**Agronomic performance and incidence of diseases in tomato grafted plants (*Solanum lycopersicum* L.)**

**Comportamiento agronómico e incidencia de enfermedades en plantas injertadas de tomate (*Solanum lycopersicum* L.)**

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**Abstract**

To determine the performance of tomato grafted on native tomato from México, a study in Valle de Apatzingán Michoacán, México in 2008 was established. As rootstock ecotypes of tomato *Solanum lycopersicum* L. variety *cerasiforme* (Tinguaraque) were used, and as graft the cultivar Toro® was used. A randomized complete block design with 13 treatments was performed: six grafts of tomato on Tinguaraque, six Tinguaraque and one control (tomato). Specifically in grafts and tomato (six treatments) the following characteristics were evaluated: plant height, stem diameter, number of flower clusters, height to the first floral cluster, weight, size and fruit yield per plant; moreover in all treatments (13 treatments) pH, soluble solids and moisture were registered in fruits; also the plant disease incidence was evaluated. Significant differences were found for height, diameter, flower clusters and fruit size, grafts showed higher values ​​in contrast to tomato. Among the three registered diseases (damping off, *Alternaria-Fusarium* complex and geminivirus), only damping off had statistical differences, the grafts presented lower incidence. By comparing the values of fruits characteristics, Tinguaraque and tomato presented particular values, and these did not influence the graft fruit. It was concluded that the tomato graft showed potential benefit in crop management, without devaluing fruit and plant characteristics, or yield; for grafting, the incidence of "damping off" with respect to the tomato was reduced.

**Key words:** Disease resistance, fruits characteristics, fungal diseases, grafting, México, *Solanum lycopersicum* L. variety *cerasiforme*.

**Resumen**

En el Valle de Apatzingán, Michoacán, México, se estudió el comportamiento del tomate injertado sobre tomate nativo de México*.* Como porta-injerto se utilizaron ecotipos de tomate *Solanum lycopersicum* L. variedad *cerasiforme* (‘tinguaraque’) y como injerto el cultivar (cv.) Toro®. En un diseño experimental de bloques completos al azar se dispusieron 13 tratamientos: seis injertos de tomate sobre Tinguaraque, seis Tinguaraques y un testigo (tomate). Específicamente en los injertos y tomate (seis tratamientos) se midieron las siguientes características: altura de planta, diámetro de tallo, número de racimos florales, altura al primer racimo floral, peso, tamaño y rendimiento de frutos por planta; además, en los frutos de todos los tratamientos se midieron el pH, los sólidos solubles y humedad; y en las plantas la incidencia de enfermedades. Se encontraron diferencias para altura, diámetro, racimos florales y tamaño de fruto. En los injertos se presentaron los mayores valores de estos parámetros, a diferencia del tomate. Entre las enfermedades registradas (‘damping-off’, complejo *Alternaria*-*Fusarium* y geminivirus) sólo el damping off fue significativo, siendo menor la incidencia en plantas de injerto. Las características de frutos fueron diferentes en Tinguaraques y tomate que no afectaron las características de fruto del injerto. Los resultados mostraron que el injerto de tomate tiene beneficios en el manejo del cultivo, debido a buenas características de planta y rendimiento de frutos, así como la reducción en la incidencia de damping-off con respecto a tomate.

**Palabras clave:** Características de fruta, enfermedades fungosas, injerto, México,resistencia a enfermedades, *Solanum lycopersicum* L. variedad *cerasiforme*.

**Introduction**

Tomato, also known as ‘jitomate’ in some re­gions of Mexico, and its more related plants have their center of origin in the mountai­nous, narrow and elongated region of los An­des comprising Peru, Ecuador and Chile (Pe­ralta and Spooner, 2000). The probable an­cestor of the cultivated tomato is *Solanum lycopersicum* L. var. *cerasiforme* (Esquinas-Alcázar and Nuez, 1995; Sánchez *et al.*, 2006) characterized for producing rounded fruits between 1 and 2.5 cm diameter (Martínez, 1979; Rick and Holle, 1990). It grows in a wide variety of habitats and responds to biotic and abiotic factors that cause death (Hoyt, 1992).

