World Listing of Avocado Cultivars According to Flowering Type*

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ABSTRACT

Nearly 500 avocado cultivars were compiled according to their country of origin, race and flowering group. Most cultivars (75%) belong to the Guatemalan race and its hybrids. Worldwide, these cultivars are divided almost equally between flowering groups A (female opening morning to noon) and B (male opening in the afternoon). Sixty-three percent of the cultivars selected in California belong to the A flowering group, indicating an inherent advantage under cool subtropical weather. In more tropical countries like Mexico, Hawaii and Guatemala, group-B cultivars predominate.

Liste des variétés d'avocat exploitées dans le monde, classées selon leur groupe de floraison.

RÉSUMÉ

Environ 500 variétés d'avocat ont été évaluées selon leur pays d'origine, leur race et leur groupe de floraison. La plupart des variétés (75 %) appartiennent au groupe Guatemala et à leurs hybrides. A l'échelle mondiale, ces cultivars se répartissent presque également entre un groupe de floraison A (la fleur femelle s'ouvre le matin et la fleur mâle le lendemain après-midi) et un groupe de floraison B (la fleur femelle s'ouvre l'après-midi, et la fleur mâle le lendemain matin). 60 % des cultivars sélectionnés en Californie appartiennent au groupe A, indiquant un avantage naturel en climat subtropical froid. Dans les régions plus tropicales comme au Mexique, à Hawaï et au Guatemala, le groupe B est prédominant.

Lista mundial de variedades de aguacate de acuerdo con el grupo floral.

RESUMEN

Se compilaron aproximadamente 500 variedades de aguacate según el país de origen, la raza y el grupo floral. La mayoría (75 %) de las variedades pertenecen a la raza guatemalteca y a sus híbridos. A nivel mundial, dichas variedades se dividen casi equitativamente entre los grupos florales A (cuya flor hembra se abre durante las mañanas) y B (cuya flor masculina se abre durante las tardes). Un 60 % de las variedades seleccionadas en California pertenecen al grupo floral, lo cual señala una ventaja inherente bajo un clima subtropical fresco.

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MOTS CLÉS

Persea americana, world, varieties, races, flowering

KEYWORDS

Persea americana, monde, variété, race, floraison.

PALABRAS CLAVES

Persea americana, mundo, variedades, razas, floración.

introduction

The avocado flower is protogynous, *i.e.* its pistil is receptive before pollen shedding. The flower opens twice and these openings are separated by at least one overnight period. Each opening lasts for several hours.

First opening (female): All nine stamens bend outward against the perianth, forming an approx. 90° angle with the lone erect pistil. The stigma is white and pollen-receptive but the pollen sacs are closed.

Second opening (male): The six stamens of the two outer whorls form a 30-40° angle with the pistil, while the three inner-whorl stamens stand erect, adjacent to and covering it. Dehiscence of the anthers usually occurs 1-2 h after the second opening. The stigmatic surface sometimes maintains its white color, but more often it darkens. Pollen may germinate on the stigma at this stage, but pollen tube growth is usually arrested in the style and fails to reach the ovule.

Avocado cultivars fall into one of two flowering groups. Under warm-weather conditions, the two groups behave as follows:

Group A - First (female) opening starts in the morning and ends before noon. Second (male) opening occurs in the afternoon of the next day.

Group B - The reverse pattern is observed: female opening occurs in the afternoon and male opening the next morning. The two groups are thus reciprocal, enabling cross-pollination to take place.

As the weather becomes cooler, the openings and closings of the flowers are delayed. In addition, more than one night may elapse between the first and second openings. During the cool, early spring, this delay may cause an apparent reversal of flowering behavior in the two flowering groups. Hence, the first opening of group-A flowers is delayed and starts at noon or even in the afternoon, while the first opening of the group-B flowers is delayed until night-time or even the following morning. Under such conditions, two to four nights can pass between the first and second openings. When the weather is cooler, no typical female opening occurs.

Interplanting cultivars that belong to complementary flowering groups and bloom at the same time tends to increase pollination rates and promote cross pollination and consequently fruit set; yields are usually improved. The data presented in Table 1 may serve the grower and breeder as a ready source of information when searching for suitable pollenizers.

The following list does not include all world cultivars, only those whose flowering types have been classified. The list was compiled mainly from reports from California (Gustafson, 1976; Hodgson, 1930; Peterson, 1956), Florida (Knight, 1971; Stout, 1933; Wolf *et al.*, 1946), Puerto Rico (Abrams *et al.*, 1957; Hume, 1951; Martin e*t al.*, 1976; Pennock *et al.*, 1963), Hawaii (Ito and Fujiyama, 1980; Yee, 1978), the Philippines (Torres, 1936), Israel (Gazit *et al.*, 1985-1992; Snir, 1971), the Canary Islands (Galvan, 1991), South Africa (Bester, 1975) and Australia (Alexander, 1978). Most unnamed selections, identified by numbers only, were not included in this list. The origin and race of the cultivars were added whenever known. These data are based mostly on publications by Pennock *et al.* (1963), Rhodes *et al.* (1971), Robinson and Savage (1926), Brooks and Olmo (1950), Rounds (1950), and on observations by the authors.

