The traditional agroforestry systems of Sierra del Rosario and Sierra Maestra, Cuba

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Abstract
Traditional coffee cultivation in Cuba is the result of a complex interaction between different flora species creating agroforestry systems widely spread in mountainous area. The systems, product of local traditional knowledge, are mainly devoted to coffee production but, thanks to the interaction with other species, farmers provide different food products both for self-consumption and to be sold. Furthermore, the adoption of shade trees in order to reach a better quality of the coffee cultivated creates particular microclimate conditions favorable for microorganisms, fauna species and also for spontaneous flora species. According to this it is clear the relationships between traditional knowledge and biodiversity preservation which is fundamental also for improving the surrounding environment, avoiding floods or hydrogeological instability damages, concurring to climate change mitigation and carbon storage. Traditional agroforestry systems are one of the best example of coexistence and coevolution between man and nature, being an historical system adopted by local communities to satisfy their needs in total respect of the surrounding environment. Considering this, the promotion and maintenance of this kind of systems and knowledge related might constitute a valid example to actively preserve biodiversity while respecting human needs for food and livelihood security. These systems are also of particular importance considering the importance of coffee as a beverage served in many countries of the world, but often produced in intensive plantations. This paper shows the high sustainability of coffee production under the shade of trees and support a new concept of food quality contributing to preserve local cultures and environments.

Keywords Agroforestry · Coffee · Agrobiodiversity · Traditional knowledge · Agricultural heritage

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Introduction

Agrobiodiversity is the synergy and interaction between living things, land, technology, and social systems (Long et al. 2003) and conserving it in farming systems could provide direct and indirect benefits necessary for livelihoods and ecosystem functioning (Chirwa et al. 2008). Agroforestry systems are characterized by important elements that can play a significant role in the adaptation to climate change including changes in microclimate structure, protection through provision of permanent cover and opportunities for diversification of the agricultural systems, improving efficiency of use of soil, water and climatic resources, contribution to soil fertility improvement, reducing carbon emissions and increasing sequestration, and promoting gender equity (Rao et al. 2007) while being characterized by high socioeconomic and ecological complexity (Troper et al. 2011). In addition, it has been exposed that agroforestry systems with greater structural complexity are capable of harboring high biodiversity (Santoro et al. 2020). The biodiversity associated to agroforestry is part of the wider concept of biocultural diversity (Agnoletti and Rotherham 2015) adopted by FAO in the criteria for the designation of agricultural heritage systems among the GIAHS sites (Globally Important Agricultural Heritage Systems).

Coffee cultivation is traditionally based on agroforestry systems considering that shade trees reduce the stress of coffee by ameliorating adverse climatic conditions and nutritional imbalances (Beer et al. 1997). Coffee is an extremely important agricultural commodity, produced in about 80 tropical countries, with an estimated 125 million people depending on it for their livelihoods in Latin America, Africa, and Asia (Krishnan 2017). Over the past 50 years, both production and consumption of coffee have risen considerably but, especially smallholders, who are the main producers, are facing growing challenges derived from climate change and more difficult natural growing conditions (FAO 2015). In Cuba, the culture of coffee has been important in many mountainous areas as a historically key element of the agricultural evolution of its landscapes (Ramírez and Paredes 2003). The first coffee plants were introduced in Cuba from 1748, having place in a farm of Wajay, a town located at the periphery of Havana city in the western geography of the country (Lapique and García 2014); but it is from the Revolution of Haiti that the coffee production in Cuba has had a particular increment (Fernandez 2012). Coffee plantations are predominant as coffee is a commercialized product in the majority of the island farms even if it is not the only species cultivated as it coexists with other cultivated species increasing the crops agricultural diversity being important repositories of biological richness for groups such as trees and epiphytes, mammals, birds, reptiles, amphibians, and arthropods (Moguel and Toledo 1999). Beside this, Cuba has the privilege of having a remarkable wealth of endemic or exclusive flora and fauna. Vales and Vilamajo (2001) highlight Cuba as the island of the Antilles with greater biological diversity, both in total species richness and in the degree of endemism, which considerably increases the value of Cuban biodiversity.

Considering this the present paper takes in consideration two traditional coffee production agroforestry systems located at the opposite extremes of Cuba with the aim of analyzing their structure and the agrobiodiversity related. The two systems considered are Sierra del Rosario and Sierra Maestra, both covering mountainous surfaces and still characterized by traditional practices related to coffee production. The paper aims to stress the importance of presence and maintenance of traditional agroforestry systems for local agrobiodiversity preservation. The agrobiodiversity linked to the presence of traditional practices, in fact, can be fundamental both from an economic and natural point of view providing multiple benefits. In addition, the maintenance of such systems is a valid example of a
sustainable alternative in order to satisfy social-economical needs while preserving the local environment and cultural heritage. The spatial scale chosen for this paper is also aimed at understanding “gamma” diversity, the one at landscape level, considering larger geographic regions compared to small sampling units, including human activity.

**Material and Methods**

The present study focused on two areas located at the two opposite extremes of the island of Cuba (Fig. 1): Sierra Maestra and Sierra del Rosario. The choice has been made mainly considering the importance of coffee production in both areas history. Furthermore, in both areas the coffee production has been maintained according to the traditional practices creating complex and sustainable agroforestry systems.

The area of Sierra del Rosario, in the north-west of Cuba, covers 80,000 hectares and it is located in Artemisa province. It is 70 km away from the capital, Havana and it is part of a mountainous area with maximum high of 560 m a.s.l.. The eastern portion of the site analyzed is also part of the Sierra del Rosario Biosphere Reserve, included in the official UNESCO list in 1984 and recognized as a reserve showing a complex geological structure, with a great diversity of rocks that produce different and special soils, which in part, determine flora endemism in its landscape (García and Castiñeiras 2006). Sierra del Rosario, according to the Koppen classification (Fig. 3), belongs to the tropical area including both the monsoon (Am) and the savannah (Aw) climate subcategories (Kottek et al. 2006).