In Mexico, native tomato is widely distri­buted in ecological reserve areas, associated with crop fields where, commonly, it becomes a weed (Sánchez *et al.*, 2006). In Michoacán, this tomato is known as ‘tinguaraque’ (Mar­tínez, 1979), grows under adverse humidity conditions and resists high incidence of pests and diseases (Eigenbrode *et al.*, 1993; Pérez *et al.*, 1997), which are important agronomic characteristics for genetic breeding of this crop.

Tomato is one of the vegetables with the highest phytosanitary problems, since disea­ses are a limiting factor in its production. Pathogenic diseases are presented in seed­lings (damping-off), leaves (early and late blight), in stem (*Fusarium* spp.) and in fruits (apical rot and rot by *Alternaria*) (Tigchelaar, 2001; González-Chávez *et al.*, 2003; Quiroga *et al.*, 2007). In this crop, like in so many others, disease control is based on the use of organo-synthetic fungicides, carrying the al­ready documented problems (Esquinas-Al­cázar and Nuez, 1995; Zavaleta-Mejía, 1999).

Conventional breeding by plant hybridiza­tion is a fundamental method to transmit characteristics of adaptation to adverse biotic and abiotic conditions (Nuez, 1995; Pérez *et al.*, 1997; Restrepo *et al.*, 2008); however grafting, although less common, was one of the first techniques used with that aim (Kogan, 1990). In the last years, this tech­nique have awaken the interest in vegetable crops like cucumber, melon, watermelon, chili, eggplant and tomato in order to obtain resistance to diverse root diseases (Santos *et al.*, 2000; Lee, 2003). In crops like tomato, eggplant and watermelon grafting causes better plant development and yield (Choi *et al.*, 2002; Cürük *et al.*, 2005; Khah *et al.*, 2006). Specifically, the tomato rootstock Ha­waii 7996 has been used as resistance source to reduce wilting by *Fusarium* (Lee, 1994) and to control vascular wilting caused by *Rals­tonia solanacearum* (Nakaho *et al.*, 2004; Coutinho *et al.*, 2006). Tomato cv. Monika (SC 6301) is a rootstock resistant to nodular nematodes attacks, resistance that is given by the *Mi*-1.2 gen (Williamson, 1998; Verdejo-Lucas and Sorribas, 2008), graft use improves quality and physico-chemical characteristics of fruits (Coutinho *et al.*, 2006), enhances tolerance to soil salinity (Fernández-García *et al.*, 2004; Estañ *et al.*, 2005), and to high temperatures and altitudes (Venema *et al.*, 2008).

In Mexico few works document vegetable grafts (González-Chávez *et al.*, 2003); there­fore, the aims of the present research were to evaluate the agronomical performance and register the incidence of the main diseases in tomato grafted on its wild relative *S. lycopersi­cum* var. *cerasiforme*.

**Materials and methods**

Field work was done in 2008 in Morelos, Paracuaro (19º 00’ 53’’ N and 102º 16’ 44’’ O, 300 MASL), Michoacán, Mexico. The predo­minant weather is warm semi-dry (Bs1) and soil is vertosol pelico (clayey) (García, 1988).

It was used as graft the commercial to­mato cv. Toro® and as rootstock native to­mato cultivars (tinguaraque), collected in three regions of Michoacán (Álvarez-Hernán­dez *et al.*, 2009). Rootstocks were: Chico Apatzingán (ChAp), Grande Apatzingán (GAp), Acahuato (Ac), Los Reyes (LR) and Jiquilpan (Jiq); plus the wild ecotype Tabasco (Tab) from La Chontalpa region, Tabasco, Mexico.

Seeds were sown in polystyrene containers with a moss substrate base previously humi­dify (Sunshine® SunGro Horticulture, Cana­da). The tinguaraques were established first with a time interval of 30 days in order to homogenize stem diameters (rootstock-graft). Rootstock seedlings with 5 – 6 leaves and graft with 3 – 4 leaves, and similar diameter, were selected. In both stems and above the cotyledon leaves a horizontal cut was done and a pencil tip (0.5 mm) was inserted in the rootstock; next, the graft was inserted until it touched the rootstock. Immediately after, grafted plants were placed on a humid cham­ber (relative humidity 100%), at 25 ± 1 ºC and 12:12 h (light-darkness). After seven days, plants were kept at room temperature for 5 days to acclimate and later transplant to the field. Distances between plant and furrow were 1 x 0.6 m.