Testing the equality of two proportions was made by normal approximation (Z-test).

results and discussion

The list (Annex 1) includes nearly 500 avocado cultivars, selected around the world during the present century. We also included five *Persea* species at the end of the list, although it may be assumed that in each species segregation to flowering groups A and B occurs, as in *Persea americana*.

Most cultivars (about 84%) were selected in developed countries where a considerable amount of research on avocado has been performed. Therefore about 77% of the cultivars on the list (excluding those of unknown origin) have been registered in the USA (including California, Florida, Hawaii and Puerto Rico) (Table 1). Varietal research is limited in Central America, where the avocado originated, consequently only 16% of the cultivars were recorded there.

Most avocado cultivars (about 75%, excluding those of unknown race) belong to the Guatemalan race and its hybrids (Tables 2 and 3). Second in number of cultivars is the West-Indian race, and third is the Mexican race. Most cultivars (58%) are "pure" to each race (Brooks and Olmo, 1972; Galvan, 1991; Rhodes *et al.*, 1971; Robinson and Savage, 1926; Rounds, 1950), but some of them are actually hybrids, as in the case of cv Hass. Although Hass looks typically Guatemalan, it contains some Mexican-race genes (Bergh and Whitsell, 1974). Other cultivars will almost certainly be identified as hybrids when isoenzyme, RFLP and DNA fingerprint analyses are used to study their genetic structures.

Out of the 495 cultivars, only three are Mexican x West-Indian hybrids. This is because of the very limited geographical contact between these two races, the Mexican one is common to the tropical highlands and the West-Indian one to the tropical lowlands. Moreover, there is only a limited overlap in flowering times between the two races; the Mexican race flowers early in the season, while the West-Indian race flowers much later.

Table 1
Avocado cultivars listed by country and flowering group.

Country	Number of cultivars	Percent of cultivars belonging to group A	B	Sig.
California	114	63.2	36.8	**
Florida	98	48.0	52.0	NS
Puerto Rico	76	52.6	47.4	NS
Mexico	32	25.0	75.0	**
Hawaii	31	38.7	61.3	NS
Guatemala	26	26.9	73.1	*
Israel	24	37.5	62.5	NS
Others	15	33.3	66.7	NS
Unknown	77	54.5	45.5	NS
Total or mean	**493[x]**	**49.1**	**50.9**	

* P>0.05; ** P>0.01; N.S.: not significant (Z-test).
[x] Two cultivars were excluded since their flowering group is in question.

Table 2
Flowering group-race relationship.

Race	Number of cultivars	Percent of cvs belonging to group A	B
Guatemalan	130	50.8	49.2
Mexican	50	44.0	56.0
West-Indian	44	61.4	38.6
Guatemalan x West-Indian	120	44.2	55.8
Mexican x Guatemalan	41	42.5	57.5
West-Indian x Mexican	3	33.3	66.7
Unknown	107	54.2	45.8
Total or mean	**495[x]**	**49.3**	**50.7**

All differences were found to be not significant. (Z-test)
[x] Two cultivars were excluded since their flowering group is in question.

relationship between country and flowering group

Avocado cultivars around the world (Annex 1) are divided almost equally between flowering groups A and B (Table 1). However in many countries and regions there are variations. Most of these noticable differences are not significant and may merely reflect accidental fluctuations. However, varietal selection in California exhibits a very significant preference for group-A cultivars (63.2%), while group-B cultivars markedly predominate in Mexico (75%) and Guatemala (73.1%). There were no significant differences in the flowering group ratios between races (Table 2).

Research performed on the mode of inheritance of flowering groups (limited to Guatemalan and Mexican races and their hybrids) has shown that the flowering group trait is encoded by several loci with several alleles at each locus. Group-B offspring have been found to predominate in hybrids, even when the two par-

Table 3
Avocado races and hybrids according to their country of origin (see table 2 for race abbreviations).

	Race							
	Guat	**Mex**	**WI**	**GxWI**	**MxG**	**WIxM**	**Unknown**	**Total**
Country								
California	57	22	1	1	28		6	114
Florida	13	3	26	44	3	3	7	99
Puerto Rico	2		3	65			6	76
Mexico	12	14	1		3		2	32
Hawaii	9	1	4	5			13	32
Guatemala	26							26
Israel	7	6	1		8		2	24
Spain, Canar.	1	1		3			1	6
Cuba			2				1	3
Morocco			2					2
Australia	2							2
Honduras		1						1
Ecuador		1						1
Unknown	3	1	3	2			68	77
Total	**132**	**50**	**43**	**120**	**42**	**3**	**106**	**495**

ents belong to group A (Lavi *et al.*, 1993). It would be interesting to study the ratio of the two flowering groups in wild avocado populations to determine whether group-B flowering actually predominates in nature.

