temperatures ranging from 5 to 30°C ± 1°C at 5°C intervals. Radial growth was measured daily, twice on each plate, for 21 days or until the colony reached the edge of the petri dish. The experiment was conducted twice. The anastomosis grouping of each isolate was tested by opposing isolates of known anastomosis groups with the potato isolates on sterile cellophane resting on 2% water agar (1).

Results are summarised in Table 1. There was no geographic grouping of temperature tolerances; isolates from Coleambally grew no faster at 30°C than those from Glen Innes. The apparently faster growth at 5°C of Guyra and Glen Innes isolates (cool Tablelands) compared with isolates from warmer soils of Coleambally were not statistically significant due to variation in growth rate among isolates from the same region. 25°C was the optimum growth temperature for all isolates. Four Coleambally isolates, two from Orange, three from Guyra and three from Crookwell did not grow at 30°C. There was no growth at 5°C in two isolates from Guyra and one from Glen Innes indicating lack of cold tolerance in these isolates. All isolates except one from Coleambally belonged to anastomosis group 3. The remaining isolate did not anastomose with any of the standard groups.

It would appear that isolates of *R. solani* from irrigated sands have not adapted in terms of growth rate to high soil temperatures which prevail in sandhill soils over the summer months. In a potato crop, soil temperatures at seed depth (10 cm) usually rise above 30°C for at least 8 hr each day from mid November to late February and only fall below 20°C following irrigation. At depths of 5 cm or less soil temperatures generally exceed screen temperatures by 5-15°C for about the same period of time and dry soil surface temperatures of 60°C at sowing are often recorded (Logan, unpublished data).

Differences in disease expression in Tableland soils and irrigated sands are not explained by adaptation to high temperatures per se. Sandhill soils are very low in organic matter content and have a low level of microbial activity. Absence of vigorous microbial competition may allow the fungus to infect stolon tissue more readily than in heavy soils with higher organic matter levels, or alternatively host physiology is sufficiently disturbed by high temperatures as to lower the plants "resistance" to infection.

ACKNOWLEDGEMENT

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Presence of *Rhizoctonia solani* in Native *Callitris* Pine Soils and its Implications for Future Potato Growing

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The potato industry in South Western N.S.W. is located on sandy soils which allow mechanical handling of the entire crop. This reduced demand for labour and double cropping each year has led to an expansion in the area sown to potatoes. Before cultivation, these areas were under native pastures or growing natural stands of *Callitris* (Murray pine). Infection of potato plants by *Rhizoctonia solani* Kuhn is most noticeable in areas where pine trees stood and/or where stumps had been burnt. The pattern of infection by *R. solani* in the first crops sown suggests that the fungus may be present in soils under pine trees prior to clearing and cultivation.

Soils from pine forests and areas recently cleared but not planted to potatoes were sampled from 26 and 9 locations respectively over an area of 400 sq km between Darlington Point, Coleambally and Narrandera. Soils were randomly sampled at each location by collecting 30-40 samples of approximately 250 g each to 10 cm depth over an area of about 1000m². Soil was bulked and mixed prior to potting. Baiting was carried out under glasshouse conditions using potato seedlings grown from true seed. Crosses with the Russian variety Ekaterinin Skij were used because progeny produce large numbers of long stolons which facilitate isolation of the fungus as there is no proven resistance to *R. solani,* the parent material is not critical. Seed was incubated for 48 hours at 25°C on moist filter paper then sown into steamed soil in seedling flats in a glasshouse at 20-22°C. The flats were covered with a plastic sheet until seedlings began to emerge.

Three week old seedlings were transplanted into soil within 1 to 5 days of collection. One or two seedlings were planted per pot with an average of 20 seedlings per locality. An additional 2-3 cm of soil was added to each pot after 14-21 days to cover stolons emerging above ground. Pots were kept in a glasshouse at 25/20°C for 4 to 6 weeks when plants were removed and examined for stem and stolon lesions: these were surface-sterilised and plated on Oxoid PDA or water agar.

R. solani was isolated from plants growing in soil from 4 sites (3 cleared and 1 forest) and plants growing in soil from another 15 sites (1 cleared, 14 forest) had typical infection symptoms (light brown stolon lesions, lesions on tuber initials, clumping of tubers around the stem with no stolon development, russetting of tuber surface, Fig. 1), but the fungus was not isolated on PDA. This problem has

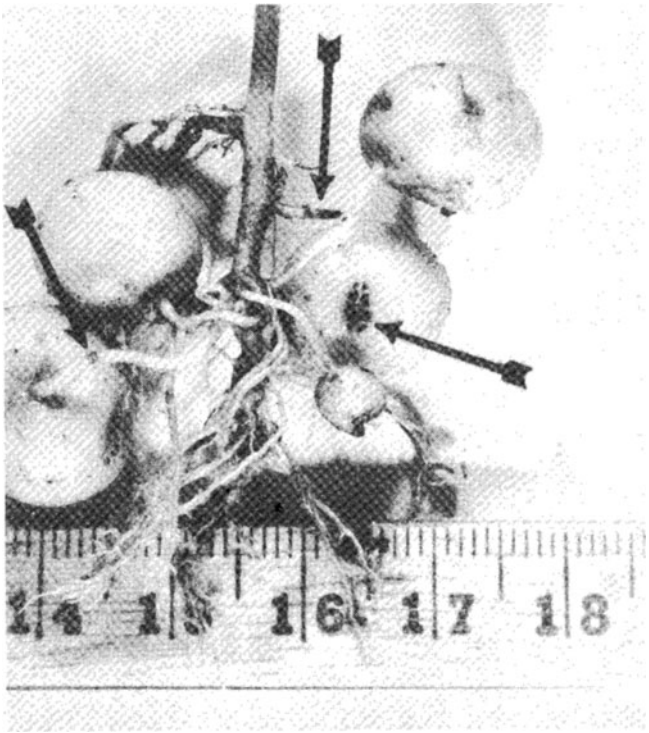

Fig. 1. Symptoms (arrowed) of *R. solani* infection on potato seedlings used for baiting soil. Scale in cm.

been encountered with field-infected plants when lesions are several weeks old.

