

THE BOTANY OF THE AVOCADO AND ITS RELATIVES

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Systematics of the Lauraceae

The family Lauraceae is in the order Ranales, a group of families considered by many botanists to be among the most primitive of the dicotyledonous plants. The order is often divided into 4 suborders as in the widely used system of Engler and Diels. However, the phylogeny of these plants is difficult and perhaps has been studied as much as any group of plants. Many botanists, if not most, now accept the view that the old Ranales might well be divided into 2 orders, the (new) Ranales containing 2 of the suborders and the Magnoliales consisting of the remaining 2 suborders. I am inclined to accept this arrangement and so I consider *Persea* and the family to which it belongs to be Magnolean. The Magnoliales are ligneous with rare exceptions. *Persea* belongs to this order and may be characterized in the same way. There is a single, curious, herbaceous genus *Cassytha*, which is a twining parasite, in the Lauraceae. *Cassytha* is not uncommon in the American tropics but most people probably would not recognize it as a member of the Lauraceae.

The great mass of species of the Lauraceae, perhaps more than 1,000 distributed into 40 or more genera, are shrubs to gigantic trees. These are found on all continents where a tropical region occurs but are most abundant in the Americas and in Asia. A few reach temperate regions.

The genera of the Lauraceae are notoriously difficult to distinguish from each other. I do not know whether or not many of these genera are more than "form" genera for I have never gone into the generic limitations seriously. The common genera in Mexico and Central America are *Nectandra*, *Ocotea* and *Persea*. I should call attention to *Bielschmeidia*, not because it is a common genus but because Wilson Popenoe, the last time that I talked to him, asked why I did not include it in *Persea*. His thoughts were based on the size of the fruits, which are edible and resemble some of the kinds of avocados. However, *Bielschmeidia* does not seem to me to be a synonym of *Persea*.

The largest of the genera found where *Persea* is native are *Nectandra* and *Ocotea*. I have seen and collected a rather large number of representatives of these 2 genera and to this day I am not always sure which genus is in hand when collected from the field. Caroline Allen and A. L. G. H. Kostermans have spent many years studying the Lauraceae but it is obvious that neither of them have been able to arrive at a satisfactory and simple method of generic separation. The continuing transfer of supposed species to one or another generic concept is an indication of this. Neither of these students had much or any field experience in the American tropics.

I have a method of separating what I think to represent the genus *Persea* from the closely allied genus *Nectandra*. The character which I use, and which Allen used, is the persistence of the calyx lobes below the fruit. I know of no other character and will

freely admit that this is a tenuous one. Characters in the stamens, as well as their number, have been used in generic differentiation. Anyone who can count and use a hand lens will find these easy to follow. I rather doubt that these characters should be used as distinctive ones.

Vegetative features of the American Lauraceae are not very helpful in separating the genera as Allen, Kostermans and myself have found. Leaves in the Lauraceae have a characteristic aspect in both living and dried specimens. One used to the handling of large number of specimens rarely misidentifies the family. Leaves, in fact most vegetative parts of the Lauraceae, bear aromatic oil glands. The odor of some of the kinds is quite characteristic but must be used with caution as a diagnostic clue. The "anise" odor, for instance, is said to be found always in the Mexican avocados, but how conspicuous the odor is may vary within-season, the maturity of the plant and certainly from plant to plant.

The trees of many Lauraceae are quite characteristic in the field but this distinctiveness is often lost when only a specimen is taken for herbarium study. Allen has determined specimens of *Nectandra* for me using the same specific name when field experience indicated that they were quite different. No one, for instance, is likely to confuse the wild *Persea nubigena* L. Williams with the cultivated or spontaneous *P. americana* Mill. var. *americana* although they are closely allied and belong in the same subgenus. Trees of *P. caerulea* (Ruiz and Pavon) Mel and *P. americana*, on the other hand, appear so similar that a person with as much field experience as Wilson Popenoe has been deceived by them.

One problem with the genus *Persea*, as I would circumscribe it, is that it brings together 2 quite unlike groups of species which I treat as subgenera. Unfortunately or not, these subgenera look as different from one another when fruiting as some of the presumed genera. Someone, perhaps facetiously, has suggested that the Lauraceae contains but a single genus—*Laurus*.

