Incidence and Distribution of Peanut Mottle Virus in Peanut in the United States[1]

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ABSTRACT

Peanut mottle virus (PMV) was isolated from commercially grown peanuts in New Mexico, Oklahoma and Texas. This is the first report of PMV in the Southwestern United States and shows PMV to be present in all states with major peanut production. The incidence of PMV in Texas and Oklahoma was low in comparison to New Mexico and the Southeastern states. PMV was found in both seed and leaves of plants grown in the various states. The mild strain of PMV is the predominant strain in the United States. Since the source of primary inoculum is infected plants that have grown from infected seeds, it is theorized that the use of seed grown in areas with little or no PMV (Texas and Oklahoma) gives the greatest possibility of eliminating or delaying PMV epidemics.

Additional key words: **Arachis hypogaea**, epidemiology, virus diseases, groundnuts.

The preponderance of commercial peanut production in the United States is limited to seven states in three geographical areas, namely, the North Carolina - Virginia area, the Georgia - Alabama-Florida area, and the Texas-Oklahoma area (11). Peanut mottle virus (PMV) causes a major disease of peanut and has been studied primarily in the Southeast (2, 3, 4, 5, 6, 7, 8, 9, 10). In Georgia, the incidence of PMV varies from field to field (1-79%) (7). In 1973, 46 percent of the fields had a yield loss greater than twelve dollars per acre, and the state loss was estimated at over ten million dollars (7).

Recent epidemiological studies (2, 6) indicate that the use of virus-free peanut seed may be beneficial in eliminating or greatly reducing the incidence of PMV. Prior to this report PMV had not been observed in the Southwestern peanut production area of the United States. Moreover, PMV symptoms were not observed in Texas during the 1973 growing season (unpublished). Therefore, this study was initiated to determine the presence and relative incidence of PMV in other peanut growing areas and to seek an area where virus-free peanut seed might be obtained.

Materials and Methods

PMV was identified by symptoms caused on Argentine peanut (**Arachis hypogaea** L.) and the tester host (3) Topcrop bean (**Phaseolus vulgaris** L.) and by its serological reaction with known PMV antiserum. For mechanical inoculation, the inoculum was prepared by grinding samples of leaf tissue with a mortar and pestle in a solution composed of 0.05 g Na_2SO_3, 0.10 g diethyldithiocarbamate, 0.5 g Celite, 5.0 ml of 0.1 M neutral potassium phosphate, and 45 ml of deionized water (one ml/ leaflet). Test plants were dusted with 600 grit silicon carbide powder and then rubbed with a cheesecloth pad that had been dipped in the inoculum.

Natural occurrence of PMV in peanut was determined three ways: 1) communication with researchers in specific states, 2) growing plants from seed produced in certain states, and 3) obtaining leaf samples from plants in certain states. Seed were obtained from Florida, New Mexico, Oklahoma, and Texas. The seed were planted in a clay-loam Vermiculite mixture in galvanized trays in the greenhouse. Seedlings were inspected visually for PMV symptoms at approximately the seventh true leaf stage. Plants with symptoms and numerous random samples without symptoms were indexed to the tester host bean.

Fresh leaf samples were collected at various times during the growing season in New Mexico, Oklahoma, Texas, and Virginia, placed in plastic bags, mailed to Georgia, and inoculated to the tester host bean. Although the fields were inspected for PMV symptoms, the leaf samples were selected at random. Until PMV was isolated from a given state, two or three leaflets from separate plants were pooled and indexed to the tester host, permitting more samples to be indexed. After PMV was isolated from a state, single leaflets were indexed to bean to determine the incidence based on the random sampling.

Results

Seed Samples. — From New Mexico, 1120 seed of the cultivar Valencia were tested for seed transmission of PMV. No symptoms were observed in the seedlings but random sampling by indexing to bean showed that 3 of 200 symptomless plants had PMV.

Two cultivars from Oklahoma were tested for seed transmission. No symptoms were observed in 1232 Florunner plants but again 3 of 200 random samples assayed positive for PMV. Of 1400 Starr plants, 12 had PMV symptoms, and random sampling showed 4 of 200 symptomless plants with PMV.

Seed of Starr and Florunner were obtained from the 1973 variety test at Yoakum, Texas. No visual symptoms were observed on 1739 Florunner plants, and PMV was not recovered from 210 random samples. Of 1738 Starr peanut seedings observed, one had a possible mottle but indexing from this plant and 200 others showed that PMV was not present. Commercial seed from Texas were also examined for seed transmission of PMV. No. symptoms were observed on 1495 Florunner and 1629 Starr plants. PMV could not be recovered from three Starr plants with symptoms suggestive of mottle or from 200 random samples of each cultivar.

