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Description of cultivar

INI-181: a new variety of husk tomato for El Bajío

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Abstract

Mexico is the center of origin and diversification of the husk tomato, but its production depends on native germplasm and local varieties. This contribution aimed to describe the INI-181 variety and its agronomic behavior. The variety was generated by stratified mass selection and individual selection methods. Varietal characterization was carried out in homologous cycles in spring-summer of 2017 and 2018, at the Bajío Experimental Field, Celaya, Guanajuato, Mexico, based on the descriptors of the International Union for the Protection of New Varieties of Plants. Agronomic behavior was evaluated under a completely randomized experimental design with four replications. Morphological and phenological traits were recorded and analyzed with the Kruskal-Wallis test ($p \leq 0.05$). Plants of the INI-181 variety are semi-erect with long internodes without pigmentation. Stem without pubescence. Green elliptical leaves of medium length with semi-dentate margin. Medium-sized flower. Green and firm fruit, strongly attached to the calyx, with shallow peduncular cavity, round apex and green pulp with 3.81 mg GAE 100 g^{-1} tomatidine on average. Intermediate flowering. Medium-sized yellow seed. It is tolerant to powdery mildew (*Oidium* sp.) and the stem borer (*Melanagromyza tomaterae* Steyskal). In 10 kg of fruit, 90 to 130 g of seed is obtained on average.

Keywords:

biological production, biological trait, fruit vegetable, germplasm.

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In Mexico, genetic improvement in vegetables has been limited to culinary species of economic importance. In this context, the importance of the husk tomato (*Physalis ixocarpa* Brot.) lies in its domestic consumption and to a lesser extent in its export. The national average yield in 2020 was 18.6 t ha^{-1} (SIAP, 2023).

Mexico has native germplasm to generate materials with high yield potential and adaptation to the different producing regions (González-Pérez *et al*., 2021). Commercial materials have been derived from the eight recognized breeds (Peña-Lomeli *et al*., 1998) based on various breeding methods.

The production of husk tomatoes in Mexico depends mainly on the seed of native species and local varieties that producers continuously multiply, which have commercial potential, but their development depends on factors such as the increase in production, quality, use, and potential (Vargas *et al*., 2015) and, to a lesser extent, on the 32 varieties grown in the national territory (SNICS, 2023).

To help meet the current demand for varieties, as of 2014, the National Institute of Forestry, Agricultural, and Livestock Research (INIFAP), for its acronym in Spanish resumed the husk tomato genetic improvement program. This contribution aimed to describe the INI-181 variety and its agronomic behavior.

Variety generation

The variety was generated by stratified mass selection and individual selection methods. Mass selection began in 2010 with a genetic base of 200 populations of *Physalis* spp. collected in producing regions of central-western and southern Mexico located at different north latitude, west longitude, and altitude, where six populations were selected: 1) L-17: Tuxpan, Guerrero (18° 19' 45" north latitude, 99° 28' 27" west longitude, 800 masl); 2) L-18: Tlapa de Comonfort, Guerrero (17° 33' 04" north latitude, 98° 33' 58" west longitude, 1 036 masl); 3) L-27: San Salvador el Verde, Puebla (19° 16' 21" north latitude, 98° 31' 7.1" west longitude, 2 302 masl); 4) L-79: San Miguel Cuyutlán, Jalisco (20° 27' 43" north latitude, 103° 27' 11" west longitude, 1 588 masl); 5) L-167: Jojutla, Morelos (18° 36' 53" north latitude, 99° 11' 28" west longitude, 900 masl) and 6) L-181: Totolapan, Morelos (18° 58' 38" north longitude, 98° 55' 47" west longitude, 1 900 masl).

From 2013 to 2016, the six populations were grown for four consecutive years in winter-spring and spring-summer (two sowings per year= eight cycles). During this period, individual plants were selected in each population to integrate a new balanced compound with the same number of seeds and a selection pressure of 10%.

The selection criteria focused on traits of high yield and tomatidine content. In addition, tolerance to powdery mildew (Guzmán-Plazola *et al*., 2010) and stem borer (Gómez and Vargas, 2014) was estimated. In the eighth cycle, based on the selection criteria, the population called TCM-Morelos-C3 was obtained with the purpose of registering it in the National Catalog of Plant Varieties (CNVV), for its acronym in Spanish as INI-181.

During the spring-summer cycles of 2017 and 2018, varietal characterization was carried out in homologous cycles at the CEBAJ facilities (20° 34' 39" north latitude, 100° 49' 13" west longitude, 1 764 masl) based on UPOV (2007) descriptors and the Rendidora variety was used as a reference.

The agronomic behavior of INI-181 and the controls, the Rendidora variety and a native material, was evaluated in the autumn-winter cycle of 2018, in a commercial plot located in Juventino Rosas, Guanajuato (20° 38# 04" north latitude, 101° 01' 06" west longitude, 1 878 masl), under a completely randomized design with four replications (eight plants per replication).