Popenoe and myself, and I believe also George Zentmyer, were not able to graft cultivars of *Persea* (which belong in the subgenus *Persea*) on species belonging to the other subgenus (*Eriodaphne*) that we had to work with. Buds from the cultivars took on the *Perseas* of subgenus *Persea*, often with difficulty and not well. However, the very different ecological niches from which some of them came may explain this.

Economic Plants Related to the Avocados

There are a number of plants of economic importance in the Lauraceae. The avocados are perhaps the most important of these and the only ones that are food plants, although several are used as condiments. Several trees, mostly of the genera *Aniba* and *Ocotea*, provide commercial timbers while others of these genera and of *Nectandra* are used locally for lumber. The genus *Cinnamomum* is the source of several economic products of which perhaps the best known are cinnamon (*C. zeylanicum* Breyn.), camphor [*C. camphora* (L.) Nees and Eberm.], and the several cassias. Cassia or Chinese cassia [*C. cassia* (Nees) Nees and Blume] is one of the oldest known spices and the best of the cassia barks and is very aromatic, but less

prized as a spice than cinnamon. The other cassias are sometimes substituted for Chinese cassia.

The bay or sweet bay (*Laurus nobilis* L.), a native of Asia Minor, is now commonly cultivated for the bitter, aromatic leaves used in cookery. The aroma of bay, as in most Lauraceae, is contained in an oil. Sassafras (*Sassafras albidum* Nees), a shrub or rarely a large tree of the central and eastern part of temperate North America, is a flavoring material of some importance. The root bark has long been used to make a tea, a "home remedy" prepared by the Indians and early settlers, assumed to thin the blood in spring. I saw the bark offered for sale in a supermarket as recently as this spring. Many things are flavored with sassafras, from medicines to real root beer.

Ornamentals should not be excluded from the economic plants. Several members of the Lauraceae are used in America. *P. indica* Spreng., which is not closely related to avocados, is an attractive ornamental used in the south. The California bay or California laurel (*Umbellularia californica* Nutt.) is a pungently aromatic tree sometimes planted for its shade. The spice bush [*Lindera benzoin* (L.) Blume] withstands a variety of climates from Maine to Florida.

History of the Cultivated Avocados

Avocados of the kinds commonly cultivated for their fruits are American and were not known in the old world until after the time of Columbus and discovery in the neotropics.

It is my opinion that the cultivated avocados historically and currently belong to only 2 of the species of *Persea* subg. *Persea*. These are *P. americana* and *P. nubigena*. There are 2 botanical varieties involved in each of these species as is detailed below. It is somewhat unfortunate that the Mexican avocado, which I believe to be a precursor of the West Indian avocado, must take a botanical name subordinate to the latter.

The center of origin of the *Perseas* to which the avocados belong is in the highlands of central and east central Mexico and on into the Guatemalan highlands. Six species of *Persia*, all avocado relatives, occur as natives in this area. It is also in this area that 2 of the derived avocados originated and several assumed natural hybrids of these were first discovered. Only one of the species of *Persea* is known to occur outside of the Mexican-Guatemalan center and that is a curious species known only in a limited area in the mountains of Nicaragua.

Popenoe, in the last years of his life, was searching for evidence that precursors of the cultivated avocados could have originated from Honduras to Columbia. It seems unlikely that origins are to be looked for in that region, since the obvious center of development of the genus *Persea* subg. *Persea* is Mexican-Guatemalan and only 2 wild species are native from Honduras southward, one of which certainly was never involved genetically in the cultigens.

My views on the origins of the cultivated avocados and their precursors follow.

Persea americana var. *drymifolia*, the Mexican Avocado

The Mexican avocado is the oldest of the avocados used for food by man, so far as we know. It was used for food prior to the development of agriculture and horticulture in

Mexico and continues to be used as a fruit today. I think it quite probable that the West Indian avocado arose as a selection from the Mexican avocado, as I have said in the account of the avocados.