The 495 selected cultivars (Annex 1) do not represent the ratio of the two flowering groups in the wild but rather the effect of varietal selection. Productivity has always been one of the major traits selected for in most cultivars. High productivity is a prerequisite trait in the selection process carried out in Californian and Israeli avocado breeding programs. There is an inherent advantage for group-A cultivars in subtropical climates where cool weather predominates during the flowering period. Flower opening is substantially delayed under cool conditions. In group A, this delay pushes flowering from the morning to the afternoon, when pollinating insects are active and the temperature is suitable for pollen germination. However, in group-B cultivars, flowering is delayed to late afternoon or even night-time when insects are inactive and temperatures too low for pollen germination. We assume this to be the reason for the significant preference for group-A cultivars in California (Table 1), where group-B cultivars give poor yields in the cool coastal regions (Peterson, 1956).

Most of the 23 cultivars selected in Israel belong to group-B (Table 1), even though Israel is a subtropical country with cool weather during a large part of the avocado flowering period. This difference with subtropical California is probably accidental. The difference between the two groups is not statistically significant, and the list also contains rootstocks, pollinators and parents selected for traits other than productivity. Among the 12 new cultivars evaluated in Israel and recommended for semi-commercial planting during the last decade, only two belong to group B, and both are late-flowering cultivars. This indicates that also in Israel group-A cultivars have an inherent productivity advantage.

In tropical countries (such as Mexico, Hawaii and Guatemala), flowering occurs in warmer weather and the prevalence of group-B cultivars may reflect a tendency of avocados to produce an excess of group-B offspring (Lavi *et al.*, 1993).

references

1. ABRAMS R., PENNOCK W., JACKSON B.C., PEREZ LOPEZ A., 1957. Flower behavior of different avocado varieties grown in Puerto Rico. *J. Agric. Univ. Puerto Rico*, 41, 236-241.

2. ALEXANDER D. MCE., 1978. Some avocado varieties for Australia. *Commonwealth Scientific and Industrial Res. Org. Australia*, 35 p.

3. BERGH B.O., WHITSELL R.H., 1974. Self pollinated Hass seedlings. *Calif. Avocado Soc. Yb.*, 57, 118-126.

4. BESTER A., 1975. Flowering types of avocado cultivars. *Citrus and Subtropical Fruit Res. Inst. Inf. Bul.*, Nelspruit (South Africa), 36, 12-13.

5. BROOKS R.M., OLMO H.P., 1972.
Register of new fruit and nut varieties. Berkeley and Los Angeles (California): Univ. of Calif. Press, 2nd ed, 708 p.

6. GALVAN D.F., 1991.
Personal communication. Centro de investigation y tecnologia agrarias, Tenerife, Canary Islands, Spain.

7. GAZIT S., EISENSTEIN D., ELIMELECH M., BEN-YA'ACOV A., ZAMET D., 1985-1992.
Observations in Israel. Bet-Dagan (Israel): Agricultural Res. Organization, The Volcani Center, internal documents.

8. GUSTAFSON C.D., 1976.
Avocado flower types. *Agricultural Extension Service. University of California (Stensil)*, 3 p.

9. HODGSON R.W., 1930.
The California avocado industry. *Calif. Agric. Ext. Ser. Circ.*, 43, 86 p.

10. HUME E., 1951.
Growing avocados in Puerto Rico. *Fed. Exp. Sta. Puerto Rico. USDA.* Mayaguez (Puerto Rico), Circ., 33, 53 p.

11. ITO P.J., FUJIYAMA D.K., 1980.
Classification of Hawaiian avocado cultivars according to flower types. *HortScience*, 15, 515-516.

12. KNIGHT R.J.Jr., 1971.
Comportamiento de la floración (clasificación A y B) de cultivares de aguacate. *Proc. Trop. Region Amer. Soc. Hort. Sci.*, 15, 14-18.

13. LAVI U., LAHAV E., DEGANI C., GAZIT S., 1993.
Genetics of skin color, flowering group and anise scent in avocado. *J. of Heredity*, 84, 82-84.

14. LICHOU J., VOGEL R., 1972.
Biologie florale de l'avocatier en Corse. *Fruits*, 27 (10), 705-717.

15. MARTIN F.W., ALMEYA N., RUBERTE R., JORDAN F., 1976.
Inventario de frutas tropicales en Puerto Rico. *La Facultad de Ciencias Agric., University Puerto Rico, Recinto Mayaguenzano,* 38 p.

16. PENNOCK W., SOTO T., ABRAMS R., GANDIA CARO R., PEREZ A., JACKSON G.C., 1963.
Variedades selectas de aguacates de Puerto Rico. *Univ. de Puerto Rico. Estación Exptl. Agric. Río Piedras, Puerto Rico. Bol.*, 172, 59 p.

