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Registration of the Maize Population Zapalote Chico 2451F

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Zapalote Chico 2451F (ZC-2451F) (Reg. no. GP-370, PI 618810), a maize (*Zea mays* L.) germplasm population was released in April 2001 by the Florida Agricultural Experiment Station and the USDA-ARS Crop Genetics and Breeding Research Unit. This population was released as a source of improved resistance to silk and ear feeding by larvae of the corn silk fly [*Euxesta stigmatias* Loew. (Diptera: Otitidae)], the fall armyworm [*Spodoptera frugiperda* (J.E. Smith)], and the corn earworm [*Heliocoverpa zea* (Boddie) (Lepidoptera: Noctuidae)]. Zapalote Chico 2451F is distinct from Shrunken Zapalote Chico (ZC-*sh2*) (PI 612343), and the Zapalote Chico land race collected in the state of Oaxaca, Mexico, in the late 1940s, and first acceded to the National Seed Storage Laboratory as PI 217413 (Scully et al., 2000; Anderson, 1959; Straub and Fairchild, 1970). PI 217413 was one of the earliest Zapalote Chico populations identified as a source of natural compounds with insecticidal properties (Wais et al., 1979; Wilson and Wiseman, 1988). Resistance in Zapalote Chico 2451F is also due to elevated levels of the flavone glycoside maysin that is found in fresh silk (Ellinger et al., 1980; Snook et al., 1993, 1995). Maysin is synthesized in the flavonoid pathway and known to specifically confer antibiosis-based resistance to silk feeding (Byrne et al., 1996).

Zapalote Chico 2451F is one of several subpopulations derived from Oaxaca Gpo. 35, a Zapalote Chico population held at CIMMYT, Mexico (A. Ortega, 1968, personal communication). Zapalote Chico 2451F was developed from two phases of selection. In the first phase, three cycles of recurrent mass selection were conducted in Tifton, GA, on Oaxaca Gpo. 35, which resulted in a germplasm line coded as ZC 2451 (P)C3. Selection was practiced primarily for a plant with a purple phenotype; secondary selection criteria emphasized agronomic traits such as plant uniformity, seedling vigor, and tight husks. Subsequently, ZC 2451 (P)C3, along with an array of other Zapalote Chico accessions, were assessed for resistance to silk and ear feeding by lepidopteran larvae. After the identification of improved insect resistance, ZC 2451 (P)C3 underwent another three cycles of phenotypic recurrent mass selection in Florida from 1995 to 1997. In different generations, selection was practiced at variable intensities of 2.063 to 1.554 (5–15%) for resistance to ear and silk feeding by the corn silk fly and fall armyworm. This selection program resulted in the Zapalote Chico 2451F population.

In Florida, Zapalote Chico 2451F was compared with the sweet corn hybrid Primetime, the Bt test hybrid GSS 0966 with the *Cry 1A(b)* construct, and ZC-*sh2*. At silk emergence, corn silk fly larvae were infested on freshly emergent silk with ear damage rated at roasting stage (±21 DAP) on a 0 to 4 scale (Scully et al., 2002). Results from 1998 to 2000 indicated that Zapalote Chico 2451F and ZC-*sh2* sustained ear damage rated at 1.31 and 1.49, respectively, and were significantly more resistant than either GSS 0966 or Primetime, each rated at 2.45 and 2.56, respectively. Silk infestation with neonate and/or first instar fall armyworm during the same time period revealed that GSS 0966, ZC-*sh2*, and Zapalote Chico 2451F were comparable and rated at 1.83, 1.78, and 1.73, respectively, on a 0 to 3 damage scale. The susceptible check, Primetime, incurred an average damage rating of 2.58. Damage caused by corn earworm in Georgia on GSS 0966, Zapalote Chico 2451F, and ZC 2451 (P)C3 was not significantly different and rated at 2.35, 2.52, and 2.83, respectively. Corn earworm damage to Primetime averaged 7.00, while ZC-*sh2* sustained an average damage rating of 4.70.

Levels of silk maysin were assayed and compared for Primetime, GSS 0966, ZC-*sh2*, Zapalote Chico 2451F, along with

ZC 2451 (P)C3 on plants grown in Georgia. On the basis of fresh silk weights, ZC-*sh2*, Zapalote Chico 2451F, and ZC 2451 (P)C3 had 1.02, 0.52, and 0.49% maysin, respectively. All three were significantly different. As expected, the maysin assay in Primetime and GSS 0966 was near zero.

In Florida, the Zapalote Chico 2451F population averaged 180 cm in height with ears placed 53 cm above the ground, and reached midsilking in 62 d, 3 d earlier than Primetime. Mature plants had 8 to 11 leaves at silk expression with mostly five leaves above the top ear. Brace roots were present, but not prolific, on stalks with a basal diameter up to 2.0 cm. Tillers were absent. Internode width at the top ear ranged from 1.7 to 2.2 cm, with internode lengths of 14.0 to 20.0 cm. Leaves at the top ear of Zapalote Chico 2451F measured 63 to 76 cm in length with leaf widths of 7.0 to 8.0 cm. Leaves at the ear node angled 45° and were pendulant toward the tip, usually with five or more marginal waves and few longitudinal creases. Husk leaves on Zapalote Chico 2451F generally ranged from 13.0 to 15.0 cm, but occasionally up to 20 cm, with two to three of these husks wrapped completely around the ear. Husk leaves clasped tightly around the ear and at the tip. Flag leaves were mostly absent. Husk leaf lengths measured 17.0 to 20.0 cm and extended 1.0 to 2.0 cm beyond the ear tip. The Zapalote Chico 2451F population is suffused with deep purple and reddish pigmentation throughout most plant organs.

Ears measured 8.0 to 10.5 cm in length, and up to 4.0 cm in width on cobs that averaged 2.7 cm wide. Ears were held on the stalk at a 15° to 30° angle. Kernel formation on the ear was distinct, with dropped rows at the base of the ear. Majority row count was 14 and commonly ranged from 10 to 16. Shank length measured between 5.0 and 7.0 cm with 7 to 8 internodes. White floury kernels taken from the mid-ear region measured 0.80 cm in length, 0.40 cm in width, and had an average kernel height of nearly 0.99 cm. Zapalote Chico 2451F was susceptible to the common races of blight and rust diseases found in Florida.

This Zapalote Chico 2451F population is part of a series of high maysin populations that include ZC-*sh2*, the popcorn accession PI 340856, EPM6 (PI 614735) with a semipopcorn type purple kernel, and SIM6 (PI 614736) with a yellow dent kernel on a red cob. (Scully et al., 2000; Widstrom and Snook, 2001, 2002). Zapalote Chico 2451F is publicly released with the request that recipients of this seed acknowledge the source when using this germplasm in either research or crop improvement. In addition to storage at the National Seed Storage Laboratory, seed stock will be maintained and is available from N.W. Widstrom or B.T. Scully at their respective addresses.

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