Resistance of Wild Species of **Arachis** to the Twospotted Spider Mite, **Tetranychus Urticae**[1 2 3]

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ABSTRACT

Wild species of **Arachis** representing all seven sections of the genus were screened in the greenhouse for resistance to the twospotted spider mite, **Tetranychus urticae** Koch. Most species of the section RHIZOMATOSAE were found to be highly resistant to the mite. Plant introductions 338296, 338317, 262840, 262827 and several other members of the section RHIZOMATOSAE were virtually mite free throughout the tests.

PI 276203 from section EXTRANERVOSAE, PI 262142 from section ERECTOIDES and PI 331194 from section ARACHIS also had relatively low damage ratings in this study. Section Arachis is the only section with resistance to the mite that will cross readily with cultivated peanuts, **Arachis hypogaea** L. Thus the utilization of germplasm resistant to the mite from the wild species will require complicated and difficult breeding procedures.

The twospotted spider mite *Tetranychus urticae* Koch is considered an important pest of peanuts. The identification of germplasm with resistance to the twospotted spider mite could contribute significantly toward management of the mite. A number of wild species of peanuts grown in the greenhouse appeared relatively free from mite infestations while others were heavily infested. As a result, an investigation was conducted to identify resistance in the wild species to the twospotted spider mite.

The potential for insect resistance among the wild peanut species was demonstrated by Leuck and Hammons (1968) when they identified five species of *Arachis* that remained almost free of the mite *Tetranychus tumidellus* Pritchard and Baker. A moderate level of resistance to the twospotted spider mite, *T. urticae* has been identified in cultivated peanuts, *Arachis hypogaea* L., (Johnson, 1976). A large collection of *Arachis* species maintained at North Carolina State University at Raleigh is being investigated to identify sources of resistance to insects and diseases considered to be of economc importance.

Materials and Methods

The species used in this study were propagated from seeds or cuttings of germplasm maintained at North Carolina State University in Raleigh. Plants were grown in the greenhouse in six-inch pots and watered without wetting the foliage using an automatic watering system. The plants were grown approximately three months and then tested for resistance.

The wild species were tested initially for resistance to the twospotted spider mite in two separate studies. A third test including resistant genotypes from the first two studies was conducted to compare the more resistant genotypes. Some susceptible genotypes were also retested as checks. The wild species, classified by W. C. Gregory, North Carolina State University (Gregory **et al.**, 1973), included collections from all sections (ARACHIS, ERECTOIDES, CAULORHIZAE, RHIZOMATOSAE, EXTRANERVOSAE, PSEUDOAXONOMORPHAE, and TRISEMINALAE). The cultivars NC 5, NC-Fla 14 and Florigiant were used as checks to compare the wild species with their cultivated relatives. Each entry was replicated four times in each test.

The mite infestation was introduced by attaching with white glue a 15 mm leaf disk cut from heavily infested bean leaves to a leaf on the upper portion of each peanut plant. Leaves from which leaf discs were cut were selected for uniformity of mite infestation and averaged 10 to 12 mites per 15 mm disc and a general distribution of eggs. Each experiment was rated after mite damage reached 70% and terminated when the most susceptible genotypes reached 100 percent mite damage. Damage was rated on 0 to 100 percent scale based on visual percent chlorosis of leaves caused by mite feeding. Test 1 was infested with mites on July 16, 1975 and evaluated for mite chlorosis on July 29 and at 4 day interval thereafter. Test 2 was infested on July 17 and evaluated for mite chlorosis on July 28 and at 4 day intervals thereafter. Test 3 was infested on March 16, 1976 and evaluated for mite damage on April 7 and at 2 day intervals thereafter.

The mite culture was maintained on 'Fordhook 242' lima beans at 16-hour daylength and 27°C. The mite was identified as **T. urticae** Koch by E. W. Baker. (USDA, ARC, Beltsville, MD).

