	<u>H. punctigera</u>
Macquarie Valley	21	136
Namoi Valley	141	883
Gwydir Valley	42	98
Darling Downs	88	316
Lockyer Valley	15	31
Theodore Irrig. Area	1	5
Emerald Irrig. Area	101	100

TABLE IV

Numbers of Heliothis collected from various cotton areas. 1983/84.

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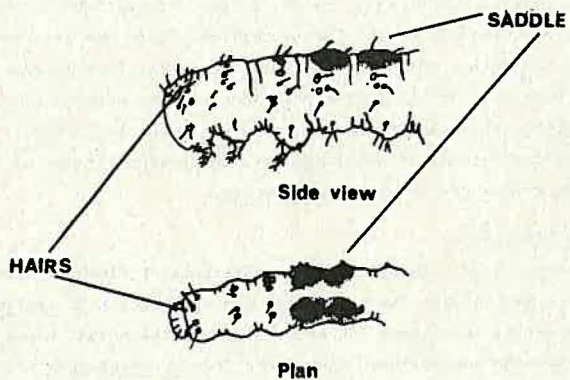


FIGURE 1