Plants were drip irrigated each 3 – 4 days for 30 min using 2 lt/plant of water keeping a lamina of around 8 cm. As fertilizer 60 g/plant of triple 17 (N-P-K) were added in a manual way in the days 20 and 45 after transplant. Pesticides were not used during the crop cycle and the few emerged weeds were manually controlled. 13 materials were conformed (each one is a treatment): five tin­guaraques (ChAp, GAp, Ac, LR and Jiq) plus Tabasco (Tab) and their corresponding grafts (I-ChAp, I-GAp, I-Ac, I-LR, I-Jiq and I-Tab) and tomato (Jit) as control. Treatments were organized on a complete randomized experi­mental design with three replicates, each ex­perimental unit was composed of 20 plants (12 m2), for a density of 16,666 plants/ha.

Both, in grafts as in tomato alone, it was evaluated stem height from the base of the plant till main apex tip, stem diameter (1 cm over graft callus) and number of floral stems, 75 days after transplanting (dat). Height to the first floral stem from the base till inflo­rescence rachis was registered at 50 dat.

Production was measured based on fruit weight per treatment in six established cate­gories with 15 g differences between them (2.2 - 17.2, 17.3 - 32.2, 32.3 - 47.2, 47.3 - 62.2, 62.3 - 77.2 and 77.3 - 92.2 g), this criterion was defined taking into account the weight of the harvested fruits. It was measured, as well, the fruit size according to the polar and equatorial diameters and the yield per plant in one cut.

In all the treatments (grafts, tomato and tinguaraque tomatoes) were measured fruit pH (manual potentiometer Hanna®), soluble solids (manual refractometer Atago® model HSR-500) and humidity content (%) by diffe­rences between initial and final weight after having the fractionated fruits at room tempe­rature for 10 days.

Disease incidence was registered by weekly samplings of leaves, wilting or death plants during the crop cycle. In the fungal diseases, besides their symptoms description in sick plants, the causal agent was isolated for its identification. For viral diseases it was considered incidence and severity (Table 1) with a harm scale designed for this evalua­tion, additionally, leaves samples with viral symptoms were sent to the specialized lab GISENA, Texcoco, Mexic, to determine the causal agent.

Data analysis for agronomic characteris­tics of grafts and tomato, excepting fruit weight, was done by variance on a completely randomized block design and, mean separa­tion was performed by Tukey’s test (P ≤ 0.05). For fruit weight the value limits were taken and classified in six categories of 15 g weight and by percentage it was determined the amount per weight interval. Fruit physico-chemical characteristics of grafts, tomato ad tinguaraques, were analyzed by descriptive analytics (mean and standard deviation). In this type of tomatoes, the accumulated disea­se incidence (%) was transformed to the arcsine of the square root ratio for its proce­ssing by analysis of variance and mean sepa­ration by Tukey´s test (P ≤ 0.05). For all the cases the statistical software SAS (SAS, 1997) was used.

**Results and discussion**

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| **Table 1.** Scale used to evaluate viral disease damage level, Michoacán México. | |
| **Level** | **Damage characteristics** | |
| 1 | Without damage; leaves extended, normal plants with buds, flowers and fruits. | |
| 2 | Initial damage: some leaves extended, others rolled, normal plant with buds, flowers and fruits. | |
| 3 | Medium damage: leaves rolled, reduced apical buds, fanleaf foliage, reduced bud and flower development, with fruits. | |
| 4 | Total damage: fanleaf in all folliage, dwarf and slim plants, no flowers, buds and fruits. | |

**Agronomical characteristics**

Seventy-five days after transplanting, plant height and stem diameter showed significant differences (P < 0.05). The highest plants were presented in the grafts I-Ac, I-Jiq and I-LR, while the control Jit (tomato) had 41.75 cm; the shortest plants were observed in the graft I-GAp (Table 2). The largest stem dia­meter was observed in Jit, but it was similar to the graft I-LR (Table 2).

