Inheritance of Resistance to Rosette Virus Disease in Groundnut

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The SADCC/ICRISAT Regional Groundnut Improvement Program for Southern Africa gives high priority to breeding agronomically acceptable, groundnut rosette virus (GRV) resistant groundnut *(Arachis hypogaea* L.) cultivars adapted to the region. The major emphasis is on short-duration types for the areas where rosette virus is most important, but there is also a need to breed bold-seeded, GRV-resistant cultivars for the confectionary trade. A breeding program was initiated in 1982, and material is now in the F_4 stage. In this paper, we report on studies on the inheritance of the resistance.

Studies in West Africa with Virginia x Virginia crosses (Berchoux 1960) indicated that resistance to groundnut rosette virus was controlled by two recessive genes. Berchoux (1960) attributed this resistance to production in the plants of antiviral substances. He noted that when subjected to massive inoculum pressure from viruliferous aphids, the resistant plants could be infected with GRV. He attributed this to the plants' inability under these conditions to produce a sufficient quantity of antiviral substances: this hypothesis was later confirmed (Daniel and Berchoux 1965).

Harkness (1977), working in Nigeria, reported low recovery of resistant plants from Virginia x Spanish crosses and ascribed this to the appearance of GRV-disease symptoms in double-recessive plants following heavy inoculation at early stages of plant growth. He also suggested that such loss of resistance from generation to generation in individuals of cross-bred material was to be expected if double-recessive genotypes did not confer resistance in all nuclear backgrounds.

Gibbons (1985), while discussing breeding for GRV resistance, mentioned unconfirmed and unpublished reports indicating that rosette resistance may not be simply inherited as suggested by Berchoux (1960).

Materials and Methods

Two GRV-resistant Virginia cultivars (RG 1 and RMP 40) were crossed with three susceptible cultivars, one from each of the Spanish (JL 24), Virginia (Mani Pintar), and Valencia (ICGM 48) groups. F_1 reciprocal crosses and their F_2 backcross generations of the resistant x susceptible F_1 crosses were produced, and the field resistance screening of parents and filial generations was carried out following the method of Bock and Nigam (see page 7 in this Summary Proceedings). Plants not infected under field conditions were harvested individually and three seedlings raised from each of them were subsequently tested for GRV resistance in the greenhouse. If any seedling was found to be susceptible to GRV in this test, its preceding F_2 or backcross plant was recorded as susceptible. This helped in eliminating escapes in field testing and allowed us to interpret more precisely the performance of the progeny. If none of the three plants could be infected under laboratory conditions, the remaining seeds were planted as progeny rows in the GRV screening nursery. The final observations on segregation for GRV resistance are awaited.

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Results and Discussion

All 12 F_1 crosses, including reciprocals, were susceptible to GRV, confirming the recessive nature of the resistance.

The F_2 data were subjected to X^2 analysis to test the fit of 3:1, 15:1,13:3, and 63:1 F_2 ratios of susceptible to resistant plants. In all the 12 cases, the 3:1, 13:3, and 63:1 F_2 ratios, did not fit the observed distribution.

In six F_2 crosses, including reciprocals, involving the resistant parent RG 1, the fit for a 15:1 F_2 ratio for susceptibility to resistance was good. In the case of resistant parent RMP 40, except for the JL 24 x RMP 40 F_2 cross, the fit for a 15:1 F_2 ratio was within acceptable limits in spite of the low recovery of resistant plants in some crosses. On pooled analysis over all RMP 40 crosses, the fit was again within acceptable limits.

In the backcross generation of 12 crosses with the susceptible parents, all the plants in all but one cross, (RMP 40 x Mani Pintar)^x Mani Pintar, were susceptible to GRV. In the cross (RMP 40 x Mani Pintar) x Mani Pintar, 3 plants from a total of 172 were not infected. Progenies of these plants are currently being tested to check if the original F_1s could have been RMP 40 selfs.

In the backcross generation of 12 crosses with the resistant parents, all except (RMP 40 x ICGM 48) x RMP 40 had a good fit for a 3:1 ratio of susceptibility to resistance.

From the F_1, F_2, and backcross generations data of 12 crosses involving resistant parents and susceptible parents of different botanical types, it can be inferred that the resistance to GRV is recessive in nature and is governed by two genes. Furthermore, the botanical type had no influence on inheritance. From this study and from observations of progenies in the GRV-resistance breeding nursery, we could find no evidence to support Harkness' suggestion of differential expression of the double-recessive genes in different nuclear backgrounds. Resistant plants identified in the F_2 generation have maintained this character for at least four generations.

References

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