17. PETERSON P.A., 1956.
Flowering types in the avocado with relation to fruit production. *Calif. Avocado Soc. Yb*, 40, 174-179.

18. RHODES A.M., MALO S.E., CAMPBELL C.W., CARMER S.G., 1971.
A numerical taxonomic study of the avocado (*Persea americana* Mill.). *J. Amer. Soc. Hort. Sci.*, 96, 391-395.

19. ROBINSON T.R., SAVAGE E.M., 1926.
Pollination of the avocado. *USDA, Dept. Circular*, 387, 16 p.

20. ROUNDS M.B., 1950.
Check list of avocado varieties. *Calif. Avocado Soc. Yb.*, 1950, 178-205.

21. SNIR E., 1971.
Flowering, pollination and fruit set in avocado. Rehovot (Israel): Faculty of Agric., Hebrew Univ., M.Sc. Thesis, 49 p.

22. STOUT A.B., 1933.
The pollination of avocados. *Fla. Agric. Exp. Sta. Bul.*, 257, 44 p.

23. TORRES J.P., 1936.
Some notes on avocado flower. *The Philippine J. of Agric.*, 7, 207-227.

24. YEE W., 1978.
Producing avocado in Hawaii. *Univ. Hawaii Coop. Ext. Ser. Circ.*, 382, 24 p.

25. WOLFE H.S., TOY R.L., STAHL A.L., 1946.
Avocado production in Florida. *Agric. Ext. Service, Gainsville, Florida, Bull.*, 129, 107 p.

Annex 1
Avocado cultivars listed by country of origin, race and flowering group.

The following abbreviations are used (for both race and country of origin).

AUSTR	Australia	HOND	Honduras
CA	California	ISR	Israel
CANAR	Canary Islands	MEX (or M)	Mexico (Mexican)
CUBA	Cuba	MOR	Morocco
ECU	Ecuador	PR	Puerto Rico
FL	Florida	SPAIN	Spain
GUAT (or G)	Guatemala (Guatemalan)	WI	West-Indian (Antillian)
HI	Hawaii		

Cultivar	Origin	Race	Flowering group	Reference
Adi (=Akko 4446)	ISR	GUAT	A	7
Adjuntas Guatemala	PR		A	1
Ajax	FL	GxWI	B	12, 25
Akbal	GUAT	GUAT	B	22
Akko 4446 (=Adi)	ISR	GUAT	A	7
Alboyce	CA	GxM	A	4, 8, 11
Anaheim	CA	GUAT	A	2, 4, 17, 21
Anakanda			B	21
Ardith (=0028)	CA	GxM	A	7
Arona	CANAR	MEX	B	6
Arturo	CA	MEX	B	8
Arue	FL	G?WI?	A	12
Ashikawa	HI	GUAT?	A	11
Atlixco	MEX	GUAT?	A	9, 12, 19, 22
Avila	PR	WI	A	1, 12, 16
Avon	FL	GxWI	A	12, 25
Aycock Red No. 19			A	12
Azul1	MEX	MEX	B	7
Bacon	CA	MxG	B	2, 4, 8, 17, 21
Baker	FL	WI	A	22
Baldwin	FL	WI	A	22, 23
Barker	FL	WI	A	19, 22
Beardslee	HI	GUAT	A (B)	11, (24)
Belize			A	12
Bender			A	12
Benik	GUAT	GUAT	A	4, 8, 9, 19, 21, 22
Beta			B	12
Bitte	FL	WI	B	12, 22, 25
Blair	FL	GUAT	B	12, 25
Blakeman	CA	GUAT	A	9, 19, 22, 23

Cultivar	Origin	Race	Flowering group	Reference
Bonita	CA	GUAT	B	5, 21
Bonita	FL	GUAT	A (B)	25, (12)
Booth No.1	FL	GxWI	A	4, 12, 22, 25
Booth (Nos. 2-12, X, Y)	FL	GxWI	B	1, 4, 12, 15, 22, 25
Borrego			A	12
Brogden	FL		B	5, 12
Brooks	FL	GUAT	A	22
BrooksLate	FL		A	12
Brooksville			A	12
Butler	FL	WI	A	1, 9, 11, 12, 15, 16, 19, 22
Butternut	MEX	GUAT	B	22
Byars	FL	GxWI	B	5, 12
Cabnal	GUAT	GUAT	B	9, 22
California (=Wagner) (inc. 4-16)	CA	GUAT	A	12, 22
Cali Poli 5 (= CPK5)	CA		A	7
Canaan (= Kanan)	PR	GUAT	A	1, 15, 16
Candelaria	PR?		A	15
Cantel	GUAT	GUAT	A	9, 22
Capac	ECU	MEX	A	12
Cardinal	FL	WI	B	22, 23
Cardo			A	12
Carlsbad	MEX	GUAT	A	4, 8, 17, 22
Case	HI	GUAT	B	11
Castaner	PR?		A	1
Catalina	CUBA	WI	A	12
Cerezo	MEX	MEX	B	7
Challenge	CA	GUAT	A	9, 19, 22, 23
Champion		GUAT	B	9, 22
Chang		GUAT	B	7, 11
Chapot (Nos. 42, 43)			A	12
Chapultepec Park	MEX	MEX	B	12
Chica			B	12
Chisoy	GUAT	GUAT	B	22
Choice (=Stephens Choice)	MEX	GUAT	B	9, 22
Choquette	FL	GxWI	A	1, 4, 12, 15, 25
Clifton	CA	MEX	B	4, 8, 17
Clower	CA	GUAT	A	9, 22
Coban	GUAT	GUAT	B	11, 22
Colin V-33	MEX	MxG	B	7
Colla	GUAT	GUAT	B	9, 12, 19, 22
Collason (Nos. 1, 2, 3)	FL	GxWI	A	4, 22
Collinred (also C, D, E)	FL	GxWI	A	22, 25
Collinred A	FL	GxWI	B	22
Collinred B (=Fairchild)	FL	GxWI	A (B)	12, 25 (22)
Collins	GUAT	GUAT	B	9, 12, 19, 22
Collinson	FL	GxWI	A	1, 8, 9, 19, 25

