Journal of the American Pomological Society 64(1): 24-27 2010

Collecting Pouterias (*Pouteria* spp.), Sapodilla (*Manilkara zapota*) and Caimito (*Chrysophyllum cainito*) for the Creation of New Markets

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Abstract

The pouterias, sapodilla and caimito are all members of the family Sapotaceae native to Central America. These fruit are important local commodities throughout Tropical America, and for sapodilla and caimito, Tropical Asia as well. They have considerable potential in the Americas and throughout the tropical world as local and export commodities; however, considerable obstacles remain for horticultural improvement. Furthermore, genetic resources are poorly understood and generally lacking for the systematic development of these crops. Fairchild Tropical Botanic Garden (FTBG) located in Coral Gables, Fla., USA has been active in the collection of these crops for the past two decades in Central America. Collecting has concentrated on collaboration with local contacts in Costa Rica and Nicaragua who are directly involved in the harvesting and marketing of local fruit. Such collaborations have allowed for the identification, collection and importation of superior selections of each fruit, nearly exclusively from seedling trees within home gardens on the Pacific Coast of Costa Rica and Nicaragua. New collections of the pouterias have concentrated on 3 species (*Pouteria sapota* (Jacq.) H. E. Moore & Stearn, *P. viridis* Cronq., and *P. fossicola* Cronq.) and possibly hybrids among them. Emphasis has been placed on selections for the fresh market with superior production, fruit quality and horticultural traits of the tree. With sapodilla, emphasis has been placed on the selection of superior fresh fruit and trees with superior horticultural traits. Caimito collections have been limited by difficulties in the location of superior selections and clonal propagation. The emphasis has been on the selections of superior fresh fruit quality. Collections have also been made of other species in the Sapotaceae with potential as rootstocks for commercial use.

The potential for market development with tropical fruit is considerable, covering a broad range of sustainable production, local sales and export. The pouterias, sapodilla and caimito are ancient crops in Central America, integral to the cultures and economies within their native regions for centuries. However, they are not widely known outside of the tropics and they present considerable challenges for economic development in a modern horticultural sense. The lack of basic horticultural knowledge has hampered any organized effort into their modern commercialization and development. Genetic resources are of specific concern, with an erosion of the available diversity in Central America due to an emphasis on agronomic and high value exotic crop production at their expense. Existing biodiversity has been, and continues to be, lost at an alarming rate and efforts for long-term conservation have largely been unorganized and inconsistent. Without an enhanced genetic base, it will be difficult to achieve further advances in the development of these crops for local and modern horticultural production.

Fairchild Tropical Botanic Garden, located in Coral Gables, Florida, USA has been active in the collection and conservation of genetic resources of minor tropical fruit since 1987 and has increased its collecting activities in the last decade (2). The effort has been focused on specific crops that have received little local and international attention and funding for conservation and development. Nearly all collecting has been based on clonal selections, with the material imported as budwood or grafted trees. Although the work is based on collaboration with local contacts, resources

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and institutions, the need for a long term, stable home for the conservation of the living collections has also been recognized. This need is particularly important, as these crops are long-lived tree fruit species and require many years to reach maturity. In the past, many collections of improved material of these crops have been lost.

Our collecting efforts began two decades ago with a series of visits and discussions with Dr. Jorge Leon, who resides in San Jose, Costa Rica. Dr. Leon is perhaps the most knowledgeable living soul with regard to genetic resources of the Sapotaceae throughout Central America. He has extensive botanical field and collecting experience in the region spanning more than five decades. His direction guided us to specific towns and regions to begin the search for superior genetic resources. His guidance was instrumental to our success and continues to fuel our collecting efforts to this day.

We concentrated on local collaborations throughout Central America and with those directly involved in the harvesting and marketing of the local fruit. Such collaborators have daily personal experience with the location and collection of superior selections of each of these crops. Collections have focused on seedling trees within home gardens on the Pacific and Atlantic coasts of Central America, from sea level to a maximum of 600 m elevation. Scion material has been collected from each tree and imported into the United States, or grafted in collaboration with the Campo Verde de la Familia nursery in Costa Rica. The bare-rooted, grafted trees have been imported to Coral Gables, Florida, USA, where they were quarantined for pests and diseases and then planted into the field at the Williams Grove Genetic Facility of FTBG located in Homestead, Fla.

Pouterias

The creation of this grouping of related fruit is based on nearly two decades of collecting experience of *Pouteria* species throughout Central America. FTBG horticultural scientists currently consider the pouterias to be a continuum of closely related species throughout Central America. These species separate out by latitude and altitude, and visual evidence in the field suggests hybridization among species; however, this has not been confirmed. All collections were made in association with human habitation sites. No collections were made in primary or secondary forests. There is compelling evidence from these collections to suggest a dramatic human selection pressure for the improvement of the pouterias in specific regions (Fig. 1).