Height to the first flower stem varied bet­ween 25.16 and 26.58 cm in the grafts and tomato (Table 2). The highest number of flo­ral stems per plant (P < 0.05) happened in the I-Jiq, I-LR, I-ChAp and I-Tab grafts, and the lowest number was found in I-Gap graft (Ta­ble 2).

Graft and tomato fruits had weights bet­ween 2.2 and 92.2 g, and were grouped in six categories (Figure 1). In general, most of the fruits were in the weight range between 17.3 and 32.2 g with fluctuation between 41% in the I-LR graft and 63% in tomato (Jit). Con­trary, in the ranges with highest fruit weight there were lower variation percentages (0 – 5% and 0 – 0.75%). In important to highlight that tomato did not produce fruits over 47.2 g whereas all the grafts had fruits heavier than that weight, even, some grafts like I-LR, I-Jiq and I-Tab had fruits in all the categories above 47.2 g (Figure 1).

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| **Table 2.** Agronomic characteristics of grafts and jitomate plants,, Michoacan México. | | | | |
| **Treatments** | **Plant height**  **(cm)** | **Stem diameter**  **(cm)** | **Height to first floral stem (cm)** | **Floral stem number** |
| I-ChAp | 40.21 b† | 0.76 c | 26.45 a | 4.45 a |
| I-GAp | 31.86 c | 0.80 bc | 25.94 a | 3.58 b |
| I-Ac | 44.15 a | 0.81 bc | 25.94 a | 4.44 a |
| I-LR | 43.12 a | 0.91 ab | 26.58 a | 4.47 a |
| I-Jiq | 43.41 a | 0.88 bc | 25.16 a | 4.70 a |
| I-Tab | 39.41 b | 0.74 c | 26.50 a | 4.45 a |
| Jit (tomate) | 41.75 ab | 1.04 a | 26.25 a | 4.25 ab |
| DMS | 2.47 | 0.15 | 6.92 | 1.04 |
| CV (%) | 2.18 | 6.45 | 6.16 | 9.36 |
| † Means with the same letter within columns are not statistically different (Tukey, P ≤ 0.05). DMS: Minimal significant difference. CV: coefficient of variation. | | | | |

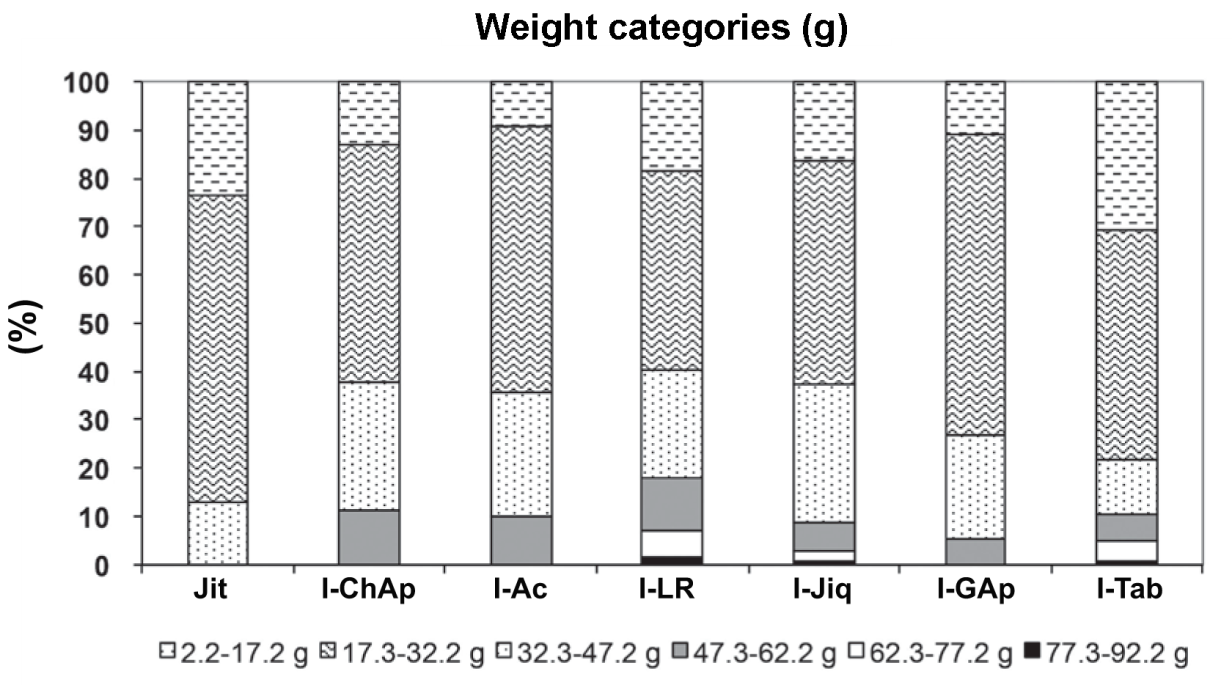
Fruit size, determined by polar and equa­torial diameters, was different (P < 0.05), bi­gger fruits were found in I-LR, I-Jiq, I-Ac and I-ChAp (Table 3). To the contrary, fruit yield/plant was similar (Table 3).