Cultivar	Origin	Race	Flowering group	Reference
Collison			A	23
Colorado	CA	GUAT	A	9, 22, 23
Commodore	FL		A	23
Cook	FL	GUAT	B	19, 22
Corona	CA	GUAT	A	14, 21
Courtright	FL	MEX	A	5, 12
Covacado (=Mayo)	CA	GUAT	A	17
CPK 5 (=Cali Poly 5)	CA		A	7
Creelman	CA	GUAT	B	12
Cyrus	FL		B	23
Dade	FL	WI	A	7, 12
Day	FL	WIxM	B	7
De Bard	CA	MxG	B	21
Decem	CA	MxG?	A	5, 8, 17
Diamond	CA	MxG?	A	5, 8
Dickey	CA	GUAT	A	9, 19, 22
Dickinson	CA	GUAT	A	1, 4, 8, 9, 19, 22, 23
Donalson			B	1, 15
Dorothea	CA	GxM	B	9, 22
Duke	CA	MEX	A	4, 8, 17
Dulce	CA	MEX	A	1
Dunedin	FL	GUAT	A	12, 22, 25
Dupuis No. 2	FL	WI	A (B)	12, (7)
Eagle Rock (=Galloupe)	CA	GUAT	B	9, 19, 22, 25
Earle's Late			B	22
Edmonds	FL	GxWI	B	12, 25
Edranol	CA	GUAT	B	2, 4, 8, 17, 21
Ein Vered	ISR	GUAT?	A	7
El Oro		GUAT	B	9, 19, 22
El Presidente			A	22
Elsie	CA	GUAT	B	8, 17
El Venado	MEX	WI	B	7
Emerald	CA	MEX	A (B)	8, 17, (21)
Epigmanyo	MEX	MEX	B	7
Esparta		MEX	B	11
Estelle	FL	WI	B	19, 22
Esther	CA	GUAT	A	7
Ettinger	ISR	MxG	B	4, 7, 8, 21
Ezaki	HI		B	11
Fairchild (=Collinred B)	FL	GUAT	A	12
Family	FL	WI	A	12, 19, 22
Fasher	ISR	MEX	B	7
Flamingo			A	22
Ford			A	21

Cultivar	Origin	Race	Flowering group	Reference
Fort Drum			B	12
Frank			A	1, 15
Frowe	HI	WI	B	11
Fuchsia (=Fuchs)	FL	WI	A	1, 5, 12, 15, 20, 22, 25
Fuerte	MEX	MxG	B	1, 2, 4, 7-9, 11, 12, 15, 17, 19, 21-25
Fujikawa	HI	GUAT	B	11, 24
Fulford	FL	WI	B	22
Gainsville	FL	MEX	B	7
Galloupe (=Eagle Rock)	CA	GUAT	B	22, 25
Galo	PR	GxWI	B	12, 15
Ganter	CA	MEX	B	8, 9, 22, 25
Garcia	CA	MEX	A	22
Gazzam	CA	MEX	A	22
Gehee	CA	MEX	A	8, 17
General Bureau	MOR	WI	A	7
Gil	ISR	GUAT	A	7
Gossman	FL	WI	B	5, 12
Gottfried	FL	MEX	A	9, 12, 19, 25
Grande	MEX	GUAT	A (B)	22, 23, (12)
Green Gold	HI	GUAT	A	7
Green Hass Mayers	CA	GUAT	B	7
Greenstem	CA	GxWI	A	7
Gripina (Nos. 1, 9, 10, 20)	PR	GxWI	A	1, 15
Gripina (Nos. 2-8, 11-16, 18, 19)	PR	GxWI	B	1, 11, 12, 15
Guatemala	GUAT	GUAT	A	1, 11
Gulfstream	FL	GxWI	B	5, 25
Gwen	CA	GxM	A	7
Haes 6/5	HI	WIxG?	B	7
Haes (=Hayes) 7315	HI	GxWI	A	7
Hal R 4 T 41	HI		B	11
Hal R 27 T 27	HI	WI	A	7
Hal R 27 T 40	HI		B	11
Hal R 28 T 18	HI	WIxG?	A	11
Hall	FL	WIxG	B	1, 9, 12, 15, 16, 21, 25
Hammock			A	12
Hansen		WI	B	7
Hanson			B	22
Hardee	FL	WI	B	12, 22
Harman	MEX	GUAT	B	9, 19
Harmon			B	22
Harris	FL	GUAT	A	5, 25
Hashimoto	HI		B	11
Hass (incl. 670, F_2)	CA	GUAT	A	2, 4, 7, 8, 11, 14, 17, 21, 24
Hasty			A	12
Hawaii	HI	WI	A	9, 12, 22

