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THE ISRAELI AVOCADO GERMPLASM BANK: WHERE AND WHY THE ITEMS HAD BEEN COLLECTED

A. Ben-Ya'acov[1], Miriam Zilberstaine[2], M. Goren[3] and E.Tomer[3]

[1] "Granot" Regional Research Center. D.N. Chefer 38100. Israel. E-mail: mirzil@shaham.moag.gov.il

[2] Dept. of Plant Protection. Ministry of Agriculture. Extension Service. Bet-Dagan 50250. Israel. E-mail: mirzil@shaham.moag.gov.il

[3] A R O., Volcani Center. Bet-Dagan, Israel

SUMMARY

Avocado seeds and graftwood were collected during the last 2-3 decades in different countries and introduced into Israel. Material that was not aimed to be evaluated as cultivars, was planted in a new gene pool orchard. This orchard includes about 200 trees, consisting of 148 different accessions. A list of these 148 different accessions is included in the article, with a description of their origin and more information.

The Israeli germplasm avocado bank is aimed to conserve endangered avocado material and to serve as a source for breeding work for new cultivars and rootstocks.

BACKGROUND

The introduction of the avocado into Israel is a continuous process, commenced in the 1930's. Seeds from different sources, graftwood and even grafted plants were introduced, and this became the grain of a successful industry, distributed all over the country, in the last 30 years.

More recently, it has become necessary to enlarge the genetic base of the propagation material, to ensure the survival of the industry. After a wide survey in countries of origin, followed by collection work, a germplasm bank was established in Israel. The rapid disappearance of many native populations was the catalyzer for this project.

METHODS

Avocado vegetal material can be conserved by one method only - as a whole plant, grown in any media. The Israeli genepool is grown as a regular orchard in Volcani Center in which 200 trees are included. Most of the trees are grafted on West Indian rootstocks, even if the introduction material was seeds. In some cases the original seedling, grown from the introduced seed, is the one planted in the genepool.

The plot, grown in six rows, each of them representing a group of Persea material: 1. West-Indian, 2. Persea species, excluding americana. 3. Not-identified items, 4. Guatemalans, 5 Conservation of interesting - not commercial – cultivars and rootstocks. 6. Mexicans. Altogether 148 different accessions are included.

The choice of material to be included in the germplasm bank was dictated by several factors:

1) The limited room: 198 places for trees,

2) The number of representatives for each accession: many of them got two representatives.

3) The importance of the accession to be conserved:

One) Is it a representative of a special population, especially endangered or neglected one?

Two) Is it a representative of a distinctive botanical group?

Three) Does it show resistance to one or more of the main avocado growing obstacles, such as root-rot, salinity, poor aerated soil, etc?

Four) Does it show any important characteristics as a cultivar, and so it can be included in a bre eding program?

Five) Commercial cultivars and rootstocks were excluded.

Six) In general, only material compatible with avocado was included.

RESULTS

The Bet-Dagan gene pool orchard now includes 194 trees, propagated from 148 accessions, and 4 free locations to be soon planted (37 with a new row).

The complete list of accessions is presented in Table 1, and a summary of the list according to country and identification - in Table 2.

Table 2: A summary of the list of accessions in Bet-Dagan genepool orchard.

Original Country	Persea americana sub-species				Other Persea & Beilschmedia species	Total
	Mexican	Guatemalan	West Indian	Not identified		
Canary Islands			6	1	1	8
Colombia			1			1
Costa Rica		1	9	10		20
Ecuador	3		5	5		13
Guatemala		4			10	14
Honduras		3	4	1	2	10
Israel		1				1
Jamaica			1	2		3
Malaysia			2			2
Mexico	13	11	13	5	8	50
Panama			2			2
Puerto Rico			2			2
Spain				5		5
USA	4	2	1	9	1	17
Total	**20**	**22**	**46**	**38**	**22**	**148**

DISCUSSION

The Volcani Center avocado genepool in Israel, although limited in space, has a high variability that represents a big portion of the avocado world germplasm.

In regard to the Mexican race (Persea americana, Var, Drymifolia), we very rarely found any resistance to known stress factors in Israel and we don not expect to produce any new cultivar through breeding. It is most tolerant to low temperature and some of the items included in the genepool are already known for this characteristic.

The Guatemalan race (Persea americana Var. Guatemalensis), could be a good source for a new cultivar, but it is not expected to produce resistant rootstocks. Some of the items conserved from these two races are included because they show "primitive" traits of the race.

The West Indian avocado (Persea americana, Var. Americana) is important in Israel because it shows resistance to salinity. Hence, this group has more representatives in the gene pool than the former two groups.

