

Ancestors of the Guatemalan "Criollo" (*Persea americana* var. *guatemalensis*) as Studied in the Guatemalan Highlands

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Abstract. For 20 years we have been exploring the highlands of Guatemala, as well as the warmer region of Alta and Baja Verapaz, for wild avocados. The Guatemalan "Criollo" group (*Persea americana* var. *guatemalensis*) has been one of the types of *Persea* studied most intensively during these years, as well as the possible ancestors of this group. We consider the ancestors of the Guatemalan "Criollo" to be: 1) *Persea nubigena*, discovered by Wilson Popenoe in 1935 in the central highlands; we have encountered several centers or areas where this species grows, between 7000 and 8500 feet elevation; 2) *Persea steyermarkii*, which grows at a similar elevation to *P. nubigena* in the cold highlands; we have found this species in four centers; and 3) *Persea zentmyerii*, a new species reported in 1987. These three species, along with a close relative of the Guatemalan "Criollos", *Persea tolimanensis* (Aguacate de Mico) reported in 1989, constitute the chain of ancestors of *P. americana* var. *guatemalensis*, in our opinion.

The late Dr. Wilson Popenoe when consulted at his beautiful colonial home at Antigua, Guatemala, about any aspects related to "wild avocados" would say: "Yes, Gene and George, it is a mighty good article, but based only on herbarium specimens...". Then he would say with a smile: "...that fellow never was out in the field looking at our real stuff!"

Twenty years ago, when Prof. Zentmyer invited the first author to collaborate in his avocado rootstock exploration project, I thought, but I am a "jungle pathologist" with botany as a minor; but looking back to July, 1971, I saw a transformation, to become a "cloud-forest botanist" right in Middle America in the Mayan World. Responsible for this transformation were of course George Zentmyer and the great Wilson Popenoe.

This large scale collecting project for finding avocado germplasm resistant to *Phytophthora cinnamomi* was initiated in 1952 by the second author (Zentmyer, 1952). In the late 1940's, the California Avocado Society's Committee on Foreign Exploration had made several trips to Mexico and had collected significant material of potential commercial fruit types as well as some collections of other species of *Persea* that might be of use as rootstocks. C. A. Schroeder at UCLA was involved in some of these trips and propagated some interesting material at UCLA.

Our primary collections featured in this article are basically from the highlands of Guatemala and involve four interesting species of *Persea* that we feel were involved in the development of the Guatemalan "Criollos" (Fig. 1). These, therefore, were involved in the ancestry of commercial Guatemalan varieties such as Nabal, Benik, MacArthur, Queen, and, more importantly, of Hass. (Hass, a chance seedling that developed in California, has become the primary commercial variety not only in California but in most of the other avocado-producing countries.) The four species are *P. nubigena*, *P. steyermarkii*, *P. tolimanensis* (Aguacate de mico) and *P. zentmyerii*.

Persea nubigena - This important species resembling a miniature typical Guatemalan "Criollo" was first found by Wilson Popenoe in 1935 (Popenoe, 1935) in the Guatemalan highlands near Tecpan. This collection was later identified and described by Williams (1950); Zentmyer collected seed for the rootstock program in 1956. This tree was reclassified by Kopp (1966) as *P. americana* var. *nubigena*.

Over the past 20 years the authors have found stands of this species from the Orizaba volcano in Mexico to Costa Rica (Schieber and Zentmyer, 1978). Schieber noted the largest stand of *P. nubigena* in 1976 in the Cuchamatanes range (Nuca-Bar-illas) in Guatemala. We have found variants of this native tree in several countries and especially within Guatemala. It and *P. tolimanensis* are the closest relatives of the Guatemalan "Criollos".

Persea steyermarkii - In 1978 (Schieber and Zentmyer, 1978), we wrote: "When we first detected trees of *Persea steyermarkii* in the remote cloud forest of 'La Lucha'¹ in western Guatemala [San Marcos], we took samples of fruit, inflorescences, leaves and branches to our friend in Antigua, the late Dr. Wilson Popenoe.

