HORTSCIENCE 32(5):914–915. 1997.

X *Alpingera martinica* (Zingiberaceae): An Intergeneric Hybrid between *Alpinia purpurata* and *Etlingera elatior*

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Additional index words. flower color, plant breeding, *Nicolaia*, *Phaeomeria*

Abstract. **Artificial intergeneric crosses between *Alpinia purpurata* and *Etlingera elatior* (Zingiberaceae) have produced hybrids. Data are presented with a Latin diagnosis and the name X *Alpingera martinica* F. Luc-Cayol proposed for these hybrids. The shape and color of the inflorescence of this hybrid species are an improvement relative to the ornamental value of the parents.**

Some of the many genera from Zingiberaceae grown as ornamentals under warm conditions are *Alpinia* Roxb., *Hedychium* J. König, *Kaempferia* L., *Etlingera* Giseke (synonyms *Nicolaia* Horan, *Phaeomeria* Lindley ex K. Schum.), and *Roscoea* Js. Sm. (Rogers 1984).

The genus *Alpinia* is subdivided into two subgenera, *Alpinia* with more than 70 species and *Dieramalpinia* K. Schum. (Smith, 1990). The center of distribution of subgenus *Alpinia* lies in tropical regions to the north of the equator (Smith, 1990).

Alpinia purpurata (Vieill.) K. Schum. commonly is called "red ginger." The geographic distribution of this species lies in tropical regions. It is cultivated widely as an ornamental plant for its beautiful and typical spike-like inflorescence, which is long-lasting. Generally the inflorescence will appear and then floral spikes are harvested 5 months after shoot emergence (Hansen, 1994). This inflorescence bears overlapping scale-like leaves called bracts. *A. purpurata* is the most important cut flower of the Caribbean nations exported to European and North American markets (Douanes francaises, 1995).

Species of Zingiberaceae have mucronate petals that correspond to hypsophylls (bracts), consisting of a leaf sheath and a rudimentary "oberblatt" (leaf petiole + lamina) (Weber, 1980). Bisexual flowers of *A. purpurata* develop in the cone-like structure behind the upper bracts. Small leafy plantlets often develop behind lower bracts.

There are only two colors of the inflorescence of marketed selections of red ginger, one red-bracteated (lacking cultivar name) and 'Eileen McDonald', with pink bracts (Criley, 1988). Breeding may produce more variation in color types that would be extremely desirable for marketing *A. purpurata*. The success of breeding this species would depend on the extent to which variation can be introduced. Hybridization between the red-bracteated and pink-bracteated selections of *A. purpurata* produced filial individuals whose color of the floral bracts varied only in range from red to pink (F. Luc-Cayol, unpublished data). The genetic base is very narrow for this trait. Consequently, one cannot hope to create valuable new cultivars with intraspecific crosses. Among the species of the genus *Alpinia*, none seem interesting to us for cross-pollination with *A. purpurata*. Therefore, we concluded that introduction of traits from other genera might increase the range of color variation and perhaps result in new avenues for cultivar development. No authenticated instance of any intergeneric hybrid involving *Alpinia* has been reported. *Etlingera elatior* (Jack) R.M. Smith [synonyms *Nicolaia elatior* (Jack) Horan or *Phaeomeria magnifica* (Roscoe) K. Schum.], a tropical ornamental plant commonly called "torch ginger," appeared potentially useful because of its inflorescence characters and 2n = 48 as in *A. purpurata*.

Nicolaia elatior is the name currently in used in the floricultural industry with the name *P. magnifica* used historically for this species. The genera *Nicolaia* and *Phaeomeria* have been reduced to synonyms of *Etlingera*, with *Nicolaia* used as a subgenus and *Phaeomeria* as a section in the genus *Etlingera* (Burtt and Smith 1986; Smith 1986). Therefore, the name of the staminate parent has been changed to *E. elatior* (Smith 1986).

In the genera *Alpinia* and *Etlingera*, 16 of 17 species studied by Beltran and Kiew (1984) appear to have a basic number of chromosome x = 12 and were tetraploid with 2n = 48. Only *A. intermedia* was diploid with 2n = 24 (Beltran and Kiew, 1984).

The objective of this investigation was to explore the possibility of introducing new genes for inflorescence color and shape into *A. purpurata* through intergeneric hybridization with *E. elatior* as the staminate parent.

Materials and Methods

Hybridization experiments were performed at Durand, Saint Joseph, Martinique, West Indies. Field grown plants of a red-bracteated and a pink-bracteated selection ('Eileen McDonald') of *A. purpurata* were cross-pollinated with a rose-pink selection of *E. elatior* under field conditions. Both species are diploid (2n = 48). *A. purpurata* was the pistillate parent. No emasculation was necessary because *A. purpurata* does not self-pollinate. The calyx and corolla of *A. purpurata* were opened manually to free the pistil. Flowers of *E. elatior* were emasculated. Each flower of the pistillate parent was pollinated by brushing the stigma with the staminal column from a flower of the staminate parent. Pollinated flowers were tagged and seeds were collected 3 months later. Female fertility was determined by calculating the percentage of ovules developing into normal-sized seeds. Seeds from these crosses were planted in 30 × 40-cm trays in the greenhouse, and seedlings were transplanted to the field 3 months later for evaluation and comparison to the parents. Later, 14-month-old flowering plants were identified as hybrids according to morphological characters distinguished as different from those of the parents.