The temperature and humidity in the autumn-winter cycle of 2018 were those required by the crop. The agronomic management was in accordance with the technological package developed by researchers from the CEBAJ-INIFAP Vegetable Program. The variables of germination percentage (%), number of fruits per plant, average fruit weight, equatorial diameter (cm), polar diameter (cm) and yield (t ha^{-1}) were recorded.

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The yield per hectare was obtained by multiplying the weight of the fruits obtained per plant (g) by the number of plants per m^2 x 10 000 m^2. The data were analyzed by the Kruskal-Wallis test ($p \leq 0.05$) with the SAS statistical program (SAS Institute, 2009).

Variety description

INI-181 plants were semi-erect in growth, with high height at the first fork and long internodes without pigmentation. They have a hairless stem, elliptical leaves of medium length, semi-dentate and semi-intense green in color. Flower with an average diameter of 3 cm. Firm green fruit strongly attached to the calyx and open calyx covering, shallow peduncular cavity, large in size, round apex, and green pulp. Pubescent and ribbed calyx with weak pigmentation intensity. Yellow seed (Table 1).

Table 1. Differences in traits between the Rendidora variety and INI-181.

Trait	Differences	
	Rendidora	INI-181
Anthocyanin pigmentation of the hypocotyl	Absent	Present
Height at first fork	Medium	High
Internode length	Short	Long
Leaf blade length	Short	Medium
Leaf blade width	Narrow	Medium
Leaf margin dentation	Weak	Medium
Petiole position	Semierect	Intermediate
Petiole length	Short	Medium
Attachment to the calyx	Medium	Strong
Shape in the longitudinal section of the fruit	Cordate	Cordiform
Pulp color	Greenish yellow	Green
Calyx covering	Completely closed	Very open
Peduncle thickness at the end of the fruit	Medium	Very thick
Fruit firmness	Soft	Firm
Seed color	Yellow-brown	Yellow
Fruit physiological ripeness	Early	Medium
Shelf life	Short	Intermediate

INI-181 flowers from 20 DAT, physiological ripeness of the fruit occurs at 55 DAT, and emergence occurs from 10 days after sowing. The fruit contains 3.81 mg GAE 100 g^{-1} tomatidine on average.

Agronomic performance

The number of fruits per plant was statistically equal in INI-181 and the native material. The germination, average fruit weight, polar and equatorial diameters of the INI-181 fruit were statistically higher than those observed in the native material and in Rendidora (Table 2).

Table 2. Comparison of agronomic traits evaluated in the INI-181 variety and in commercial materials of husk tomato (*Physalis ixocarpa* Brot.).

Trait	Native	Rendidora	INI-181
Germination percentage (%)	76.6b[†]	92.3a	96.5a

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Trait	Native	Rendidora	INI-181
Number of fruits per plant	38.6b	58a	39.3b
Average fruit weight (g)	14c	28.4b	60.6a
Equatorial diameter (cm)	3.1b	3.8b	5.4a
Polar diameter (cm)	2.6b	3.1b	4a
Yield (t ha^{-1})	11.4b	35a	38.5a

The values correspond to the average obtained in two cycles evaluated in 2018. †= means with the same letter within each row indicate non-significant differences by Kruskal-Wallis test ($p \leq 0.05$).

Similar values in germination and yield were observed in INI-181 and Rendidora; nevertheless, INI-181 showed less variation in the average weight of the fruit but a lower number of fruits per plant (Table 2). INI-181 exhibits tolerance to powdery mildew and stem borer, whereas Rendidora is declared not resistant to powdery mildew.

Because it is of intermediate cycle, INI-181 is grown from February to October in temperate and warm regions. The recommended planting density is 18 000 plants ha^{-1}, which is covered with 200 g ha^{-1} of seed with germination of 98%. Direct seeding requires 4 kg ha^{-1}. Due to the self-incompatibility of the husk tomato, the presence of pollinating insects is relevant. Seed is increased in isolated lots at a minimum of 1 000 m to avoid natural crossing. The estimated production per 10 kg of fruit ranges between 90 and 130 g of seed.

INI-181 has the breeder's title 2311 and is registered with the registration number TOM-030-201219 in the National Catalog of Plant Varieties (CNVV), for its acronym in Spanish of the National Seed Inspection and Certification Service (SNICS, 2023). The basic seed is available at INIFAP Bajío Experimental Field, in Celaya, Guanajuato, Mexico.

Conclusions

The INI-181 variety was registered in the National Catalog of Plant Varieties (TOM-030-201219), its main distinctive traits were reflected in the size, internodes, stem, leaves, flower, calyx, and fruit. It has a high tomatidine content and fruit yield statistically equal to Rendidora, but with greater fruit weight and size. This variety can contribute to solving the demand for improved varieties of husk tomatoes in the El Bajío region.

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