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Sources of resistance against the *Pepper yellow mosaic virus* in chili pepper

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ABSTRACT

The *Pepper yellow mosaic virus* (PepYMV) naturally infects chili and sweet pepper, as well as tomato plants in Brazil, leading to severe losses. This work reports the reaction to the PepYMV of 127 *Capsicum* spp. accessions, aiming at identifying resistance sources useful in breeding programs. The experiment was carried out in a completely randomized design, with eight replications, in greenhouse conditions. Plants were protected with an insect-proof screen to avoid virus dissemination by aphids. Leaves of *Nicotiana debneyi* infected with the PepYMV were used as the inoculum source. Plants were inoculated with three to four fully expanded leaves. A second inoculation was done 48 hours later to avoid escapes. Only the youngest fully expanded leaf was inoculated. Two plants were inoculated only with buffer, as negative control. Symptoms were visually scored using a rating scale ranging from 1 (assymptomatic plants) to 5 (severe mosaic and leaf area reduction). Nine accessions were found to be resistant based on visual evaluation. Their resistance was confirmed by ELISA. Two resistance accessions belong to the species *C. baccatum* var. *pendulum*, while the seven other were *C. chinense*. No resistant accessions were identified in *C. annuum* var. *annuum*, *C. annuum* var. *glabriusculum*, and *C. frutescens*.

Keywords: *Capsicum* spp., *Pepper yellow mosaic virus*, *Potyvirus*, germplasm evaluation, disease resistance, pre-breeding.

RESUMO

Fontes de resistência ao Mosaico Amarelo do Pimentão em pimentas

O Mosaico Amarelo do Pimentão é causado pelo *Pepper yellow mosaic virus* (PepYMV) e tem ocorrência natural na maioria das regiões produtoras de pimenta, pimentão e tomate do Brasil, causando sérias perdas nas culturas de pimentão e pimenta. Este trabalho teve como objetivo avaliar a resistência de 127 acessos de *Capsicum* spp. ao PepYMV, com o intuito de identificar fontes de resistência a serem utilizadas em programas de melhoramento. O experimento foi conduzido em delineamento inteiramente casualizado, com oito repetições, em casa de vegetação, protegida com tela à prova de insetos, para evitar a disseminação do vírus por afídeos vetores. Folhas de *Nicotiana debneyi* infectadas com o PepYMV foram utilizadas como fonte de inóculo. Plântulas dos diferentes acessos foram inoculadas no estádio de três a quatro folhas definitivas e reinoculadas 48 horas após, para evitar escapes. Apenas as folhas mais jovens completamente expandidas foram inoculadas. Como controle negativo, duas plantas de cada acesso foram inoculadas apenas com solução tampão. A avaliação visual foi feita por meio de escala de notas de 1 (plantas assintomáticas) a 5 (plantas com sintomas severos de mosaico bolhoso e redução da área foliar). Nove acessos foram identificados como resistentes e, por meio do teste sorológico ELISA indireto, as plantas assintomáticas foram confirmadas como resistentes. Dois acessos resistentes pertencem à espécie *Capsicum baccatum* var. *pendulum* e, sete, à espécie *Capsicum chinense*. Não foram encontrados acessos resistentes de *C. annuum* var. *annuum*, *C. annuum* var. *glabriusculum* e *C. frutescens*.

Palavras-chave: *Capsicum* spp., *Pepper yellow mosaic vírus*, *Potyvirus*, avaliação de germoplasma, resistência a doenças, pré-melhoramento.

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Chili and sweet pepper belong to the genus *Capsicum*. Both crops have an increasing importance as a suitable alternative to small farmers, representing an incentive for family agriculture in Brazil (Ribeiro, 2004). Chili peppers represent a new market to Brazilian agriculture and to the food, pharmaceutical, and cosmetic industry. Products containing substances extracted from these species are currently used by a quarter of the global population, particularly for food seasoning (Carvalho *et al*., 2003).

In spite of the recent technological advances in chili pepper production systems, plant pathogens still rank among the key impediments for end-products high yield and quality. Several fungi, bacteria, and virus diseases, occurring both in protected and non-protected cultivation, are main causes of farmers´ difficulties (Azevedo *et al*., 2005). The aphid-transmitted viruses caused by species of the genus *Potyvirus*, namely the *Potato virus Y* (PVY), the *Tobacco Eech virus* (TEV), the *Pepper veinal mottle virus* (PVMV), the *Chilli veinal mottle virus* (ChiVMV), and the *Pepper yellow mosaic virus* (PepYMV) (Inoue-Nagata *et al*., 2001), impose severe losses to chili and sweet pepper production all around the world.

