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BANANA FLOWER THRIPS AND ITS RELATIONSHIP TO CORKY SCAB DAMAGE OF CAVENDISH BANANAS IN SOUTH-EAST QUEENSLAND

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SUMMARY

A laboratory experiment and field experiments have demonstrated that the banana flower thrips, *Thrips florum* Schmutz, is the cause of the skin blemish of Cavendish bananas known as corky scab.

The insect is attracted to the new bunch as it appears in the throat of the plant and damage is caused at this early stage.

I. INTRODUCTION

Corky scab of Cavendish bananas, previously known as Coffs Harbour scab, is one of a number of skin blemishes of the banana which cause down-grading of the fruit and hence loss of profit. In Queensland, the blemish is important in the southern banana-growing areas only.

On mature fruit, typical damage (figure 1) is seen as a grey-brown corky roughening of the outer face of the banana hand, sometimes accompanied by cracking. The corking extends right across the finger from angle to angle, along the length of the fruit and onto the basal cushion where it appears as grey-brown to bronze blisters. The wing or outer fingers are often more damaged than the others.

Since field observations showed that insects on damaged mature fruit were few in number, attention turned to those insects associated with young fruits (0 to 2 weeks old). The most commonly-occurring insect in the newly-emerged bunch is the banana flower thrips, *Thrips florum* Schmutz. It is also the most common and abundant insect on the initial inner face of the new hand (later outer face of the mature fruit) which subsequently shows most signs of corky scab damage.

The relationship of the banana flower thrips to corky scab was investigated in the laboratory and in the field. Observations were made on the biology of the insect, and records were obtained of its numbers and distribution on the developing bunch and in the male bell. Information was also obtained on the seasonal activity of the insect, from water-trap and sticky-trap catches, in relation to the seasonal development of the crop and seasonal temperature changes.