Grafts did not affect negatively the eva­luated characteristics in tomato and fruits. Thereby, the value of plant height was low (31.86 – 44.15 cm) if compared to results of other studies (Khah *et al.*, 2006) where it was found heights between 69.31 and 75.31 cm. However, in this study there were no disease and pest controls, which could affect plant development. For the variable height to the first floral stem there were no differences bet­ween grafts and tomato. Number of bunches/plant showed a tendency to be higher in I-LR and I-Jiq grafts (Table 2). Si­milarly, the biggest fruits (62.3 - 77.2 g and 77.3 - 92.2 g categories) belonged to I-LR, I-Jiq and I-Tab grafts despite of their higher variability when compared to tomato (Figure 1). Although, there were no detectable diffe­rences in yield per plant (Table 3), it is im­portant to notice that grafts and control reached all the phenological phases without any pesticide application, even so, LR (167.79 g) and I-Jiq (141.42 g) produced more than tomato (128.54 g), which is a desirable cha­racteristic from the agronomical point of view.

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| **Table 3.** Size and yield of grafts and jitomate fruits, Michoacan México. | | | |
| **Treatments** | **Polar diameter (cm)** | **Equatorial diameter (cm)** | **Fruit yield/plant (g)** |
| I-ChAp | 3.93 ab† | 3.53 a | 125.16 a |
| I-GAp | 3.77 b | 3.52 a | 107.33 a |
| I-Ac | 3.95 ab | 3.51 a | 112.99 a |
| I-LR | 4.07 a | 3.59 a | 167.79 a |
| I-Jiq | 3.96 ab | 3.58 a | 141.42 a |
| I-Tab | 3.71 b | 3.32 ab | 128.61 a |
| Jit (tomate) | 3.72 b | 3.17 b | 128.54 a |
| DMS | 0.29 | 0.29 | 80.53 |
| CV (%) | 17.51 | 19.17 | 22.17 |
| † Means with the same letter within columns are not statistically different (Tukey, P ≤ 0.05). DMS: Minimal significant difference. CV: coefficient of variation. | | | |

Fruit physico-chemical characteristics: pH, soluble solids and humidity percentage showed variable values; for instance, pH was higher in tinguaraques than in tomato and grafts since, ChAp, GAp, Ac, LR, Jiq and Tab tinguaraques showed higher acidity, and the grafts showed an acidity similar to tomato (Table 4). Tinguaraques with more soluble solids were Ac, LR and Jiq, whereas Tab had the lowest value. In grafts the soluble solids value varied from5.5 for I-Jiq to 6.75 (I-Gap and I-Tab), and Jit (tomato) showed 7.0 °Brix (Table 4). Fruit humidity was lower in tingua­raques tomatoes with values varying from 88.39 to 91.43% compared to grafts and to­mato that were on 93.99 – 97.44% range (Ta­ble 4).