The PepYMV causes the yellow mosaic. The virus is present in most of the chili and sweet pepper (Inoue-Nagata *et al*., 2002) and tomato (Cunha *et al*., 2004) production zones in Brazil. The disease is responsible for significant losses in the Brazilian Mid-West and Southeast regions, mainly in sweet pepper (Echer & Costa, 2002; Zambolim *et al*., 2004). In tomato, Costa *et al*. (2003) estimated production losses ranging from 60 to 80% in fields at Venda Nova do Imigrante County (ES). The PepYMV

was first reported in Brazil in 1980. It was at that moment named as PVY^M, since it was supposed to be an aggressive PVY strain, able to break the resistance of some cultivars (Boiteux *et al*., 1996). Later, Inoue-Nagata *et al*. (2001) isolated and molecularly characterized some PVY^M isolates. These studies confirmed a new *Potyvirus* species, named then *Pepper Yellow Mosaic Virus.*

The use of improved cultivars that bring together virus resistance, marketable fruit quality, and high yield is one of the most efficient alternatives for controlling the yellow mosaic. Therefore, breeding programs currently active in the country have been searching for resistance sources within *Capsicum* spp. germplasm banks. Sources of resistance to the PepYMV in *Capsicum* have been effective and long-lasting under artificial inoculation in the field (Echer & Costa, 2002). Resistant sweet pepper (*Capsicum annuum*) cultivars are already available, such as the hybrid Magali R, considered as the commercial resistance pattern to the PepYMV (Truta *et al*., 2004), and the open-pollinated cultivars Myr-29 and Myr-10 (Echer & Costa, 2002).

The objective of this research was to evaluate 127 *Capsicum* accessions of the Germplasm Bank of the State University of Norte Fluminense Darcy Ribeiro (UENF). The target was to identify new sources of resistance to the PepYMV to be included in *Capsicum* breeding programs.

MATERIAL AND METHODS

Plant material and growing conditions - The experiments were carried out in the area used under an Agreement signed by the State University of Norte Fluminense (UENF) and the Agricultural Research Corporation of the State of Rio de Janeiro (PESAGRO-RIO), Experimental Station of Campos, in Campos dos Goytacazes County, Rio de Janeiro State, in two steps, from May to November, 2007. We evaluated 127 accessions (Table 1), which had been previously agronomic and morphologically characterized (Sudré *et al*., 2005; Bento *et al*., 2007; Lima *et al*., 2007). The susceptible sweet pepper cultivar Ikeda (Ávila *et al*., 2004) was used as positive control.

Seeds of the accessions and cultivar Ikeda were sown in 128-cell polystyrene foam trays with organic substrate (Plantmax®). Upon developing two pair of leaves, plantlets were individually transferred to plastic pots filled with a mixture of soil and substrate (2:1). The experiment was carried out in cages covered with aphid-proof screens to avoid virus dissemination by vectors, in greenhouse. The average temperature ranged between 27.6ºC (day) to 21.5ºC (night). Each accession was replicated eight times, in a completely randomized design, numbering 1016 plants.

Inoculation and evaluation of resistance to the PepYMV - The inoculum source consisted of plants of *Nicotiana debneyi* mechanically inoculated with the PepYMV-3 isolate, collected in sweet pepper, in Igarapé County, Minas Gerais State (Truta *et al*., 2004). Plants under evaluation, including cultivar Ikeda, were inoculated using extracts of the inoculum source, prepared in potassium phosphate buffer 0.05 M, pH 7.2, with sodium sulphate 0.01%. Carborundum (600 mesh) was used as abrasive (Truta *et al*., 2004). Inoculum extracts were prepared using 1.0 g of infected leaves in 1.0 mL of buffer. Plants were inoculated when presenting three to four fully expanded leaves, and re-inoculated 48 hours later, to avoid infection escape. Only the youngest and fully developed leaf was inoculated in each plant. Two plants of each accession were inoculated exclusively with buffer, as a negative control.