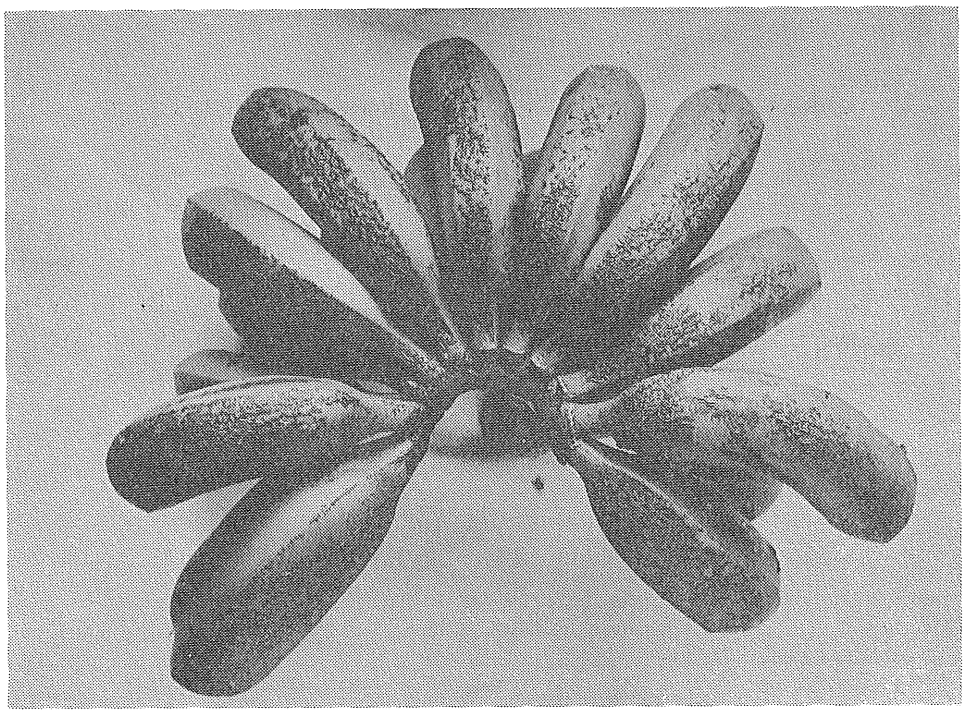


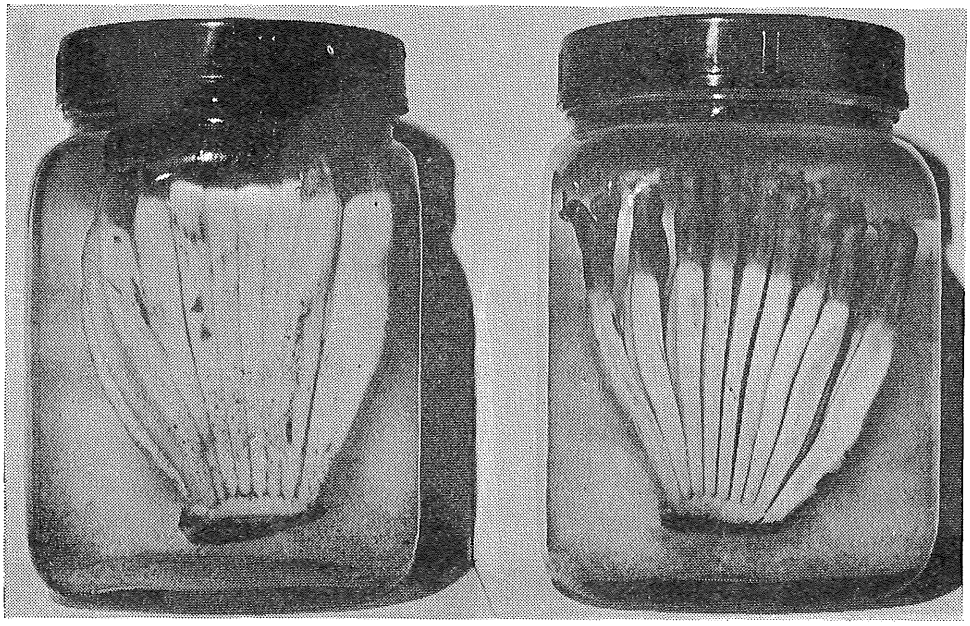
Fig. 1.—Corky scab damage on mature Cavendish bananas.

II. MATERIALS AND METHODS

a. *T. florum* as the cause of corky scab

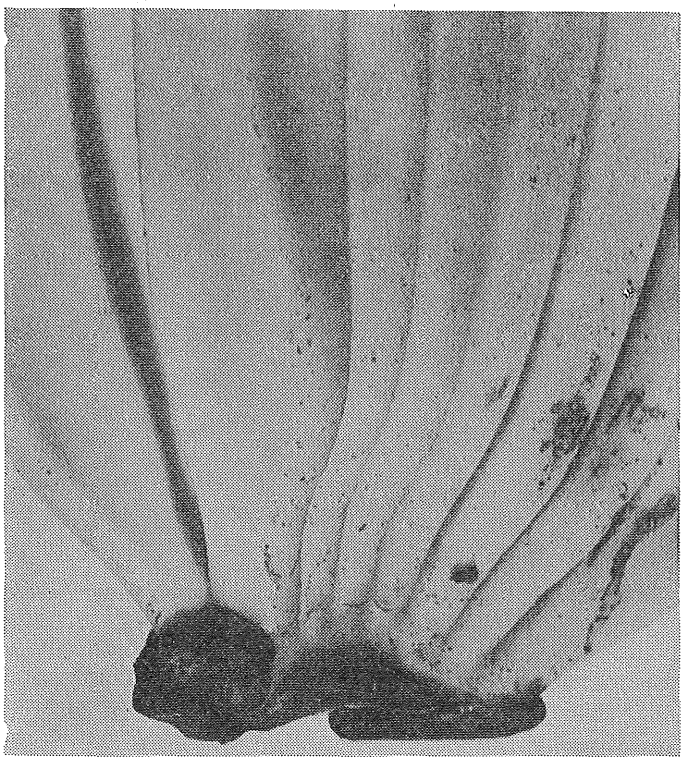
A laboratory experiment was designed to investigate whether infestations of *T. florum* caused early signs of corky scab damage in newly-formed banana bunches. Two bunches of Cavendish bananas were removed shortly after they had emerged in the throat of the plant, while they were still in the upright position tightly encased in covering bracts. Inspection showed the numbers of *T. florum* adults on the fingers beneath the bracts to be small and that no damage was present on the fingers themselves. One bunch was washed free of thrips by carefully lifting the bracts and flushing with water containing Teepol detergent at 0·01% v/v. It was then placed on sawdust in a plastic garbage bin and the lid replaced to exclude any insects. The second bunch was put on sawdust in another plastic garbage bin together with two male banana bells heavily infested with *T. florum*. This second bin was covered with muslin to allow adequate ventilation for the continued development of the insects, as well as to exclude other insects. The bins were kept at room temperature (27–29°C) and the bunches were inspected after 6 days.