The archeological evidence for the use of the Mexican avocado by man is very good. Avocado seeds were discovered in cave deposits in the Tehuacán Valley, Puebla, Mexico. Five cave deposits were studied by R. S. MacNeish and associates of the Proyecto Arqueológico-Botánico of the R. S. Peabody Foundation. Earle Smith, Jr. (7), friend and former colleague who studied the avocado cotyledons, estimated that the oldest of the seeds may have been discarded by Indians as early as 8000-7000 B.C. Carbon datings from other caves gave B.C. dates of 4000, 3200, 2800, then a hiatus to 500, 400, 300 and 200 B.C. through 700 A.D. These were followed immediately by datings of 700-1540 A.D., the last during the time of the conquest.

Smith presents data which seems to indicate that the Indians did select avocados for size during the prehistoric period. Smith thinks that the little Mexican avocado once may have been restricted to the moist montane forests. Zentmyer wrote me that he believes that he has seen wildlings of this plant. I have not seen plants that I thought to be unquestionably wild, a condition difficult to prove at this late date since obviously this avocado has been used as a wild plant, as a cultigen and as an escape for some 9,000 years.

Smith (8) analyzed avocado seeds found in caves in the hills near Mitla in a later study based on archeological materials from the Oaxaca Valley of Mexico. These may date from as long ago as 7800 B.C. to as recently as 1300 A.D. Smith believes that the Indians in the Oaxaca Valley never selected superior strains of the Mexican avocado as he thinks the Indians in the Tehuacán Valley did, nor apparently did the selected forms from the Tehuacán Valley get to the Oaxaca Valley.

I think it likely that the little Mexican avocado, through its long history, did not spread far from its original home in the montane forests of the eastern and central highlands of Mexico. It was perhaps man-carried to the Pacific slope of Mexico and down onto the relatively low areas of eastern Mexico. Man, I would suspect, carried it south to Chiapas and Guatemala, as the Isthmus of Tehuantepec would have been a natural barrier to the spread of a montane species. Whether it got to Guatemala pre-conquest is questionable and if it did it was probably not much appreciated since undoubtedly superior kinds of the Guatemalan avocado were already there.

Persea americana var. americana, the West Indian Avocado

The use of West Indian when applied to the avocado which we know by that name is unfortunate. There is evidence, mostly negative, that the West Indian avocado was not in the West Indies before the time of the conquest. This seems to be borne out by the writings of Patrick Browne, Jacquin and de Candolle. Jacquin did much of the early botanical work and thought that the avocado had been introduced to the West Indies in historic times.

There is increasingly good archeological evidence that avocados were in coastal Peru some 3,000-4,000 years ago (10). Plant remains, and other things, are remarkably well preserved due to the almost rainless weather along the Peruvian coast. The most

recent and perhaps most precise archeological evidence of the avocado in Peru is in a doctoral thesis on the Moche Valley where Pozorski (5) excavated 2 sites, one dated about 2000-1500 B.C. and the other 1500-1200 B.C., and found ample remains of avocados. Rocheburn (6) reported finding remains of whole seeds and separated cotyledons at Ancon as long ago as 1879. Seeds and leaves have been reported by several others in the interval of nearly 100 years.

I assume with considerable reason that the West Indian avocado originated somewhere between the mountains and the lowlands of east central Mexico. I assume again that it arose by selection from the Mexican avocado, *P. americana* var. *drymifolia*. The presence of the avocado in Peru about 3,500-4,000 years ago argues for fairly early origin. I do not know how long it would have taken prehistoric people to carry the plant from Mexico to Peru, but considering its usefulness as a food plant as well as its ability to thrive at low altitudes, I would guess 200-300 years at most would have sufficed.

It is curious that the West Indian avocado was not reported from the West Indies at the time of discovery since the distance from Mexico to Cuba is short. It must have been there. Likewise that avocado must have been along the northern and eastern coasts of South America long before the time of discovery. The climate along the coasts from Mexico southward, except in Peru, is such that plant remains would not have been preserved in archeological sites.

