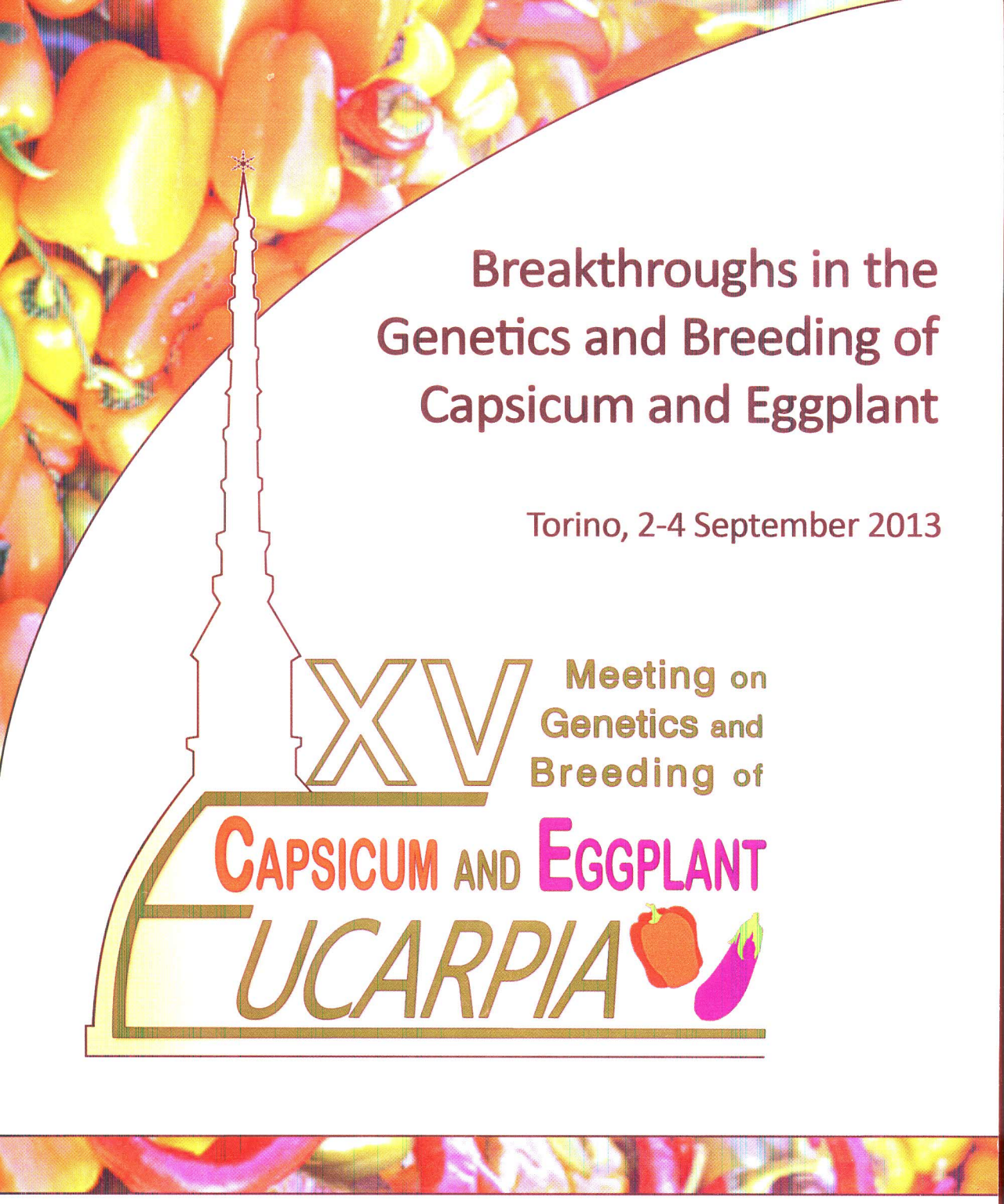

Breakthroughs in the Genetics and Breeding of Capsicum and Eggplant

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New Jalapeño-type cultivars developed by EMBRAPA, Brazil