The field experiments were carried out to supplement the laboratory experiment by demonstrating the association between the early infestation of the newly-emerged bunch by *T. florum* and the subsequent appearance of the typical corky scab damage of the mature fruit. On each of several occasions throughout the season, newly-emerged bunches, upright in the throat of the plant, were protected from infestation by *T. florum* by injecting 80 ml of an 0·08% w/v



2a. Thrips present.

2b. Thrips absent.



2c. Enlargement of 2a to show distribution of damage.

Fig. 2—Early damage to Cavendish bananas by the banana flower thrips.

DDT emulsion in water into the distal end of the bunch so that the insecticide ran down over the fingers inside (Swaine, 1968). The same numbers of untreated, newly-emerged bunches as in the treated lot were selected on each occasion as controls. The bunches were cut at maturity and the extent of the corky scab damage to each finger on each hand in turn was assessed on a rating scale: 0 = undamaged, 1 =very light damage, 2 = light damage, 3 = moderate damage, 4 = heavy damage. The maximum possible rating for damage on a bunch was a 4-rating for all fingers. The percentage damage was obtained by summing the ratings for every damaged finger and expressing the sum as a percentage of the maximum possible rating.

b. The biology and seasonal abundance of *T. florum*

Records were obtained of the numbers and distribution of adults and nymphs of *T. florum* on bunches and male bells of differing ages. Thrips on the young bunch (between fingers, in the flowers and under bracts) and inside the male bell were extracted in the field by washing out with water containing Teepol detergent at 0·01% v/v. The washings were collected into a vial after seiving through a muslin sleeve on the end of a funnel, and counts were made subsequently under a stereo microscope.

Counts of adult thrips were obtained weekly from catches in a water trap (1 m x 1 m x 10 cm). This was painted yellow inside, filled with water containing Teepol detergent at 0·01% v/v, and positioned along one of the rows in the middle of a 1 ha patch of non-irrigated Cavendish bananas at a height of 1 m above the ground. Weekly counts of adult thrips were also obtained in the same patch for sticky-traps tied to 1 to 2-week-old bunches of plants picked at random, and for other sticky-traps tied at a height of 2 m above the ground on to upright stakes positioned between plants in the rows. With the exception of three records between 13 January and 24 February 1972, when one, two and four traps were used, all other sticky trap records were from five traps on each occasion. The sticky traps were made of 30 cm x 4 cm strips of stiff white paper glued onto a stiff, cardboard backing. Waterproof black lines were ruled across the paper at 1·3 cm intervals to facilitate subsequent counting of thrips. The paper was coated with a smear of a proprietary formulation, Tack Trap, supplied by Animal Repellants Inc., Griffin, Georgia, U.S.A.

III. RESULTS

a. *T. florum* **as the cause of corky scab**

In the laboratory experiment involving new bunches with and without *T. florum*, the bunch which had been cross-infested from the male bells enclosed with it for 6 days showed a large number of thrips egg punctures and silvery patches of feeding damage distributed precisely as is corky scab damage on mature fruit (figures 2a and 2c). The only insect present in the areas of damage, and indeed within the bunch, was *T. florum*. Conversely, the control bunch was without damage and was free of *T. florum* (figure 2b).

In the field, the effect of controlling early infestation of the insect in newly-emerged bunches by DDT injection was to markedly reduce the incidence of corky scab damage in mature fruit (table 1).

TABLE 1

THE EFFECT OF INJECTING EMERGING BUNCHES OF CAVENDISH BANANAS WITH DDT EMULSION TO CONTROL BANANA FLOWER THRIPS ON THE INCIDENCE OF CORKY SCAB DAMAGE

Location	Date Bunch Thrown	Number of Bunches Compared	Percentage of Maximum Possible Rating for Corky Scab Damage	
			Control	*DDT Injected
Narangba	3 Dec 69	5	1·3	1·0
	23 Dec 69	5	5·1	0·4
	29 Jan 70	5	16·3	3·3
	12 Feb 70	9	7·3	1·9
	26 Feb 70	21	17·9	1·1
	2 Mar 70	2	10·8	1·3
	18 Mar 70	3	18·4	0
Currumbin	30 Dec 69	1	4·7	4·3
	30 Jan 70	3	24·8	1·3
	13 Feb 70	1	11·2	0
	27 Feb 70	1	14·4	0
	13 Mar 70	2	8·9	0

* Newly-emerged bunches upright in the throat of the plant injected with 80 ml of 0·08% w/v DDT in water.