Results and Discussion

Resistance to the twospotted spider mite in certain wild species of Arachis was documented in this investigation. A number of collections were found resistant to the mite in the first study. Species from RHIZOMATOSAE were the most resistant with PI 262840, 262286 and 262827 receiving damage of 7.0, 9.3 and 10.0%, respectively, compared to damage of over 90% for the cultivated checks, NC 5, Florigiant and NC-Fla 14 (Table 1). Species in other sections were also resistant with PI 262142 (ERECTOIDES), 331194 (ARACHIS) and 338448 (TRISEMINALAE) receiving damage of 22.0, 23.0 and 29.8%, respectively. The wild species PI 219824 (*A. monticola*), 338280 (Coll. 210), 219823 (*A. duranensis*), 262133 (Coll. 10038) and several other wild species were very susceptible with damage ratings greater than 90%.

The species evaluated in the second study were

[1]Acarina: Tetranychidae.

[2]Portion of a dissertation submitted for partial fulfillment of the Ph.D. degree in Entomology at North Carolina State University.

[3]Paper No. 5184 of the Journal Series of the North Carolina Agricultural Experiment Station, Raleigh. Received for publication _____.

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Table 1. Differences among wild peanut species in damage from the twospotted spider mite in greenhouse study one.

PI No.	Collection no. or species name	Section	% Spider[a] mite damage
219824	A. monticola	ARACHIS	98.0a
338280	c410	ARACHIS	97.0a
219823	A. duranensis	ARACHIS	95.8a
262133	10038 s.l.	ARACHIS	95.8a
	Florigiant	ARACHIS	94.8ab
	NC 5	ARACHIS	94.3ab
	NC-Fla 14	ARACHIS	93.8ab
	Ac 3033	ARACHIS	93.5ab
338279	c408	ARACHIS	92.5a-c
262133	10038 l.l.	ARACHIS	91.3a-d
338297	c565-66	ERECTOIDES	87.5a-e
262808	9530	ARACHIS	84.8a-f
338447	12787	CAULORHIZAE	82.3a-g
262842	9646	ERECTOIDES	78.8a-h
262803	9530-31	ARACHIS	77.5a-i
276235	10602	ARACHIS	74.3a-i
276231	10585	ERECTOIDES	71.3b-i
	10002	ERECTOIDES	71.3b-i
261878	9993	ERECTOIDES	69.5c-j
261877	9990	ERECTOIDES	68.8d-j
336985	A. villosulicarpa	EXTRANERVOSAE	66.0e-k
331196	22585	ARACHIS	65.0e-k
	Manfredi 8[b]	ARACHIS	63.8f-k
262137	7830	ARACHIS	62.5f-k
262278	9841	ERECTOIDES	61.0g-k
	11488	ERECTOIDES	60.0g-k
338452	12943 II	PSEUDOAXONOMORPHAE	58.0h-l
262134	7897	ARACHIS	55.0i-m
338257	10550 I	RHIZOMATOSAE	47.5j-n
262808	A. correntina	ARACHIS	44.8k-o
261869	Manfredi 36	ARACHIS	44.8k-o
276225	10573	ERECTOIDES	44.8k-o
	A. villosa	ARACHIS	43.8k-o
338449	12922	TRISEMINALAE	36.5l-p
276203	10127	EXTRANERVOSAE	33.3m-q
276229	10580-17	ERECTOIDES	33.0m-q
262301	9935 pl.2	RHIZOMATOSAE	32.5m-q
262834	9629	RHIZOMATOSAE	21.3n-r
338448	12881	TRISEMINALAE	29.8n-r
262299	9925	RHIZOMATOSAE	29.5n-r
262296	9921	RHIZOMATOSAE	28.8n-r
338267	c486	RHIZOMATOSAE	26.3n-r
	9643 pl.2	RHIZOMATOSAE	24.5n-r
338257	c489c	RHIZOMATOSAE	24.3n-r
338284	c492	RHIZOMATOSAE	24.0n-r
276202	10120 pl. 1	RHIZOMATOSAE	23.3o-r
331194	9548	ARACHIS	23.0o-r
	9618	RHIZOMATOSAE	22.5o-r
338257	c489B	RHIZOMATOSAE	22.3o-r
262142	10034	ERECTOIDES	22.0o-r
338257	c489A	RHIZOMATOSAE	22.0o-r
276200	1015 III	RHIZOMATOSAE	21.8o-r
262838	9637	RHIZOMATOSAE	20.8p-r
262297	9922	RHIZOMATOSAE	17.3p-r
262287	9893 pl. 1	RHIZOMATOSAE	16.5p-r
262796	9827	RHIZOMATOSAE	14.5p-r
262294	9818	RHIZOMATOSAE	14.3p-r
262287	9893 pl. 2	RHIZOMATOSAE	13.3p-r
262832	9610B pl. 2	RHIZOMATOSAE	13.0p-r
262794	9815	RHIZOMATOSAE	12.5p-r
262827	9591	RHIZOMATOSAE	10.0z-r
262286	9882	RHIZOMATOSAE	9.3q-r
262840	9644	RHIZOMATOSAE	7.0r

