Investigation note

Preliminary test of tropical pumpkin lines with higher productivity

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Abstract

The vast majority of pumpkins consumed in the world have their origin in species that were domesticated in Mexico, all of them belong to the genus Cucurbita. Seed collections were obtained from the Huasteca, the localities are: Cd. Mante, Antiguo Morelos, Cd. Valles, Río Verde and Huejutla. In relation to the antecedents, for this investigation it was decided to scrutinize by hybridization in simple cross and selfing with individual selection of fruits. Being warm weather gourds we started and made the crosses in a greenhouse with controlled temperatures of 25 to 35 degrees, at CEVAMEX, in 2015 a direct cross of all against all in which we had flowers to pollinate began and it was observed that the stamens filaments formed a foot and nectariferous discs, also with different numbers 3, 4, 5 and up to 6. Genetic improvement with self-fertilization and individual selection of fruits, for which we try to match the stigmas and the same stamens, we are currently in F3 which is an inbreeding of 87.5%. It is observed in Figure 4 the progress of the increase of pumpkin seed cheeks is illustrated and eliminating the spaces within the pumpkin fruit cavities, as well as in Table 1, the weights of the fruits and their seed yields dry and the percentage of seed gain within the fruit, that of 4 cheeks from 5 to 53% and those of 5 cheeks is from 37 to 53%.

Keywords: Huasteca, pipian, stigma cheeks.

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Introduction

The oldest evidence of cultivated *Cucurbita argyrosperma* remains comes from the Romero cave, Tamaulipas, with an approximate date of 3085 BC. Perhaps the most characteristic trait of this species and the most appreciated by man, are its abundant and large seeds, which are consumed in a wide variety of forms, whole, roasted, roasted and mainly, ground and serve as the basis for a wide range of dishes such as green mole and pipian. These seeds have a remarkable nutritional value and a high content of oil (39%) and protein (44%) Arqueología Mexicana (2010).

Since the (monoecious) reproduction system of pumpkin is similar to that of maize (Pérez *et al*., 1997), breeding methods are also similar (selection, retro-crossing, hybridization) Whitaker and Robinson (1986) mention that there are absence of inbreeding depression does not mean that there is no hybrid vigor in Cucurbita and a hybrid would combine the desired traits of the parents, so the main method of improvement used in pumpkin is simple crossbreeding, taking advantage of mild inbreeding depression.

In the huasteca there is a very high demand for pumpkin seeds, for consumption in confectionery of approximately 5 000 tons and they are produced from the pumpkins of Castilla (*Cucurbita moschata*) and pipian (*Cucurbita argyrosperma*), where the former is used for sweet and the second for seed; not having an established commercial production, the production of the small lots associated with corn is used, where a production of 70 to 100 kg ha^{-1} is obtained. There is a deficit of 70%.

This is an opportunity to generate productive, uniform and disease resistant materials that stimulate pumpkin planting for seed production and a higher economic income for producers. In 2015, one kilogram of seed was obtained from collections from Huasteca, from the following localities. (Table 1) shows the climatic characteristics of the localities of origin of the materials used in this study (INEGI, 2000, 2009a, 2009b, 2009c, 2009d).

Table 1. The climatic characteristics of the localities of origin of the materials used in this study-2015 are shown.

Location	Climate	Altitude	Precipitation	Medium temperature
Cd. Mante, Tamaulipas	A(w0) the warm sub humid climate with rains in summer, with lower humidity	90 m	1 070-1 170 mm	24-25.9 ºC 
Antiguo Morelos, Tamaulipas	A (Ca) the warm sub humid climate with rains in summer, with lower humidity	242 m	1 100-1 300 mm	23-26 ºC 

Location	Climate	Altitude	Precipitation	Medium temperature
Ciudad Valles, San Luis Potosí	Aw1 warm subhumid with summer rains of higher humidity	80 m	1 000-2 000 mm	22-26 ºC 
Huejutla, Hidalgo	Af(m) semi-warm humid with abundant rains in summer	400 m	1 400-2 100 mm	20-26 ºC 
Rio Verde, San Luis Potosí	BS1hw Semi-dry semi-warm	990 m	300-800 mm	14-24 ºC 

The antecedents demonstrated by Whitaker and Robinson (1986), it was decided to perform hybridization with simple crosses in heterozygous plants and we added self-fertilization with individual selection of fruits. Being warm climate pumpkins, a greenhouse with controlled temperatures of 25 to 35 degrees was used, opening and closing the curtains and watering to have a humidity of 80%. In the experimental field of CEVAMEX, we sowed 5 seeds in March to obtain the minus three plants per selected line, only enough water was applied and a kilo of compost per plant when transplanting them to the ground and then leachate of vermicompost was put, since there was not enough space, a distance of 50 cm was used between plants that were later directed and when the space is finished, the upper cables of the greenhouse were climbed, so that they did not get entangled with those next to them, there was white mold, no biological or chemical control was carried out.