**Figure 1.** Weight fruit frequency (%) in six intervals in grafts and tomato, Michoacan México.



Fruit physico-chemical characteristics in the grafts were similar to the ones of tomato, however tinguaraques were different accor­ding to the cultivar used. The less acidic pH of tinguaraques fruits (4.77 – 5.37) did not affect the graft fruits. In this sense, it has been observed that in grafted tomato plants pH is more acidic (4.04 -4.30) than in plants without grafting (4.35 – 4.47) (Coutinho *et al.*, 2006). However, this variation is minimal since in commercial varieties pH is between 4.2 and 4.4 (Nuez, 1995); on the other hand, Khah *et al.* (2006) did not find statistical diffe­rences in pH of grafts (4.33 – 4.41) and con­trol (4.34). Soluble solids, except for the ma­terials ChAp, GAp, Tab, I-Ac and I-Jiq, tended to be more concentrated in tinguaraques (7.5 to 7.75 °Brix) in comparison to grafts (6.25 – 6.75 °Brix), while tomato had 7.0 °Brix. The range of soluble solids in commercial toma­toes is between 4.5 and 5.5 °Brix, however more than the variety character, the agroeco­logical factors affect the soluble solids state since they can make changes between 4 and 7 in fruits of the same variety (Nuez, 1995). In other studies there have not been found di­fferences in soluble solids between grafted and no-grafted plants, for instance, Coutinho *et al.* (2006) found values between 3.95 and 4.7 °Brix in grafted plants and between 3.95 and 4.95 °Brix in no-grafted plants. Similar­ly, Khah *et al.* (2006) found values between 3.1 and 4 ºBrix in grafts and 3.68 ºBrix in the control. In relation to fruit humidity, tingua­raques showed less humidity (88.39 – 91.33%) than grafts and tomato, which have values of 93.99 and 97.44%, respectively. These differences could be due to the wild origin of tinguaraques. Humidity values for tomato were 94 and 95% (Nuez, 1995), very similar to the grafts used in this study.

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| **Table 4.** Physico-chemical characteristics of grafts, jitomate and tinguaraques fruits, Michoacan México. | | | |
| **Treatments** | **pH** | **ºBrix** | **Humidity**  **(%)** |
| ChAp | 5.07 ± 0.05 † | 6.0 ± 0.0 | 90.73 |
| GAp | 5.02 ± 0.05 | 6.0 ± 0.0 | 91.43 |
| Ac | 5.35 ± 0.1 | 7.75 ± 0.5 | 89.94 |
| LR | 4.77 ± 0.05 | 7.75 ± 0.5 | 89.05 |
| Jiq | 4.87 ± 0.05 | 7.5 ± 0.57 | 90.13 |
| Tab | 5.37 ± 0.05 | 5.25 ± 0.5 | 88.39 |
| I-ChAp | 4.67 ± 0.05 | 6.25 ± 0.5 | 97.37 |
| I-GAp | 4.55 ± 0.05 | 6.75 ± 0.5 | 93.99 |
| I-Ac | 4.45 ± 0.05 | 6.0 ± 0.0 | 97.44 |
| I-LR | 4.45 ± 0.05 | 6.5 ± 0.57 | 96.52 |
| I-Jiq | 4.5 ± 0.0 | 5.5 ± 0.57 | 96.41 |
| I-Tab | 4.5 ± 0.0 | 6.75 ± 0.5 | 97.44 |
| Jit | 4.52 ± 0.09 | 7.0 ± 0.0 | 94.28 |
| † n = 5. | | | |

**Disease incidence**

Registered disease during the crop develop­ment were damping-off caused by the complex of soil fungi *Pythium* sp., *Fusarium* sp. and *Rhizoctonia solani*, which cause base stem constriction. Another disease observed was the late blight *Alternaria solani*)followed by general plant wilting and death in adult plants. In that stage the causal agent was isolated and identified as an unknown *Fusarium* sp. For the leaf analysis in plants with viral symptoms, positive results were found, being identified a Geminivirus as causal agent.