Baiting indicates that *R. solani* is present in some virgin sandhill soils and these may be the source of inoculum for infection on newly planted crops.

Isolation was also attempted from these soil samples using seedlings of pea, bean, tomato, cotton, cress and cabbage but was largely unsuccessful. Various techniques for isolating *R. solani* from soil are described in the literature (1, 2, 3, 4) but of the last three methods tried at Yanco, none was successful. This is because techniques are usually developed with particular refinements for a given population and host in a given locality and consequently may not necessarily be immediately suitable or as successful for baiting other populations elsewhere. *R. solani* was isolated from one cleared site using potato seedlings but the screening technique of Weinhold (4) did not detect the fungus in the same soil.

This is the first report on the use of potato seedlings for baiting soils. Although one disadvantage of potato seedlings is the time required (about 10 weeks) for baiting, their distinct advantage is that only strains of the fungus pathogenic to potato are isolated. Other isolation techniques tend to sample the total population but if an isolate is not pathogenic, it cannot be considered part of the inoculum in soil (3). Plantlets can also be grown from eyes taken from sprouting tubers with a cork borer but this requires a continuous supply of seed potatoes which may not be available all year and there is much less uniformity of size in these plants than in those grown from true seed.

From observations over many seasons, it would appear that the indigenous soil population of *R. solani* is largely a saprophytic one. The level of disease in potatoes is at first comparatively low but tubers harvested from the first and second crops have a high proportion of their surface covered with sclerotia. With successive cropping the incidence of *R. solani* infection of stolons and stems increases but the sclerotial coverage of tubers decreases. This is particularly noticeable in early harvested tubers; although in regularly cropped land, the longer the tubers remain in the ground the greater the sclerotial coverage of tubers. A more pathogenic population of the fungus arises by selection for pathogenicity from the original population by successive cropping. It is usual practice to grow two crops per year with infrequent or no rotation or fallow.

It is a current recommendation that farmers treat their seed prior to sowing for control of *R. solani* sclerotia and hyphae. In new sowings on virgin ground, this practice may not guarantee disease-free crops because of the likelihood of the fungus being already present in the soil. If it is shown from trials currently in progress that *Rhizoctonia* does contribute to yield depression then disease control measures must consider the soil population in addition to seed piece inoculum.

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Resistance to *Septoria tritici* in two Wheat Cultivars, determined by Independent, Single Dominant Genes

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Speckled leaf blotch of wheat caused by *Septoria tritici* Rob. ex. Desm. (imperfect stage of *Mycosphaerella graminicola* (Fuckel) Schroeter), is a serious disease in southern Australia. The breeding of resistant cultivars would be facilitated by understanding the modes of inheritance of the sources of resistance.

Simple inheritance has been demonstrated (6). Single dominant genes for resistance have been shown to be present in the cultivars Lerma 50, P14 (2), Bulgaria 88 (PI94407†) (4) and IRN 641 (AUSEN II-21†) (Wilson, unpublished data). The inheritance of resistance in the winter wheat Nabob is governed by two partially dominant genes with additive effects (2) and the F_2 of crosses with the cultivar Touko Jokioninen (AUS19536†) segregated to fit a 9:7 ratio of resistant to susceptible plants indicating two complementary dominant genes (Wilson, unpublished data). In addition, single recessive genes have been detected in an unnamed cultivar (1), and in Seabreeze [AUS 19532] and Gala [AUS 19530] (Wilson, unpublished data).

However these cultivars are unsuitable for Australian breeding programmes except where backcrossing is used, because of their late maturity, susceptibility to stem and leaf rust and lack of adaptation to Australian environmental conditions. More suitable parents are Veranopolis [AUS 1553] (5) and Israel 493 [AUS 16144, Miriam 4/Lakhish 1552-3] and the patterns of inheritance of resistance to *Septoria* for these cultivars are reported here. The characteristics of the resistant and susceptible cultivars used in this study are shown in Table 1.

Table 1. *Septoria* ratings and agronomic data for the resistant and susceptible cultivars used in this study.

	Septoria rating*	Height (cm)	Maturity rating**	Grain colour	Awns Present
Resistant Cultivars					
Israel 493	0	55	VE	Red	+
Veranopolis	2	110	E	Red	+
Bulgaria 88	1	105	L	Red	+
Susceptible Cultivars					
Tanori 71	5	80	E	Red	+
Lance	4	85	M	White	—
Kite	4	85	M	White	—
RAC 88***	4	85	E	White	+
RAC 177***	3	85	M	White	+

* Rosielle 0-5 scale (see text)
** VE=Very early, E=Early, M=Midseason, L=Late
*** Roseworthy Agricultural College Advanced Crossbred

† PI — Canadian Plant Introduction Number; AUSEN — Entry Number in Australian Septoria Nursery II; AUS — Accession Number in Australian Wheat Collection.