Sierra Maestra is set in the opposite side of the island, in the south-east of Cuba. The area considered covers a surface of 494,889 hectares of which 59,066 hectares are characterized by coffee and cocoa cultivation (Fig. 2). It extends across 14 municipalities in Granma, Santiago de Cuba and Guantanamo provinces. The area is set along the Sierra Maestra massif from 240 to 1200 m a.s.l.. According to the Koppen climate classification it belongs to Tropical, both monsoon (Am) and savannah (Aw), and Temperate, no dry
season, warm summer (Cfb) classes (Fig. 3). Inside the study area boundaries there are also protected areas, part of the National System of Protected areas which are of as national or local significance (Fig. 2). Furthermore, as in the case of Sierra del Rosario even in this area there is a surface included in UNESCO Biosphere Reserve List from 1987: the Baconao Biosphere Reserve, located in the south of the provinces of Santiago de Cuba and Guantánamo, in the eastern region of Cuba.

The two areas choice has been made according to the recognized importance of traditional coffee cultivation in both of them and because they are, even in the present days, a good example of agroforestry systems sustainable management.

The study carried out is based on the comparison between the two sites. The analysis mainly focuses on the agroforestry systems structure characteristics, the ecological interactions created by the systems themselves and on the traditional practices and agrobiodiversity related. In particular: the first part of the study aims to provide a description of coffee agroforestry system structure, practices and traditional knowledge, focusing on their effects on the surrounding environment, while the second part provides a detailed assessment of coffee agroforestry system agrobiodiversity richness considering the different varieties of species both endemic and cultivated which are deeply related to the maintenance of the systems themselves.
The biodiversity inventories in Sierra del Rosario is the accumulative knowledge resulting of expeditions and field work jointly conducted over the last 35 years between Sierra del Rosario Ecological Station (EESR) and different institutions involved in systematics and taxonomy in Cuba, as is the case of the Cuban National Garden, the Institute of Ecology and Systematics and the National Museum of Natural History. Agricultural diversity has been compiled as the result of field works jointly conducted by INIFAT and EESR since 1999 and recently updated by COBARB project (2012–2019) due to expeditions and surveys conducted among 75 traditional farmers placed in agricultural landscapes.

Results

In Cuba, the introduction of agroforestry system and practices related dates back to the eighteenth century when French settlers introduced coffee cultivation (*Coffea arabica*) in the mountainous areas of the country, where by the first time trees were associated with permanent cultivation, with the goal of obtaining sustained yields in hillside conditions, not forgetting the “conucos” or family parcels, a traditional form of integrated production known as an agrosilvopastoral practice.

In traditional coffee plantations in the mountainous areas of the Sierra Maestra de Cuba, a multiple cultivation method is practiced, since they are established on the same surface, in addition to coffee trees and trees, *Dioscore alata* and *Xathosoma sp.* some varieties of banana are cultivated. Even if coffee is the main source of resources, fruit species are important supplements to the family’s daily diet. Currently 57 673.36 ha are dedicated to coffee cultivation in Sierra Maestra.

Sierra del Rosario traditional system is similar to the one of Sierra Maestra: the farms characterized by coffee cultivation of important extension see also the presence of other species also important for farmers livelihood like *Xanthosoma sagittifolium*, *Citrus*, *Pouteria sapota*, *Manhiot esculenta*, *Cucurbita moschata* and *Ipomoea batatas*. Coffee cultivation is in fact part of the system diversity being particularly valorized in polycultural systems as when it is mixed with fruit trees as plátano (*Musa spp.*), mamey colorado (*Pouteria sapota*) and aguacate (*Persea americana*) used as shade trees. In addition, the traditional coffee system is characterized by a series of herbaceous species used as food.

The traditional structure of traditional agroforestry system for coffee production is the result of a complex combination of species strongly influencing the agrobiodiversity richness of the system itself (Fig. 4). The farmers use to create shade with species like fruit trees that can contribute to their sustenance but it is also common the utilization of forestry species like *Ficus aurea* and *Trophis racemosa*. Among the species adopted to create shade farmers prefer *Gliricidia sepium* and *Samanea saman* (Gonzalez Alvarez et al. 2016).

From an ecological point of view, in agroforestry systems, nutrients enter through various sources such as rain and organic residues; these can be accumulated either in the shade trees cultivation, soil or litter. At the same time, interactions occur between crop layers such as residue deposition, infiltration, absorption and mineralization; likewise, outputs can occur by crops yields, leaching, runoff, and denitrification processes. The increase in litter shade trees promotes a diversity of decomposer organisms and other species can provide ecosystem services such as pest control (Petite Aldana et al. 2019) (Fig. 5) while protecting the soil from direct insolation, helping maintain organic matter, reducing evaporation and maintaining soil productivity (Siebert 2002).
Fig. 4 The traditional polyculture coffee garden is a complex combination of multiple species needed both from an economic and ecological point of view. It is important for farmers’ sustenance the presence of different species in the system that contributes to food security and good livelihood conditions but, at the same time, it results fundamental from an environmental point of view providing multiple ecological benefits while improving the agrobiodiversity richness (from Moguel and Toledo 1999).

Fig. 5 Ecological interactions in coffee agroforestry system (Petite Aldana et al., 2019)
Besides the ecological functions derived from the system complexity, agricultural diversification is promoted by local farmers as a way to increase options of keep economic inputs in face of extreme climatic impacts. In general, the traditional farms are featured in a high integration of crop production and animal breeding, which is highly desirable under the perspective of agroecology (Figs. 6 and 7).

