Combining Ability for Resistance to Sweetpotato Feathery Mottle Virus

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Abstract. Combining ability for resistance to Sweetpotato Feathery Mottle Virus (SPFMV) was evaluated in seven sweetpotato [Ipomoea batatas (L.) Lam] clones. A diallel mating design was used, which resulted in 16 full-sib families. Families were evaluated for SPFMV resistance under greenhouse conditions in a randomized complete-block design. Resistance was tested by grafting Ipomoea nil ‘Scarlet O’ Hara’ infected with the russet crack strain of SPFMV (RC-SPFMV) onto individual plants of the families being evaluated. Symptomless plants were further indexed by cleft grafting virus-free Ipomoea setosa Ker plants onto the tested plants. Those plants in which the virus was not recovered by this test were considered resistant. Analysis of variance for SPFMV resistance revealed significant general combining abilities (GCA). Two clones, DLP-886 and TN90.300, exhibited significant positive GCA for SPFMV resistance. No significant specific combining abilities (SCA) were detected among the crosses. Breeding for resistance to SPFMV should focus on careful selection of resistant parents. In addition, results suggest that additive gene action is important in resistance to SPFMV.

Materials and Methods
Seven sweetpotato clones from CIP’s germplasm collection held in trust at the International Potato Center (CIP) (1990). However, incorporation of this resistance into breeding populations has not been achieved. The lack of knowledge about the inheritance of this resistance is one of the factors that hinders its use. The objectives of this study were to evaluate the resistance to SPFMV among families derived from a sample of CIP’s sweetpotato accessions in a diallel mating design, in order to estimate combining ability for SPFMV resistance. This will allow the identification of parental clones and selection methods to introduce SPFMV resistance into advanced breeding populations.

Results and Discussion
The percentage of SPFMV-resistant plants in the 16 families ranged from 39 to 88 (Table 1). ANOVA for percentage of SPFMV resistance showed significant differences among families (P ≤ 0.01) and nonsignificant differences among replications. Partitioning of the family variation revealed significant GCA (P ≤ 0.01); specific combining abilities were
Since the trial was conducted in one environment, the frequency of resistance among offspring depended primarily on the parents instead of their specific combinations or interactions. A diallel mating design among resistant and susceptible parents was used to estimate the general combining ability (GCA) and specific combining ability (SCA) for resistance to RC-SPFMV of seven sweetpotato parental clones.

Table 1. Mean percentages ± se of RC-SPFMV-resistant plants in 16 sweetpotato families generated in a diallel mating design among resistant and susceptible parents.

| Parents                  | RCB-IN238 (S) | ARB-9996 (S) | DLP-2247 (R) | DLP-886 (R) | DLP-1913 (R) | TN90.300 (R) |
|--------------------------|---------------|---------------|--------------|--------------|--------------|--------------|
| YM88.030 (S)             | 38.8 ± 2.7    | 42.2 ± 6.9    | 40.4 ± 2.0   | 68.8 ± 10.3  | 43.9 ± 6.9   | 70.7 ± 8.7   |
| RCB-IN238 (S)            | 49.5 ± 13.2   | 69.6 ± 12.9   | 46.9 ± 8.0   | (−)          | (−)          | (−)          |
| ARB-9996 (S)             | 42.2 ± 11.3   | 61.3 ± 4.4    | 64.2 ± 1.9   | (−)          | (−)          | (−)          |
| DLP-2247 (S)             | 80.8 ± 4.7    | 69.4 ± 10.1   | (−)          | (−)          | (−)          | (−)          |
| DLP-886 (R)              | (−)           | (−)           | (−)          | (−)          | (−)          | (−)          |
| DLP-1913 (R)             | 82.4 ± 3.3    | 87.9 ± 5.3    | 82.4 ± 3.3   | 87.9 ± 5.3   | 87.9 ± 5.3   | 87.9 ± 5.3   |
| TN90.300 (R)             | 82.4 ± 3.3    | 87.9 ± 5.3    | 82.4 ± 3.3   | 87.9 ± 5.3   | 87.9 ± 5.3   | 87.9 ± 5.3   |

R = resistant, S = susceptible. 
*= incompatible.

Three of the four susceptible parental clones (YM88.030, RCB-IN-238, and ARB-9996) showed significant negative GCA effects. In contrast, Clone DLP-1913 was resistant but showed nonsignificant GCA for resistance (Table 2). The level of resistance to SPFMV observed in this material has been reported by other researchers, who proposed that resistance limited multiplication or translocation of the virus so that it could not be recovered by graft indexing (Arrendell et al., 1986). Intermediate resistance levels may exist, but are difficult to identify because current techniques do not quantify SPFMV infection. This is not a serious limitation to developing an improvement program for SPFMV resistance, since careful selection of resistant parents with good combining abilities will allow achievement of this goal.

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