During 2015, it was observed that the parents presented floral structures (corolla) of greater size than others (Figure 1), the male flowering begins at 45 days and the female ones at 55 days and we observed that the stamens formed filaments one foot and discs nectariferous, also with different numbers 3, 4, 5 and up to 6 (Figure 2).

During the spring-summer (S-S) sowing period of 2015, we started a direct hybridization cross, all against all in which we had flowers to pollinate, we obtained seed from 10 genetic combinations, in 2016 in (F_1) we sowed 5 seeds of each crosses and obtained 32 plants for the 10 combinations, with a filial advance or inbreeding (50%) we observed that the stamens formed filaments, a foot and nectariferous discs, also with different numbers 3, 4, 5 and to 6 (Figure 2).

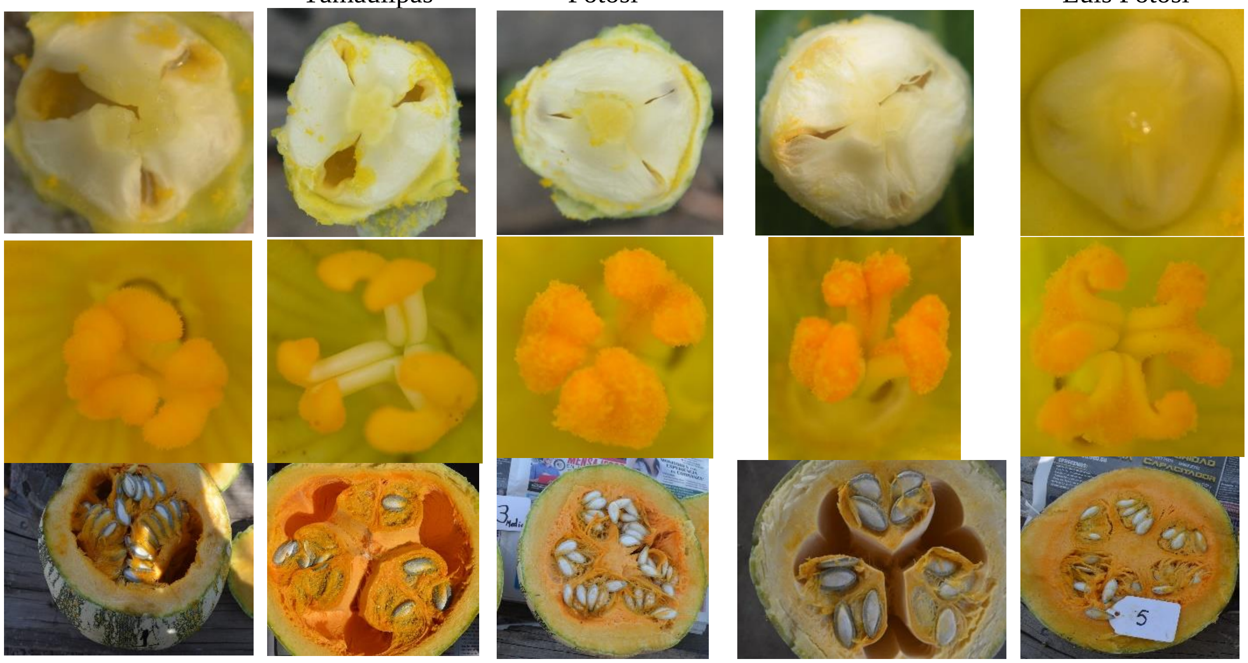


Figure 1. The number of nectariferous pits and stigmas of pipian pumpkin (*Cucurbita argyrosperma*) and the number of seed cheeks of the parents collected in 2015 are shown.