Sierra del Rosario is recognized for its crop genetic resources with high levels of varietal diversity of coffee (*Coffea* sp), maize (*Zea mays*), lima bean (*Phaseolus lunatus*), common bean (*Phaseolus vulgaris*), chilli (*Capsicum* sp.), etc. (Castiñeiras et al. 2006). The multistate agroecosystems areas can include up to 500 plant species most of which are ornamental and medicinal, followed by fruit and timber species. There is also an amount of plants used and preserved by farmers because of its sacred conditions. Data base of the Ecological Station of RBSR reports a floristic diversity that reaches 889 upper and 281...
lower plants, of which 11% are endemic. The richness of Plant Genetic resources of Sierra del Rosario has been object of research and in situ conservation by INIFAT, in collaboration with international partners like Bioversity International (García and Castiñeiras 2006). In this sense, the last project conducted between this organizations (COBARB), budged by 7 GEF and implemented by UNEP, had actualize the inventories of the agrobiodiversity in many traditional systems placed inside or around the RBSR. The actions of this project have been also aware of the landscape peculiarities of the regions (Sánchez et al. 2015).

In the following tables are expressed the species characterizing the systems: the Table 3 is only dedicated to the Sierra del Rosario flora species, Supplementary Material Table 1 to Sierra Maestra species and the last one (Supplementary Material Table 2) contains the species that the two systems have in common.

The fauna diversity is also very rich, both for wild species and livestock. In Sierra del Rosario, among livestock species (Table 1), the most important in terms of number of individuals are pigs. In traditional farms the traditional race of pigs is named “creole”. The term “creole” is used academically in reference to the animals considered genetically descendants from those brought to Cuba by Spaniard conquerors. However, the farmers make a broader use of the term; many times they use the word “creole” to name the colored animals or those born in their farms without racial control.

Wild fauna reported at Sierra del Rosario, in studies also conducted at the RBSR, shows a high rate of endemics, among them the best represented groups are Birds (131 species identified including 12 endemics), Reptiles (33 species identified including 27 endemics), Amphibia (16 species identified including 13 endemics), Mammals: (including a remarkable number of bats, with 11 species and among there is very important the presence of two species of genus Capromys, commonly known as hutias).

Some of the most charismatic species are reported in the best-preserved areas, but is also possible to observed them in the mountains traditional systems. Ramírez y Paredes and Pupo (2005) remarks that in Sierra del Rosario is not very difficult to see the high flight of the “Gavilán del Monte” (rapacios bird: Buteo jamaicensis) or the hummingbird (Chlorostilbon ricordii), even in the home gardens, but also other birds like: the national one “Tocororo” (Plioterus temnurus), the “Cartacuba” (Todus multicolor), the colorful of the “Bijirita” (Dendroica discolor) and the Common Bijirita and the familiar and endemic

| Livestock species | Scientific name | Common Name |
|-------------------|----------------|-------------|
| 1                  | Sus scrofa domestica | Pigs; Spanish: “cerdo”, “puercos” |
| 2                  | Gallus gallus domesticus | Chickens; Spanish: “pollos”, “gallinas” |
| 3                  | Ovis orientalis aries | Sheep; Spanish: “carneros” |
| 4                  | Equus ferus caballus | Horses; Spanish: “caballos” |
| 5                  | Bos primigenius taurus | Caws, Bulls and Oxen; Spanish: “Vacas”, “Toros” y “Bueyes” |
| 6                  | Meleagris gallopavo | Turkeys; Spanish: “Pavos” |
| 7                  | Ananas platyrhyncos domesticus | Ducks; Spanish: “Patos” |
| 8                  | Oryctolagus cuniculus | Rabbit; Spanish: “Conejos” |
| 9                  | Equus africanus x ferux | Mules; Spanish: “Mulos” |
Tomeguín del Pinar (*Tiaris canora*), as well as the beautiful and laborious Carpenters: the “Scapular” (*Colaptes auratus*), the “Churroso” (*Colaptes fernandinae*), the “Jobado” (*Centurus superciliaris*) and the “Green” (*Xiphidiopicus percussus*). Population of butterflies such as: *Calisto herophile*, *Eurema larae*, the beautiful *Helicornius charithonius*, *Appias drucilla*, *Utetheisa ornatrix* and *Marpesia chiron*, among many others.

In the areas where calcareous rocks predominate, it is easy to find several species of mollusks, with showy shapes and colors, from the *Zachrycia rangelina*, the largest terrestrial mollusk in the region, but also the species *Emoda sagraiana* and *Emoda margi nata*, *Helicina adspersa*, *Plicathyrella assimilis*, and *Vianas regina* Morelet, among other twenty-three species reported. This diversity is consistent with the character of Cuba as a world center of diversity of mollusks.

In the case of Sierra del Rosario, as the result of the field visits conducted by COBARB project, there were observed examples of the use of wild animal used for feeding, as is the case of shrimps and hutias, which are endemic species. In the case of the Cuban majá (*Epi crates angulifer*) the biggest snake of the island, which is also an endemic, it is reported the use of its fats for medical purposes. In the case of bees, there are either the species “abeja europea” (*Apis mellifera*) and “abeja de la tierra” (*Melipona beecheii*) that can be managed. Even when both bees are considered as introduced, there are wild populations of these species which are present in the forest or agroforestry areas of the landscapes.

Also Sierra Maestra has a remarkable endemic fauna (Tables 2, 3 and 4).

Among all the species in particular the mollusks could be highlighted considering their multiple uses in Sierra Maestra where they have been used as jewels and personal ornaments, for their color and beauty, including the species: *Zachrysia bayamensis* and *Coryda lindoni*. In addition, also lepidopterans perform various functions such as forming part of food chains and participating in the pollination of many plants. In the ecosystems of the Sierra Maestra can be see *Greta cubana*, *Virbia heros* (restricted to the Nipe-Sagua-Baracoa and Sierra Maestra mountain ranges), *Calisto isnaeli*. In Sierra Maestra there is also a great diversity of amphibians and reptiles, in particular the species *Eleutherodactylus alipes*, *Eleutherodactylus cubanus*, *Eleutherodactylus jaumei* are endemic of the Sierra Maestra.