He marveled at seeing for the first time this important species of *Persea*: *P. steyermarkii*. He touched the leaves, then the fruit and the branches and exclaimed to both of us watching him in silence, "You made it. It is *P. steyermarkii* that I see for the first time as a living specimen."

This species is quite distinctive from *P. nubigena* in the field (Fig. 2). Trees have quite a different aspect, different foliage color and leaf venation, and the leaves are not as coarse as in *P. nubigena*. The fruit is pyri-form with a small neck, in contrast to the oblate-shaped fruit of *P. nubigena*. We have found several variants of this species in the Guatemalan Highlands.

Persea steyermarkii has been described from only Guatemala and El Salvador. In Guatemala, we have made collections of this tree in four-centers from the Mexican-Guatemalan border to the Honduras-El Salvador border. The highest collection was in Maria Tecun, near the border of Solola and Totonicapan Departments; here this species grows at an elevation of over 8500 feet.

Persea tolimanensis - After observing the tree known as Aguacate de Mico for many years, we described it in 1990 as a new species of *Persea*: *P. tolimanensis*.

Zentmyer made the first collection of this unique tree from the volcano El Boqueron in El Salvador in 1954. In El Salvador, this tree is known also as "Aguacamico". Since the early collections, this species has also been found in Guatemala, Honduras, Nicaragua, and Costa Rica. Since a concentration of these trees has been studied for 14 years on the slopes and canyons of the volcano Toliman south of Lake Atitlan in Guatemala, the authors named this species *P. tolimanensis* (Zentmyer and Schieber, 1990).

This species is characterized by the thick-skinned (hard-shelled) fruit that is not edible and is eaten only by monkeys, hence the name of Aguacate de Mico in Central America. The fruit is typically oblate, dark green in color with irregular skin (Fig. 3). The fruit persists long on the tree after maturation.

The seed is comparatively large and also oblate similar to the fruit. The leaves are similar to those of *P. americana* var. *guatemalensis*, but are more opaque. The inflorescence is subterminal and either compact or loose. Branching usually begins very high in the tree and the trunk is whitish to gray.

The authors regard this species as one of the ancestors of the Guatemalan "Criollos".

Persea zentmyerii - In the fall of 1981, during the exploration of a cloud forest in northern Guatemala at about 3,500 feet elevation, *P. zentmyerii* was discovered. The young trees (about 10 years old and a seedling) were found in the Baja Vera-paz province, Purulha Municipality. The collection was recorded as Gu-1083 and was identified as a different *Persea* from any previously reported. This new species is characterized by large leaves, red new growth, and has a small fruit resembling a miniature *P. steyermarkii* with rough surface. The trunk is gray to dark brown with corky bark. The flowers are greenish-yellow and grouped in sub-terminal panicles or cymes.

Schieber and Bergh (1987) described this new species in the 1987 Yearbook of the California Avocado Society, and for the first time stated that this tree appears likely to be an important link in the evolutionary chain leading to modern commercial avocados, via the Guatemalan "Criollos".

Another Species of *Persea* from Xiquival - In 1978, we found what appeared to be a new species of *Persea* on the slopes of the volcano Xiquival, southwest of Quetzaltenango in Guatemala. For several years the authors considered this tree to be a variant of *P. steyermarkii*. However, in recent explorations when the three trees in the cloud forest of Xiquival were studied again, we believe that this may indeed be a different species of *Persea*.

The leaves of this new collection are very different in texture from the coarse, oak-like leaves of *P. nubi-gena*; the leaves of the Xiquival *Persea* are very smooth. The venation of Xiquival leaves is also different from both *P. nubigena* and *P. steyermarkii*.

Inflorescences are terminal, compact to loose, and yellow-green in color. The fruit also differs from the fruit of the other two species, although in size the fruit of the Xiquival collection is similar to *P. steyermarkii*.

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Fig. 1. Guatemalan "Criollo" fruit, Rio Frio, Alta Verapaz, Guatemala, with Daniel Lopez.



Fig. 2. Tree of *Persea steyermarkii* (center), photographed in Miramundo-Jalapa, Guatemala.



Fig. 3. Fruit and branches of *Persea tolimanensis* tree, at center background, on slopes of Volcan Toliman, Guatemala, with Martin Cumes Morales (Martincito).