Cultivar	Origin	Race	Flowering group	Reference
Hawaiian	HI		A	22
Hayes (=Haes) 7315	HI	GxWI	A	7
Hazzard	CA	GUAT	A	2
Herman	FL	GxWI	A	5, 7, 25
Hernandez	PR	WI	A	1
Hickson	FL	GxWI?	B	1, 5, 12, 15, 25
Hollis			A	22
Horshim	ISR	MxG?	B	7
Hosack			B	22
Hulumanu	HI	WI	A	11, 24
Ile de France	MOR	WI	B	7
Ilialu	HI	GxWI	A	11, 24
Indian River	FL	MxWI	A	25
Iriet	ISR	GUAT?	B	7
Irvings (Nos. 34, 65, 78, 134)	CA		B	8, 12, 17, 21
Isabela (Nos. 1, 14, 21, 126, 152, 167, 179, 182, 204, 219, 233, 360)	PR	GxWI	B	1, 12, 15
Isabela (Nos. 2, 11, 28, 38, 41, 68, 86, 109, 111, 116, 138, 147, 155, 178, 186, 188, 221, 227, 236, 330, 354)	PR	GxWI	A	1, 12, 16
Ishim	GUAT	GUAT	B	9, 22
Ishkal	GUAT	GUAT	A	9, 22
Itzamna	GUAT	GUAT	B	1, 9, 11, 12, 15, 19, 22, 24, 25
Ixtapan 101	MEX	MxG?	B	7
J 241	CA		A	7
Jalna	CA	MEX	A	2, 8, 17
Janboyce			A	8
Jim (=Jim Bacon)	CA	MxG	B	7, 8
JJ 9	CA	GUAT	A	7
Johnston	MEX	GUAT	B	1, 15
Jose Antonio			A	12
Julia (=N526)	CA	GUAT	A	7
Kaguah	HI		A	24
Kahaluu	HI	WIxG	B	7, 11, 24
Kalusa			A	12
Kampong	HI		B	11
Kanan (=Canaan) (Nos. 1, 2)	PR	GUAT	A	1, 15, 16
Kashlan	GUAT	GUAT	A	9, 11, 12, 22
Kay	FL	WI	A	22, 25
Kilgore Special	FL	GxM	B	25
Kosel (Nos. 1, 3-6)			A	22
Kosel (Nos. 2, 7)			B	22
Knight	GUAT	GUAT	B	1, 9, 15, 19, 22

Cultivar	Origin	Race	Flowering group	Reference
La Cruz	MEX?	MEX	B	7
Lamat	GUAT	GUAT	B	19, 22
La Sierra (=Fuerte)	CA	MxG	B	7
Las Mesas 221			A	1
Las Mesas 222			B	1
Leona	CA	GUAT	A	12
Lima Late			B	12
Linda	GUAT	GUAT	B	4, 8, 12, 19, 22-25
Lindgren	FL	GxWI	A	5, 25
Lula (Lulu)	FL	GxM	A	1, 4, 5, 9, 12, 15, 19, 22, 25
Lyon	CA	GUAT	B	4, 8, 19, 22, 23
Lyon 172	CA	GUAT	A	7
Mahan			A	22
Major	FL	GxWI	B	12, 25
Mal 2-1			B	11
Manik	GUAT	GUAT	A	9, 19, 22, 23
Maoz	ISR	WI	B	21
Marcianeco	MEX	MEX	B	7
Marcus			B	12
Marfield	FL	GxWI	A	12, 25
Marguerite	FL	GxWI	B	12, 25
Marshelline	CA	MxG?	B	7, 8
Masutomi	HI		B	11
Matsuba	ISR	MxG	B	7
Mattair			B	22
Mayapan	GUAT	GUAT	A	4, 8, 9, 22, 23
Mayo (=Covacado)	CA	GUAT	A	8, 17
Mayo B (=WW5)	CA	GxM?	A	7
Mayo 133A	CA?	MEX	A	7
McArthur	CA	GUAT	A	4, 8, 17
McCann	FL	WI	A	19, 22
McClure	FL	WI	B	22
McDonald	HI	GUAT	B	9, 12, 19, 22, 24, 25
Meico Negro			B	1, 15
Melendez 2	PR	GxWI	B	1, 12, 16
Mesa	CA	GUAT	A	5, 14
Meserve	CA	GUAT	B	9, 19, 22
Mexicola	CA	MEX	A	4, 8, 17
Miami			B	23
Millicent	AUSTR	GUAT	B	2
Mitchell	PR	WI	A	12, 25
Moanaloa	HI		A	22
Monge (Monje)	HI or PR	WI	B	1, 10, 11, 15
Monroe	FL	WIxG	(A) B	(25), 5, 7, 12
Montezuma	MEX	GUAT	B	9, 22
Montrei			A	21