**Discussion**

Coffee culture, as part of mixed systems, tends to be more important in the south of Sierra del Rosario range system while livestock, mainly cows and pigs, tend to be predominant in the more rural farms at the northern side of the range system. The production of coffee seems to be not very high in traditional farms in terms of gross production or productivity. This is in concordance with the arguments of Ospina (2008) pointing that what is remarkable in these ecological coffee systems is the kaleidoscope of food products and ecosystems service. However, in the case of the traditional systems of Sierra del Rosario, there is a surplus of coffee production that is placed in the national markets by different ways, but mainly because of State´s purchases. In the traditional farms placed in Sierra del Rosario, agricultural typologies vary according to differences in topography. For example, is very notable the nonuse of the slopes for practicing the agriculture when the availability of cropping areas in valleys is enough for food requirements. This conducts to differences in the cultures of managing these areas diversifying the traditional practices.
| Fauna list species | Apodidae | Parulidae |
|-------------------|----------|-----------|
| 1. Chorostivon ricordis | 20. Dendroica caeniulenscens |
| 2. Bubulcus ibis | 21. Dendroica tigrina |
| 3. Butoride virescens | 22. Mniotilta varia |
| 4. Columbina passerina Linnaeus | 23. Seluris motacilla |
| 5. Patagioenas leucocephala | 24. Setophaga ruticilla |
| 6. Patagioenas squamosa | 7. Zenaida aseatica |
| 8. Cooyzus americanus | 9. Crotophaga ani Linnaeus |
| 10. Aurothera merlini d’Orbigny | 11. Accipiter striatus Vieillot |
| 12. Buteo platypterus | 13. Cyrcus cyaneus |
| 14. Falco sparverius Linnaeus | 15. Dives atroviolacea d’Orbigny |
| 16. Iterus dominicensis Linnaeus | 17. Quiscalus niger |
| 18. Molothrus bonoriensis | 19. Mimus polyglottos Linnaeus |
| 20. Dendroica caeniulenscens | 21. Dendroica tigrina |
| 22. Mniotilta varia |
| 23. Seluris motacilla | 24. Setophaga ruticilla |
| 25. Tyrannus caudacatus | 26. Tyrannus dominicensis |
| 27. Tyrannus caudacatus | 28. Tyrannus dominicensis |
| 29. Vireo antilogois | 30. Melanerpes superciliaris Temminck |
| 31. Sphipyacus varius | 32. Xiphidiopicus percussus Temminck |
| 33. Cathartes aura Linnaeus | 34. Priotelus temnurus Temminck |
| 35. Bufo spp. | 36. Eleutherodactylus varleyis Dunn |
| 37. Eleutherodactylus atkinsi Lynch | 38. Eleutherodactylus simulans Díaz y Fong |
| 39. Eleutherodactylus rocdordii (Dumeril y Bibron) | 40. Eleutherodactylus cuneatus (Cope) |
| 41. Eleutherodactylus auriculatus (Cope) | 42. Eleutherodactylus ronaldi Schwartz |
| 43. Eleutherodactylus dimidiatus (Cope) | 44. Osteopilus septentrionalis (Dumeril y Bibron) |
| 45. Anolis anfiloquiois | 46. Anolis equestris |
| 47. Anolis porcatus | 48. Anolis sagrei |
| 49. Anolis allogus | 50. Anolis baracoe |
| 51. Anolis argenteuluis | 52. Anolis angusticeps |
| 53. Ameiva auberi | 54. Leyocephalus macropus |
| 55. Leyocephalus raviceps | 56. Capromys piloridae Say |
As has been pointed out, there is a diversity of sources of incomes for the traditional farming systems, condition that can be considered a guarantee of resilience. It is hypothesized that shade promotes slower and more balanced filling and uniform ripening of berries, thus yielding a better-quality product than unshaded coffee plants (Muschler 2001). In addition, the multiplicity of agricultural activities and the traditional knowledge is an opportunity for keeping the functioning in the system itself when a stressing situation occurs. The multifunctionality of many biological resources is also a distinctive attribute of the traditional systems still present in Sierra del Rosario. A very iconic example is the case of Cuban national tree (Roystonea regia), a forest resource with multiple uses and cultural signification. The species is a source of traditional materials for buildings, food for humans and animals, and also row materials for packaging. In this sense the petioles of the royal palm are very demanded in the elaboration of boxes for transportation of tobacco leaves.

Even when coffee and fruits trees are very important components of the traditional systems of Sierra del Rosario, other crops species like annual crops are important as complement of the systems. As Brown and Hodgkin pointed (2007), there are three categories of plant species make up plant biodiversity in the rural landscape:

1. The plant species that are deliberately cropped or tended and harvested for food, fiber, fuel, fodder, timber, medicine, decoration, or other uses.
2. At the other extreme, wild species that occur in natural communities and benefit the agricultural environment by providing protection, shade, and groundwater regulation.
3. Between these extremes, the wild related species of domesticates that can interbreed with and contribute to the gene pool of their crop cousins, that survive autonomously, that share many of the pests and diseases of crops, and that sometimes are eaten to relieve famine.

Regarding the Sierra Maestra, it represents one of the main nucleus of biodiversity in Cuba. The system traditional structure, today maintained, results to be a tool for the conservation and management of biodiversity, inside or outside protected areas or where the habitat is very disturbed. The use of forest trees as a shadow of coffee and cocoa cultivation has proven to be sustainable over three centuries creating also a favorable scenario to increase biodiversity. Forest trees are not the only one used to create shade in coffee cultivation, it is, in fact, easy and common to find fruit trees that apart from the function as shade and crop protection, also provide additional food products so that coffee and cocoa systems in Sierra Maestra not only generate coffee and cocoa as a product, but also high quality wood, fruits and agricultural products. Moreover, diversified coffee and cocoa plantations that look like a natural forest are ideal for protecting the soil, conserving water and maintaining high biodiversity constituting excellent wildlife habitat sites.

As seen from the result of the present study traditional agroforestry systems, as the ones in Sierra del Rosario and Sierra Maestra, have the potential to hold high species richness and constitute a valuable tool that could be used to complement conservation effort while being designed to improve farmers’ livelihoods by generally increasing productivity, profitability and sustainability.