Damage to individual fingers rated: 0 = undamaged; 1 = very light damage; 2 = light damage; 3 = moderate damage; 4 = heavy damage.

b. The biology and seasonal abundance of *T. florum*

The adults fly in the plantation and are attracted to the young bunches shortly after they emerge from the throat of the plant (table 2). They work their way beneath the ensheathing bracts and feed on the flower parts, on the developing fingers and on the inside of the bracts, thereby causing a silvering damage. Silvery feeding damage is also caused to the outside of the bract. Eggs laid in the flower parts, young fruit and in the bracts give rise to nymphs which occur in large numbers on the fruit, together with the adult insect.

The bracts around the hands of the bunch remain closely adherent during the first week and conditions for the thrips are favourable. By the end of the second week, the bracts have begun to lift and the unfavourable conditions at that time are reflected in the fall in numbers of the thrips (table 3).

As the bunch becomes unfavourable, the insect is attracted to the male bell which develops at the end of the fruit stalk beneath the bunch (table 4). The bracts around the male bell in the Cavendish banana varieties grown in south-east Queensland are persistent and conditions for the continued development of the insect remain favourable for a long time. This is demonstrated by table 5 which gives the numbers of thrips adults and nymphs found in male bells ranging in age from 21 to 118 days.

TABLE 2

THE ATTRACTION OF NEW BUNCHES FOR ADULT BANANA FLOWER THRIPS, NARANGBA 17 FEB–29 MAR 1972

Week	Number of Thrips Adults Caught on Five Sticky Traps in Specified Location	
	On Outside of New Bunches	On Wooden Stakes at 2 m Above Ground
1	63	8
2	86	4
3	48	1
4	111	7
5	224	3
6	244	4
7	412	39

TABLE 3

NUMBERS OF BANANA FLOWER THRIPS IN 1 AND 2-WEEK-OLD BANANA BUNCHES, NARANGBA 2 MAR 1972

1-week-old Bunch		2-week-old Bunch	
Thrips Adults	Thrips Nymphs	Thrips Adults	Thrips Nymphs
51	7	3	0
59	16	0	0
37	30	3	1
11	20	1	2
31	28	2	0
40	9	0	0
25	24	1	0
10	5	4	1
47	32	1	0
7	2	6	3
318	173	21	7

TABLE 4

NUMBERS OF BANANA FLOWER THRIPS IN 2-WEEK-OLD BUNCHES AND IN MALE BELLS ON THE SAME PLANT, NARANGBA, 2 MAR 1972

Plant	Bunch		Male Bell	
	Thrips Adults	Thrips Nymphs	Thrips Adults	Thrips Nymphs
1 ..	3	0	73	0
2 ..	0	0	59	0
3 ..	3	1	8	0
4 ..	1	2	23	0
5 ..	2	0	21	0
6 ..	0	0	1	0
7 ..	1	0	109	9
8 ..	4	1	120	20
9 ..	1	0	135	12
10 ..	6	3	19	0
Total ..	21	7	568	41

Records taken in non-irrigated bananas show that the adult *T. florum* is active throughout the year. Weekly counts of adults caught in a water trap (figure 3) show, however, that activity declines during the cooler months of June, July and August. Increase in activity begins with the seasonal rise in temperature in September-October and continues with fluctuations into May (figure 4).

Increase in numbers of *T. florum* depends on the increase in food supply as represented by new bunches and male bells. Figure 5, which gives the rates of bunching for an old, irrigated banana patch and for a new, non-irrigated patch in its first and second year, shows that the main bunching in south-east Queensland occurs in the months October to May. The actual number of bunches available at any particular time is subject to considerable variation (figure 5)

