Soil Populations and Anastomosis Groups of *Rhizoctonia solani* Associated with Peanut in Texas and New Mexico

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ABSTRACT

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Soil from 33 peanut fields in Texas and New Mexico was assayed for *Rhizoctonia solani* propagules (P). The range was from none detected to 14 P/100 g of soil, and the mean for all fields was 3.2 P/100 g of soil. Sixty-six percent of the fields assayed at two or fewer P/100 g of soil. The highest *R. solani* population on an area basis was in west Texas (Gaines County), with an average of 7.4 P/100 g of soil. Anastomosis group (AG) determinations were made with *R. solani* isolates from peanut field soils and diseased peanut plants. All isolates were in AG-4, except for one AG-2 isolated from field soil. Seven percent of the soil isolates and 6% of the plant material isolates were binucleate *Rhizoctonia*-like fungi.

Rhizoctonia solani Kühn (*Thanatephorus cucumeris* (Frank) Donk) is a common pathogen in commercial peanut (*Arachis hypogaea* L.) fields in Texas (2). The pathogen can damage any part of the peanut plant at any stage of growth. Disease is most severe in the early seedling stage and in the fruiting stage as a rot of peanut pods.

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Cultural and chemical methods are being used to control *R. solani* in peanut fields, but the increasing cost of these methods makes resistant cultivars an attractive alternative. Development of agronomically acceptable cultivars of peanut resistant to *R. solani* has been unsuccessful (3); however, progress has been reported when the anastomosis group (AG) concept has been followed in breeding for resistance in flax (1) and sugar beet (6).

Plant pathologists in the United States generally recognize four hyphal AGs of *R. solani* (5). Parmeter et al (5) reported that the four groups were genetically isolated and that they should be recognized as distinct evolutionary units. In addition to the AG factor, Anderson (1) reported that "*Rhizoctonia*-like" hyphae of other fungi are often confused with *R. solani*, which further complicates the successful development of resistant crop cultivars.

To aid future attempts to breed peanut cultivars resistant to *R. solani*, this study was undertaken to determine: 1) the *R. solani* population in soils where peanut are grown commercially in Texas and New Mexico, 2) the AG of *R. solani* associated with peanut, and 3) the extent of *Rhizoctonia*-like fungi in these areas.

MATERIALS AND METHODS

Soil samples were collected from four commercial peanut-growing areas of

Texas: central (Comanche, Erath, and Hood counties), east (Houston County), south (Frio County), and west (Gaines County). Soil was also collected from the only commercial peanut-production area of New Mexico (Roosevelt County). Soil samples were collected from six fields where Spanish-type (ST) and five fields were Valencia peanuts were growing in west Texas and New Mexico, respectively, in July 1978 and five fields in south Texas (four ST, one runner-type [RT]) in September 1978. Soil samples were collected from 15 peanut fields (10 ST, five RT) in central Texas, which include preplant, growing season, and postharvest periods of 1978 and 1979. Soil samples were taken in east Texas fields, where ST peanuts were grown, postharvest of the 1979 growing season.

Fields ranged in size from 10 to 50 acres, and the number of sampling sites was about one site per acre. About 100 g of the top 15 cm of soil was taken at regular intervals on a diagonal of the long axis of each field. Individual field samples were mixed thoroughly and stored at room temperature from 1 to 15 days. Three 50-g portions were taken from each soil sample to be used for the *R. solani* assay by the method of Weinhold (9).

Peanut plants with disease symptoms were collected from each field where soil was taken during the growing season. Tissue samples from seedling hypocotyls and epicotyls, mature roots, and rotted pods were surface-sterilized in a mixture of 5.25% sodium hypochlorite, 95% ethanol, and deionized water (1:1:2, v/v) and plated on 2% water agar (WA). After 18–24 hr of growth on WA (soil assay and plant material isolates), *R. solani* candidates were transferred to potato-dextrose agar (PDA) by selecting the leading edge of colony growth. Given adequate growth periods on PDA, isolates obviously not *R. solani* were eliminated. The remaining cultures were transferred to WA, grown 24 hr, then hyphal tips were transferred to fresh PDA and grown at 24–26 C for 7 days. Isolates from the same soil assay or from the same plant tissue that seemed identical when comparing growth rate, morphology, color, and type of sclerotia (if produced) were grouped together. A representative of each identical-isolate group was selected for nuclear staining by the HCI-Giemsa method (4).

