SEED TRANSMISSION OF *PSEUDOMONAS PHASEOLICOLA* (HALO BLIGHT) IN *MACROPTILIUM ATROPURPUREUM* CV. SIRATRO

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ABSTRACT

Pseudomonas phaseolicola, *the casual agent of halo blight of French bean* (Phaseolus vulgaris) *and siratro* (Macroptilium atropurpureum), *was seed transmitted in siratro in glasshouse and field experiments. This bacterium was isolated from brown, sunken lesions on siratro pods collected from a field planting infected naturally. Transmission was also demonstrated in seed collected from heavily diseased plantings in the Bundaberg and Brisbane districts. The significance of this perennial pasture legume as a source of contamination for the French bean industry is stressed.*

INTRODUCTION

Halo blight [(*Pseudomonas phaseolicola,* Burkholder, 1926) Dowson, 1943] was first observed on siratro (*Macroptilium atropurpureum*) at the Redlands Horticultural Research Station in 1961 (Oxenham, 1962). Subsequently Johnson (1970) demonstrated that *P. phaseolicola* incited both halo blight of French bean (*Phaseolus vulgaris*) and halo blight of siratro. Neither of these reports mentioned pod infection.

Although seed infection (Zaumeyer, 1932) and seed infestation (Grogan and Kimble, 1967) have been shown to operate in the transmission of *P. phaseolicola* in French bean it is not known whether the organism is similarly transmitted in siratro. The latter plant species, an important tropical pasture legume in Queensland, is widely recommended for mixed pastures or as a pure stand. In addition to its use in the pastoral industry siratro has become established along roadsides, railway cuttings and in irrigation ditches in many districts. With its common use in pastures in the French bean cropping districts and its naturalisation in these areas any seed transmission of *P. phaseolicola* by this species is of vital concern to the bean industry. Experiments reported here were carried out to investigate this possibility.

MATERIALS AND METHODS

Artificial inoculations

Two series of artificial inoculations of siratro pods were made, one in the glasshouse and the other in the field. Inoculum was prepared from a 48 hour old agar culture of *P. phaseolicola* growing on King's medium B (King, Ward and Raney, 1954). A light scraping of growth of the organism was suspended in sterile distilled water to give a moderately turbid suspension. One drop of this suspension was pricked into each pod selected for inoculation. The size of the pods varied from 30 mm to 90 mm in length.

Two inoculated pods were harvested when the seeds inside had reached maturity but still retained a high moisture content. These pods and their seeds were examined microscopically and isolations made from any watersoaking or discolouration of the tissue. The remainder of the inoculated pods were bagged prior to shattering and the seeds collected. These seeds were germinated following the method described by Grogan and Kimble (1967) and isolations carried out from any watersoaked lesions which subsequently developed on the cotyledons. The pathogenicity of representative pseudomonads isolated was determined on French bean plants (cultivar Redlands Greenleaf "B") by spraying a suspension of the organism onto the young leaves and pricking a drop of the inoculum into the stem.