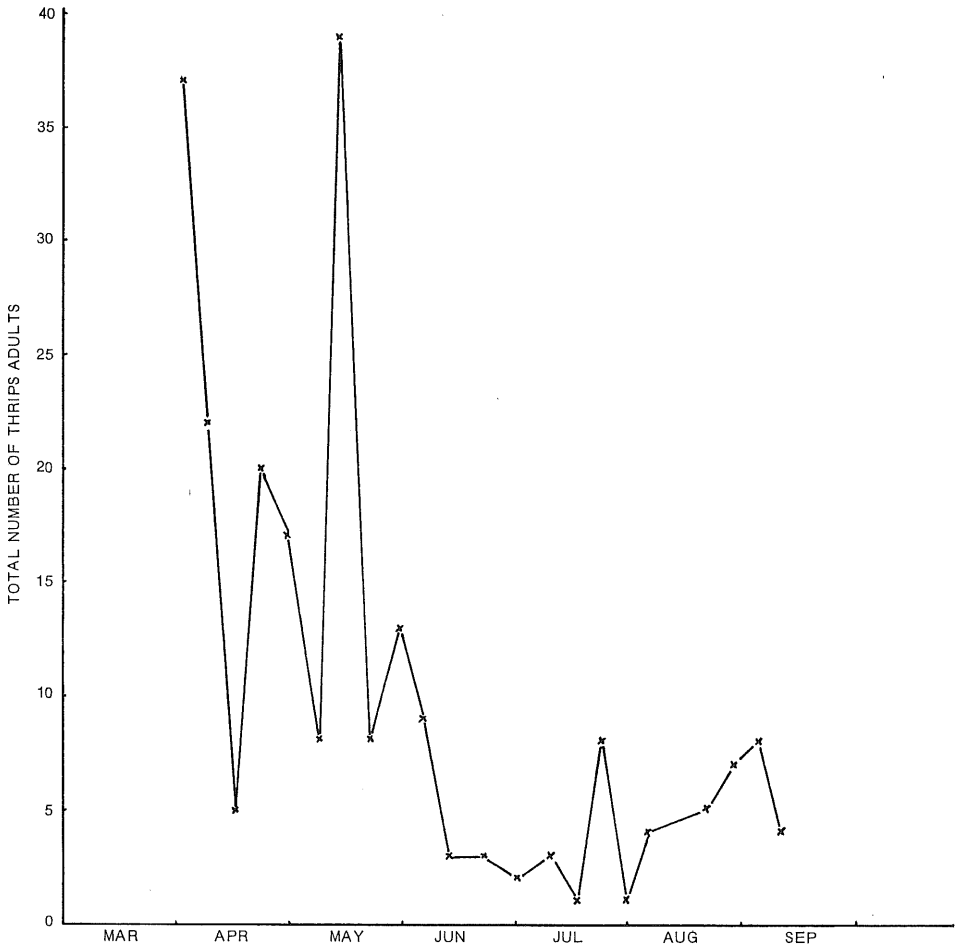


Fig. 3.—Numbers of banana flower thrips adults caught in a water trap during the autumn and winter months, Narangba 1970. (The trap was set up in a non-irrigated patch of Cavendish bananas 1 m above ground level).

depending upon the particular year and upon cultural management in bringing the crop forward. Bunching virtually ceases during the winter months of June, July and August, especially in non-irrigated bananas. During that period, the insect is therefore dependent on the male bells which persist through the winter on the plant.

The effect of the cultural practice of cutting off the male bell to increase the development of the bunch is seen to be unfavourable to *T. florum* in that it rapidly makes the bell unsuitable for the insect (table 6).

