Association of Soil Particles with Seeds and Three Pathogens of Chickpea in California

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ABSTRACT

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A root rot of chickpea (*Cicer arietinum*) in an experimental planting in the Salinas Valley of California was determined to result principally from infection by *Macrophomina phaseolina*. *Pythium ultimum* and *Rhizoctonia solani* also were isolated. Because the field only had a history as grass pastureland, seed was suspected as the source of the pathogens. No pathogens were isolated from the seed, but small clumps of soil the size and shape of the seed, and found in seed lots, did contain these fungi and successfully served as inoculum in greenhouse inoculations.

Additional key words: garbanzo, gram

In California, chickpea, or garbanzo (*Cicer arietinum* L.), is grown commercially in the south central coastal area. Recently, this plant was included in an experimental attempt to introduce new crops to the Salinas Valley. As the crop matured, a serious root rot was found throughout the planting. Infected plants showed typical charcoal root rot symptoms, and when infected plants were cultured, *Macrophomina phaseolina* (Tassi) Goid. was the most prevalent pathogen, although *Pythium ultimum* Trow also was isolated. *M. phaseolina*, *P. ultimum*, *Rhizoctonia solani* Kühn, and *Fusarium solani* (Mart.) Appel & Wr. f. sp. *pisi* (E.R. Jones) Snyd. & Hans. were previously reported to cause root rots of chickpea in the south central coastal area of California by Westerlund et al (20). In their studies, *M. phaseolina* was isolated only from an unusually dry field.

MATERIALS AND METHODS

Because the experimental field had been irrigated, greenhouse experiments were started in which chickpea plants were inoculated by placing pieces of tomato stem, colonized by *M. phaseolina*, in the root balls of plants as they were transplanted from clay pots 7.6–10.1 cm. Plants were placed in constant-temperature rooms at 21, 26.7, and 32 C. Only plants at 32 C became infected, and from these plants, the fungus was recovered.

Inasmuch as the land where the crop was grown in the Salinas Valley had only a history of grass pastureland and diseases resulting from infection by *M. phaseolina* are rarely found in the Salinas Valley (A. S. Greathead, *personal communication*), chickpea seeds were suspected as the source of inoculum. *M. phaseolina* previously was reported as seedborne on okra (*Abelmoschus esculentus* Moench) (19), peanut (*Arachis hypogaea* L.) (7), watermelon (*Citrullus vulgaris* Schrad) (14), jute (*Corchorus capsularis* L. and *C. olitorius* L.) (2), gourd (*Cucurbita* sp.) (17), soybean (*Glycine max* (L.) Merr.) (9), cotton (*Gossypium* sp.) (18), tomato (*Lycopersicon esculentum* L.) (16), mung bean (*Phaseolus aureus* Roxb.) (13), lima bean (*P. limensis* Macf.) (1), sieva or civet bean (*P. lunatus* L.) (1), field bean (*P. vulgaris* L.) (12), sesame (*Sesamum indicum* L.) (11), sorghum (*Sorghum vulgare* Pers.) (10), foxtail millet (*Setaria italica* L.) (6), subterranean clover (*Trifolium subterraneum* L.) (3), and cowpea or black-eyed pea (*Vigna unguiculata* (L.) Walp.) (16).

Seed from the same lot as used in the Salinas Valley (and which had been produced in the south central coastal area of California) was cultured on natural media (15), and no pathogens were found. This is similar to the findings of Westerlund et al (20), who found that few chickpea seeds contained *F. solani* f. sp. *pisi* when cultured. Examination of the seed lot from which the field was planted revealed the presence of soil clumps about the same size and shape as the seed (Fig. 1). When these were cultured on natural media, *M. phaseolina*, *P. ultimum*, and *R. solani* grew from the pieces. These soil clumps also were used as inoculum by placing them next to chickpea seeds planted in a pasturized planting mix in 12.7-cm clay pots and put in a greenhouse at 32 C. As soon as seedlings showed symptoms, they were cultured. *P. ultimum* was isolated most frequently, although *M. phaseolina* and *R. solani* were also isolated.

RESULTS AND DISCUSSION

M. phaseolina occurs in the south central coastal area of California and does little damage there, but it did severe damage in the warmer Salinas Valley. The reason is that the fungus is a virulent pathogen under high temperatures, as has been shown by many researchers but described in detail by Kendrick (8). This also was verified in the present study, where infection in the greenhouse occurred only at 32 C. In their research, Westerlund et al (20) found *M. phaseolina* only in a dry field. Dryness has also been shown to be important in infection by this fungus in sorghum (4) and cotton (5). It also might be possible that dry soils are warmer than moist soils.

In addition, Westerlund et al (20) found *P. ultimum* and *R. solani* to be the main cause of root rot in fields not previously cropped to chickpeas. This also might be explained by the possible transmission of the pathogens in the soil pieces carried with the seed.

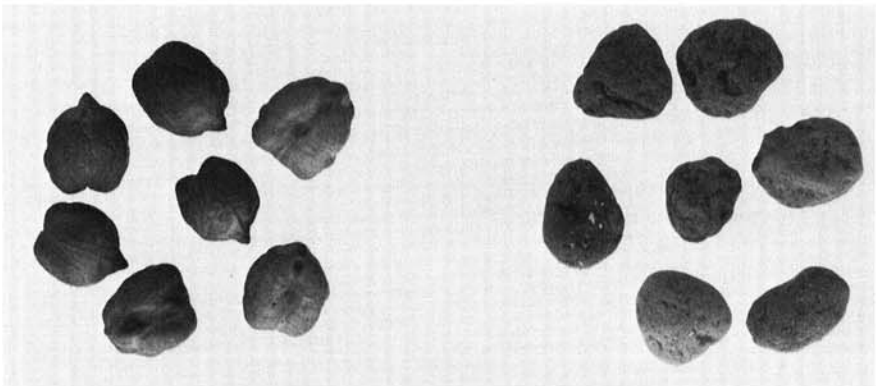

Fig. 1. (Left) Seed of chickpea (*Cicer arietinum*). **(Right)** Soil particles found in chickpea seed used in planting.

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