Evaluation began 15 days after the first inoculation, when symptoms started appearing, and went on every other day, up to 39 days after the first inoculation. Symptoms were visually assessed using a rating scale (Bento, 2008), developed on preliminary pilot experiments, as follows: score 1 = symptomless plants; 2 = plants showing slight symptoms (up to 25% of the leaf area with small mosaic dots); 3 = plants showing moderate symptoms (up to 50% of the leaf area with mosaic); 4 = strong symptoms (up to 75% of the leaf area with mosaic); and 5 = severe symptoms (100% of the leaf area with mosaic, leaves displaying swelling and curling, and reduction of leaf area). Analysis of variance and the means clustering test of Scott-Knott were performed using the software GENES (Cruz, 2006).

Accessions with score 1 in this first assay were re-evaluated using the same methodology. To confirm accessions resistance to the PepYMV, symptomless plants were submitted to indirect ELISA (*Enzyme-linked immunosorbent assay*) (Clark *et al*., 1986), using a polyclonal antiserum produced against the isolate PepYMV-3 (Truta *et al.*, 2004). Indirect ELISA was carried out at the Plant Virology Laboratory, Federal University of Viçosa (UFV), in Viçosa County, Minas Gerais State. To perform ELISA, we used 0.5 g of plant tissue collected in 4 to 6 young leaves from the *Capsicum* accessions that re-scored 1 in the second assay, as well as from the positive and negative controls, and from *N. debneyi* plants infected with the PepYMV. Leaves were crushed in a mortar, with 2.5 mL of extraction buffer (1:5 dilution). Plant extracts were stored in labeled flasks and kept at -20ºC until using. Four 100 µl replications per accession, per plate, were used. Antiserum was diluted to 1:10.000, and, the conjugate, to 1:2000, both in PEP buffer (Clark *et al.*, 1986). After adding the substrate (*p*-nitrofenil-fosfato, 1 mg mL^{-1}), plates were kept at room temperature, in the dark, for 30 minutes. Following, the color intensity developed as consequence of the enzymatic reaction was assessed using a Titertek Multiskan Plus MK II data logger, at 405 nm. Absorbance values lower than twice the negative control (healthy plants) were considered as indication of virus absence in the sample (Sutula *et al.* (1986).

RESULTS AND DISCUSSION

Virus symptoms were observed in several plant growing stages, confirming the virulence of isolate PepYMV-3. There were significant differences among the 127 *Capsicum* spp. accessions in relation to resistance to the PepYMV, ranging from absence of symptoms (score 1) to leaf distortion and swelling mosaic (score 5). Such variation

Table 1. Code number, species, origin, and average of scores of 128 *Capsicum* accessions assessed for resistance against the *Pepper yellow mosaic virus* - PepYMV (número de registro, espécie, procedência e médias das notas dos 128 acessos de *Capsicum* spp. testados quanto à resistência ao PepYMV). Campos dos Goytacazes, UENF, 2007.