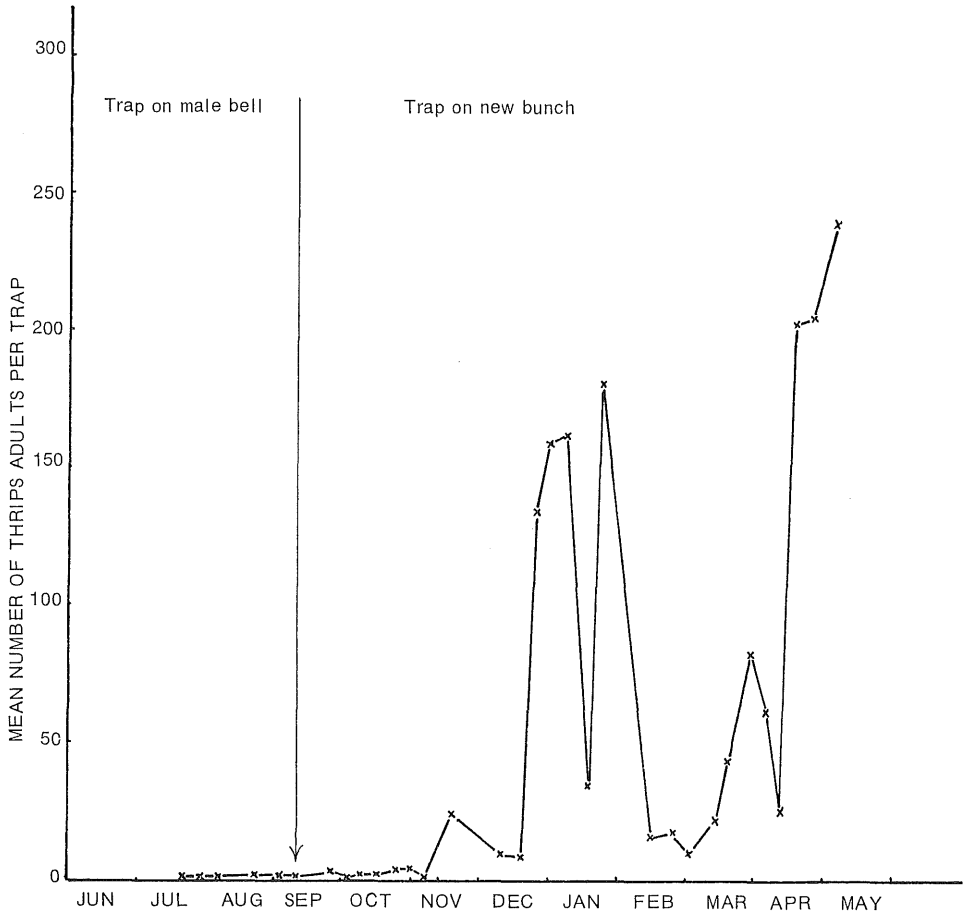


Fig. 4.—Catches of banana flower thrips adults on sticky-traps in non-irrigated Cavendish bananas, Narangba 1971-72. (The traps were tied to the fruit stalk in such a way that they hung down the side of the male bell or new bunch).