Cultivar	Origin	Race	Flowering group	Reference
Moreno	HOND	MEX	B	7
Mowry			A	22
Murashige	HI	GUAT	B	7, 11
Murphy			A	12
Murrieta	MEX	GUAT	B	9
Murrieta 2 lb	CA	GUAT	A	22
Murrieta Green	CA	GUAT	A	22, 23
N (Nos. 12, 66, 151-2)	CA	GUAT	A	7
N-119	CA	GUAT?	B	11
N-526 (=Julia)	CA	GUAT	A	7
Nabal	GUAT	GUAT	B	2, 4, 7, 8, 11, 14, 17, 21, 24
Nabal (Karni)	ISR	GUAT	B	21
Nadir	FL	WIxG	A	5, 12
Nehrling	FL	GUAT	B	25
Nelson	FL	Gx?	B	12, 25
Nena	MEX	MEX	B	5, 11
Nesbitt			A	12
Netaim	ISR	MxG	A	7, 21
Newman	CA	MxG	B	21
Nezahualcoyotl	MEX		A	12
Nimlioh	GUAT	GUAT	B	9, 12, 19, 22
Nimliohson			B	22
Nir	ISR	GxM	A	7
Nirody	FL	GxWI	B	12, 22, 25
Nishikawa	HI	GUAT?	B	11
NN (Nos. 39, 62)	CA	GUAT?	A	7
No Race	MEX		A	7
Norman	FL	GUAT?	A	5, 12
Northrup	CA	MEX	B	8, 9, 17, 22
Nowels	CA	MxG	A	5, 14, 17
Nutmeg	HI	GUAT	B	22
0028 (=Ardith)	CA	GxM	A	7
0067	CA	GxM	A	7
Orit	ISR	GUAT	A	7
Orotava	CANAR	GUAT	B	6
Oshri	ISR	MEX	B	7
Padre	CA	GUAT	B	12
Panchoy	GUAT	GUAT	B	1, 9, 15, 19, 22, 23
Pankay	GUAT	GUAT	A (B)	9, 22 (11)
Pera Negra	MEX	MEX	B	7
Perfecto	MEX	MEX	A	1, 9, 19, 22
Peterson	FL	WI	A	12, 22, 25
Pinelli	FL	WI	A	12, 19, 22, 25
Pinkerton	CA	GxM	A	7, 8, 21

Cultivar	Origin	Race	Flowering group	Reference
Pinto	PR		A	15
Pollock	FL	WI	B	4, 9, 12, 19, 22, 23, 25
Popenoe (Nos. 3, 51029)	CA	MxG	A	22
Popenoe (also 51105)	CA	MxG	B	21, 22
Progreso Late			B	12
Puebla	MEX	MEX	A	4, 8, 9, 19, 22
Puerto Rico R.A.1	PR		A	1
Puerto Rico R.A.8	PR		B	1
Queen	GUAT	GUAT	B	4, 7-9, 19, 22, 23
Reasoner	FL	WI	A	22
104 Red Lable	CA	GUAT	B	7
Reed	CA	GUAT	A	2, 4, 7, 8
Regina	CA	GUAT	(A) B	(7), 8, 17
Reif (Nos. 1, 2)			A	12
Reinecke	CA	GUAT	A	7
Rey	GUAT	GUAT	B	9, 19, 22
Rey Tacamba	MEX	MEX	B	7
Richardson	FL		A	22
Rincon	CA	MxG?	A	2, 4, 8, 11, 17, 21
Robert's Seedling		WI?	B	7
Rodriguez			A	11
Roland 2-2			A	12
Rolfs (=Winslowson)	FL	GxWI	B	19
Romain		WI	A	7, 12
Rome (=S.P.I. 34831)			B	22
Rosh Hanikra II	ISR	MEX	A	7
Rosh Hanikra (III, IV)	ISR	MEX	B	7
Rue	CA	GUAT	A	12
Ruehle	FL	WI	A (B)	5, 7, 12, (11)
Russell	CA	WI	A	12
Ryan	CA	GxM	B	4, 8, 17
Saar I	ISR		B	7
San Javier (Nos. 1, 8)	SPAIN	WIxG	B	7
San Juaquin	SPAIN	WIxG	B	7
San Sebastian	MEX	MEX	B	9, 19, 22
Santana	CA	MEX	B	7, 8
Sartini			A	12
Sato T-53	HI		A	11
Schaff		WIxG	A	7
Schediana 154			B	1
Schmidt	MEX	GUAT	B	9, 19, 22, 25
Scotland	ISR	MxG	B	21
Semil (Nos. 23, 31, 34, 42, 44)	PR	GxWI	A	11, 12, 16
Semil (Nos. 37, 43, 45-47)	PR	GxWI	B	7, 11, 12