Analysis of variance for damping-off attack showed highly significant differences. I-LR graft was not affected by this disease whereas tinguaraque Ac was the most susceptible. With exception of I-AGp, all the other grafts showed to be less susceptible, although only I-LR showed differences with the control (to­mato-Jit) (Table 5). For the affected plants variable in the case of the complex *Alternaria solani-Fusarium* sp. there were no differences, however, LR, I-AGp and I-ChAp were not affected by these fungi opposite to Jit (tomato) and Tab, which had the highest percentage of incidence (Table 5). Finally, Geminivirus in­cidence did not show statistical differences (P > 0.05) and the values varied between 12.93% and 52.67% (Table 5).

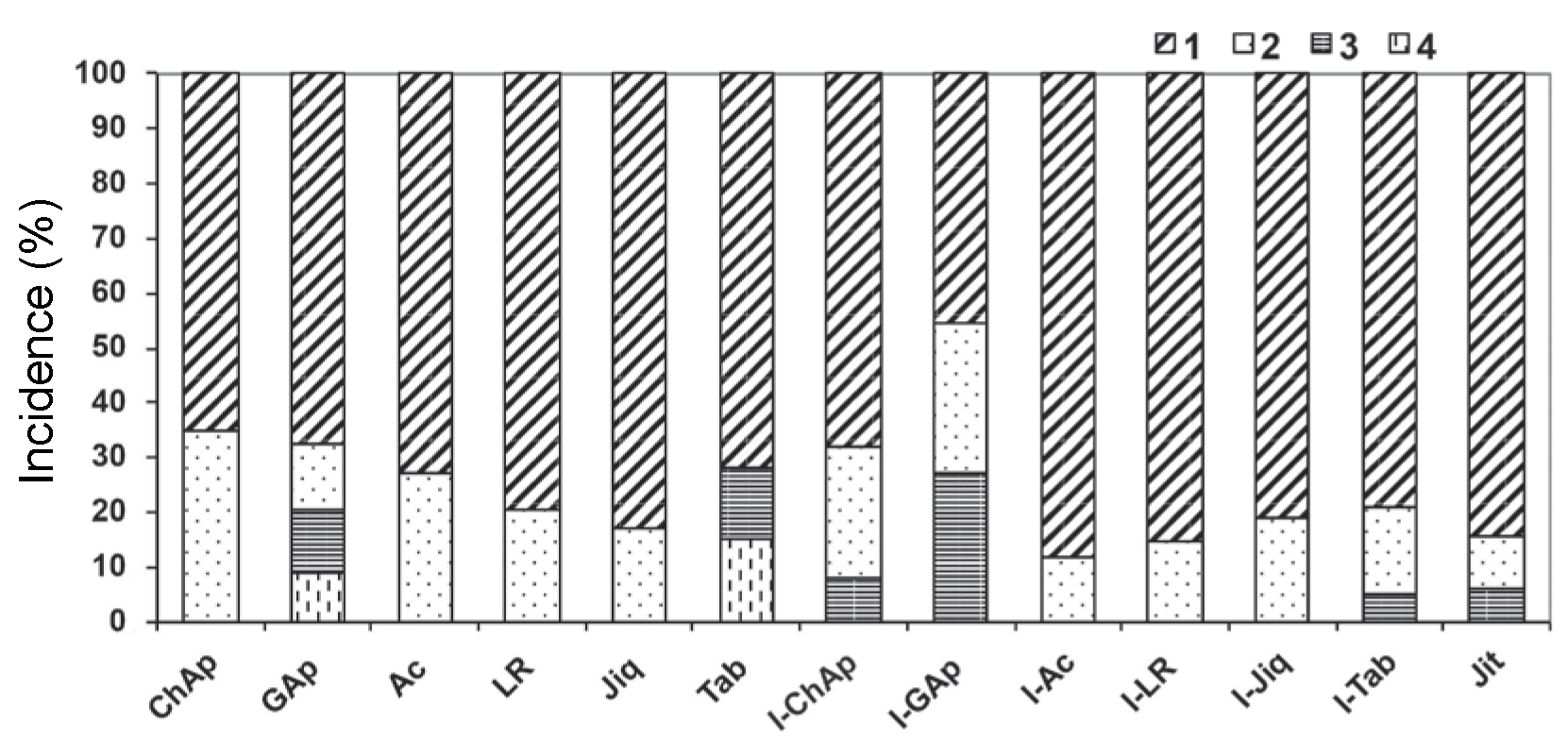
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| **Table 5.** Disease (damping-off, *Alternaria solani*-*Fusarium* sp. complex andGeminivirus) incidence in grafts, tomato and tinguaraques tomato, Michoacan México. | | | |
| **Treatments** | **Damping off**  **(%)** | ***Alternaria* *solani*-*Fusarium* sp. complex (%)** | **Geminivirus**  **(%)** |
| ChAp | 22.33 bc † | 5.55 a | 36.00 a |
| GAp | 29.66 bc | 3.92 a | 33.33 a |
| Ac | 76.66 a | 3.33 a | 20.00 a |
| LR | 10.00 cd | 0.00 a | 19.33 a |
| Jiq | 18.33 bc | 5.00 a | 18.33 a |
| Tab | 18.33 bc | 5.00 a | 32.33 a |
| I-ChAp | 16.66 bc | 0.00 a | 30.33 a |
| I-GAp | 46.00 ab | 0.00 a | 52.67 a |
| I-Ac | 10.23 cd | 5.12 a | 12.93 a |
| I-LR | 0.00 d | 4.44 a | 15.07 a |
| I-Jiq | 8.33 cd | 1.66 a | 19.33 a |
| I-Tab | 6.56 cd | 6.66 a | 21.00 a |
| Jit (tomate) | 25.00 bc | 16.66 a | 17.03 a |
| DMS | 12.20 | 5.75 | 8.37 |
| CV (%) | 30.71 | 87.34 | 42.26 |
| † Means with the same letter within columns are not statistically different (Tukey, P ≤ 0.05). DMS: Minimal significant difference. CV: coefficient of variation. | | | |

