New Source of Leafhopper Resistance in Peanut[1]

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Abstract Field screening for potato leafhopper, *Empoasca fabae* Harris, resistance among peanut, *Arachis hypogaea* L., genotypes were conducted for three consecutive years (2001, 2002, and 2003) at the University of Georgia, Coastal Plain Experiment Station in Tifton, GA. Irrigated field trials were used for evaluations, and plants were grown without any pesticides other than preplant and occasional postemergence herbicides. Results from these replicated tests showed a wide-range of leafhopper damage. During each of the 3 yrs, 'Georgia-01R' consistently had the lowest leafhopper damage rating of all genotypes tested. Likewise, each year 'Georgia Hi-O/L' had the highest leafhopper damage rating. 'Georgia Green' and other cultivars and breeding lines were intermediate between Georgia-01R and Georgia Hi-O/L for leafhopper ratings. These field trials confirmed the multiple-pest resistant runner-type cultivar Georgia-01R as a new source of leafhopper resistance in peanut.

Key words groundnut, *Arachis hypogaea*, *Empoasca fabae*, insect resistance, breeding line, cultivars

One of the major intracellular foliage feeding insects of peanut, *Arachis hypogaea* L., in the U.S. is the potato leafhopper, *Empoasca fabae* Harris. Nymphs and adults feeding on peanut leaves results in the classic "v" shaped yellowing or chlorosis at the leaflet tips followed later by leaf scorching or necrosis inside the more severely damaged areas of the leaflets.

Chemical control is costly and kills beneficial arthropods which may trigger subsequent pest problems. So, insect resistance is highly desirable as a means of control (Lynch and Mack 1995). Resistance of peanut to the potato leafhopper has previously been reported (Campbell et al. 1976, Lynch 1990). However, much of the resistance found so far has been in either unadapted plant introductions or germplasm lines which are not commercially acceptable for release as new cultivars, except for the 'NC 6' virginia-type cultivar (Campbell et al. 1977). The objective of this study was to field screen for leafhopper resistance among the more advanced Georgia breeding lines and newly-released peanut cultivars.

Material and Methods

Each year, peanut cultivars and breeding lines were selected for this study based upon previously known resistant traits and/or pedigree information. During 2001, eight

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advanced Georgia breeding lines were compared with eight peanut cultivars. During 2002-03, the best performing breeding lines from the previous year were reevaluated, and new lines and cultivars added each subsequent year.

Field screening trials were conducted on a Tifton loamy sand soil type (fine-loamy, siliceous, thermic, Plinthic Kandindult) at the Gibbs Research Farm near the University of Georgia, Coastal Plain Experiment Station in Tift Co., GA. A randomized complete block design was used each year with six replications. Plots consisted of two rows 6.1 m long × 1.8 m wide. Row spacing was 0.8 m within and 1.0 m between adjacent plots. Seed were spaced approximately 6 cm apart within each row. Planting dates were 23 April 2001, 22 April 2002, and 23 April 2003. Production practices included fertilization and irrigation, but excluded all pesticides (fungicides, insecticides, and nematicides), except for preplant-incorporated and postapplied herbicides as needed for weed control. Previous crop rotation involved following fallow in 2001, cotton in 2002, and cotton in 2003.

Visual leafhopper damage ratings were made on individual whole plot during the latter half of the growing season each year according to the following 0-9 scale; where 0 = 0% leafhopper burn (normal leaves), 1 = <5% leafhopper burn (yellowish v-tip chlorosis), 2 = 5 – 10% leafhopper burn, 3 = 10 – 25% leafhopper burn, 4 = 25 – 50% leafhopper burn, 5 = >50% leafhopper burn + <5% leaf lesion (necrosis), 6 = >50% leafhopper burn + 5 – 10% leaf lesion, 7 = >50% leafhopper burn + 10 – 25% leaf lesion, 8 = >50% leafhopper burn + 25 – 50% leaf lesion, 9 = >50% leafhopper burn + >50% leaf lesion.

Yield data were taken but are not reported here because of a confounding effect from heavy disease pressure caused by tomato spotted wilt virus (TSWV), early leafspot (*Cercospora arachidicola* Hori) and late leafspot [*Cercosporidium personatum* (Berk. and Curt.) Deighton].

Data from each test were subjected to analysis of variance. Waller-Duncan's T-test (k-ratio = 100) was used for means separation.

Results and Discussions

Soon after tobacco thrips, *Frankliniella fusca* Hinds, recovery at approximately midseason each year, symptoms of leafhopper damage began to appear on the leaflet tips with the classic yellowish v-shaped chlorosis followed later by leaf scorching or necrosis inside the more severely damaged areas of the leaflets. Genotypic differences became quite apparent at this time each year and remained throughout the growing season. Thus, only a single rating was needed for assessing leafhopper damage among genotypes.

During 2001, the recently released runner-type peanut cultivar 'Georgia-01R' (Branch 2002) had the lowest leafhopper damage rating of all genotypes (Table 1). The high-oleic (O) and low-linoleic (L) fatty acid oil ratio cultivar, 'Georgia Hi-O/L' (Branch 2000) had the highest leafhopper damage rating which was not significantly different from three advanced Georgia breeding lines GA 992526, GA 942007-53, and GA 992558. Other cultivars and advanced breeding lines had leafhopper ratings between Georgia-01R and Georgia Hi-O/L.