UENF Code	Species	Origin	Score Average[1]	UENF Code	Species	Origin	Score Average[1]
1553	*C. chinense*	Goiânia, GO	5 a	1784	*C. chinense*	São Luís, MA	3 c
1615	*C. chinense*	Viçosa, MG	5 a	1786	*C. chinense*	São Luís, MA	3 c
1630	*C. baccatum var. pendulum*	Campos, RJ	5 a	1789	*C. chinense*	São Luís, MA	3 c
1735	*C. baccatum var. pendulum*	Viçosa, MG	5 a	1790	*C. frutescens*	São Luís, MA	3 c
1743	*C. chinense*	Marajó-Souré, PA	5 a	1797	*C. baccatum var. pendulum*	Viçosa, MG	3 c
1800	*C. frutescens*	Bequimão, MA	5 a	1799	*C. annuum var. annuum*	Bequimão, MA	3 c
1810	*Capsicum sp.*	Campos, RJ	5 a	1805	*C. chinense*	Campos, RJ	3 c
1417	*C. chinense*	Campos, RJ	4 b	1422	*C. annuum var. annuum*	Topseed	2 d
1424	*C. chinense*	Campos, RJ	4 b	1490	*C. frutescens*	Rio de Janeiro, RJ	2 d
1426	*C. chinense*	Campos, RJ	4 b	1498	*C. chinense*	Rio de Janeiro, RJ	2 d
1497	*C. chinense*	Campos, RJ	4 b	1503	*C.chinense*	México	2 d
1499	*C. chinense*	Campos, RJ	4 b	1611	*C. baccatum var. pendulum*	Viçosa, MG	2 d
1559	*C.annuum var. glabriusculum*	Cachoeira de Macacu,RJ	4 b	1612	*C. baccatum var. pendulum*	Viçosa, MG	2 d
1612	*C. baccatum var. pendulum*	Viçosa, MG	4 b	1616	*C. baccatum var. pendulum*	Viçosa, MG	2 d
1613	*C. baccatum var. pendulum*	Viçosa, MG	4 b	1618	*C. chinense*	Viçosa, MG	2 d
1615	*C. chinense*	Viçosa, MG	4 b	1631	*C. baccatum var. pendulum*	Celina, ES	2 d
1622	*C. annuum var. annuum*	Estados Unidos	4 b	1634	*C. chinense*	Vargem Alta, ES	2 d
1628	*C. baccatum var. pendulum*	Campos, RJ	4 b	1636	*C. frutesces*	Miranda, MS	2 d
1629	*C. baccatum var. pendulum*	Campos, RJ	4 b	1637	*C. baccatum var. pendulum*	Miranda, MS	2 d
1639	*C. baccatum var. pendulum*	Feltrin Sementes	4 b	1714	*C. baccatum var. pendulum*	Peru	2 d
1722	*C. chinense*	Ilhéus, BA	4 b	1715	*C. chinense*	Peru	2 d
1723	*C. chinense*	Campos, RJ	4 b	1719	*C. baccatum var. pendulum*	Renascença, PR	2 d
1752	*C. chinense*	Ilhéus, BA	4 b	1731	*C. frutescens*	Petrolina, PE	2 d
1771	*C. chinense*	Bequimão, MA	4 b	1733	*C. baccatum var. pendulum*	Campos, RJ	2 d
1772	*C. chinense*	Bequimão, MA	4 b	1736	*C. chinense*	São Domingos, ES	2 d
1774	*C. chinense*	Bequimão, MA	4 b	1737	*C. baccatum var. pendulum*	Cachoeira de Macacu, RJ	2 d
1779	*C. frutescens*	Bequimão, MA	4 b	1745	*C. chinense*	Marajó-Souré, PA	2 d
1567	*C. annuum var. annuum*	Bahia, BA	3 c	1746	*C. chinense*	Marajó-Souré, PA	2 d
1623	*C. annuum var.annuum*	Campos, RJ	3 c	1747	*C. frutescens*	Marajó-Souré, PA	2 d
1625	*C. baccatum var. pendulum*	Campos, RJ	3 c	1750	*C. annuum var. glabriusculum*	Campos, RJ	2 d
1626	*C. annuum var. annuum*	Campos, RJ	3 c	1762	*C. chinense*	Belém, PA	2 d
1633	*C. baccatum var. pendulum*	Campos, RJ	3 c	1763	*C. chinense*	Belém, PA	2 d
1704	*C. baccatum var. pendulum*	Viçosa, MG	3 c	1767	*C. chinense*	Belém, PA	2 d
1707	*C. chinense*	São Luis, MA	3 c	1768	*C. chinense*	Belém, PA	2 d
1709	*C. chinense*	São Luis, MA	3 c	1775	*C. frutescens*	Bequimão, MA	2 d
1716	*C. chacoense*	Argentina	3 c	1785	*C. chinense*	São Luís, MA	2 d
1717	*C. annuum var annuum*	Renascença, PR	3 c	1788	*C. chinense*	São Luís, MA	2 d
1718	*C. baccatum var pendulum*	Renascença, PR	3 c	1790	*C. frutescens*	São Luís, MA	2 d
1721	*C. chinense*	Ilhéus, BA	3 c	1792	*C. chinense*	São Luís, MA	2 d
1725	*C. chinense*	Ilhéus, BA	3 c	1793	*C. chinense*	São Luís, MA	2 d
1726	*C. chinense*	Ilhéus, BA	3 c	1794	*C. chinense*	São Luís, MA	2 d
1727	*C. frutescens*	Ilhéus, BA	3 c	1798	*C. chinense*	Campos, RJ	2 d
1744	*C. chinense*	Marajó-Souré, PA	3 c	1802	*C. frutescens*	Campos, RJ	2 d
1748	*C. chinense*	Marajó-Souré, PA	3 c	1806	*C. chinense*	Campos, RJ	2 d
1749	*C. chinense*	Campos, RJ	3 c	1808	*Capsicum sp.*	Campos, RJ	2 d
1753	*C. chinense*	Ilhéus, BA	3 c	1811	*Capsicum sp.*	Campos, RJ	2 d
1757	*C. chinense*	Ilhéus, BA	3 c	1812	*Capsicum sp.*	Campos, RJ	2 d
1758	*C. chinense*	Ilhéus, BA	3 c	1624	*C. baccatum var. pendulum*	Campos, RJ	1 e
1761	*C. chinense*	Belém, PA	3 c	1755	*C. chinense*	Peru	1 e
1765	*C. chinense*	Belém, PA	3 c	1764	*C. chinense*	Belém, PA	1 e
1766	*C. frutescens*	Belém, PA	3 c	1770	*C. chinense*	Belém, PA	1 e
1773	*C. chinense*	Bequimão, MA	3 c	1703	*C. chinense*	Viçosa, MG	1 e
1776	*C. frutescens*	Rosário, MA	3 c	1730	*C. chinense*	Peru	1 e
1780	*C. chinense*	Bequimão, MA	3 c	1732	*C. baccatum var. pendulum*	Campos, RJ	1 e
1781	*C. chinense*	Bequimão, MA	3 c	1751	*C. chinense*	Parintins, AM	1 e
1782	*C. chinense*	Bequimão, MA	3 c	1803	*C. chinense*	Campos, RJ	1 e