Isolates determined to be multinucleate were subjected to hyphal anastomosis pairings by using tester isolates (AG-1, AG-2, AG-3, AG-4) obtained from C. R. Howell (National Cotton Pathology Research Lab, College Station, TX 77843). Hyphae from tester and unknown colonies were placed 1.0 cm apart on a sterile microscope slide coated with PDA. Three drops of deionized water and a cover glass (22 × 50 mm) were added to each slide and sealed with petroleum jelly. The AG-unknown pairings were maintained at 24–26 C for 12–24 hr. Anastomosis was determined by microscopic examination of the pairings.

RESULTS

All of the peanut-growing areas sampled in this study had detectable populations of *R. solani* (Table 1), although there were two individual fields in the central Texas area where no *R. solani* propagules (P) were detected. The highest population was 14 P/100 g of soil. The mean for all fields assayed was 3.2 P/100 g of soil. Sixty-six percent of the fields contained two or fewer P/100 g of soil, whereas 9% had populations >13 P/100 g of soil.

One isolate from the soil assays was in AG-2, and 129 were in AG-4. Ten isolates were *Rhizoctonia*-like fungi (Table 1), which were evenly distributed on a geographical basis, except for east Texas. No *Rhizoctonia*-like organisms were isolated in the two east Texas fields where soil was collected postharvest.

The number of *R. solani* isolates from diseased peanut roots, hypocotyls, epicotyls, and pods were 43, 20, 4, and 4, respectively. Sixty-seven plant material isolates tested as AG-4 and four isolates were *Rhizoctonia*-like organisms. *Rhizoctonia*-like fungi were isolated only from peanut roots.

DISCUSSION

Peanut soils assayed in this study had a *R. solani* population that ranged from none detected to 14 P/100 g of soil. This range is similar to that reported by Weinhold (9) for cotton and potato fields in California. Sixty-six percent of the peanut fields assayed had populations at or below two P/100 g of soil, compared with 77% of the fields in the Weinhold study assaying fewer than two P/100 g of soil.

Peanut soil from west Texas averaged 7.4 P/100 g of soil, with two fields having 14 P/100 g of soil. Pathogenicity tests conducted in controlled-environment chambers by using *R. solani* isolates from west Texas indicate that an inoculum density of 10 P/100 g of soil of most of the west Texas isolates will completely inhibit untreated Tamnut 74 seed emergence (*unpublished*). The west Texas region presents a paradox with its high soil population of *R. solani*, yet producing record peanut yields for the United States. Extensive damage to the peanut crop was observed in the central Texas field that assayed 13 P/100 g of soil. This indicates that conditions in west Texas are unfavorable for *R. solani* pathogenicity, although the environment is conducive for the fungus to thrive as a saprophyte.

Data from this study indicate that AG-4 is the primary *R. solani* AG associated with commercial peanut culture in Texas and New Mexico. The only other AG representative we found in this study was a single AG-2 isolate. Sumner and Bell (8) reported isolating *R. solani* AG-2 occasionally from peanut in Georgia.

Weinhold (9) reported isolating AG-3 and AG-4 with his assay method, which relies on the rapid growth of *R. solani* hyphae to separate it from other fungi. AG-1 of *R. solani* is a fast-growing fungus on culture media (7) and should be recovered without difficulty by using the Weinhold method. AG-2 of *R. solani* usually has a slower growth rate on culture media than either AG-1 or AG-4 (7) and could prove difficult to isolate with the Weinhold method. If AG-2 were

Table 1. Populations of *Rhizoctonia solani*, anastomosis group (AG), and *Rhizoctonia*-like isolates obtained from soil samples from peanut fields in Texas and New Mexico

Soil collection areas	Number of fields	Number of isolates					*R. solani* propagules/100 g soil	
		AG-1	AG-2	AG-3	AG-4	*Rhizoctonia*-like	Average[a]	Range
Texas[b]								
Central	15	0	1	0	37	4	2.8	0–13.0
West	6	0	0	0	68	2	7.4	0.8–14.0
South	5	0	0	0	9	2	1.5	0.8–1.5
East	2	0	0	0	4	0	2.5	1.0–4.0
New Mexico[c]	5	0	0	0	11	2	1.7	0.5–4.0
Total	33	0	1	0	129	10	3.2	0–14.0

[a] Average is based on three replicates per field.
[b] Texas: central (Comanche, Erath, and Hood counties), west (Gaines County), south (Frio County), and east (Houston County).
[c] New Mexico: Roosevelt County.

pathogenic to peanut, however, it probably would have been isolated from the diseased peanut plant material in this study.

Most of the *Rhizoctonia*-like fungi we isolated were easily confused with *R. solani* on culture media, as suggested by Anderson (1). These isolates have not been identified, but all were binucleate.

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