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Developing stress tolerant tepary bean through mutation breeding

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BACKGROUND

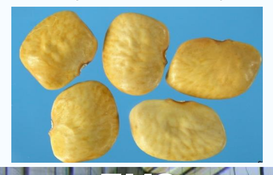
Phaseolus acutifolius A. Gray (tepary bean)

- Traditional crop of the deserts and semi-arid regions of Mexico and southwestern USA .It is a minor crop compared to common bean and is used only for subsistance.
- Highly tolerant to drought and high temperature. Has a high potential of adaptation to the climate change.
- The genetic base of cultivated tepary accessions is narrow. A reason for this reduced genetic variability might be the historic regression of tepary after the introduction of new wattering technonologies in Mesoamerica after 1492 (Nabhan & Felger 1978, Debouck 1992).
- The genetic extinction in tepary led to the loss of variation in seed color.
- Induced mutation is a powerful tool for tepary crop improvement and to develop new mutant varieties showing a greater diversity. Traits that are of interest for tepary are: uniform red seed color and erect growth habit.

The objectives of the present study were:

- To generate genetic variability among tepary lines.
- To evaluate the tepary bean M_6 mutated lines under stress of drought and/or high temperature and identify heat and drought tolerant mutant lines.

G40068
(Arizona-USA)



G40159
(Sonora-Mexico)

EXPERIMENTAL PROCEDURE & RESULTS

Table 1. Mean values of pod number, pod biomass, seed number, 100 seed biomass and nodules number for the **M_6 mutant lines (CMT 38, CMT 109 and CMT 187)** and their original **M_0** tepary accessions (G40068 and G40159) grown in greenhouses under **High Temperature (HT)** and **Controlled Temperature conditions** (CT)

	Pods/plant		Pod biomass, g/plant		Seeds/plant		100 seeds biomass		Nodules/plant	
	HT	CT	HT	CT	HT	CT	HT	CT	HT	CT
Genotype										
CMT 38	22.2 a	25.6 a	15.2 a	18.2 a	69.9bc	83.5c	18.0 a	18.0 a	3.6 a	15.3 a
CMT 109	21.2 a	23.9 a	13.8 b	16.6 b	75.2 a	95.8 a	14.4 d	13.4 d	2.7 a	14.4 a
CMT 187	18.9 a	24.7 a	13.4 b	16.9 b	68.3 c	91.1 b	15.9 b	15.2 b	2.8 ab	9.4 a
G40068	20.1 a	24.9 a	14.0 b	17.3 b	60.2 d	78.0 d	18.9 a	17.3 a	5.1 a	14.1a
G40159	20.3 a	24.7 a	13.5 b	16.9 b	73.1ab	96.3 a	15.2 c	14.8 c	1.1 b	9.1a
Mean	**20.5**	**24.8**	**14.0**	**17.2**	**69.3**	**88.9**	**16.5**	**15.7**	**3.0**	**12.5**

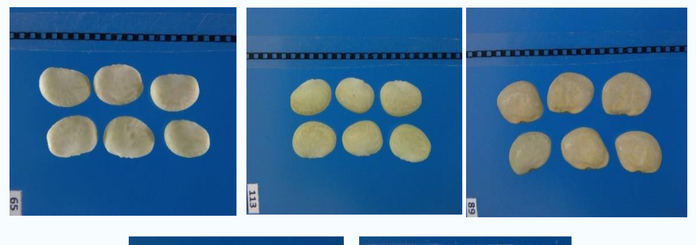
Table 2. Mean values of pod number, pod biomass, seed number, 100 seed biomass and nodules number for the **M_6 mutant lines (CMT 38, CMT 109 and CMT 187)** and their original **M_0** tepary accessions (G40068 and G40159) grown in greenhouses under **High Temperature (HT) and irrigated and drought conditions**

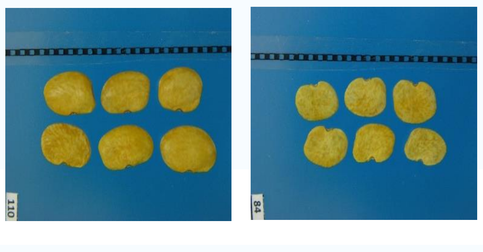
	Pods/plant		Pod biomass, g/plant		Seeds /plant		100 seed biomass, g/plant		Nodules/plant	
	Irrigated	Drought	Irrigated	Drought	Irrigated	Drought	Irrigated	Drought	Irrigated	Drought
Genotype										
CMT 38	28.8 a	15.6 a	20.3 a	10.1 a	95.5 ab	44.3 b	17.5 b	19.0 a	5.9 ab	1.3 a
CMT 109	28.5 a	13.9 b	18.5 ab	9.1 b	103.0 a	47.3 a	13.9 e	15.5 c	4.6 bc	0.9 a
CMT 187	23.4 b	14.5 ab	17.4 a	9.4 ab	88.8 bc	47.7 a	15.8 c	16.4 b	4.1 bc	1.5 a
G40068	26.5 ab	13.8 b	18.5 ab	9.6 ab	80.2 c	40.2 c	18.7 a	19.4 a	9.4 a	0.8 a
G40159	25.7 ab	14. 9 ab	17.4 b	9.7 ab	96.0 ab	50.2 a	14.7 d	16.1 b	1.6 c	0.6 a
Mean	**26.6**	**14.5**	**18.4**	**9.6**	**92.7**	**45.9**	**16.1**	**17.3**	**5.1**	**1.02**

Tepary (M_3) mutant seed variation

G40068 ←

→ **G40159**





CONCLUSIONS

- The mutant induction in G40068 and G40159 cultivated tepary accessions, increased the genetic variability in morpho-physiological characteristics of the species.
- This work provided tepary bean mutated lines : CMT 38, CMT 109 and CMT 187, with seed yield values per plant comparable to or higher than that of the original accessions, under heat and drought conditions.
- The mutation breeding has the potential to generate phenotypic and genotypic variations in tepary that can be exploited by breeders for the development of new cultivars with improved adaptation to heat and drought stress.

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