[1]Means followed by the same letter in each column did not differ significantly from each other, Scott & Knott clustering test, $p<0.01$ (médias seguidas das mesmas letras em cada coluna não diferem significativamente entre si, teste de agrupamento de Scott & Knott, $p<0,01$).

reveals the diversity present within the germplasm assessed regarding resistance to the PepYMV. Nine accessions did not develop symptoms and were scored as 1 (Table 1). Among these, two accessions were *Capsicum baccatum* var. *pendulum* (UENF1624 and UENF1732) and, seven, *C. chinense* (UENF1703, UENF1730, UENF1732, UENF1751, UENF1755, UENF1764 and UENF1803). The *C. baccatum* accessions were both collected in Campos dos Goytacazes, Rio de Janeiro State, while *C. chinense* had several origins: one accession came from Viçosa County, Minas Gerais State; two from Pará State (UENF1764 and UENF1770, from Belém County); one from Amazonas State (UENF1751, from Parintins County); and two from Peru (UENF1730 and UENF1755) (Table 1). Cunha *et al*. (2004) had previously identified two *C. chinense* accessions, PI159236 and PI152225, as sources of resistance to the PepYMV. Nevertheless, as far as we are concerned, no resistance sources have been described yet in *C. baccatum*.

Following the identification of the symptomless accessions, the serological indirect ELISA was carried out to confirm the resistance to the PepYMV. Symptom development in inoculated plants is dependent on the virus isolate, cultivar, and environmental conditions (Rowhani, 1997). The remaining accessions were susceptible, developing typical symptoms, and were not submitted to ELISA.

Capsicum plants inoculated only with buffer and *Nicotiana debneyi* plants infected with isolates PepYMV-3 and PepYMV-11 correspond respectively to ELISA negative and positive controls. Results reconfirmed accessions resistance to the PepYMV: the average absorbance values of samples coming from symptomless plants were below the threshold, namely, twice the average of the negative control. Therefore, those plants were not infected by PepYMV, according to the methodology suggested by Sutula *et al.* (1986) (Table 2). Positive controls had high absorbance values, attesting that ELISA was properly performed and the antiserum was effective in recognizing the virus isolate. Accessions found as resistant in the first assay behave as resistant also in a second assay, carried out using the same inoculation and evaluation protocols as before, both in visual evaluation and ELISA. No plants showed late infection or restriction of symptoms to isolated plant parts.

Table 2. Code number, species, absorbance values for indirect ELISA, and final evaluation of nine *Capsicum* sp. accessions assessed for resistance to the *Pepper yellow mosaic virus* (número de registro, espécie, valores de absorbância para ELISA indireto e avaliação final de nove acessos de *Capsicum* spp. testados quanto à resistência ao PepYMV). Campos dos Goytacazes, UENF, 2007.