The non-identified group of the avocado should receive more attention, as some hybrids are included here and some other could be older forms of Persea americana, from which the known races were developed.

Out of Persea americana, we got 22 items in the genepool. 21 of them are Persea species, such as Persea schiedeana, which differ in many characters from P. americana, and have not yet produce any fruits in Israel. The other Persea species are mostly close relatives of the Persea americana, and in our opinion are primitive types of the americana. There are also some representatives of the Eriodaphne sub-genera, such as P. borbonia and P. Indica, and one Beilschmedia species from Chile.

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Table 1: Alphabetical list of accessions included in Bet-Dagan genepool, their location in the orchard and their description

	Row/Tree	Country of Origin	State or Region	Type/race	Description
Aguacate de Anis	7/33, 9/18	Honduras	San Pedro Sula	Guatemalan?	Anise smell of fruit
Aguacate de Monte	7/29	Costa Rica	Alajuela	Ag. de Monte	Endemic type
Aguacatitlan	10/13	Mexico	Mexico state	Mexican	Old tree
Amatenango	8/21	Mexico	Chiapas	Guatemalan	Primitive type
Amatlan	8/14	Mexico	Nayarit	West Indian	Isolated tree
Antigua	5/11-12	Mexico	Vera Cruz	West Indian	Dwarfing type
Apakia 1	8/8	Ecuador	Chota Valley	Hybrid?	Primitive type
Apakia 2	8/7	Ecuador	Chota Valley	Hybrid?	Primitive type
Aquila 1	10/2	Mexico	Vera Cruz	Mexican	Very primitive
Aquila 2	10/3	Mexico	Vera Cruz	Mexican	Very primitive
Arbol 1	7/22, 28	Panama	Chiriqui	West Indian	
Arbol 2	7/21, 26	Panama	Chiriqui	West Indian	
Argui 1	7/11	Canary Isl.	Grand Canary	West Indian	Arid zone
Argui 3	7/15-16	Canary Isl.	Grand Canary	West Indian	Arid zone
Avocatosa 2	5/15	Mexico	Nayarit	West Indian	Primitive and strong
Avocatosa3	5/26	Mexico	Nayarit	West Indian	Primitive and strong
Baños	10/4	Ecuador	Baños	Mexican	Big "Nacional"
Basaldua (1)	10/12	Mexico	Michoacan	Mexican	Cultivar-big fruit
Blue Mts 1	9/30-31	Jamaica	Blue Mountains	Not identified	Local type
Blue Mts 2	9/32-33	Jamaica	Blue Mountains	Not identified	Local type
Beilschmedia miersii	6/28	Chile	Quillota	Bielschmedia Miersii	Belloto
Borchard	9/4	USA	California	Mexican	Lime tolerant
Buena Fe 2	9/17	Ecuador	Pacific Coast	West Indian	Special type
Buena Fe 3	9/20	Ecuador	Pacific Coast	West Indian	Special type
CH-C11 Pahua (4)	9/6-7	Mexico	Tochimilco	Guatemalan	Pahua
CH-G 26/5 (3)	10/21, 33	Mexico	Chiapas	Mexican	Amatenango S4
Comitan 1	8/26	Mexico	Chiapas	Guatemalan	Primitive type
Comitan 3	8/15	Mexico	Chiapas	Guatemalan	Primitive type
Costa Rica 4	5/27	Costa Rica	Peninsula Nicoya	West Indian	Inundation tolerant
Cuevas	8/13	Mexico	Chiapas	Guatemalan	
Damian 1	10/16-17	Mexico	Motozintla	Mexican	Precocious
Damian 2	10/15	Mexico	Motozintla	Mexican	Precocious
Day	5/22	USA	Florida	Hybrid W.I.xMex	Cold resistant
Egami	7/12-14	USA	Hawaii	Guatemalan	
El Cercado	7/9-10	Spain	Malaga	Not identified	
El Charco 1	7/19	Spain	Malaga	Not identified	Old introduction
El Charco 2	7/17-18	Spain	Malaga	Not identified	Old introduction
El Charco 3	7/20	Spain	Malaga	Not identified	Old introduction
El Pino	7/25	Honduras	Atlantic Coast	West Indian	
El Venado 2	5/17	Mexico	Nayarit	Hybrid?	Strong tree
Fredi 4	7/30	Costa Rica	Poas de Aseri	Ag. de Monte	
Fredi 5	7/31	Costa Rica	Poas de Aseri	Ag. de Monte	
Fredi 7	10/31-32	Costa Rica	Poas de Aseri	Ag. de Monte	
Frowe	5/30	USA	Hawaii	West Indian	Cultivar