[a]Values with same letters are not significantly different at the 5 percent level according to Duncan's Multiple Range Test.

[b]Received as A. hagenbedii (RHIZOMATOSAE) but the material now carried under Manfredi 8 is probably A. correntina or A. villosa.

primarily from the section RHIZOMATOSAE (Table 2). Mite damage on species from this section was significantly lower than the cultivated checks. In general, most of the RHIZOMATOSAE lines in this test received relatively little damage throughout the experiment. The wild species PI 338329, 338296 and 262841 received the lowest damage with ratings of 10.0, 12.3 and 13.8%, respectively.

The most resistant species and several other species from the first two studies were reexamined in a third study (Table 3). The species receiving the least damage in the third study were also from the section RHIZOMATOSAE. PI 338296, 338317 and 262840 from the section RHIZOMATOSAE again had the lowest mite damage with ratings of 9.25, 9.25 and 10.0%, respectively. Species from other sections that also received low damage were PI 276203 (EXTRANERVOSAE), 262142 (ERECTOIDES), 331194 (ARACHIS) and 276199 (CAULORHIZAE). They exhibited damage of 15.25, 15.17, 21.00 and 21.25%, respectively. Most wild species in the section ARACHIS were highly susceptible to mite injury. PI 262133, 219824 and 338279 received damage ratings of 99.0, 96.5 and 93.5%, respectively. The cultivated checks were lower in damage than several wild species. Florigiant, NC 5 and NC-Fla 14 had damage of 94.8, 94.3 and 93.8%, respectively, which was lower than

Table 2. Differences among wild peanut species in damage from the twospotted spider mite in greehouse study two.

