EFFECTS OF LARVAL DIET ON THE FATTY ACIDS OF ADULT *HELICOVERPA ARMIGERA*

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INTRODUCTION

The review by Zalucki *et al.* (1986) on the biology and ecology of *Helicoverpa* spp. in Australia indicates at once the amount of research that has been done on these major pests and how much still remains before a substantial understanding of their life systems is achieved.

In studying the population dynamics of pest species capable of long distance migration, the ability to differentiate between local and immigrant individuals is important. While many factors contribute to the trivial and migratory movements of the moths (Farrow and Daly, 1987), being able to define larval host origin(s) for trapped moths may provide valuable circumstantial evidence for their likely geographical origins.

The ratios of inorganic elements in a moth have been suggested as a means of identifying the larval host plant. However, Bowden *et al.* (1985) concluded that interactions between plants and soil types may confound the source of differences between insects.

Many insects of the order Lepidoptera have been shown to require certain polyunsaturated fatty acids in their diets for normal development. The types and proportions of these acids in the lipids (fats) of adults (moths) may provide information on the larval diet. The adults feed predominantly on sugars so that the major fat intake for the insect occurs during the larval stage.

The aim of the present work was to assess if the fatty acid profiles of moths are useful in establishing different larval dietary histories.

METHODS

Rearing of *H. armigera*

Larvae were reared individually at 25°C on either an artificial diet based on navy beans or on fresh cotton leaves (Deltapine 90) grown in the glasshouse. The insects were divided into male and female at the pupal stage, allowed to emerge and adult moths given sugar solution as food.

Five representative moths from each sex and dietary background were frozen at ages 2, 5, 10 and 15 days, freeze dried and analysed for fatty acids.

Chemical analysis

After weighing a moth, total lipids were extracted by high speed blending in a chloroform/methanol mixture. The extracted lipid was saponified and fatty acids converted to their methyl esters. The esters were analysed by gas liquid chromatography.

The fatty acid profiles of the navy bean diet and cotton leaves were determined by a similar procedure.

RESULTS AND DISCUSSION

As anticipated, the major acids of moths from both dietary backgrounds were qualitatively similar.

Also, the fatty acid profiles of moths did not change greatly with increasing age in this experiment. Similarly, differences between the sexes were apparent but not of great magnitude, especially for the younger moths.

The data in Table 1 show that while the major fatty acids are similar qualitatively there are some distinct differences in the profiles for moths with the two dietary histories.

Table 1 Fatty Acids as percentage of dry matter.
Values for the moths in Tables 1 and 2 are the means (± S.D.) of all ages and both sexes for each dietary history.

FATTY ACIDS	MOTHS (*H. armigera*) from			
	DIET	COTTON	DIET	COTTON
Myristic C14.0	0.14 (± .03)	0.12 (± .02)	0.003	0.099
Palmitic C16.0	10.1 (± 2.5)	14.6 (± 3.8)	0.22	0.67
Palmitoleic C16.1	1.5 (± 0.3)	1.5 (± 0.5)	0.03	0.01
Margaric C17.0	trace	not detected	0.007	n.d.
Stearic C18.0	0.45 (± 0.13)	0.86 (± 0.4)	0.03	0.04
Oleic C18.1	9.7 (± 2.0)	15.6 (± 5.2)	0.21	0.13
Linoleic C18.2	1.97 (± 0.6)	0.45 (± 0.1)	0.45	0.38
Linolenic C18.3	1.85 (± 0.4)	2.39 (± 0.5)	0.45	1.49

The level of linoleic (C18.2) is higher in moths from the navy bean diet and conversely concentrations of C16.0 and C18.1 tend to be greater in moths from cotton. As well, low levels of the minor fatty acid C17.0 were detected both in the navy bean diet and in moths (especially the young) from it but not in cotton derived moths.

Differences are even more obvious when ratios of selected fatty acids are considered (Table 2).

Table 2 Ratios of Fatty Acids

	MOTHS *(H. armigera)* from			
RATIOS	**DIET**	**COTTON**	**DIET**	**COTTON**
$\frac{C18.1}{C18.2}$	5.4 (± 1.9)	35.2 (± 11.8)	0.46	0.35
$\frac{C18.3}{C18.2}$	0.97 (± 0.1)	5.4 (± 0.9)	1.0	3.9

In this respect, the $\frac{C18.3}{C18.2}$ ratio is especially important. These polyunsaturated fatty acids are probably not synthesized by the insect so tbat the ratios for the moths may approximate those for the dietary background. The data in Table 2 strongly suggest that this has occurred.

Recently, Guerra and Robacker (1989) have shown that ratios of fatty acids can be used to distinguish between boll weevils (*Anthonomus grandis* Boheman) that have fed on cotton squares or bolls.

CONCLUSIONS

The fatty acid profiles of *H. armigera* moths appear to have the potential for distinguishing between different larval dietary backgrounds.

Because of the wide host plant range and larval movements in the species not all hosts may be identifiable.

Most immigrant moths will be young so that minor fatty acids in host plants may also be important markers.

Research initially will be widened to include *H. punctigera* and will concentrate on major crop hosts such as maize, sorghum and sunflower under field conditions.

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