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Abstract

Capsicum agribusiness in Brazil is worth about US$ 50 to 60 million a year. Chile peppers are cultivated in all Brazilian states, with expressive areas of Jalapeño-type in Goiás, Minas Gerais, and São Paulo. *Capsicum* agribusiness has demanded the generation of new chile pepper cultivars adapted to Brazil, due to increased demands from small and large processing companies. Since 1980, the Brazilian Agricultural Research Corporation (Embrapa) has conducted projects on *Capsicum*, from germplasm collection in the Amazon to participatory breeding with farmers' communities. Embrapa's main *Capsicum* breeding program is conducted by its National Research Center for Vegetable Crops, Embrapa Hortaliças. The program has been partly financed by the private sector. Two Jalapeño-type cultivars were released in 2009 that were the result of a joint research project between Embrapa and Sakura-Nakaya Alimentos Ltda. The main objective of this work was to develop high-yielding Jalapeño-type cultivars with high pungency, concentrated fruit set and agronomically adapted to Central Brazil. These new cultivars were derived from a varietal mixture cultivated by the private sector, with predominance of Jalapeño-like plants. Two superior open-pollinated Jalapeño-type lines were selected and released, 'BRS Sarakura' and 'BRS Garça.' Selection was based on plant and fruit characteristics such as plant architecture and height (compact plants), concentrated fruit ripening and easy picking, shape and size of fruit, immature and mature fruit color, pungency, field and industrial yield. Both cultivars are early yielding and highly uniform. 'BRS Garça' has yielded around 55 t/ha and its pungency is *circa* 50,000 SHU. 'BRS Sarakura' plants are compact with concentrated fruit ripening, yielding up to 60-65 t/ha with a pungency of about 58,000 SHU. Their resistance to virus diseases and nematodes are noteworthy; and in comparison to the original population, yields have increased by ca. 90-100%.

Keywords: *Capsicum annuum*, breeding, yield.

Introduction

Jalapeño peppers (*Capsicum annuum* L.) are originally from Mexico and were so named because they are traditionally grown in the city of Jalapa (Xalapa), Vera Cruz (Hernández, 1994). The jalapeño pepper is very popular in Mexico and in the United States of America, and it is becoming increasingly popular also in Brazil. Jalapeños are very versatile and green fruit can be consumed fresh, canned, pickled, dried and smoked (chipotle) and in sauces. The Jalapeño red fruit is commonly used by sauce processing industries in Brazil. This type of chile pepper is around 7 cm long and 3 cm wide, mildly pungent (8,000 to 30,000 SHU), and with a flavor similar to bell peppers (Casseres, 1981; Hernández, 1994). The standard Jalapeño pod is smooth, glossy, with suberized longitudinal cracks, thick walls, and taper to a rounded tip (Andrews, 1985).

The area cultivated with Jalapeño in Brazil is still small, restricted to the states of Minas Gerais, Goiás, Paraná, Bahia, and São Paulo, but the interest by processing industries in this type of hot pepper is increasing (Ribeiro et al. 2008). Most of the Jalapeño cultivars available in the Brazilian market have been imported from the U.S.A. and are not adapted to the agroecological conditions of central Brazil. Moreover, some farmers cultivate their own variety or population that presents high heterogeneity, segregating for important traits such as pungency. These genotypes generally present low yield, small fruit, with a pungency level below that desired by the processing industry, and indeterminate habit that hinders mechanical harvest.

Since 1980, Embrapa Vegetables has conducted projects on *Capsicum*, from germplasm collection to participatory breeding with farmers' communities; these programs have been partly financed by the private sector, and the main objective of this joint research project was to develop high-yielding Jalapeño-type cultivars, with good industrial traits (high pungency), and adapted to Central Brazil.

Materials and Methods

Individual Jalapeño-like plants were selected from a varietal mixture cultivated by the private sector. From each plant selected in the field F_2 families were developed, and single plant selection was accomplished within each family. Five generations of single plant selection and selfing were performed until the progenies showed no segregation. During each generation, selection for agronomic and processing traits relevant to the industry was undertaken. Selection was based on plant and fruit characteristics such as plant architecture and height (compact plants), concentrated fruit ripening and easy picking, shape and size of fruit, immature and mature fruit color, pungency, field and marketable yield.

Two superior lines were selected and seeds were increased to be used in subsequent field trials.