PI No.	Collection no. or species name	Section	% Spider[a] mite damage
	Florigiant	ARACHIS	94.3a
	NC-Fla 14	ARACHIS	92.5a
	NC 5	ARACHIS	90.0a
262798	9834III	RHIZOMATOSAE	55.0b
262826	9587 pl. 1	RHIZOMATOSAE	48.5bc
262819	9572	RHIZOMATOSAE	47.5b-d
262820	9574	RHIZOMATOSAE	46.3b-e
261865	7910	RHIZOMATOSAE	46.3b-e
261862	c217	RHIZOMATOSAE	46.3b-e
262811	9564	RHIZOMATOSAE	43.8b-f
262826	9587 pl. 2	RHIZOMATOSAE	42.5b-f
261864	c220	RHIZOMATOSAE	41.3b-f
262825	9580	RHIZOMATOSAE	41.3b-f
262822	9576 pl. 1	RHIZOMATOSAE	40.0b-g
338256	c2	RHIZOMATOSAE	39.5b-h
338304	c334	RHIZOMATOSAE	37.5b-i
338261	c552	RHIZOMATOSAE	36.8b-j
338262	c553	RHIZOMATOSAE	35.8b-j
262792	9806	RHIZOMATOSAE	35.8b-j
276223	10566	RHIZOMATOSAE	34.5b-k
261865	7910 pl. 1	RHIZOMATOSAE	34.3b-k
262801	9553	RHIZOMATOSAE	34.0b-k
262841	9645 pl. 1	RHIZOMATOSAE	33.8b-k
261862	c217	RHIZOMATOSAE	32.5b-l
262807	9797	RHIZOMATOSAE	32.5b-l
262814	9567 pl. 1	RHIZOMATOSAE	32.5b-l
262793	9813 pl. 2	RHIZOMATOSAE	32.5b-l
338257	10550 pl. 2	RHIZOMATOSAE	31.0c-l
262796	A. glabrata b.l.	RHIZOMATOSAE	31.0c-l
262832	9610B	RHIZOMATOSAE	30.8c-l
262844	9649	RHIZOMATOSAE	30.3c-l
262822	9576 pl. 2	RHIZOMATOSAE	30.0c-l
262286	9882 pl. 246	RHIZOMATOSAE	29.5c-l
262828	9592	RHIZOMATOSAE	29.5c-l
261851	Coll. #210 (7864)	RHIZOMATOSAE	29.3c-l
338265	c571	RHIZOMATOSAE	29.3c-l
262848	9667	RHIZOMATOSAE	28.8c-l
338306	Coll. #208	ERECTOIDES	28.8c-l
338263	c560	RHIZOMATOSAE	28.8c-l
261851	c210	RHIZOMATOSAE	28.8c-l
262793	9813 pl. 1	RHIZOMATOSAE	28.0c-l
338316	c333	RHIZOMATOSAE	27.5c-l
262812	9566 A&B	RHIZOMATOSAE	27.3c-l
338300	c568	RHIZOMATOSAE	26.5c-l
262821	9575	RHIZOMATOSAE	26.3c-l
231318	A. glabrata	RHIZOMATOSAE	25.8c-l
261855	c208	RHIZOMATOSAE	25.0d-l
262815	9568	RHIZOMATOSAE	24.0e-l
262824	9578	RHIZOMATOSAE	21.5f-l
338264	c563	RHIZOMATOSAE	21.0f-l
261856	7934	RHIZOMATOSAE	17.0g-l
338317	c335	RHIZOMATOSAE	16.5h-l
276233	10596c	RHIZOMATOSAE	15.8i-l
338305	c349	RHIZOMATOSAE	15.5i-l
338299	c567	RHIZOMATOSAE	15.3i-l
262841	9645 pl. 2	RHIZOMATOSAE	15.3i-l
338296	c564	RHIZOMATOSAE	12.3kl
338329	c27	RHIZOMATOSAE	10.0l

[a]Values with same letters are not significantly different at the 5 percent level according to Duncan's Multiple Range Test.

Table 3. Greenhouse resistance of several wild species and cultivated lines of peanuts to the twospotted spider mite in green house study three.