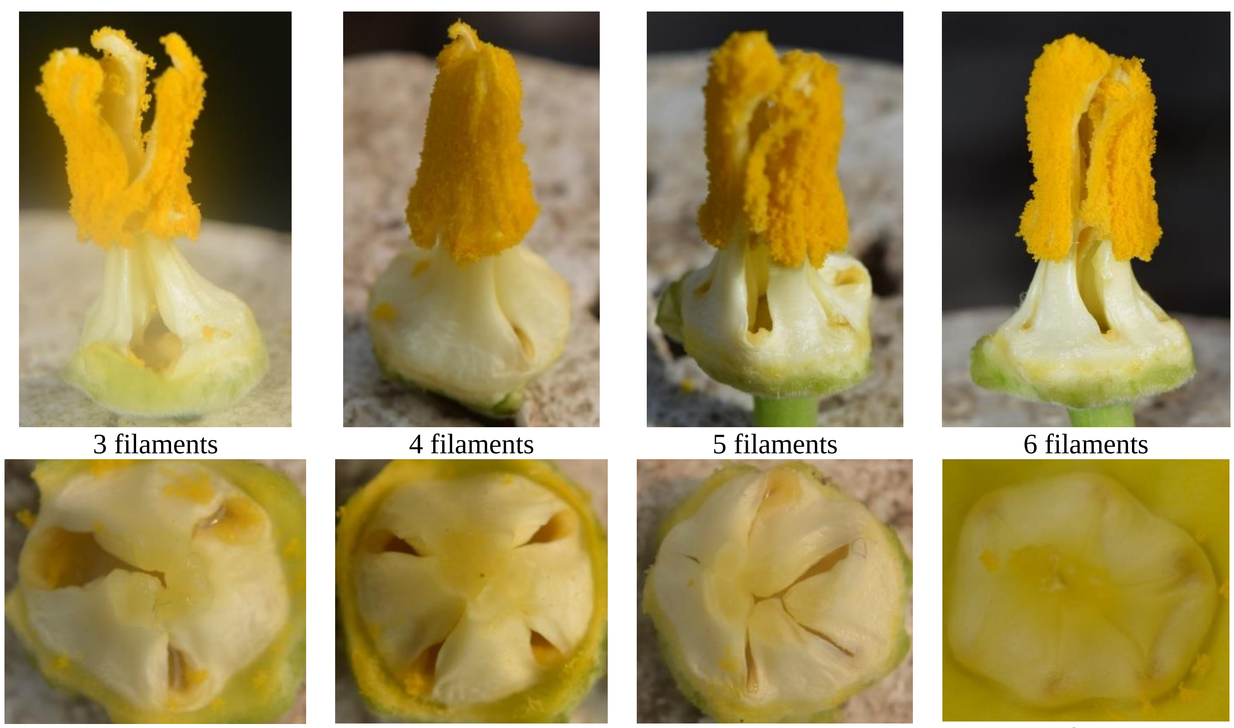


Figure 2. The increase in nectariferous filaments and pits in the lines of pipian pumpkin (*Cucurbita argyrosperma*) Santa Lucia, 2018 are shown.

It is started a genetic improvement with self-fertilization and individual selection of fruits, for which we tried to match the stigmas and stamens with equal nectariferous pits; for example, 3 with 3 and 4 with 4, we selected plant 27 (2 x 3) and two fruits with 4 stigmas, in (F_2) we sowed the seeds of the 2 selected pumpkins, apart we made a selection of broad and thin pepa and obtained 4 selections 27-1A, 27-1B, 27-2A and 27-2B, 10 plants were born from these combinations with a filial advance or inbreeding (75%).

The self-fertilization process with those of 4 stigmas was repeated with the stamens with 4 nectariferous pits currently, but we found flowers with 5 stigmas and nectariferous discs, also with different numbers 3, 4, 5 and up to 6, we selected plant 3-1 and three fruits with 5 and 4 stigmas (Figure 3).