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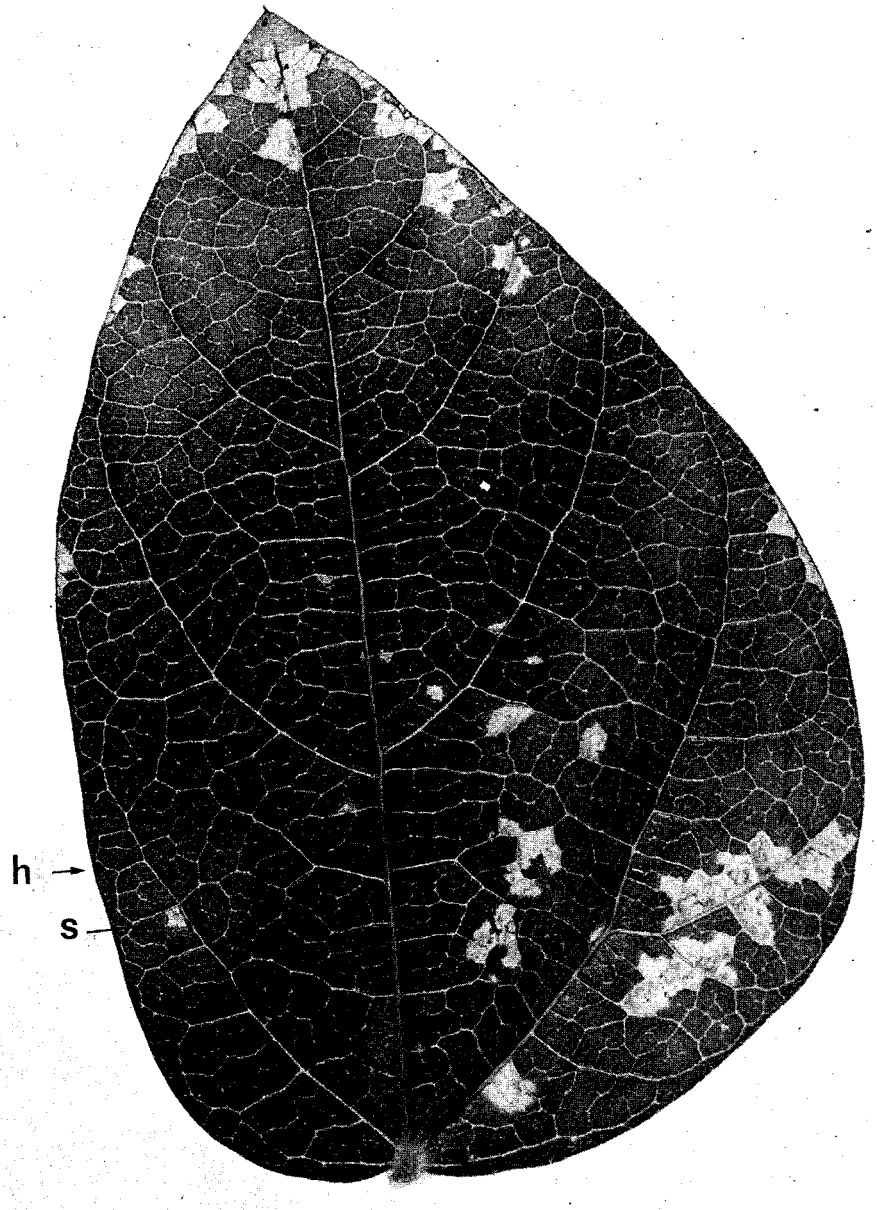

FIGURE 1
Halo blight on siratro leaf; (h) halo surrounding central tan spot (s).

Natural infection

Seed was collected from two stands of siratro badly affected by halo blight. These were in the Bundaberg and Brisbane districts.

Examination of the pods, isolations from diseased tissue and testing of the seed for the presence of *P. phaseolicola* and pathogenicity tests were carried out as before.

RESULTS

Description of the disease

Halo blight on siratro leaves consist of small greasy or watersoaked spots which become tan in colour and are most frequently surrounded by a wide pale green to yellow halo (Fig. 1). The extent and intensity of the halo are dependant upon temperature and become less obvious over 27°C. Where infection is severe the young leaves become yellow and stunted with watersoaked elongated lesions occurring on the stems.

Artificial inoculations

Tan, depressed lesions developed on inoculated pods in both the glasshouse and the field but a bacterial exudate was noted only on the pods inoculated in the glasshouse.

A small number of withered and undeveloped seeds was present in the pods collected at seed maturity. On microscopic examination it appeared that a number of these seeds, particularly those at the point of inoculation, had withered as a result of infection. Pin point, light tan, watersoaked lesions were observed on some of the fully developed seeds, while on one of the seeds the lesion was more extensive (Fig. 2). A bacterial exudate was observed at the centre of this lesion and also spreading from an area of discoloured watersoaked fleshy pod tissue. This exudate appeared to be contaminating the adjacent seed. An isolate from a seed lesion and one from the discoloured pod tissue both produced halo blight symptoms on French beans.

