ETIOLOGY OF FRUITLET CORE ROT OF PINEAPPLE IN QUEENSLAND

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SUMMARY

Penicillium funiculosum **and** *Fusarium moniliforme* **were shown to be the most common organisms associated with pineapple fruitlet core rot of pineapple in Queensland. Their role as wound parasites of the fruit was established.**

The stage of maturity of the fruit at the time of inoculation did not affect the incidence of the disease in the ripe fruit.

I. INTRODUCTION

Fruitlet core rot disease of pineapple is sporadic in occurrence in Queensland, but in some seasons and in some plantations it may cause appreciable damage. The incidence and symptoms have been described previously (Oxenham 1953, 1957). The present paper is an account of investigations carried out in the period 1957–1959 pertaining to the identity of the causal organisms and some aspects of infection.

II. ORGANISMS RESPONSIBLE FOR FRUITLET CORE ROT

Various workers (Tryon 1898; Larsen 1910; Matz 1910; Veitch and Simmonds 1928; Weiss 1947; Linford 1952; Oxenham 1953; Edmonstone-Sammons 1957) in a number of countries have attributed fruitlet core rot to wound infection by species of *Penicillium* and *Fusarium*.

During the summer of 1957–58 the disease was common in pineapple fruit received at the Northgate Cannery, Brisbane. The oportunity was taken to study the organisms present in infected fruit from different districts of Queensland. Six infected fruits were taken at random from consignments arriving from farms in each of 16 different districts in the region from Brisbane to Cairns. Isolations were made from each lesion in each fruit, there being 237 isolations in all.

Penicillium funiculosum Thom was recovered from 67 per cent. of the isolations and *Fusarium moniliforme* Sheld. from 25 per cent. The remainder of the isolations yielded cultures of yeasts or *Ceratocystis paradoxa* (Dade) Moreau, both of which cause rapid soft rots of pineapple fruit in warm weather.

P. funiculosum was the only organism consistently isolated from infections occurring on 10 of the 16 farms. *F. moniliforme* was prevalent on three farms, and both fungi were isolated from fruit from the remaining three sources.

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As had been noted previously (Oxenham 1953), two cultural types of *Penicillium* were consistently isolated. One produced little discolouration of potato dextrose agar while the other produced a red pigmentation of the medium. Single-spore transfers from these two types showed similar characteristics to the mother cultures. The two types were morphologically similar and Mr. J. J. Elphick of the Commonwealth Mycological Institute, who examined the cultures, placed both in *P. funiculosum.*

III. PATHOGENICITY TESTS

Inoculation tests were carried out in the laboratory with *P. funiculosum* and *F. moniliforme,* using green and ripening Smooth Cayenne fruit from a plantation where the disease was not occurring naturally.

At first a sterile needle dipped in a water suspension of spores and mycelium was used to make the inoculation. However, a small hypodermic syringe was found to be more satisfactory and was later used for all inoculations. The fruit were surface-sterilized with 90 per cent. alcohol and after drying were inoculated both through and between the floral cavities in the fruitlets. The sterile needle was inserted for about 1 in. and a small volume of inoculum was injected into the wound.

Some uninjured fruits were dipped in a suspension of inoculum and others were injected with sterile water. There were also untreated controls. All injection sites were sealed with sterile paraffin wax. The fruit were stored in a moist chamber for 5–7 days in various tests.

Both fungi consistently produced lesions following injection into the flesh. In the ripening fruit the lesions were soft and spreading and varied from light-brown to dark-brown in colour. They extended up to 1 in. from the inoculation site. There were no consistent differences in appearance between the lesions produced by the two organisms.

In green fruit the lesions were dark in colour, harder in texture and more restricted than those produced in ripe fruit.

The respective fungi were consistently re-isolated from the appropriate inoculation sites. No lesions developed in the fruits that were injected with sterile water, dipped uninjured into the inoculum or untreated.

This laboratory work established the role of the two fungi as wound parasites of pineapple fruit.

IV. FIELD INOCULATION EXPERIMENT

Field inoculations were carried out in a plant crop of Smooth Cayenne variety at the Maroochy Experiment Station, Nambour, in 1957-58. The purpose of this experiment was primarily to determine the effect on disease expression

in the field of the stage of maturity of the fruit at time of inoculation. The effect of fruit inoculation without artificial injury was also studied. The two cultural types of *P. funiculosum* and two isolates of *F. moniliforme* were used.

The fruit were inoculated on the plant at three stages of development: on December 19 when the fruit were about three-quarters grown, on January 14 when they were green mature, and on February 12 when external skin colouring had commenced.

Inoculations were carried out in two ways: firstly by spraying the uninjured fruit with a water suspension of inoculum; and secondly by injecting the suspension with a hypodermic syringe as described above.

At each stage of development four fruit were inoculated by each method with each fungus—two fruit with one isolate and two fruit with the other. There were five points of injection in each of the injured fruit and these sites were marked with India ink. On each date two fruit were similarly injected with sterile water and two were sprayed with sterile water. All fruit were topped and covered with plastic bags to increase humidity and then paper bags to prevent sunburn.