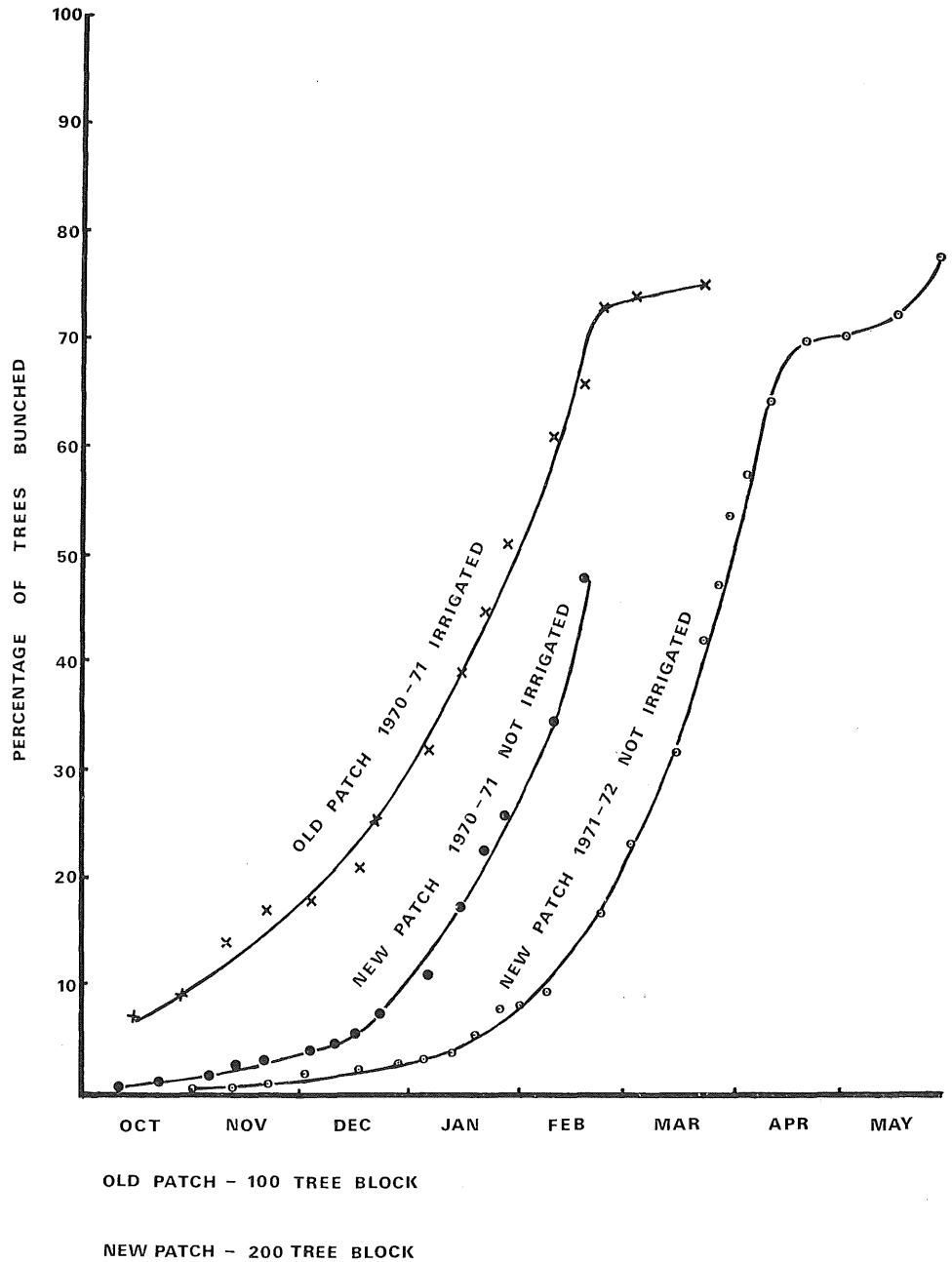


Fig. 5.—Bunching of Cavendish bananas, Narangba 1970-71 and 1971-72.

TABLE 5

THE PERSISTENCE OF BANANA FLOWER THRIPS IN MALE BELLS, NARANGBA 1971–72

Date when Bunch Thrown	Age of Bell (days)	Number of Thrips			
		Female	Male	Total Adults	Nymphs
12 Nov 71	118	9	3	12	17
2 Dec 71	98	70	2	72	56
2 Dec 71	98	36	3	39	35
16 Dec 71	84	19	4	23	20
20 Jan 72	49	91	7	98	81
17 Feb 72	21	50	6	56	14

TABLE 6

THE PERSISTENCE OF *T. florum* INFESTATIONS IN CUT-OFF BANANA BELLS

Weeks After Cutting	Bell Number	Number of *T. florum*			
		Female	Male	Total Adults	Nymphs
0	1	44	9	53	5
	2	37	5	42	43
1	3	4	2	6	30
	4	19	2	21	12
2	5	3	0	1	1
	6	42	1	43	12
3	7	1	0	1	0
	8	0	0	0	0
4	9	0	0	0	0
	10	0	0	0	1
5	11	0	0	0	0
	12	0	0	0	0

Bells cut off 17 Mar 1972 and placed on the ground
All bells had rotted completely by the fifth week

IV. DISCUSSION

The evidence presented of the early infestation and damage by *T. florum* of the newly-emerged banana bunch, coupled with the reduction observed in corky scab damage on mature fruit following control of the insect with DDT, is considered proof that *T. florum* is the cause of corky scab of Cavendish bananas. However, a great deal remains unknown about the relationship between the insect and the damage. For example, in south-east Queensland the damage appears to be more important on some plantations than on others and differences in extent of damage vary from one month to another and from year to year. Differences in damage between the different selections of the Giant Cavendish variety grown in south-east Queensland are also suspected. Again, the damage appears to be unimportant in north Queensland, even though the insect occurs there.

No attempt has been made to evaluate control methods against *T. florum*. Indeed, the irregular nature of bunching in a banana patch, coupled with the evident need to effect control at an early period in the development of the bunch, appears to rule out any chemical method of control. The weak link in the biology of *T. florum* seems to be its dependence on and withdrawal to the remnant male bell during the winter months. Even though the adult insects have been recorded on a number of other plants, including *Faradaya splendida, Gardenia* sp., *Ipomoea* sp., *Lantana camara* and *Passiflora edulis,* there are no records of the insect breeding on them. In view of the very large numbers of the insect which are bred up in a plantation of bananas it is considered that alternative host plants are relatively unimportant for *T. florum* in areas of banana cultivation. Removal of all male bells during the winter months to prevent or retard the spring upsurge in numbers would be worth trying and seems to be the only practicable method possible against the insect.

V. ACKNOWLEDGEMENTS

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REFERENCE

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The authors are officers of Entomology Branch, Queensland Department of Primary Industries, and are stationed in Brisbane.