Code number	Species	Absorbance	[1]ELISA	[2]Final evaluation
1624	*C. baccatum var. pendulum*	0,142	-	R
1703	*C. chinense*	0,145	-	R
1730	*C. chinense*	0,131	-	R
1732	*C. baccatum var. pendulum*	0,132	-	R
1751	*C. chinense*	0,141	-	R
1755	*C. chinense*	0,106	-	R
1764	*C. chinense*	0,179	-	R
1770	*C. chinense*	0,163	-	R
1803	*C. chinense*	0,150	-	R
1624 (-)	*C. baccatum var. pendulum*	0,174	-	-
1703 (-)	*C. chinense*	0,127	-	-
1730 (-)	*C. chinense*	0,115	-	-
1732 (-)	*C. baccatum var. pendulum*	0,155	-	-
1751 (-)	*C. chinense*	0,289	-	-
1755 (-)	*C. chinense*	0,238	-	-
1764 (-)	*C. chinense*	0,302	-	-
1770(-)	*C. chinense*	0,306	-	-
1803 (-)	*C. chinense*	0,209	-	-
N. debneyi (-)	*Nicotiana debneyi*	0,333	-	-
N. debneyi (-)	*Nicotiana debneyi*	0,326	-	-
1422 (+)	*C. annuum var. annuum cv. Ikeda*	0,711	+	S
Isolado 3 (+)	*Nicotiana debneyi*	1,468	+	S
Isolado 11 (+)	*Nicotiana debneyi*	1,259	+	S

[1](+) = Positive reaction to the virus presence (reação positiva à presença do vírus); (-) = negative reaction to the virus presence (reação negativa à presença do vírus); [2]R = resistance (resistência); S = susceptibility (suscetibilidade).

According to the rating scale, some accessions were more susceptible than cultivar Ikeda, the susceptible control. However, due to the large number of plants, we did not submit plants with symptoms to ELISA. Thus, no comparisons of the absorbance values of these accessions were made. Nevertheless, symptoms observed in susceptible plants were clear enough to unquestionably consider them as susceptible.

In *Capsicum* spp., the first promising sources of resistance to the PepYMV were *C. annuum* cultivar Criollo de Morellos 334 (CM334, monogenic dominant resistance) and *C. chinense* PI 159236 (monogenic recessive resistance) (Boiteux & Pessoa, 1994; Boiteux *et al*., 1996). Nonetheless, in spite of the broad literature survey, we did not find reports of resistance to the PepYMV in *C. baccatum*. Thus, this report is likely to be the first ever. Additional investigation about the inheritance of resistance by means of intra and interspecific crosses, in *C. baccatum* and *C. annuum* backgrounds, respectively, must be carried out to identify the number of genes involved in the reaction, as well as other genetic parameters important to breeders. Molecular techniques are helpful in characterizing the resistance sources described here. PCR-based molecular markers able to detect some PepYMV resistance genes are already available. This is the case for allele *Pvr4*, original

from *C. annuum* accession CM-334, which was mapped to sweet pepper chromosome 10 (Grube *et al*., 2000): there is a marker only 2,1 ± 0,8 cM away from allele *Pvr4* (Caranta *et al*., 1999; Arnedo-Andrés *et. al*., 2002).

Although *C. baccatum* and *C. annuum* are clustered in distinct gene pools, crossings between the two species had been successfully made (Campos, 2006). Therefore, the transference and pyramiding of resistance genes from one species to the other is expected to be feasible. It should be highlighted that the search for resistance to the PepYMV is important not only to sweet and chili peppers, but also to tomato. Contrary to what is found in *Capsicum*, in which resistance sources have already been identified in *C. annuum*, in commercial terms the most important species in the genus, *C. chinense*, and now in *C. baccatum*, in tomato, Juhász *et al.* (2006) did not find resistance among the 355 *Lycopersicon esculentum* accessions studied and, among 21 wild relatives, only a single accession of *L. hirsutum* was resistant. Lourenção *et al.* (2005) identified only two sources of resistance to *Potyvirus* in tomato when assessing 16 tomato genotypes. On the other hand, in *Capsicum*, Nascimento *et al.* (2007), found resistance to the PepYMV in six experimental and one commercial hybrids out of 26 genotypes.

In sweet pepper, mostly in regions where PepYMV outbreaks take place regularly, as in Espírito Santo State (Inoue-Nagata *et. al*., 2003), it was noticed that sweet and chili pepper pictures are similar to tomato: cultivars with no genetic resistance to the pathogen prevail. Regarding sweet pepper, some resistant hybrids are already available in the market. However, the incorporation of resistance into hybrids that correspond to commercial requirements of distinct markets must be encouraged (Ávila *et al*., 2004). The resistant accessions reported in this paper are useful in breeding programs that target at the incorporation of resistance genes into the process of both sweet and chili pepper cultivar development.

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