According to the World Bank (2008), improving these three aspects of small-scale agriculture is a key way out of poverty, emphasizing the potential of agroforestry practices to alleviate shortages. In addition, it has been exposed that agroforestry systems with greater structural complexity are capable of harboring high biodiversity and in particular the functional biodiversity, which can increase productivity and ecological resilience. For example,
| Species                                      | Common name                        |
|----------------------------------------------|------------------------------------|
| Asclepias curassavica                        | Flor de la calentura               |
| Arachys hypogeae                             | Maní                               |
| Arthrostylidium capillifolium                | Tibisi                             |
| Averrhoa bilimbi                             | Pepinillo                          |
| Bahinia cumanensis                           | Bejuco de Tortuga                  |
| Argemone mexicana                            | Cardo Santo                        |
| Artemisia absinthium                         | Ajenjo                             |
| Andropogon glomeratus                        | Rabo de zorra                      |
| Andira jamaicensis                           | Yaba                               |
| Amyris balsamifera                           | Cuaba                              |
| Ambrosia artemisiifolia                      | Artemisa                           |
| Alternanthera sp.                            | Tapón                              |
| Allium tuberosum                             | Cebollino                          |
| Allium sativum                               | Ajo criollo                        |
| Allium cepa                                  | Cebollino, Ajo de jardín           |
| Allium cepa var aggregatum                   | Cebolla corojo                     |
| Allium cepa                                  | Ajo porro                          |
| Allium chinense                              | Ajo criollo                        |
| Allium fistulosum                            | Cebollino                          |
| Alternanthera sp.                            | Tapón                              |
| Andropogon glomeratus                        | Rabo de zorra                      |
| Arachys hypogeae                             | Maní                               |
| Argemone mexicana                            | Cardo Santo                        |
| Artemisia absinthium                         | Ajenjo                             |
| Andropogon glomeratus                        | Rabo de zorra                      |
| Ambrosia artemisiifolia                      | Artemisa                           |
| Amyris balsamifera                           | Cuaba                              |
| Andira jamaicensis                           | Yaba                               |
| Allium tuberosum                             | Cebollino                          |
| Allium sativum                               | Ajo criollo                        |
| Allium cepa                                  | Ajo porro                          |
| Allium cepa var aggregatum                   | Cebolla corojo                     |
| Allium chinense                              | Ajo criollo                        |
| Allium fistulosum                            | Cebollino, Ajo de jardín           |
| Alternanthera sp.                            | Tapón                              |
| Andropogon glomeratus                        | Rabo de zorra                      |
| Ambrosia artemisiifolia                      | Artemisa                           |
| Amyris balsamifera                           | Cuaba                              |
| Andira jamaicensis                           | Yaba                               |
| Alternanthera sp.                            | Tapón                              |
| Andropogon glomeratus                        | Rabo de zorra                      |
| Ambrosia artemisiifolia                      | Artemisa                           |
| Species                     | Common name               |
|-----------------------------|---------------------------|
| *Bauhinia divaricata*       | Pata de Vaca              |
| *Blechum browneii*          | Mazorquilla               |
| *Boconia frutescens*       | Yagrumita                 |
| *Bourreria crassinifolia*   | Hierro de sabana          |
| *Brassica juncea*           | Mostaza                   |
| *Byronima spicata*          | Peralejo de Pinar         |
| *Caesalpinia pulcherrima*   | Guacamaya                 |
| *Caesalpinia vesicaria*     | Brasil                    |
| *Calophyllum pinetorum*     | Ocuje                     |
| *Calyptrantes capitulata*   | Guairaje                  |
| *Canavalia ensiformis*      | Nescafé                   |
| *Capsicum annuum*           | Ají angolano              |
| *Capsicum chinense*         | Ají cachucha              |
| *Capsicum frutescens*       | Ají chile                 |
| *Casearia hirsuta*          | Raspalengua               |
| *Cassia diphylla*           | Maní cimarrón             |
| *Catharanthus roseus*       | Vicaria                   |
| *Cayaponia racemosa*        | Brionia                   |
| *Celtis iguanea*            | Zarza Blanca              |
| *Celtis trinervia*          | Hueso                     |
| *Cinnamomum aromaticum*     | Canela china               |
| *Cissus verticillata*       | Bejuco ubí                 |
| *Citharexylum caudatum*     | Penda                     |
| *Citrullus lanatus*         | Melón de agua              |
| *Citrus bergamia*           | Bergamota                 |
| Species                        | Common name               |
|-------------------------------|---------------------------|
| *Cladium jamaicensis*         | Cortadera                 |
| *Clematis dioica*             | Cabello de Ángel          |
| *Cidemia hirta*               | Cordobán peludo           |
| *Clusia minor*                | Copecillo                 |
| *Coccoloba retusa*            | Uvilla                    |
| *Coix lacryma jobii*          | Santa Juana               |
| *Colocasia esculenta*         | Malanga                   |
| *Colubrina ferruginosa*       | Bijaguara                 |
| *Cordia nitida*               | Ateje de Costa            |
| *Costus sp.*                  | Caña mexicana             |
| *Costus speciosus*            | Caña americana, Cañuela santa |
| *Costus spicatus*             | Caña mexicana             |
| *Cucumis melo*                | Melón de Castilla         |
| *Cupania glabra*              | Guara de costa            |
| *Cupania macrophylla*         | Guara macho               |
| *Cymbopogon citratus*         | Caña santa                |
| *Cynodon dactylon*            | Pasto bermuda             |
| *Dalbergia ecastophyllum*     | Pendola                   |
| *Davilla rugosa*              | Bejuco colorado           |
| *Deherainia cubensis*         | Contraguao cimarrón       |
| *Dendropanax arbores*         | Vibona                    |
| *Dichrostachys cinerea*       | Marabú                    |
| *Didymopanax morototoni*      | Yagruma macho             |
| *Diospyros caribae*           | Tagua                     |
| *Diospyros crassinervis*      | Ebano carbonero           |
| Number | Species                        | Common name                |
|--------|-------------------------------|-----------------------------|
| 76     | Dovyalis hebecarpa            | Aberia                      |
| 77     | Drypetes alba                 | Hueso                       |
| 78     | Drypetes serrata              | Chicharrón de costa        |
| 79     | Echinochloa colonum           | Grama pintada               |
| 80     | Echites umbellata             | Caramagüey Blanco           |
| 81     | Ehretia tinifolia             | Roble prieto                |
| 82     | Elephantopus scaber           | Lengua de vaca              |
| 83     | Enallagma latifolia           | Güira de olor              |
| 84     | Eryngium foetidum             | Culanthro                   |
| 85     | Erythroxylon alternifolium    | Arabo Prieto                |
| 86     | Erythroxylon areolatum        | Jibá Macho                  |
| 87     | Eucaliptus resinifera         | Eucalipto                   |
| 88     | Eugenia glabra                | Guairaje macho              |
| 89     | Eugenia maleolens             | Guairaje                    |
| 90     | Eugenia rigidifolia           | Biriji                      |
| 91     | Eugenia rimosaa               | Guairajillo                 |
| 92     | Eupatorium capillifolium      | Copal                       |
| 93     | Eupatorium odoratum           | Rompezaragüey de sabana     |
| 94     | Eupatorium villosum           | Albahaca de sabana          |
| 95     | Faramea occidentalis          | Nabaco                      |
| 96     | Ficus aurea                   | Jagüey Hembra               |
| 97     | Ficus cassinervia             | Jagüey                      |
| 98     | Ficus combissi                | Jagüey Macho                |
| 99     | Ficus laevigata               | Jagüey                      |
| 100    | Ficus membranacea             | Jagüey                      |
| Species                        | Common name          |
|-------------------------------|----------------------|
| Ficus subscabrida            | Jagüey Macho        |
| Flacourtia indica            | Ciruela gobernadora |
| Foeniculum vulgare           | Hinojo               |
| Gaya occidentalis            | Botón de Oro        |
| Genipa americana             | Jaga                 |
| Gerascanthus coloccocus      | Ateje                |
| Gerascanthus gerascanthioides| Varía                |
| Gilibertia edulis            | Vibona               |
| Gossypium sp                 | Algodón              |
| Guettarda cobsii             | Hueso                |
| Guettarda lindeniana         | Cuero                |
| Guettarda valenzuelana       | Vigueta              |
| Guzmania monostachya         | Curujey Bonito       |
| Gymnanthes lucida            | Yaití                |
| Hamelia patens               | Ponasí               |
| Hedychium coronarium         | Mariposa blanca     |
| Helianthus annua             | Girasol              |
| Heliotropium indicum         | Alacrancillo         |
| Hibiscus costatus            | Majaguilla           |
| Hibiscus pernambucensis      | Majagua              |
| Hibiscus sabdariffa          | Serení               |
| Hibiscus tiliaceus           | Majagua              |
| Hura crepitans               | Salvadera            |