Fresh Leaf Samples. — PMV was recovered from peanut leaf samples from fields in New Mexico, Oklahoma, and Texas in 1974. The highest

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incidence of PMV occurred at three locations in New Mexico (Table 1). A relatively low incidence of PMV was found in two of seven locations in Oklahoma and three of eight counties in Texas (Table 1). There appeared to be no relationship between the presence of PMV and peanut cultivars; all cultivars tested had PMV at least at one location.

Table 1. Incidence of peanut mottle virus in several locations in New Mexico, Oklahoma, and Texas.

State	County	Peanut Cultivar	Month Sampled	Virus Infection
New Mexico		Valencia	Sept	17/49[a]
		Valencia A	Sept	39/49
		McRan Valencia	Sept	18/49
Oklahoma	Hughes	Comet	Sept	0/62
	Hughes	Comet	Sept	0/50
	Hughes	Comet	Sept	0/50
	Hughes	Comet	Sept	1/38
	Caddo	Spanish	Sept	0/200
	Caddo	Spanish	Sept	0/200
	Stephens	Spanhoma	Oct	2/200
Texas	Frio	Starr	May	0/200
	Frio	Starr	June	0/200
	Wilson	Starr	July	0/200
	Erath	Starr	Aug	0/200
	Lee	Starr	Aug	0/200
	Waller	Starr	Aug	0/200
	Waller	Starr	Sept	0/200
	Dewitt	Starr	Sept	0/200
	Commanche	Starr	Sept	1/200
	Erath	Starr	Sept	1/200
	Atascosa	Florunner	Oct	1/200
	Dewitt	Florunner	Oct	0/50

[a]Number of plants with peanut mottle virus/number tested.

Most leaf samples were collected 12-18 weeks after planting, a time when the highest incidence of PMV would be expected. In Texas, leaf samples were tested from widely scattered areas of the state throughout the growing season in 1974. Virus was not detected in the early part of the growing season but was present in the fall-harvested Texas crop (Table 1).

PMV Strain Identification. — When local lesions were produced on the tester host bean, they were used to inoculate Argentine peanut and Little Marvel pea (*Pisum sativim* L.) Using the criteria established earlier (5), only mild mottle isolates were obtained from peanuts from Florida, New Mexico, Oklahoma, Texas, and Virginia. Although other PMV strains are present in North Carolina (9) and Georgia (5), mild mottle isolates are by far the most important in those states. No other viruses were isolated from any of the peanut samples tested.

Discussion

PMV has been reported previously in Georgia (3) and North Carolina (9). R. T. Gudauskas has found PMV in peanut in Alabama (personal communication), and O. W. Barnett has found the virus in soybean but not peanut in South Carolina (personal communication). S. A. Tolin has frequently isolated PMV from peanut and soybean (10), and a previous study (4) established its presence in peanut leaf samples in Virginia. PMV was found in peanut breeders' seed grown in Florida, commercial seed from New Mexico and Oklahoma, and in peanut leaf samples from New Mexico, Oklahoma, and Texas.

Paguio and Kuhn (6, 7) have studied the incidence of PMV in Georgia, and have shown that significant economic losses are incurred as a result of PMV epidemics which are of apparent yearly occurrence. This is noteworthy because the casual observer of peanuts probably overlooks the occurrence (with subsequent yield loss) of PMV in a field, even when the disease is present in epidemic proportions. Peanut mottle virus apparently occurs wherever peanuts are grown in the United States. This is understandable because PMV is seedborne, commercial peanut seed are sold from one area to another, and there is an interchange of peanut seed for use in variety trials and other research purposes.

These tests were not extensive enough to clearly establish that peanut growing areas differ in the incidence of PMV. However, the most thorough testing was done in Texas in 1974, and it indeed appears to have less PMV than Georgia (6, 7), North Carolina (9), or Virginia (4). The paucity of PMV in Texas cannot be explained either on the basis of cultivar resistance or on a lack of inoculum. The low incidence is probably due to lack of natural spread. The aphids responsible for PMV transmission (1, 8) may be absent or in relatively low numbers.

Although PMV is present in Oklahoma and Texas, these may be desirable locations to grow peanuts for seed production for other peanut growing areas. The most promising area/time combination appears to be the early season crop in Texas from which no virus could be found in 1974. Initially, virus-free seed could be obtained under controlled conditions and then planted in isolation away from other peanuts. Field inspections and indexing of suspicious plants would be required to verify that seed from a given field could be classified as free of PMV. It may be possible to produce virus-free seed in other states, but the high incidence and the rapid rate of transmission (2, 6) would increase the difficulties.

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