When Geminivirus incidence was evalua-ted based on damage level, results were diffe-rent, for instance, ma­terials with damage level 3 (medium damage) were I-Gap, Tab, Gap, I-ChAp, I-Tab and tomato (Jit) with infected plants percentage from 5.26% and 27.27%. Only GAp and Tab showed plants with damage level 4 (total damage) with 8.82% and 15.38%, respectively (Figure 2).

In relation to disease incidence is im­portant to highlight the behavior of I-LR graft, which was not affected by damping-off. However, the result was not the same for LR, ChAp, Gap, Ac, Jiq and Tab tinguaraques and Jit (tomato), because they were all susceptible to the disease (Table 5). Even though, low incidence was observed (6.56 – 16.66%) in I-Tab, I-Jiq, I-Ac and I-ChAp grafts. Indepen­dently of the lack of statistical significance between the evaluated materials for early blight and wilting by *Fusarium*, as well as for the incidence of the virus from Geminivirus group, different response trends were ob­served between the materials. Highlighted materials against *Alternaria solani*-*Fusarium* sp were I-ChAp, I-GAp and LR because they did not show any symptoms.

Although it was expected that wild plants showed higher disease tolerance, apparently, the graft technique favored plant development and their adaptation to the environmental conditions in the location of the study. Fina­lly, it was observed that viral disease affected tinguaraques, grafts and tomato in levels 2, 3 and 4 (initial damage, medium damage and total damage), however, plants were able to develop.

**Figure 2.** Distribution of Geminivirus damage level in different outbreaks in grafts, tomato and Tinguaraque tomato, Michoacan México.



**Conclusions**

Tomato graft in its wild relative (*S. lycopersi­con* var. *cerasiforme*) showed potential for crop management. By grafting disease incidence was reduce without devalue fruits agronomi­cal and physico-chemical characteristics, or plant yield in the cultivated tomato cariety. I-LR graft was not affected by damping-off, however, the result was not the same as in tinguaraques LR, ChAp, GAp, Ac, Jiq and Tab and, in tomato (Jit), because all of them showed high suceptibility to the disease.

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