PI No.	Collection no. or species name	Section	% Spider[a] mite damage
262133[b]	10038 s.l.	ARACHIS	99.00a
262133[b]	10038 l.l.	ARACHIS	96.75a
219824[b]	A. monticola	ARACHIS	96.50a
338279[b]	c408	ARACHIS	93.50ab
298639[b]	9484	ARACHIS	91.75a-c
338280[b]	c410	ARACHIS	90.00a-c
219823[b]	A. duranensis	ARACHIS	89.75a-c
	Florigiant[b]	ARACHIS	83.75a-d
	NC-Fla 14[b]	ARACHIS	75.00b-d
	NC 5[b]	ARACHIS	72.50cd
262134	7897	ARACHIS	65.75de
262808	9530-31	ARACHIS	52.50ef
	Man. #8	ARACHIS	48.00e-g
331196	A. villosa	ARACHIS	45.00fg
262808	A. correntina	ARACHIS	42.00f-g
	22585 (Burkart)	ARACHIS	30.75g-i
262137	7830	ARACHIS	25.50h-j
276233	10596c	RHIZOMATOSAE	24.25h-j
262841	9645	RHIZOMATOSAE	23.75h-j
262306	9966	RHIZOMATOSAE	23.50h-j
262294	9918	RHIZOMATOSAE	22.00ij
276199	10538	CAULORHIZAE	21.25if
331194	9548	ARACHIS	21.00ij
262301	9935	RHIZOMATOSAE	20.50ij
276233	10596c	RHIZOMATOSAE	20.50ij
338299	c567	RHIZOMATOSAE	17.50ij
262797	9830	RHIZOMATOSAE	15.75ij
262142	10034	ERECTOIDES	15.75ij
276203	10127	EXTRANERVOSAE	15.25ij
262836	9634	RHIZOMATOSAE	15.00ij
262286	9882	RHIZOMATOSAE	14.50ij
338301	c569	RHIZOMATOSAE	14.00ij
338305	c349	RHIZOMATOSAE	13.00ij
262794	9815	RHIZOMATOSAE	11.25ij
262832	9610B	RHIZOMATOSAE	11.00ij
262827	9591	RHIZOMATOSAE	10.50ij
262840	9644	RHIZOMATOSAE	10.00ij
338317	c335	RHIZOMATOSAE	9.25j
338296	c564	RHIZOMATOSAE	9.25j

[a]Values with same letters are not significantly different at the 5 percent level according to Duncan's multiple Range Test.

[b]Identified as susceptible in Test 1 or Test 2.

PI 219824, 338280, 219823, and 262133. Results from the third study were comparable to the first two studies. For example, PI 331194 had damage of 23.0 in test one and 21.0 in test three; PI 3388329 had 12.3 in test two and 9.25 in test three.

A correlation coefficient of 0.76 was found between species of a taxonomic section and mite damage observed in test three. Plants from the section *RHIZOMATOSAE* were the most resistant, section ARACHIS was in general the most susceptible and the remainder of the sections contained species with moderate to little damage from the twospotted spider mite.

Leuck and Hammon (1968) examined resistance of wild peanut species to the mite *T. tumidellus*. Several of the species used in this study were also used in their study. In general, the results were similar for the two studies even though a different species of mite was used in the two studies. For example, PI 262841 was very resistant, PI 262844 was moderately resistant and PI 262133 was highly susceptible to mite damage in both studies.

Several sources of resistance to the twospotted spider mite have been identified in this study. Section RHIZOMATOSAE was the most resistant with PI 338296, 338317, 262827 and several others being highly resistant. Other sections also contain mite resistant species with PI 276203 (EXTRANERVOSAE), 262142 (ERECTOIDES), 331194 (ARACHIS), and 276199 (CAULORHIZAE) exhibiting resistance to mite damage.

The species from RHIZOMATOSAE would be difficult to use in any breeding program for mite resistance since they do not cross readily with cultivated peanuts. Bridge crossing techniques will be needed in order to transfer the resistance from RHIZOMATOSAE to cultivated peanuts (Personal communications, W. C. Gregory, North Carolina State University, Raleigh). The wild species PI 331194 (ARACHIS) cross readily with cultivated peanuts. However, studies on the mechanisms of resistance of PI 331194 to the spider mite indicate that the mite has high fecundity on this species (Johnson, 1976). Observations indicate that the mite develops readily on PI 331194 which suggests that tolerance is probably involved. Although resistance to the twospotted spider mite is available, the utilization of this germplasm from the wild species will require considerable breeding effort.

The authors recognize that these tests were conducted in the greenhouse in the absence of natural environmental effects on the plant and the mites; therefore prior to any breeding effort, species performance in the field would be essential.

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