Persea nubigena var. *nubigena*, the Wild Progenitor of the Guatemalan Avocado

A relatively homogeneous population of wild avocados which I have called *P. nubigena* is distributed in all of the virgin montane forests from Puebla and Vera Cruz in Mexico to the Cordillera de Talamanca in Costa Rica. It is most abundant in Guatemala, where high mountains are extensive and montane forests remain. The wild avocado is in all of the montane or cloud forests in Honduras and Nicaragua that we have explored and I found it once in Costa Rica.

This is the species from which I believe the Guatemalan avocado originated. It is reasonable to expect that selections may have been made from this wildling at several places within its range since it is so widely distributed geographically. It is interesting to note that the greatest concentration of seedling trees of the Guatemalan avocado are in central Guatemala at 1,500-1,800 m. These trees are both cultivated and spontaneous. It is also in the montane-forests of the central Guatemalan highlands where the greatest concentration of *P. nubigena* occurs. It has not escaped my attention that this is the region where a rather dense indigenous population existed over a long period of time. These people certainly would have selected the better fruits to eat and thereby improve the avocado to that which we know today.

Persea nubigena var. *guatemalensis*, the Guatemalan Avocado

The Guatemalan avocado is, in my opinion, the best avocado that appeared pre-conquest in America. The origin seems easy to postulate. I feel that the cultigen derived from *P. nubigena*, which I call *P. nubigena* var. *guatemalensis*, quite possibly originated in some of the high valleys of central or western Guatemala and was dispersed from there. There is the possibility that selections were made at more than

one place due to the wide geographical range of its progenitor. The progenitor, *P. nubigena*, is or was native in the montane forests all the way from Puebla, Vera Cruz, and Chiapas in Mexico through Guatemala, Honduras, and Nicaragua to Costa Rica where it is rare. It is often a gigantic tree in the montane forests and in the high forest of Guatemala it is often quite abundant. The oblate to spheroidal to slightly pyriform fruits are rarely more than 5 cm in diameter and usually are about 3 cm in diameter. A few questionable trees seen in Nicaragua had fruits perhaps as much as 7 cm in diameter. These possibly are an introduction to or a selection from the region.

The selections which make up the Guatemalan avocado, I think, are relatively recent, possibly not more than 2,000 years old. The area of dispersal in pre-Columbian times doubtless extended from the highlands of east central Mexico to Guatemala and possibly to Honduras and Nicaragua, although I suspect that the lowlands that occur between central and western Guatemala and Honduras and Nicaragua may have presented a considerable barrier to the migration with man of a plant from the cool interior valleys.

The cultivated avocados then appear to me to consist of 2 species, with each of these species represented by 2 varieties, one variety being a native species and one being a derived cultigen.

Species of *Persea* Subgenus *Persea* related to the True Avocado

There are 5 additional species of *Persea* subg. *Persea* in addition to *P. americana* and *P. nubigena*, each with 2 varieties as detailed above.

P. floccosa Mez, is a relatively rare montane species somewhat related to both *P. americana* var. *drymifolia* and to *P. nubigena*. It is distinguished from both by the floccose pubescence of the young growths and leaves and by the small fruits which have a thin, green shell. I have seen this species but once in the field and that near Aquila, Vera Cruz, at some 1,800 m. Seeds were taken to Honduras and grown out but did not do well at this lower and warmer elevation. Buds from Fuerte-like avocados grafted onto it did not prosper.

P. steyermarkii Allen, named for the well-known American (now Venezuelan) botanist Julian A. Steyermark, is the least-known of the true avocados and the only one that I have not seen in the field. It is known from 1 locality each in Guatemala and El Salvador. The relationship is with *P. nubigena* from which it may be distinguished by the relatively smaller leaves with widely divergent secondary nerves.