Replicated trials were conducted at Embrapa in Brasília, DF. Data for plant and fruit traits were based on a randomized complete block design with 8 replications containing 36 plants each over 2 years. Plants were uniformly spaced at 0.40 x 0.75 m for a plant population of 33,333 plants per hectare. Plants were grown using standard agronomic practices for pepper that are commonly used in central Brazil. From each plot, 10 randomly selected fruit were analyzed for quality traits. Pungency was determined by high-performance liquid chromatography and liquid chromatography-mass spectrometry (Parrish, 1996).

Both lines were evaluated for resistance to bacterial wilt (*Ralstonia solanacearum*), bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*), phytophthora root rot (*Phytophthora capsici*), powdery mildew (*Oidiopsis taurica*), and root-knot nematodes (*Meloidogyne incognita* race 1, *M. javanica* and *M.mayaguensis*).

Results and Discussion

The new open-pollinated Jalapeño-type cultivars named 'BRS Sarakura' and 'BRS Garça' were released in 2009 (Figure 1). Both cultivars are early yielding and highly uniform. 'BRS Garça' yielded 55 t/ha and its pungency is circa 50,000 SHU. Plant height (≈ 80 cm) and width (≈ 75 cm) are higher than 'BRS Sarakura.' Plants of 'BRS Sarakura' are compact (plant height ≈ 40 cm and width ≈ 65 cm), fruit ripening is concentrated, and yields up to 60-65 t/ha with a pungency of about 58,000 SHU. In comparison to the original population (≈ 30 t/ha), yields have increased by 90-100% (Table 1).

Their resistance to bacterial wilt, bacterial spot and root-knot nematodes are noteworthy (Table 2) and virus diseases have not been detected in commercial fields of 'BRS Sarakura'.

Table 1. Fruit and plant characteristics for 'BRS Sarakura' and 'BRS Garça' evaluated over the years 2007 and 2008.

	Yield (T/ha)	Fruit width (cm)	Fruit length (cm)	Fruit weight (g)	Wall thickness (mm)	Heat (SHU)
BRS Sarakura	60	3.2	10	40	5	58,000
BRS Garça	55	3.0	11	40	5	50,000

Table 2. Evaluation of 'BRS Sarakura' and 'BRS Garça' for multiple disease resistance.

	BW	BS	PM	Nematodes			Phy
				Mi R1	Mj	Mg	
BRS Sarakura	IR	R	S	R	R	S	S
BRS Garça	R	R	S	S	R	S	S

BW= bacterial wilt; BS= bacterial spot; PM= powdery mildew; Mi R1 = *Meloidogyne incognita* race 1; Mj= *M. javanica*; Mg= *M.mayaguensis*; Phy= Phytophthora root rot.
R=Resistant; IR= Intermediate resistance; S=Susceptible.

'BRS Sarakura' and 'BRS Garça' produce excellent yields that have been superior to hybrids and open-pollinated cultivars available in the Brazilian market, and to the original population. The heat levels of both cultivars are considered high by industry standards, and are superior to the hot cultivar 'Early Jalapeño', with about 48,000 SHU (Bosland and Votava, 1998).

Both cultivars have a per-pod weight greater than 'NuMex Jalmundo' (34 g), an open-pollinated large-sized jalapeño cultivar recently released by New Mexico State University (Bosland, 2010).

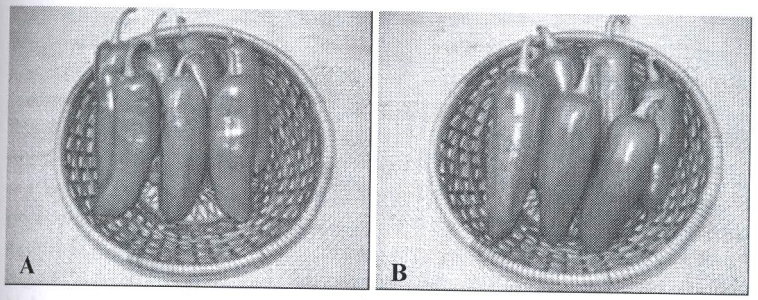

Figure 1. 'BRS Garça'(A) and 'BRS Sarakura'(B).

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