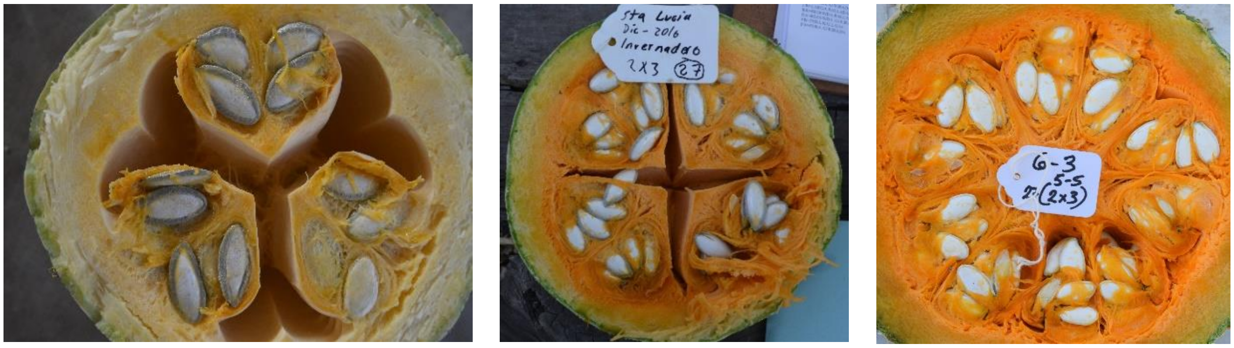
3 stigmas 4 stigmas 5 stigmas

Figure 3. The increase in the number of female stigmas of the lines of pipian pumpkin (*Cucurbita argyrosperma*) Santa Lucía, 2018.

It is considered that more productive and disease tolerant materials can be generated, this research is focused on obtaining more stable, productive and disease resistant pumpkin materials. This work was carried out as follows: during the S-S period of 2018, currently in (F_3), the seed of the 3 selected pumpkins was sown.

Besides we made a selection of broad and thin seed and we obtained 6 selections 6-1A, 6-1B, 6-3A and we were born with 7 plants of these combinations, which is a filial advance or inbreeding of 87.5%, we have lines with 4 and 5 stigmas female and nectariferous discs, also with different numbers 4 and 5 and up to 6 that translate into a greater number of cheeks of seeds.

The results are shown in Figure 4, which illustrates the progress of the increase of pumpkin seed cheeks and eliminating the spaces inside the pumpkin fruit cavities: likewise, it was observed in Table 2, the weights of the fruits and their yields in fresh seed and the percentage that composes the seed within the fruit, that of 3 cheeks from 8.9 to 12.7%, those of 4 cheeks from 6 to 13.2% and those of 5 cheeks is from 8 to 8.3%.



3 cheeks 4 cheeks 5 cheeks

Figure 4. The progress of obtaining a greater number of cheeks of seeds or seeds was observed in the lines of pipian pumpkin (*Cucurbita argyrosperma*) Santa Lucía, 2018.

Table 2. Comparative data of fresh pumpkin seed yield with the number of stigmas or cheeks of fruits pipian pumpkin (*Cucurbita argyrosperma*) Santa Lucía, 2018.

Crosses	Plot2018	No. of cheeks	Fruit weight grams	Wet seed weight	Number of seeds per fruit
27 (2 X 3)	2-3	3	1 458	137	236
27 (2 X 3)	3-2B	3	606	77	192
27 (2 X 3)	5-3A	4	1 717	226	326
27 (2 X 3)	6-1B	4	2 407	153	304
27 (2 X 3)	7-3A	4	2 482	150	263
27 (2 X 3)	7-3D	4	1 722	153	297
27 (2 X 3)	6-1A	5	2 714	216	396
27 (2 X 3)	6-3A	5	2 171	180	444

In Table 3, the dry seed yields, such as the sizes of the seeds between the lines and the gain in the number of seeds per fruit, those of 4 cheeks from 27 to 90 and those of 5 cheeks are from 160 to 208, According to the results, it can be determined that there is a good potential to obtain 2 to 3 materials with very good pumpkin seed yield results.

Table 3. Comparative data on dry pumpkin seed yield with the number of stigmas or cheeks of fruits pipian pumpkin (*Cucurbita argyrosperma*) Santa Lucía, 2018.

Plot 2018	No. cheeks	Dry weight of seeds in grams	(%) of gain	No. seeds per fruit	Seed number gain
2-3	3	99	-	236	-
3-2B	3	62	-	192	-
5-3A	4	153	+53	326	90
6-1B	4	105	+5	304	68
7-3A	4	108	+8	263	27
7-3D	4	113	+13	297	61
6-1A	5	153	+53	396	160
6-3A	5	137	+37	444	208

Conclusions

Seed or seed yield increases were observed to fluctuate between 5% to 53% greater than the control. Continue with the improvement to fix the character of more stigmas.

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