| Hyphantria rufa              | Jaragua              |
| Ilex cassine                 | Yanilla Blanca       |
| Species                  | Common name                  |
|--------------------------|------------------------------|
| 126 Ilex repanda         | Naranjo Blanco               |
| 127 Imperata brasiliensis| Yaguna                       |
| 128 Ipomoea batatas      | boniato                      |
| 129 Isora floribunda     | Lengua de vaca               |
| 130 Jacquinia brunnescens| Espuela de Caballero         |
| 131 Jatropha multifida   | Ceibilla                     |
| 132 Justicia pectoralis  | Tilo, carpintero             |
| 133 Khaya senegalensis   | Caoba africana               |
| 134 Krugiodendron ferreum| Carey de costa               |
| 135 Lantana camara       | Filigrana                    |
| 136 Lantana involucrata  | Filigrana cimarrona          |
| 137 Laplacea curtyana    | Almendro                      |
| 138 Laurentia longiflora | Revienta caballos            |
| 139 Licaria triandra     | Laurel de la Loma            |
| 140 Lippia alba          | Flor de España               |
| 141 Lippia dulcis        | Orooz                        |
| 142 Lippia micromera     | Oreganillo                   |
| 143 Lonchocarpus pentaphyllus | Guamá de Costa              |
| 144 Lonchocarpus sericeus| Guamá                        |
| 145 Lysiloma sabicu      | Sabicú                       |
| 146 Malpighia biflora    | Palo bronco de Monte         |
| 147 Malpighia glabra     | Acerola                      |
| 148 Mammee americana     | Mamey de Santo Domingo       |
| 149 Manihot esculenta    | Yuca                         |
| 150 Manilkara albescens  | Acana                        |
|   | Species                          | Common name             |
|---|---------------------------------|-------------------------|
|151| *Manilkara jaimiqui*            | Jaimiquí                |
|152| *Manilkara sapota*              | Sapote                  |
|153| *Mappia racemosa*               | Palo de Cana            |
|154| *Margaritaria nobilis*           | Azulejo                 |
|155| *Mastichodendron foetidissimum*  | Jocuma                  |
|156| *Matayba apetala*               | Macurije                |
|157| *Matayba oppositifolia*          | Macurije                |
|158| *Matricaria recutita*            | Manzanilla              |
|159| *Melia azedarach*                | Paraíso                 |
|160| *Mentha sp.*                     | Menta                   |
|161| *Mentha spicata*                 | Hierba buena            |
|162| *Mentha x piperita*              | Menta                   |
|163| *Miconia laeviagata*            | Cordobancillo de arroyo |
|164| *Mikania cordifolia*             | Guaco                   |
|165| *Mikania hastata*                | Guaco                   |
|166| *Mikania ranunculifolia*         | Guaco                   |
|167| *Morinda royoc*                  | Piñipiñi                |
|168| *Mucuna pruriens*               | Pica Pica               |
|169| *Muntingia calabura*             | Capulí                  |
|170| *Myrcia valenzuelana*            | Pimienta cimarrona      |
|171| *Myrica cerifera*                | Arraiján                |
|172| *Nectandra earlet*               | Boniato amarillo        |
|173| *Neobracea valenzuelana*         | Meloncillo              |
|174| *Neurolea lobata*                | Victoriana              |
|175| *Ocimum basilicum*               | Albahaca                |
| Species                        | Common name               |
|-------------------------------|---------------------------|
| Ocimum gratissimum            | Orégano cimarrón          |
| Ocimum sanctum                | Albahaca morada           |
| Ocotea cuneata                | Canelón                   |
| Ocotea floribunda             | Boniato Laurel            |
| Ocotea leucayxylon            | Aguacatillo               |
| Olyra latifolia               | Tibisí                     |
| Origanum majorana             | Mejorana                  |
| Oryza sativa                  | Arroz                     |
| Oxandra lanceolata            | Algarrobo, Yaya           |
| Paspalum conjugatum           | Cañamazo amargo           |
| Passiflora edulis             | Maracuyá                  |
| Passiflora sexflora           | Pasionaria de cerca       |
| Passiflora suberosa           | Huevo de Gallo            |
| Pavonia fruticosa             | Tabano                    |
| Peltophorum adnatum           | Moruro Abey               |
| Pennisetum purpureum         | King Grass                |
| Phaseolus lunatus             | Frijol caballero          |
| Phaseolus vulgaris            | Frijol comun              |
| Phoebe elongata               | Boniatillo                |
| Picramnia pentandra           | Aguedita                  |
| Picramnia plumata             | Palo amargo               |
| Piper auritum                 | Anísón                    |
| Piscidia piscipula            | Guamá candelón            |
| Pisonia aculeata              | Medicinal                 |
| Pithecellobium arboreum       | Moruro Rojo               |
| Species                              | Common name                                      |
|--------------------------------------|--------------------------------------------------|
| Moruro Rojo                          | Encinillo                                        |
| Pithecellobium saman                 | Algarrobo                                        |
| Plantago major                       | Llantén                                          |
| Platygine hexandra                   | Ortiga                                           |
| Plectranthus amboinicus              | Orégano francés                                  |
| Plectranthus sp                      | Meprobamato, Mandelamina                         |
| Pluchea carolinensis                 | Salvia                                           |
| Potomorphe peltata                   | Caisimón de Anís                                 |
| Potomorphe umbellata                 | Caisimón                                         |
| Pouteria chrysophyllifolia           | Sapote culebra                                   |
| Pouteria dictyoneura                | Vigueta peluda                                   |
| Pouteria dominicensis                | Sapote culebra                                   |
| Pouteria sapota                      | Maney colorado                                   |
| Protium cubense                      | Copal                                            |
| Prunus myrtifolius                   | Almendrillo                                      |
| Prunus occidentalis                  | Cuiaján                                          |
| Prunus persica                       | Melocotón                                        |
| Pseudolmedia spuria                 | Macagua                                          |
| Psychotria grandis                   | Tapa caminos                                     |
| Psychotria horizontalis              | Dagame cimarrón                                  |
| Psychotria revoluta                  | Lengua de vaca                                   |
| Psychotria undata                    | Árbol Plateado                                   |
| Punica granatum                      | Granada                                          |
| Pyrus malus                          | Pyrus malus                                      |
| Rauvolfia cubana                     | Vibona                                           |
| Number | Species                  | Common name       |
|-------|--------------------------|-------------------|
| 226   | Rauvolfia nitida         | Malambo           |
| 227   | Renealmia aromatica      | Cojate            |
| 228   | Reynosia wrightii        | Almendrillo       |
| 229   | Rheedia aristata         | Manajú            |
| 230   | Rheedia fruticosa        | Manajú            |
| 231   | Rheedia roscifolia       | Manajú            |
| 232   | Richardiabrasiliensis    | Garro             |
| 233   | Rondeletia odorata       | Clavellina        |
| 234   | Rosmarinus officinalis   | Romero            |
| 235   | Ruta sp                  | Ruda              |
| 236   | Sabal parviflora         | Palma Cana        |
| 237   | Saccharum officinarum    | Caña de Azúcar   |
| 238   | Sapindus saponaria       | Jaboncillo        |
| 239   | Savia bahamensis         | Icaquillo macho  |
| 240   | Savia clusiifolia        | Icaquillo         |
| 241   | Securidaca virgata       | Medicinal         |
| 242   | Senna alata              | Guacamaya francesa|
| 243   | Senna occidentalis       | Yerba hedionda    |
| 244   | Sesamum orientale        | Ajonjoli          |
| 245   | Setaria geniculata       | Rabo de gato     |
| 246   | Simaruba laevis          | Gavilán           |
| 247   | Sinapis alba             | Mostaza           |
| 248   | Sloanea amygdalina       | Cresta de Gallo   |
| 249   | Smilax dominguensis      | Raíz de China     |
| 250   | Smilax havanensis Jacq.  | Bejuco Ñame       |
| Species                              | Common name       |
|--------------------------------------|-------------------|
| Smilax lanceolata L.                 | Raíz de China     |
| Smilax mollis Willd.                 | Bejuco de Name    |
| Solanum torvum                       | Pendejera         |
| Sorghum bicolor                      | Millo, sorgo      |
| Spondias purpurea                    | Ciruela           |
| Sporobolus indicus                   | Espartillo        |
| Stachyctapheta jamaicensis           | Verbena           |
| Stevia rebaudiana                    | Estevia           |
| Stygmaphyllum sagreanum              | Bejuco San Pedro  |
| Suberanthus nerifolius               | Caobilla          |
| Satureja brownei                     | Menta             |
| Symplocos strigillosa                | Jibacoa           |
| Syzygium malaccense                  | Albaricoque, pera |
| Tabebuia shaferi                     | Roble blanco      |
| Tabernaemontana ambliocarpa          | Lechoso           |
| Tabernaemontana citriflora           | Jazmín café       |
| Tagetes erecta                       | Carolá            |
| Tagetes lucida                       | Anís              |
| Tapura obovata                       | Cagada de aura    |
| Teloxys ambrosioides                 | Apasote           |
| Terminalia intermedia                | Chicharrón        |
| Ternstroemia peduncularis            | Copey Vera        |
| Tillandsia usneoides                 | Guajaca, Curujey  |
| Tillandsia valenzuelana              | Curujey           |
| Tournefortia hirsotissima            | Nigua             |
Table 3 (continued)