Cultivar	Origin	Race	Flowering group	Reference
Sexton	HI	MEX	B	25
Sharpless	CA	GUAT	A	4, 8, 9, 19, 22, 23
Sharwell			A	12
Sharwil	AUSTR	GUAT	B	2, 7, 11
Shiller 1	ISR	MEX	B	7
Shomrat	ISR	GUAT	B	7
Simmonds	FL	WI	A	4, 9, 12, 19, 22, 25
Simpson	FL	WIxG	B	5, 12, 22, 25
Sinaloa	MEX	GUAT	A	9, 19, 22
Solano	CA	GUAT	A	9, 19, 22
S.P.I. 34831 (=Rome)			B	22
Spinks	CA	GUAT	A	8, 9, 17, 22
Steffani	FL		B	12, 22
Stephens Choice (=Choice)	MEX	GUAT	B	9, 22
Stewart	CA	MEX	A	7, 8
Streamliner			A	12
Suardia	FL		B	12
Supply			A	12
Surprise	CA	GUAT	B	9, 19, 22
T 142	CA	GUAT?	B	7
T 205	CA	GUAT	A	7
Taft	CA	GUAT	A	9, 12, 19, 22, 23
Tanaka	HI		B	11
Tantlinger	CA	MxG	B	21
Tappen		WIxG	B	12
Taylor	FL	GUAT	A	4, 9, 12, 19, 22, 23, 25
Taylorson	FL	GxWI	A	22
Teague	CA	MEX	A	7
Tenerife	CANAR		B	12
Tensen			A	12
Tertoh	GUAT	GUAT	B	1, 9, 22, 23
Tito Perla			B	12
Toltec			B	12
Tomko	CA	GxM?	B	5, 12
Tonnage	FL	GUAT	B	12, 25
Topa Topa	CA	MEX	A	2, 4, 8, 14, 17
Tova	ISR	GxM	A	21
Trapp	FL	WI	B	9, 12, 19, 22, 23, 25
Trappson	FL	WIxG	B	12
Tucuata	MEX	MEX	B	7
Tumin	GUAT	GUAT	B	9, 22
TX 531	CA	GUAT	A	7
Ultimate	CA	GUAT	A	9, 22
Utuado (No. 1)	PR	GxWI	B	12, 15, 16

Cultivar	Origin	Race	Flowering group	Reference
Val de Flor	MEX	MEX	B	9, 22
Vannel Late			B	1
Vega	CUBA		A	23
Venus			A	12
Verde	MEX	GUAT	B	9, 19, 22
Vero	FL	MxWI	B	12, 25
Wagner (=California)	CA	GUAT	A	9, 12, 19, 22, 23, 25
Wahiawa	HI		B	11
Waldin	FL	WI	A	9, 12, 19, 22, 23, 25
Walker	CA	GUAT	B	22
Ward	CA	GxM	A	22
Weisl (=Fuerte)	CA	MxG	B	21
Wester	FL	WI	A	12, 22, 23
Whitcomb			B	22
Whitsell	CA	GUAT	B	7
Wilson	CUBA	WI	A	12
Wilson Popenoe			A	1, 12, 15
Winslowson (=Rolfs)	FL	GxWI	B	1, 9, 12, 15, 19, 22, 23, 25
Winslow	FL	GUAT	B	9, 19, 22, 23
Winter Mexican	FL	GxM	B	25
Wright	CA	MEX	B	5, 8, 17
Wurtz	CA	GxM	A	21
WW5 (=Mayo B)	CA	GxM?	A	7
XX 102	CA	GUAT	B	7
Yama	CA	MEX	A	8, 17
Yama A	CA?	MEX?	A	12
Yama 175	CA?	MEX?	A	12
Yama 381	CA	MEX	B	12
Yamagata	HI		B	24
Yates			B	12
Yehiam III	ISR	GxM	B	7
Yon	FL	GxWI	B	12, 15
Young 2			B	12
Young Special			A	12
Zrifin 99	ISR		B	21
Zutano	CA	MxG?	B	2, 4, 5, 8, 17
Persea 14371			B	17
Persea borbonia			B	8, 17
Persea flocossa			A	7, 8, 17
Persea nubigena			A	7
Persea skutchii			B	7, 8