	Row/Tree	Country of Origin	State or Region	Type/race	Description
Fuerta Negra	9/8	Mexico	Coatepec Harinas	Mexican	Good fruit quality
Gainsville	10/5-6	USA	Florida	Mexican	Frost resistant
Galvan	5/24-25	Mexico	Vera Cruz	West Indian	
Gordienko 1	5/19, 23	Costa Rica	Atenas	West Indian	Rootrot resistant
Guacimal	10/25	Costa Rica	Guacimal	Not identified	Arid zone
Guadelupe 1	9/24	Mexico	Puebla	Not identified	
Guadelupe 2	9/25	Mexico	Puebla	Not identified	
Guat 1	8/19	Ecuador	Guayabamba	Not identified	Local hybrid
Guayabamba	10/7-8	Ecuador	Guayabamba	Mexican	"nacional" type
Guzman	5/16	Mexico	Nayarit	West Indian	Drought resistant
HAES 7315	9/2	USA	Hawaii	Hybrid	Cultivar
Hojancha 2	10/29	Costa Rica	Peninsula Nicoya	West Indian	Cultivar?
Huitepec 2	6/27	Mexico	Chiapas	Persea steyermarkii	
Huixtla	8/33	Mexico	Chiapas	West Indian	
IB Chalam	6/20	Mexico	Chiapas	Persea schiedeana	Old huge tree
IB Chalam B	6/24-25	Mexico	Chiapas	Persea schiedeana	Young tree
IB Chalam S	6/12	Mexico	Chiapas	Persea schiedeana	Seedling
Irigaray 141	8/32	Costa Rica	Guanacaste	Hybrid?	Arid zone
Irigaray 148	8/31	Costa Rica	Guanacaste	Hybrid?	Arid zone
Km 145	10/1	Mexico	Chiapas	Mexican	Primitive type
Km 43	8/22	Mexico		Mexican	
La Lucha	6/19	Guatemala	San Marcos	Persea nubigena	Young seedling
La Merced	9/26-27	Ecuador	Amazonas	West Indian	Special type
La Mesa	9/16	Chile	Quillota	Guatemalan	Cultivar candidate
La Piscina	7/5-6	Spain	Malaga	Not identified	Old tree
Las Americas	8/24-25	Honduras	Atlantic Coast	Guatemalan	Huge tree
Leyad Aro	7/13-14	Canary Isl.	Tenerife	Not identified	Strong tree
Lino	6/6	Honduras	Ocotepeque	Persea schiedeana	Called zucte
Llano Lindo 1	5/31	Costa Rica	Orotina	West Indian	Seedless fruit
Los Angeles 1	10/26	Costa Rica	Guacimal	Not identified	Arid zone
Los Angeles 3	10/28	Costa Rica	Guacimal	Not identified	Arid zone
Lula	9/9	USA	Florida	WI x Guat. Hyb.	Cultivar
Marichal	10/14, 24	Costa Rica	Orotina	Not identified	
Maskaria 1	8/17	Ecuador	Chota Valley	Not identified	
Maskaria 3	8/18	Ecuador	Chota Valley	Not identified	
Mayo 133	9/15	USA	California	Mexican	Cultivar?
Mercado S. Pedro Sula	7/32	Honduras	San Pedro Sula	Guatemalan?	Ag. de anise
Mina 1 “S”	9/13	Costa Rica	Guanacaste	West Indian	Cultivar candidate
Mina 2 “S”	9/14	Costa Rica	Guanacaste	West Indian	Cultivar candidate
Miremar	5/1-2	Costa Rica	Limon	West Indian	Old and resistant
Miremar “S”	5/32	Costa Rica	Limon	West Indian	
Motozintla 3	6/29, 9/19	Mexico	Motozintla	Guatemalan	Very primitive
Nabal 3	9/3	Israel	Volcani Center	Guatemalan	Salinity tolerant
Negra de la Cruz	10/10-11	Chile		Mexican	Cultivar
Nochan 3	8/27	Guatemala	Quetzaltepeque	Guatemalan	Market sample
Nevillero	5/14	Mexico	Vera Cruz	W.I.xGuat?	Flood resistant
No race	7/7-8	Mexico	Vera Cruz	Not identified	
Ocho Rios	9/10	Jamaica	North Coast	West Indian	
Orizaba 1	5/18	Mexico	Vera Cruz	West Indian	Market sample
Orizaba 3	5/29	Mexico	Vera Cruz	West Indian	Market sample