| Species                        | Common name                                      |
|--------------------------------|--------------------------------------------------|
| Trichilia havanensis           | Siguaraya                                        |
| Trichilia hirta                | Cabo de hacha                                    |
| Trichospermum grewiifolius     | Guasimilla                                       |
| Trophys racemosa               | Ramón de Caballos                                |
| Turnera ulmifolia              | Marilope                                         |
| Ureca baccifera                | Chicicate                                        |
| Vernonia havanensis            | rompezaragüey                                    |
| Vigna umbellata                | Frijol picolino, Frijol diablito, Frijol de Navidad |
| Vigna unguiculata              | Péinate para atrás                               |
| Vitis tiliaeiflia              | Parra Cimarrona                                  |
| Vitis vinifera                 | Uva                                              |
| Xanthium strumarium            | Guizazo de caballo                               |
| Xanthosoma atrovirens          | Malanga amarilla                                 |
| Xiphidium caeruleum            | Mandelamina                                      |
| Zanthoxylon cubense            | Ayúa blanca                                      |
| Zanthoxylon fagara             | Amoroso                                          |
| Zea mays                       | Maíz                                             |
| Zuelania guidonia              | Guaguasí                                         |
| Species | Flora species list in Sierra Maestra |
|---------|-------------------------------------|
| Acacia magniflora | 1 |
| Acacia alpinopectinata | 2 |
| Acacia retinonata | 3 |
| Adiantum latifolium | 4 |
| Adiantum tenuifolium | 5 |
| Adiantum tenerum | 6 |
| Aeschynomene americana | 7 |
| Alchornea falcata | 8 |
| Alchornea formosana | 9 |
| Alchornea glauca | 10 |
| Alchornea incana | 11 |
| Alchornea javanica | 12 |
| Alchornea glandulosa | 13 |
| Alchornea insignis | 14 |
| Alchornea krapfiana | 15 |
| Alchornea laeteviridis | 16 |
| Alchornea longipes | 17 |
| Alchornea macrodonta | 18 |
| Alchornea microphylla | 19 |
| Alchornea multiflora | 20 |
| Alchornea nuda | 21 |
| Alchornea obovata | 22 |
| Alchornea paniculata | 23 |
| Alchornea pilosa | 24 |
| Alchornea pubescens | 25 |
| Alchornea rigidula | 26 |
| Alchornea scoparia | 27 |
| Alchornea speciosa | 28 |
| Alchornea triplica | 29 |
| Alchornea undulata | 30 |
| Alchornea viable | 31 |
| Alchornea wightii | 32 |
| Alchornea zeylanica | 33 |
| Alchornea zizyphoides | 34 |
| Alchornea zygophylla | 35 |
| Alchornea zygophylla subsp. indica | 36 |
| Alchornea zygophylla var. indica | 37 |
| Alchornea zygophylla var. maxima | 38 |
| Alchornea zygophylla var. nuda | 39 |
| Alchornea zygophylla var. pubescens | 40 |