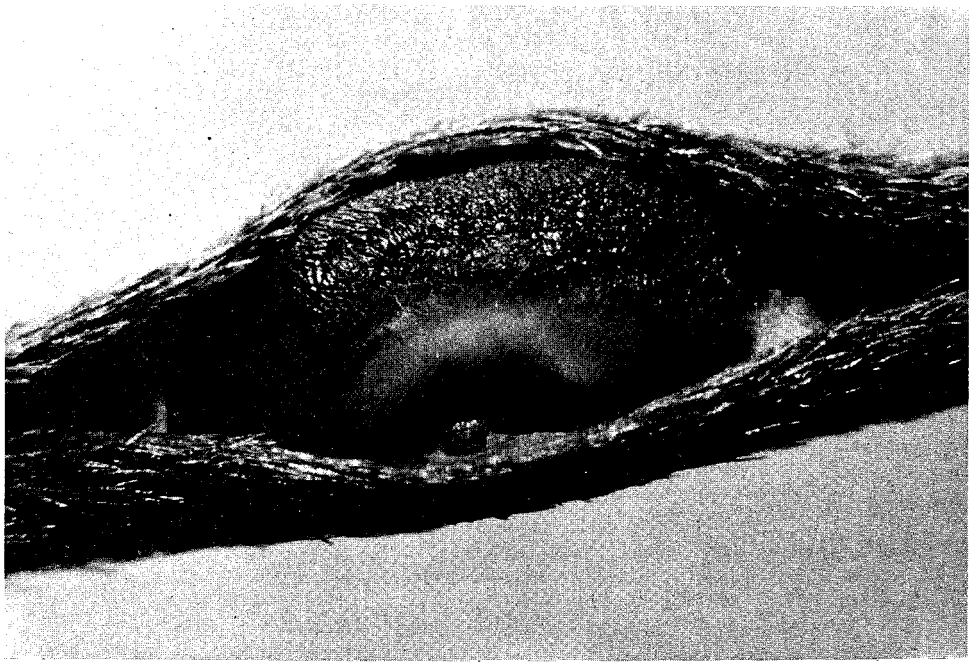

FIGURE 2
A watersoaked lesion on siratro seed following artificial inoculation of pod with an isolate of *Pseudomonas phaseolicola*.

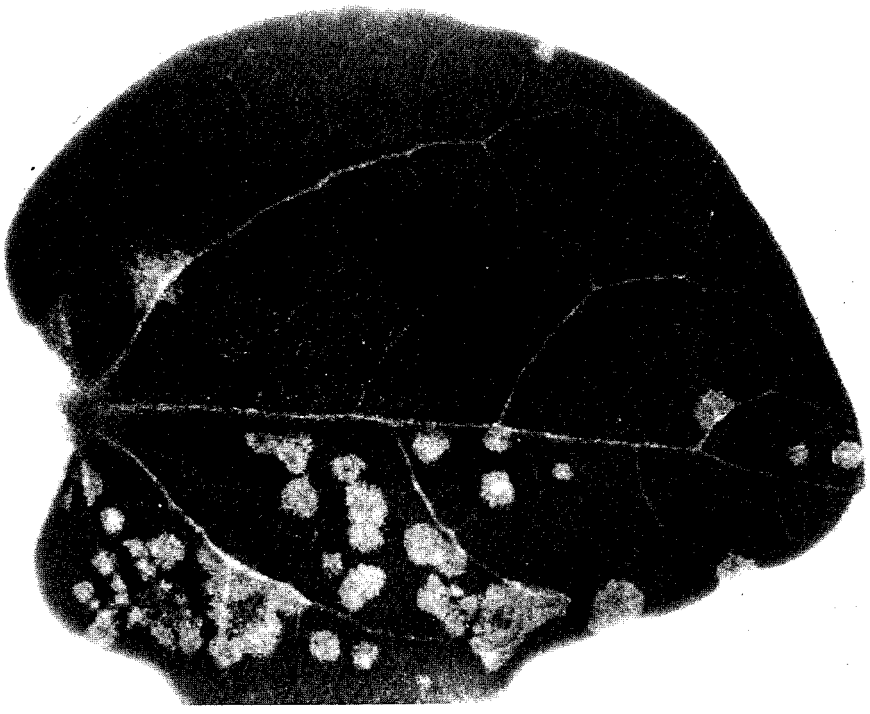

FIGURE 3
Watersoaked lesions on siratro cotyledons resulting from seed transmission of *Pseudomonas phaseolicola*.