	Row/Tree	Country of Origin	State or Region	Type/race	Description
Orizaba 4	5/9	Mexico	Vera Cruz	West Indian	Market sample
Pacayal 1	9/21	Guatemala	Pochuta	Persea tolimanensis	Ag. de mico
Pacayal 5	9/29	Guatemala	Pochuta	Persea tolimanensis	Ag. de mico
Palestina	8/10-11	Guatemala	San Marcos	Guatemalan	Early ripening
P. americana C 2+ (2)	8/2	Colombia		Wild West Indian	
P. americana H1-72 (2)	8/3	Honduras		Not identified	Aguacate de anise
P. americana T2 (2)	8/9	USA	Hawaii		
P. borbonia (2)	6/31	USA	California	Persea borbonia	
P. cinerascens (2)	6/30	Mexico			
P. fluccosa H1-71 (2)	6/15-16	Mexico		Persea floccosa	
P. gigantea (2)	6/22	Honduras		Persea gigantea	
P. indica (2)	6/32-33	Canary Isl.		Persea indica	
P. longipes (2)	6/5, 10	Mexico		Persea longipe	
P. nubigena 1/7 (2)	6/17-18	Guatemala		Persea nubigena	Israeli selection
P. nubigena 1/8 (2)	6/21	Guatemala		Persea nubigena	Israeli selection
P. schiedeana Var. (2)	6/7	Guatemala		Persea schiedeana	
P. schiedeana 46/05 (2)	6/1-2	Guatemala		Persea schiedeana	
P.i.s. 6915	8/16	USA		Hawaii	
Progresso	5/6	Honduras	Progresso	West Indian	Market sample
Puerto Jimenez	5/10	Costa Rica	Peninsula OSA	West Indian	Old, huge tree
Puerto Viejo	8/4-5	Costa Rica	Sarapiqui	Guatemalan	
Rio Negro 1	10/20	Ecuador	Amazonas	Mexican?	
Rio Negro 2 9/22-23	Ecuador	Amazonas	West Indian	Special type	
Rirotonga A (2)	5/20	Malaysia		West Indian	Flooding tolerant
Rirotonga B (2)	5/21	Malaysia		West Indian	Flooding tolerant
Rocja	6/13-14	Guatemala	Alta Vera Paz	Persea schiedeana	Very primitive
Rollie	8/1	USA	California	Guatemalan	
San Cristobal	8/12	Mexico	Chiapas	Guatemalan	Market sample
San Cristobal Mer 35	8/28	Mexico	Chiapas	Guatemalan	Market sample
San Cristobal Mer 36	8/29	Mexico	Chiapas	Guatemalan	Market sample
San Javier 1 7/1-2	Canary Isl	La Gomera	West Indian		
San Javier 8 7/3-4	Canary Isl	La Gomera	West Indian		
San Marcos	8/6, 30	Guatemala	San Marcos	Guatemalan	Cultivar candidate
San Rafael	7/23, 27	Guatemala	San Marcos	Guatemalan	
San Sebastian 10	5/8	Canary Isl.	La Gomera	West Indian	
San Sebastian 11	5/7	Canary Isl.	La Gomera	West Indian	
Semil 34	9/11	Puerto Rico		West Indian	Tested as cultivar
Semil 43	8/12	Puerto Rico		West Indian	Tested as cultivar
Sholola 1	8/23	Mexico	Chiapas	Guatemalan	
Sholola 6	8/20	Mexico	Chiapas	Guatemalan	
Tantima 2	5/28, 33	Mexico	Vera Cruz	West Indian	Wild tree
Tantima 3	10/18-19	Mexico	Vera Cruz	Mexican	Wild tree
Tapachula	5/4	Mexico	Chiapas	West Indian	Big seedling
Tela 2	5/3	Honduras	Tela	West Indian	Market sample
Tela 3	5/5	Honduras	Tela	West Indian	Market sample
Tezuitlan	10/9	Mexico	Vera Cruz	Mexican	
Tochomilco 1	10/27, 30	Mexico	Puebla	Mexican	Oldest tree
Toro Blanco	5/13	Mexico	Vera Cruz	West Indian	Flood tolerant
Toro Canyon	9/5	USA	California	Mexican	Pc tolerant
Tzontehuitz	6/8-9	Mexico	Chiapas	Persea sreyermarkii	Wild population

	Row/Tree	Country of Origin	State or Region	Type/race	Description
Trapp	9/1	USA	Florida		Cultivar
Urdesa “S”	10/22-23	Ecuador	Pacific Coast	West Indian	Special type
Xichoy 1	6/26	Guatemala	Tecpan	Persea nubigena	Old huge tree
Xichoy 1 “S”	6/23	Guatemala	Tecpan	Persea nubigena	Seedling

(1) Brought to Israel from Hawaii

(2) Brought to Israel from Riverside, California

(3) Material was taken from low altitude CICTAMEX genepool, trees 137, 135

(4) Material was taken from high altitude CICTAMEX genepool, trees 8, 9