Results and Discussion

Intergeneric hybrids between both selections of *A. purpurata* and a rose-pink bracteated selection of *E. elatior* were achieved with relative ease. It was not necessary to apply embryo rescue techniques to obtain intergeneric progeny. *Alpinia purpurata* and *E. elatior* are perennial diploids having 2n = 48 chromosomes; thus, intergeneric hybrids can be formed. Optimum growing conditions (temperature, light, water, and mineral nutrition) may have contributed to the high success rate for these control pollinations. Pollination and fertilization were successful for both combinations. About 20% of the pollinations yielded viable hybrid seeds (Table 1).

The inflorescence in *A. purpurata* is a terminal spike at the apex of a leafy shoot, congested, and may be up to 25 cm long. It is cone-like with an acute apex (Fig. 1). Bracts measure 2 × 1 cm; are numerous, obovate, and

Received for publication 8 July 1996. Accepted for publication 25 Feb. 1997. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

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Table 1. Number of pollinations attempted and intergeneric fruits, seeds and plants obtained from crossing *Alpinia* purpurata (female) with *Etlingera elatior* (male).

Combination	Pollinations attempted	Structures obtained (no.)		
		Fruits	Seeds	Plants
Red-bracteated female x male	84	18	1100	187
Pink-bracteated female x male	72	15	678	103

Fig. 1. Inflorescences of taxa involved in the intergeneric cross. (**left**) = *Etlingera elatior*, (**middle**) = *Alpinia* purpurata, (**right**) = intergeneric hybrid between.

acute; are borne close together; and some upper bracts envelop an inconspicuous white flower. Seed is formed only with manual pollination. These inflorescences commonly produce aerial offshoots. Small leafy plantlets often develop behind bracts on the lower part as the inflorescence matures.

The inflorescence in *E. elatior* is a terminal panicle on a leafless floral shoot, shaped like a spectacular torch, obloid with an obtuse apex. Bracts are waxy, rose-red to rose-pink, and narrowly tipped with white (Fig. 1). The lowermost bracts are greatly enlarged, waxy, and flowerless, forming a collar or nest for smaller, upper bracts that contain red flowers (Steffey, 1986). Fruits are seed-bearing capsules with three compartments.

Hybrid seedlings were vigorous with vegetative morphology similar to the maternal parent, but they exhibited characters not previously observed in *A. purpurata* (Fig. 1). These hybrids differed from *E. elatior* in the shape and color of their inflorescences, reduced aerial offshoot production, and increased production of flowers. The inflorescence of hybrids was intermediate in shape between those of the parents and bulkier than that of the parental species (Fig. 1), but it resembled *A. purpurata* in having obloid morphology, yet it was more rigid than this pistillate parent. Bracts showed a close resemblance to *A. purpurata*, but were slightly larger and spathulate-shaped, with the apex pinkish and becoming whitened toward the base. Inflorescence morphology exhibited more variation than vegetative morphology. The pseudo-stem was intermediate between those of the parental species in terms of robustness, but was similar to the paternal parent in being more waxy. The surface texture of the hybrid leaves was coarse like that of *A. purpurata*, as contrasted to the soft, downy texture of *E. elatior*. A total of 88 hybrids observed revealed variation within this progeny concerning shape and color of the inflorescence.

These hybrids were fertile and produced more flowers than *A. purpurata,* and fruits were formed from these flowers without manual pollination, traits similar to the staminate parent. All fruits exhibited ovule development, with an average of 70 well-developed seeds. From an estimated total of 300 ovules, 95 developed into larger seeds.

In a series of reciprocal crossing experiments over 3 years, using the red-bracteated and the pink-bracteated selections of *A. purpurata*, the crosses yielded only 10% fruit set.

Conclusion

Intergeneric hybridization between *A. purpurata* and *E. elatior* was easily obtained and constitutes the first intergeneric cross involving the genera *Alpinia* and *Etlingera*. The northogenus X *Alpingera* is proposed for the generic name. The new hybrid species is described as follows:

Northospecies nova x *Alpingera martinica* F.Luc-Cayol [female *Alpinia purpurata* (Vieill.) K. Schum. x male *Etlingera elatior* (Jack) R. M. Smith] *distinguibili inflorescentia lata ellipsoidica cum bracteae spathulatis cum apice subroseo albicani prope base.*

Robust perennial herb with pseudo-stems arising from a rhizome system to a height of 2 to 5 m. Leaves are alternate, pointed, to 50 cm long in two ranks. Inflorescences are a congested, oblong ellipsoidal spike bearing bracts up to 25 cm long, and borne terminally on a leafy shoot. Bracts are spathulate-shaped with apex pinkish becoming whitened near base, to 2×1.5 cm. Numerous white flowers are borne behind upper bracts. Fruits are capsules with three compartments, oblong to 4×3 cm, with color variable from deep pink to white. Each capsule contains about 70 round seeds that are grey and 1 to 2 mm in diameter.

Holotype: Fereol 001, 25 Nov. 1996, deposited at MPU (Institut de botanique, 163 rue Auguste Broussonnet, 34000 Montpellier, France); Isotypes: Fereol 001, Museum d'Histoire Naturelle, Parc floral, 97200 Fort de France, Martinique.

One hybrid progeny exhibits superior floricultural traits and is worthy of extensive propagation.

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