Because of the presence of hard seed, the germination of seed from pods inoculated in the glasshouse was very poor. Most of the ungerminated seeds were recovered, the seed coat chipped and replanted. Germination usually occurred in seven days and characteristic watersoaked lesions on the cotyledons (Fig. 3) commenced to appear a few days later. Approximately half the isolates obtained from lesions on the cotyledons in the glasshouse experiment and all those from the field test were inoculated into French bean. They all produced characteristic watersoaked lesions. The number of infected seedlings obtained in both experiments is set out in Table 1.

TABLE 1
The number of infected seedlings produced from glasshouse and field inoculations of siratro pods with Pseudomonas phaseolicola *and from seeds collected from natural halo blight affected stands of siratro at Bundaberg and Brisbane*

	Artificial inoculation		Natural infection	
	Glasshouse	Field	Bundaberg	Brisbane
No. of seed germinated	169	50	95	13
No. of plants with watersoaked lesions on the cotyledons	45	2	34	2

Natural infection

A pseudomonad was isolated from the brown, sunken lesions on four pods collected from the Brisbane district. These isolates produced halo blight symptoms on French bean. Many infected seedlings resulted from the germination of the Bundaberg and Brisbane seed (Table 1). In the case of the Bundaberg seed the

identity of at least half of the isolates obtained from the watersoaked lesions on the cotyledons was again checked by inoculating French bean. These produced halo blight symptoms. The pathogenicity of the two isolates obtained from the Brisbane seed was confirmed.

Seed transmission was considered to have occurred where halo blight symptoms developed on the inoculated French bean plant.

DISCUSSION

The work reported in this paper established that seed transmission of *P. phaseolicola* does take place in siratro. The percentage of transmission on the seed from the Bundaberg district was extremely high. Such a high percentage of seed transmission may not have been obtained if a sample was examined from seed harvested from the whole stand.

Johnson (1970) found that *P. phaseolicola* could persist for long periods in siratro with little adverse effect on the stand. However the wet conditions prevailing during the 1972 summer and autumn were very conducive to the development of halo blight. The systemic infection frequently observed caused an extreme stunting and chlorosis of young growth which would have had an adverse effect on productivity. Johnson (1970) considered that glycine (*Glycine wightii*) was probably a more potent source of *P. phaseolicola* than siratro, but, from observations in 1972 of affected siratro plantings, the latter must now be considered equally important as an alternative host.

The increased intermingling of dairy farming and green bean growing in the coastal strip of southern Queensland and the inclusion of halo blight susceptible legumes in pasture crops has created the situation where there could always be a ready source of *P. phaseolicola* and a high probability that halo blight will be introduced into clean areas. The hard seed factor in siratro may also ensure that halo blighted seedlings occur intermittently over long periods. In dry years this may not pose a great danger to the bean crops, but, in years where wet autumns occur, large acreages of unmarketable bean crops could result. This situation was predicted by Johnson (1970) when he foresaw that, unless thought was given to segregation of the areas for green bean growing and pastures containing halo blight hosts, the control of this disease in beans would become extremely difficult in the future. This fact is of vital importance to the bean industry and should be considered by the agrostologist.

REFERENCES

GROGAN, R. G., and KIMBLE, K. A. (1967)—The role of seed contamination in the transmission of *Pseudomonas phaseolicola* in *Phaseolus vulgaris*. *Phytopathology* **57**: 28-31.

KING, E. O., WARD, M. K., and RANEY, D. E. (1954)—Two simple media for the demonstration of pyocyanin and fluorescin. *Journal of Laboratory and Clinical Medicine* **44**: 301-07.

JOHNSON, J. C. (1970)—Bean halo blight on *Phaseolus atropurpureus*. *Queensland Journal of Agricultural and Animal Sciences* **27**: 129-35.

OXENHAM, B. L. (1962)—Report of the Plant Pathology Section. In *Report of the Queensland Department of Agriculture and Stock* 1961-62.

ZAUMEYER, W. J. (1932)—Comparative pathological histology of three bacterial diseases of bean. *Journal of Agricultural Research* **44**: 605-32.

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