P. schiedeana Nees, the *chinini*, *yas*, *coyo*, *chucte*, *aguacate de monte*, is the most easily distinguished of the avocado group of species. Young branches, leaves and inflorescences are much more pubescent than any other avocado relative except *P. floccosa*. The large scarious-margined bud scales are distinctive and the widely spreading secondary leaf veins help to distinguish it. Widely spreading leaf veins also occur in the rare but very different *P. steyermarkii*. The ovaries are densely pubescent when young and the pubescence may persist until the fruit is mature. The tree ranges from Puebla and Vera Cruz to Chiapas and then through Central America to Panama, possibly to Colombia. How much of the presently known range is natural and how

much is due to man I do not know. The tree is capable of invading forest situations and does well on moist, open slopes. Spontaneous trees are often permitted to persist and are left in clearings, like most food plants, but probably are not planted in planned orchards. The altitudinal range where I have seen and collected the plant is from near sea level to nearly 2,000 m.

The fruit may be relatively large and is used for food. Variations in the fruit and in the vegetative structure are rather great and not unexpected in a plant that may have been selected over a long period of time. The fruit is found in season in markets in Mexico, Guatemala and Costa Rica. Some fruits have adequate flesh, usually brownish, of fair quality while others have scant flesh and are fibrous.

P. primatogena Williams and Molina is a little-known avocado relative from the montane forest of the Cordillera Central de Nicaragua. It is uncommon where originally found and is most unusual of the avocado relatives.

The fruit is small with scant flesh and black skin when mature. It is eaten by birds (quetzales), monkeys and sloths, to my knowledge. The common name is *guaslipe*. The species is unusual also in that it is the only species of *Persea* subg. *Persea* not found in the developmental center of the genus in Mexico and Guatemala.

P. parvifolia L. Wms. is a little-known avocado relative that we have found but once, in the montane forest above Tetla, Vera Cruz. No experimental work has been done with the species so far as I am aware. The fruits are small, obovoid-orbicular, about 3.5 cm long and 2.5 cm in diameter, the seed about 1.7 cm in diameter, the shell of the fruit is thin, the flesh about 4 mm thick and greenish. The species is somewhat related to *P. americana* var. *drymifolia* but easily distinguished by the fruits and by the very small (4-11 cm long and 1-3 cm broad) elliptic to elliptic-lanceolate leaves. This species probably had nothing to do with the origin of the cultivated avocados. The local names are *aguacate cimarron* or *aguacatillo*, the last a name which may be applied to almost any lauraceous tree.

Curious Avocados or Avocado Relatives

Several curious avocados or avocado relatives should be mentioned. Wilson Popenoe and Paul Allen have found a large, round-fruited avocado in the low-elevation forest near Lancetilla, Honduras. It is rare there and I have not seen it with fruits, but flowering material is much like the West Indian avocado and I suspect that it is a seedling or a segregate of this.

Paul Allen found an avocado similar to the Lancetilla fruit near Palmar, Costa Rica. I have seen only a photograph and do not know what it is.

Otón Jimenez and Wilson Popenoe found a relatively large-fruited avocado in Costa Rica. Popenoe thought it to be an undescribed species. I searched for it several times and found it above Tres Rios, or found what I thought must have been the same avocado. It seemed questionable to me that those which I found were natives and perhaps were rather poor seedlings of something like the cultivars from Mexican-Guatemalan segregates.

Dennis Breedlove has found a montane species of *Persea* in Chiapas, Mexico, related to *P. nubigena* but with smaller fruits, the secondary leaf veins nearly parallel to the main vein and with other nebulous differences. I told Zentmyer about it so that he might try to secure it for rootstock studies. I know it from only 2 specimens sent by Breedlove for determination.

Antonio Molina R. and Pompilio Ortega at different times have found a curious Guatemalan-like plant in the highlands of Honduras. The shell is very thick and the flesh is so acrid with anise that it is inedible according to Molina.

The leaves of a seedling grown at Zamorano, Honduras, had exceedingly strong anise odor. I suspect it to be a segregate from a Guatemalan seedling.

There are Guatemalan-type avocados in the Cordillera Central de Nicaragua where *P. nubigena* is native. These could be local selections from *P. nubigena* or possibly seedlings from fruits brought in recently from Guatemala. Archeological ruins on the *hacienda* of Leo Salazar indicate that a population of civilized peoples existed in the proximity of *P. nubigena*. Residents in the region call both the native and this larger fruited avocado *aguacate de mico*, and the howler monkeys do eat it.