Similarly in 2002 (Table 2), Georgia-01R again had the lowest leafhopper damage rating of all genotypes evaluated. Georgia Hi-O/L again had the highest leafhopper rating which was not significantly different from the advanced Georgia breeding line

Table 1. Leafhopper rating (0-9 scale) among peanut genotypes within no-pesticide irrigated field trial, 2001

Peanut genotype	Leafhopper rating	Peanut genotype	Leafhopper rating
Georgia Hi-O/L	7.8 ± 0.4 a*	Georgia Browne	5.8 ± 0.4 de
GA 992526	7.7 ± 0.5 a	Georgia-03L	5.7 ± 0.5 ef
GA 942007-53	7.5 ± 0.5 a	Southern Runner	5.3 ± 0.5 fg
GA 992558	7.5 ± 0.5 a	C-99R	5.3 ± 0.5 fg
GA 992501	6.7 ± 0.5 b	Florida MDR 98	5.0 ± 0.6 g
GA 992540	6.5 ± 0.5 bc	GA 942516	5.0 ± 0.0 g
GA 992525	6.2 ± 0.7 cd	GA992504	5.0 ± 0.6 g
Georgia-02C	6.2 ± 0.4 cd	Georgia-01R	3.0 ± 0.0 h
Mean			6.0
% CV			7.9

* Means ± SD within both columns followed by the same letter do not differ significantly at $P \leq 0.05$.

Table 2. Leafhopper rating (0-9) scale among peanut genotypes within no-pesticide irrigated field trial, 2002.

Peanut genotype	Leafhopper rating	Peanut genotype	Leafhopper rating
Georgia Hi-O/L	9.0 ± 0.0 a*	Georgia-03L	6.5 ± 0.8 d
GA 962569	8.5 ± 0.8 ab	Hull	5.7 ± 1.0 e
DP-1	7.8 ± 0.7 bc	GA 962540	5.7 ± 0.8 e
Georgia-02C	7.8 ± 1.0 bc	GA 942516	5.7 ± 0.8 e
Georgia Green	7.5 ± 0.5 c	GA 992504	5.5 ± 0.5 e
AgraTech 201	7.3 ± 1.6 c	Carver	5.0 ± 0.6 e
C-99R	6.5 ± 0.5 d	Georgia-01R	3.2 ± 0.4 f
Mean			6.5
% CV			12.1

* Means ± SD within both columns followed by the same letter do not differ significantly at $P \leq 0.05$.

GA 962569. 'Georgia Green' (Branch 1996) and other peanut cultivars and breeding lines were intermediate in leafhopper damage ratings.

Results in 2003 were very similar to the previous 2 yrs (Table 3). Georgia-01R had the lowest leafhopper damage rating, and Georgia Hi-O/L had the highest leafhopper damage rating. Georgia Green and other cultivars and breeding lines were intermediate between Georgia-01R and Georgia Hi-O/L for leafhopper damage ratings.

These three no-pesticide irrigated field trials confirmed Georgia-01R as a new source of leafhopper resistance in peanut. Means and percentages of coefficient of variation (CV) were very acceptable and consistent across each and every year. The data also confirm that Georgia Hi-O/L is quite susceptible to leafhopper damage which emphasizes its greater potential need for insecticide application.

The specific nature of resistance for Georgia-01R is not yet clearly known. How-

Table 3. Leafhopper rating (0-9 scale) among peanut genotypes within no-pesticide irrigated field trial, 2003.

Peanut genotype	Leafhopper rating	Peanut genotype	Leafhopper rating
Georgia Hi-O/L	8.0 ± 0.6 a*	GA 011557	6.5 ± 0.5 de
DP-1	7.3 ± 0.5 b	Hull	6.3 ± 0.5 e
Georgia-03L	7.3 ± 0.5 b	GA 011568	6.3 ± 0.5 e
Georgia-02C	7.2 ± 0.4 bc	GA 992504	6.2 ± 0.7 ef
Georgia Green	7.0 ± 0.6 bcd	GA 011567	6.2 ± 0.4 ef
C-99R	6.7 ± 0.8 cde	AP-3	5.7 ± 0.5 f
GA 012602	6.7 ± 0.8 cde	GA 002506	5.0 ± 0.6 g
Carver	6.5 ± 0.5 de	Georgia-01R	3.0 ± 0.6 h
Mean			6.4
% CV			9.0

* Means ± SD within both columns followed by the same letter do not differ significantly at $P \leq 0.05$.

ever, previous reports have shown leafhopper resistance among other peanut genotypes due to long, straight leaf trichomes (Campbell et al. 1976) and antibiosis expressed as reduced fecundity for leafhopper feeding (Lynch 1990).

In summary, Georgia-01R is a new multiple-pest resistant runner-type cultivar with resistance not only to leafhopper but also to TSWV, early and late leafspots, white mold or stem rot (caused by *Sclerotium rolfsii* Sacc.), and Cylindrocladium black rot (caused by *Cylindrocladium parasiticum* Crous, Wingfield & Alfenas) (Branch and Brenneman 2003, Branch and Fletcher 2001). Georgia-01R has a spreading runner growth habit, tan testa color, and late maturity. Maturity of Georgia-01R is approximately 2-3 wks later than Georgia Green in south Georgia which should be beneficial to growers for staggering harvest as well as potentially lowering pesticide costs.

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