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Assessment of insect damage to litchi fruit in northern Queensland

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Summary

An assessment was made of the incidence of insects and insect damage on litchis in the 6-week period before harvest and of the effect of an insecticidal spray on the incidence of such damage. Results show that insects are responsible for significant losses on litchis and that carbaryl 0.1% sprays applied at approximately 10-day intervals significantly reduce the percentage of damaged fruit on the tree and the number of fruit falling from the tree before harvest. Seed feeding Lepidoptera, particularly *Cryptophlebia ombrodelta* and *Lobesia* sp., are the most important insects associated with preharvest fruit losses on the litchi in north Queensland.

1. Introduction

The litchi (*Litchi chinensis* Family Sapidaceae) is a subtropical fruit tree originating in China. In Australia it is grown in coastal regions between Cairns in north Queensland and northern New South Wales. Commercial plantings in Queensland were estimated at 16 000 trees in 1980 and further expansion is expected.

The litchi is susceptible to attack from a variety of insect pests. Storey and Rogers (1980) list 34 Lepidopterous species recorded in north Queensland. This paper reports the results of two studies which assessed losses caused by insects on litchis in the 6 weeks before harvest in a commercial orchard near Cairns during 1975 and 1976.

2. Materials and methods

Eight unsprayed trees of the variety Kwai Mi were sampled at weekly intervals during October–November 1975. Each tree was subdivided into eight sectors based on the four cardinal points and the top and bottom half of the tree. Samples of 25 fruit were selected at random from each sector of each tree examined for damage. Split and damaged fruits were placed on clean sawdust in cardboard cartons to allow insect development for later identification. At harvest, records were kept of the weight of commercially acceptable and unmarketable fruit. Rejected fruit were examined and classified according to the reason for rejection and each group was weighed. The crop was harvested between 4 and 13 November 1975.

In 1976 a comparison was made of pest incidence on sprayed and unsprayed trees. The trees used were 9 years old with an average canopy diameter of 4.8 m. Ten Kwai Mi trees were paired on the basis of tree size and amount of fruit carried. One of each pair was left unsprayed and carbaryl 0.1% was applied to the other at approximately 10-day intervals from 26 October to 4 December 1976. All trees had received carbaryl 0.1% sprays on 6 and 16 October, prior to the initiation of sampling.

Carbaryl was chosen on the basis of efficacy against *Cryptophlebia ombrodelta* (Lower) on macadamia nuts (Ironside 1973), the 1975 study having indicated that seed feeding Lepidoptera, including *C. ombrodelta,* were the main cause of insect damage during the pre-harvest period. Fruit sampling commenced on 29 October 1976 and continued at weekly intervals until 10 December 1976. For on-tree sampling, each tree was divided into four sectors based on the four cardinal points. From each sector 50 fruit were selected at random and examined for insect damage. The number of fallen fruit was recorded weekly from four 1 000 cm^2 quadrats laid out beneath each tree.

Damaged fruits from on-tree samples and all fallen fruit were returned to the laboratory and incubated as during 1975. In 1976, flowering occurred over a longer period than normal and while most of the fruit reached commercial maturity between the 12 and 26 November, some fruit was present on the trees until 10 December.

3. Results and discussion

1. 1975 study

Examination of unmarketable fruit indicated that seed feeding Lepidoptera were responsible for rejection of 11.1% of fruit and *Xylotrupes gideon* (L.) (Coleoptera:Scarabaeidae) feeding for rejection of 2.5% of fruit. Splitting caused 2.1% of fruit to be rejected while another 3% were unmarketable because they were either mis-shapen or small. These data show that losses from insect damage (13.6%) are considerably larger than those from all other causes (5.1%). The percentage of insect damaged and split fruit found in the on-tree sampling is given in table 1.

Fruit examination and insect identifications indicated that attack by seed feeding Lepidoptera caused the most significant damage. Such fruits were characterized by an entrance hole in the skin with frass and/or sugary exudates.

Table 1. Incidence of damage in litchi fruit 1975

Sampling date	Insect damaged fruit (%)	Split fruit (%)
21 October ..	0.6	1.0
29 October ..	1.3	1.7
4 November ..	4.7	1.9
11 November ..	14.2	1.7

Feeding by *X. gideon* was responsible for some losses. Beetles damaged fruit by breaking through the skin to feed on the flesh inside. Liquid from the damaged fruit dripped onto the other fruit in the cluster causing discoloration. *X. gideon* was thus responsible for a direct loss by feeding and also for a reduction in quality of other fruit in the same cluster as the damaged fruit. Only direct feeding by *X. gideon* is included in the damage estimate given above as no estimate of the quality loss from the sticky deposit was possible.

Splitting of the skin was another reason for fruit being unmarketable. While this was not the result of insect activity, the split fruit sometimes subsequently became infested by some of the Lepidoptera discussed by Storey and Rogers (1980).

In 1975 the incidence of insect infestations rose rapidly as the fruit approached maturity. By harvest, infestation caused significant losses. Fruit rejected at harvest showed an insect infestation level similar to that recorded at the end of the sampling programme (table 1). Seed feeding Lepidoptera were the most important insects infesting litchi fruit in 1975. Of these, *Cryptophlebia ombrodelta* (Tortricidae) was the species most commonly recovered from infested fruit. *Adoxophyes templana* (Pangenstecher) (Tortricidae) and *Lobesia* sp. (Tortricidae) were obtained in smaller numbers. No fruit flies were bred from infested fruit.

2. 1976 study

On-tree fruit sampling data and fruit fall records are presented in table 2. The fruit damage data shows that within 17 days after the two overall carbaryl applications, unsprayed trees carried significantly more damaged fruit than those where spraying had been continued. There was also a highly significant difference between the number of fruit falling per week. Over the 6 weeks in which fruit fall data were recorded, unsprayed trees lost a mean 58.2 fruit per m^2 while sprayed trees lost only 13.8. Fruit drop appeared to be an important cause of yield loss on unsprayed trees.

Table 2. Incidence of insect damage and fruit fall in litchi fruit 1976

Treatment	Insect damaged fruit					Fruit fall (fruit per m^2 per week)	
	29 Oct	5 Nov	12 Nov	19 Nov	26 Nov	Transformed mean*	Equivalent mean
Sprayed	1.0	5.3	2.6	5.0	7.3	1.68	2.3
Unsprayed ..	1.6	2.4	9.1	13.3	15.3	3.19	9.7
Nec diff 5% ..			5.5			0.55	
for sign 1% ..			7.4			0.74	

* $\sqrt{x+\frac{1}{2}}$ transformation.

Lobesia sp. and *C. ombrodelta* were the most common Lepidoptera species recovered from damaged fruit collected in the on-tree sampling and in fallen fruit. *Cateremna quadriguttella* Walker (Pyralidae), *Anarsia* sp. (Gelechiidae), *Tirathaba rufivena* Walker (Pyralidae) and *Hydrillodes lentalis* Guenée (Noctuidae) were also bred from fruit, but in smaller numbers.

Further testing of carbaryl and other insecticides is required before definite insecticide recommendations can be made. Data are required on timing and relationships to particular pest species.

4. Conclusions

The difference in the percentage of damaged fruit in the on-tree sampling and the rate of fruit fall between sprayed and unsprayed trees indicates that insects are responsible for significant losses of litchi fruit in the 6 weeks prior to harvest. Seed feeding Lepidoptera are the most important insects involved. Larvae enter the fruit to feed on the seed and after some time such fruit fall to the ground. The most common species bred from litchi fruit were *C. ombrodelta* and *Lobesia* sp.

5. Acknowledgements

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References

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