Botanical Names For Avocado Cultivars

The making of botanical names to designate cultivars of avocados would be an easy matter and there is a prescribed way to proceed according to the Rules of Botanical Nomenclature. I prefer to leave this to someone with a greater knowledge of the cultivars.

Recent Literature on the Systematics of the Genus *Persea* in America

There have been 2 surveys of the *Perseas* in recent years. Allen's (1) survey of the Mexican and Central American species included an account of all the *Perseas* as well as other genera in the family. Her account was followed by Standley and Steyermark in the Flora of Guatemala (9) where all of the cultivated avocados were placed under *P. americana* var. *americana* and var. *drymifolia*. In these works the typical *P. americana* (var. *americana*) included the West Indian and the Guatemalan avocados while var. *drymifolia* included the Mexican avocado.

The most recent review of the *Perseas*, of both sub-genera in the Americas, is that of Lucille Kopp (3). The work is quite a good one and I agree with it in most ways. Kopp was not familiar with living specimens of *Persea* and apparently had not seen any in the field. Unfortunately, she did not see the specimens in the United States National Arboretum herbarium where all of Popenoe's specimens, which were gathered in the early years of his field work, are to be found.

Kopp reduced *P. nubigena* to varietal status under *P. americana* but, curiously, made no mention of the Guatemalan avocado either there or under var. *americana*. My main disagreement with Kopp's treatment is the disposal of *P. nubigena* under *P. americana* and her failure to account for the abundant and important Guatemalan avocado under either var. *americana* or var. *nubigena*.

I have come to believe that *P. nubigena* and *P. gigantea* are forms of the same species. C. H. Lundell (4), apparently unaware of Kopp's revision or of my publications of *P. nubigena* and *P. gigantea*, redescribed the 2 forms of the native species of Guatemala as *P. paucitriplinervis* and *P. perglauca*, Kopp accounted for both of my specific names under *P. americana* var. *nubigena*.

I have in press 2 additional species of *Persea* subg. *Persea* but neither, I think, is involved with the cultivated avocados.

A recent account of the cultivated avocados by B. O. Bergh (2) touches on the systematics of the avocados under "Horticultural races" and would place all 3 under *P. americana*. Bergh seems to have had no field experience with the wild or cultivated avocados in Mexico or Central America. He indicates that a form still more primitive than an unspecified progenitor of the 3 horticultural races has been found at higher elevations in southern Mexico (Mexican), in the highlands of central Guatemala (Guatemalan) and in Colombia (West Indian). What this supposed more primitive form may be I have no idea. Elsewhere (p. 556) he suggested that *P. floccosa* should probably be included in *P. americana*.

Summary

This paper provides an account of the avocados and their relatives as seen by a systematic and economic botanist who has spent many years studying the wild and cultivated *Perseas* both in the field in Mexico and Central America and in herbaria. There are 7 species of *Persea* (*Persea* subg. *Persea*) known in Mexico and Central America. Five of these species are believed not to have been involved in the selection and development of the common avocados. Two of these species, *P. americana* and *P. nubigena*, each with 2 botanical varieties, are seen as progenitors and the selected varieties from which most horticultural avocados came. It is assumed that crossing, and back-crossing, of the selected avocados from these 2 species may have given rise to the Fuerte-like cultigens. The author's concept of the origin of the avocados from 2 species, instead of viewing them all as selections from a single wild progenitor, is new. He believes that the Mexican avocado, *P. americana* var. *drymifolia*, is the progenitor of the so-called West Indian avocado, *P. americana* var. *americana*. Likewise, he sees it as logical to believe that the Guatemalan avocado, *P. nubigena* var. *guatemalensis*, was derived by selection from the wild, and widely distributed, *P. nubigena* var. *nubigena*. It has not escaped the author's attention that the Guatemalan avocado is more similar to *P. nubigena* than to *P. americana* var. *drymifolia*, the Mexican avocado and the only other wild plant from which he believes avocados could have developed through selection by the pre-Columbian Americans.

Attention is called to the geographical distribution of the true avocados and that the developmental center of *Persea* subg. *Persea* is in Mexico and Guatemala.