The fruit were harvested as they ripened over a period of four weeks in February-March. Each fruit was sectioned and the lesions were counted and their positions noted. A number of isolations were carried out from each treatment and the appropriate fungi were readily re-isolated from the inoculated fruit.

V. RESULTS AND DISCUSSION

It is seen from Table 1 that the stage of maturity of the fruit at the time of inoculation did not affect the incidence of fruitlet core rot at harvest time. There were no consistent differences in size or appearance of the lesions between

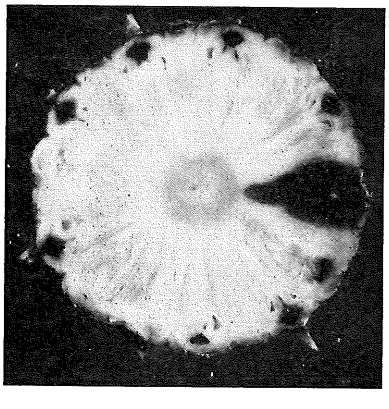

Fig. 1.—Fruitlet core rot lesion developed from artificial inoculation with *P. funiculosum*.

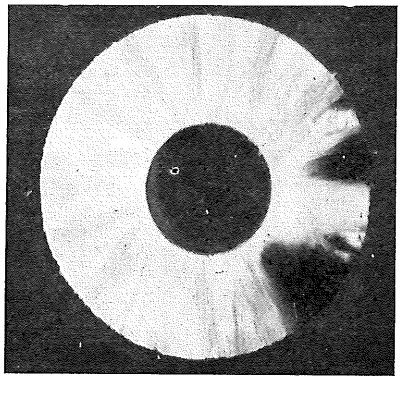

Fig. 2.—Fruitlet core rot lesions in pineapple "slice" collected at the cannery.

the fruits inoculated at different times. A number of infections occurred in the colouring control fruit injected with sterile water on February 12, 1958. Both *P. funiculosum* and *F. moniliforme* were isolated from these lesions. Infection had apparently taken place per medium of inoculum of these fungi inside the floral cups, which were not reached by the surface sterilization.

TABLE 1

EFFECT OF TIME OF WOUND INOCULATION ON DISEASE DEVELOPMENT

Date of Inoculation	Injection Treatment	Proportion of Lesions*
19.xii.57	*P. funiculosum*	17/20
19.xii.57	*F. moniliforme*	19/20
19.xii.57	Sterile water	1/10
14.i.58	*P. funiculosum*	17/20
14.i.58	*F. moniliforme*	17/20
14.i.58	Sterile water	2/10
12.ii.58	*P. funiculosum*	16/20
12.ii.58	*F. moniliforme*	18/20
12.ii.58	Sterile water	7/10
Totals (all dates) ..	*P. funiculosum*	50/60
	F. moniliforme	55/60
	Sterile water	10/30

* $\frac{\text{No. of lesions at harvest}}{\text{No. of inoculations}}$

TABLE 2

EFFECT OF SPRAY INOCULATION ON DISEASE DEVELOPMENT

Date of Inoculation	Spray Treatment	Proportion of Affected Fruit*
19.vii.57	*P. funiculosum*	3/4
	F. moniliforme	5/4
	Sterile water	3/2
14.i.58	*P. funiculosum*	3/4
	F. moniliforme	3/4
	Sterile water	0/2
12.ii.58	*P. funiculosum*	4/4
	F. moniliforme	9/4
	Sterile water	1/2
Totals (all dates)	*P. funiculosum*	10/12
	F. moniliforme	17/12
	Sterile water	4/6

* $\frac{\text{No. of lesions at harvest}}{\text{No. of fruit}}$

Spraying the uninjured fruit with a heavy suspension of inoculum increased the incidence of fruitlet core rot in the ripe fruit (Table 2). The infections presumably occurred through growth cracks or other naturally occurring breaks in the skin. The rugged nature of the skin of pineapple fruit often does not permit the ready detection of such potential infection sites.

VI. CONCLUSIONS

It may be concluded from these investigations that *P. funiculosum* and *F. moniliforme* are the most common organisms associated with fruitlet core rot in pineapple fruit in Queensland.

Wound infections may occur at any stage of fruit development but decay of the flesh is most rapid in near-ripe or ripe fruit.

Spraying the fruit with a suspension of inoculum without artificial injury increased disease incidence, infections apparently occurring in these fruit through naturally occurring fissures or wounds in the skin. Such infection could be expected to occur during humid periods in the field. The causal fungi have also been found growing on floral remnants in the floral cavities under the eyes (Oxenham 1953). They may readily enter the flesh from these sites if the lining of the cavity is damaged by insect feeding or growth cracking. On a number of occasions fruitlet core rot has been prevalent when wet weather has followed a dry season during which mealybug activity in the fruit has been high and growth cracking has been prevalent.

VII. ACKNOWLEDGEMENT

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