Fig. 1. Pouteria 'Asilo', collected on the Pacific coast of Costa Rica.

New collections of the pouterias have concentrated on three recognized species (*Pouteria sapota, P. viridis and P. fossicola*) and possibly hybrids among them. Emphasis has been placed on selections for the fresh market with superior production, fruit quality (smooth exterior, red flesh color, small seed, and superior flavor) and horticultural traits of the tree. Superior horticultural traits of early flowering, adaptation to annual pruning and self-compatibility will be necessary to further commercialize these fruit.

Hot spots of diversity for pouterias were identified in several localized regions of the Central Pacific and Atlantic coast of Costa Rica and along the shores of Lake Nicaragua in southern Nicaragua (3, 4). These two regions have shown the greatest diversity in form and quality of the fruit and the trees of pouterias.

The diversity is concentrated into specific towns and within these towns there is often considerable uniformity among seedling trees. Superior selections grown in the home gardens are the result of informal selection within each region and the fruit are harvested for local sale. These trees represent an important income source for the home owner and thus the trees are protected and well cared for. Outside of these locations the quality of the germplasm, and even the presence of pouterias, is reduced. Currently some of the superior selections are clonally propagated by local nurseries, but the availability is regionally restricted and many nurseries are unreliable in their naming and true identification of local selections.

We currently have 25 new selections from these regions in the genetic collections at FTBG. The most important distinctions among them are skin color and texture, flesh color, productivity of the tree, cropping habit and flavor. The oldest trees in the field are less than 5 years of age, thus it is not possible to determine if these traits will be consistent under South Florida conditions. Blooming and fruiting began on all selections before the fourth year in the field. It is not clear if these selections are more precocious or if the blooming is due to specific environmental conditions here in Florida. In order to serve as a new horticultural crop, potential selections must begin fruiting early, be productive and of superior quality and responsive to modern horticultural management systems.

Sapodilla

With sapodilla, emphasis has been placed on the selection of superior fresh fruit and trees with superior horticultural traits. Unlike the pouterias, the sapodilla diversity throughout Central America has been more difficult to locate. Wild-type sapodilla are common throughout all of Central America, but the greatest diversity of quality selections has come from a single farm in southern Nicaragua, near Rivas, between Lake Nicaragua and the Pacific Ocean. This 10 ha farm has a surrounding windbreak row of seedling sapodilla planted nearly 80 years ago. Among these seedlings are fruit from 100 to over 900 g in weight, flesh colors ranging from brown to white or even yellow, and a wide range of growth habits. Numerous collecting expeditions have been conducted on this property at different times of the year to search for off-season fruiting and other quality traits (Fig. 2).

Fig. 2. Sapodilla from Rivas, Nicaragua.

We have no good explanation for the wide diversity found on this single farm in Nicaragua and we have been unable to locate other regions of high-quality diversity for sapodilla. Clonal propagation of sapodilla was considered a challenge until quite recently. Now we are able to reliably graft sapodilla from foreign collecting, but the trees are slow to develop, requiring nearly 3 years for a tree suitable for planting in the field. There are 25 new accessions of sapodilla from Tropical America in the FTBG genetic collections, as well as several sapodilla clones from Tropical Asia (1). The accessions from Thailand are named cultivars and possess superior growth habits and productivity compared with those of the Tropical American selections. The sapodilla selections are less than 5 years in the ground and have produced for the last 2 years; however, production has thus far been modest. Fruit quality has been promising and proven acceptable to consumers in limited trials with local marketing.

Caimito

Caimito collections have been more limited due to difficulty in the location of superior selections and challenges in propagation. The emphasis has been on selections from the Pacific coast of Costa Rica near the city of Esparza. Here we have had the guidance of local collaborators to locate superior selections. We are aware of only limited local selection work with caimito, thus locating superior clones is time-consuming and advances will most likely be more difficult. It remains unclear whether there are areas with better germplasm of caimito. Propagation is a challenge and we are still not confident with the collection, importation and survival of clonal material. Advances have been made by grafting at Campo Verde de la Familia Nursery in Costa Rica and subsequent importation of the bare-root grafted tree (Fig. 3).

Fig. 3. 'Aurelio' caimito from Pacific Coast of Costa Rica.

Selections are purple- and green-skinned and were selected for superior production and fruit quality. Trees are 5 years old in the field and have fruited for the last two seasons. Production has been superior to local selections in South Florida and readily accepted by the consumer. The caimito is readily marketable to Latin, Asian and Anglo customers alike; thus there is considerable potential for this crop in modern horticulture. We have been unsuccessful in the identification of regions with a wide diversity of quality selections beyond this region of Costa Rica.

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