

The Environment Produces a Significant Effect on Pungency of Chiles

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Pungency, or the organoleptic sensation of heat, is an important quality characteristic of chiles (*Capsicum annuum* L.). Specific pungency levels must be maintained for food manufacturers to label products as mild, medium, or hot. Variation in pungency can be attributed to cultivar differences (Bosland, 1992). However, pungency differences are often observed when the same chile cultivar is grown in different locations.

The phenotypic expression of pungency is the result of a genotype \times environment interaction. Any stress to the plant increases pungency in chile. However, to our knowledge, little is known about the extent to which the environment can affect pungency, and no studies are known in which environmental effects on pungency have been measured in a commercial chile field. This study estimated the environmental effect on pungency within such a field in southern New Mexico.

Double haploids (dihaploids) are seed-propagated clones. Each plant is identical in genotype to all its siblings. The double haploid line, 'CaGC 87', generated from the New Mexican-type cultivar 'NuMex R Naky' (Munyon et al., 1989), was planted at Las Cruces, N.M., within a test field, 20 \times 183 m; 120 uniform seedlings \approx 10 cm in height were transplanted. The five plots, each consisting of \approx 24 plants, were planted in single rows, among plots of several other chile cultivars to be evaluated. The five plots were \approx 1 \times 9 m and were strategically placed in the field to test for field differences. Optimum growing conditions were provided. Mature red chile pods from the third, second, and first node were harvested from three randomly chosen individual plants per plot. The pods were oven-dried at 58 to 60 $^{\circ}$ C for \approx 5 d, until mass was constant. The pods from each plant were ground using a Wiley laboratory mill equipped with a

1-mm screen and bulked. Pungency was quantified using high-performance liquid chromatography analysis of capsaicinoids (Collins et al., 1995). Two replicate samples per plant were injected and a mean calculated. Analysis of variance and Duncan's multiple range test ($P \leq 0.05$) were used to determine the significance of observed differences.

The variability in pungency observed among the double haploids was dramatic. Differences were found among plots, among individual plants within a single plot, and among the individual plants across the field (Fig. 1). In Fig. 1, plot numbers were assigned based on the descending order of mean Scoville heat units (SHU). Pods from plot 1 had the highest plot mean (7482 SHU), but did not differ significantly from the pods of plot 2, which averaged 5863 SHU. Values of SHU for the pods from plots 1 and 2 were statistically significant from those of pods harvested from plot 5 (3956 SHU). The pods of plot 5 were the mildest, but were not statistically different from pods of plots 3 and 4 with 5451 and 4203 SHU, respectively. When plant-to-plant variation was examined within plots, four of the five plots had significant variation among the individual plants (Fig. 1). In plot 1, for ex-

ample, plants 1 and 2 did not differ significantly from each other at 5936 and 6894 SHU, respectively, but both differed from plant 3 at 9614 SHU. When plants were ranked from highest to lowest SHU they ranged from 9614 (78% higher than the field mean) to 2896 SHU (46% lower than the field mean). This variation is greater than any reported in the literature. The findings demonstrate the strong effect that the environment can have on pungency.

The pungency differences observed in this study exceeded 6000 SHU, demonstrating that the environmental component can have a greater influence on the pungency level than does the genotype. Among the New Mexican-type chiles 'NuMex R Naky' is a mild cultivar, 'NuMex Joe E. Parker' is a medium pungent cultivar, and 'Sandia' is a hot cultivar. The average heat values for these cultivars are 500, 1000, and 5000 SHU, respectively (Bosland and Votava, 1997). Therefore, the grower who contracts with a chile processor to grow a mild chile variety may actually harvest a chile crop that is equal to or greater in pungency than a medium pungent cultivar. Cultivars expressing a low environment \times genotype interaction for pungency may be needed by the industry.

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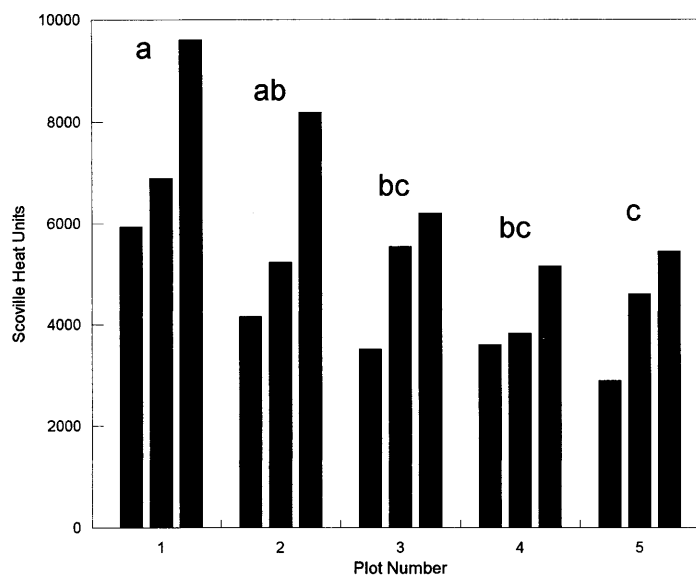


Fig. 1. Pungency (Scoville Heat Units) of fruits of three individual plants of 'CaGC 87', double haploid chile, from each of five plots across a 20 \times 183-m field. Mean separation among plots by Duncan's multiple range test, $P \leq 0.05$. LSD ($P \leq 0.05$) for individual plant means was 1984 SHU.

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