The other subgenus, *Eriodaphyne*, is in both hemispheres. Only 1 poorly known species, in Nicaragua, is not known from the Mexican-Guatemalan center. Based on the known ranges of wild species, it seems unlikely that origins of avocados are to be looked for elsewhere.

Mexican avocados are known, through carbon datings, to have been used for food in Mexico perhaps as long as 9,000-10,000 years ago. The West Indian is shown by archeological evidence to have been in Peru perhaps as long ago as 4,000 years, taken there by migrating pre-Columbian peoples. No evidence is known for the early selection and use of the Guatemalan avocado but the author hazards a guess of perhaps 2,000 years. The plant was common in Guatemala at the time of conquest.

The author does not use the word "race" for any of the kinds of avocados but refers to them as West Indians, Mexicans or Guatemalans, or technically the appropriate botanical name is used.

Resume of the Principal Botanical Names with Bibliography

1. *Persea americana* Miller, 1768. Gard. Diet. ed. 8. 1753. *Laurus Persea* L. Sp. Pl 370. *Persea gratissima* Gaertn. 1805. Frucht. and Sem. 3:22. *Persea leiogyna* Blake. 1920. *J. Wash. Acad. Sci.* 10:19.

1.a. *Persea americana* var. *americana*. This is the typical form upon which the name is based. It includes only the West Indian avocado.

1.b. *Persea americana* Miller var. *drymifolia* (Schlecht. and Cham.) Blake. 1920. *J. Wash. Acad. Sci.* 10:15. *Persea drymifolia* Schlecht. and Cham. 1831. *Linnaea* 6:365. *P. gratissima* var. *drymifolia* Mez. 1889. *Engler Bot. Jahrb.* 5: 147. This varietal name includes only the Mexican avocado, the presumed progenitor of the West Indian avocado.

2. *Persea nubigena* L. Wms. 1950. *Ceiba* 1:55. *P. gigantea* L., Wms. 1953. *Ceiba* 4:39. *P. americana* var. *nubigena* Kopp. 1966. *Mem. N. Y. Bot. Gard.* 14:19. *P. paucitriplinervis* Lundell. 1975. *Wrightia* 5:146. *P. perglauca* Lundell. 1975. *Wrightia* 5:147.

2.a. *Persea nubigena* L. Wms. var. *nubigena*. This is the wildling which I presume to have given rise to the Guatemalan avocado, by selection.

2.b. *Persea nubigena* L. Wms. var. *guatemalensis* L. Wms. 1976. *Econ. Bot.* (In press). This name applies to the cultivated or spontaneous Guatemalan avocado which I assume originated from *P. nubigena*.

3. *Persea steyermarkii* Allen. 1945. *J. Am. Arb.* 26:286. A little known relative of *Persea nubigena*.
4. *Persea floccosa* Mez. 1889. *Engler Bot. Jahrb.* 5:148. A little known species somewhat related to *P. americana* var. *drymifolia* and to *P. nubigena*.
5. *Persea parvifolia* L. Wms. 1976. *Econ. Bot.* (In press). A rare and little known species somewhat allied to *P. americana* var. *drymifolia*.
6. *Persea schiedeana* Nees. 1836. *Syst. Laur.* 130. *P. pittieri* Mez. 1901. *Engler Bot. Jahrb.* 30, *Beibl.* 67:15. The most distinctive of the avocados. Probably not grown as an orchard tree but fruits from spontaneous or wild trees are harvested and eaten.
7. *Persea primatogena* Williams and Molina. 1976. *Econ. Bot.*, (In press). A curious avocado relative from Nicaragua.

Literature Cited

1. Allen, C. K. 1945. Studies in Lauraceae. VI. Preliminary survey of the Mexican and Central American species. *J. Arn. Arb.* 26:280-303.
2. Bergh, B. O. 1975. Avocados. *In: Advances in fruit breeding*, J. Janick and N. Moore, ed., Purdue University Press, West Lafayette, IN. 623p.
3. Kopp, L. E. 1966. A taxonomic revision of the genus *Persea* in the Western Hemisphere. *Mem. N. Y. Bot. Gard.* 14:1-177.
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