**Table 4**: Flora species list in Sierra Maestra
| Species                        | Number | Species                        | Number | Species                        |
|-------------------------------|--------|-------------------------------|--------|-------------------------------|
| Borreria laveis              | 68     | Dichanthium annulatum         | 108    | Panicum maximum               |
| Bouchea prismatica           | 69     | Dichanthium caricasum         | 109    | Panicum pilosum               |
| Brachiaria extensa           | 70     | Dieffebanchia seguine          | 110    | Panicum reptans               |
| Brachiaria fasciculata       | 71     | Digitaria adscendens          | 111    | Paspalum fimbriatum           |
| Brachiaria subquadripara     | 72     | Echinochloa colona            | 112    | Pedilanthus angustopholium    |
| Brassia caudata              | 73     | Echinochloa cruzgalli         | 113    | Petiveria alliacea L          |
| Buherhavia erecta L          | 74     | Eleusine indica               | 114    | Philodendron consanguineum    |
| Bursera simaruba             | 75     | Emilia sonchifolia            | 115    | Phyla nodiflora               |
| Cajanus indicus              | 76     | Epidendrum nocturnum Jacq     | 116    | Pimenta dioica                |
| Caladium bicolor             | 77     | Epidendrum radicans           | 117    | Plumeria montana              |
| Calocarpum sapota            | 78     | Eringium phoetidim           | 118    | Poeppigia prest               |
| Calycopillium candidissimum   | 79     | Erythrina poeppigiana        | 119    | Poeppigiana erythrina         |
| Campyloneurum cubense        | 80     | Erythrina vellutina           | 120    | Polypodium astropelis         |

Table 4 (continued)
cross-pollination can increase coffee production by up to 50% compared to self-pollination (Tscharntke et al. 2011) and biological control can reduce outbreaks of plagues or herbivores (Kellerman et al. 2008; Perfecto et al. 2004). Interactions between woody and herbaceous plants in agroforestry systems usually improve the microclimate and nutrient availability in the soil. The belowground presence of trees affects moisture availability and soil temperature and these, in turn, affect transpiration and energy conversion of nearby plants (Rosenberg et al. 1983; Atangana et al. 2014). Biologically complex agroforestry systems often reveal greater ecosystem functioning and a reduced reliance on chemical inputs (Drinkwater and Snapp 2007; Malézieux et al. 2009; Martin and Isaac 2015). Such benefits have been observed from farm to landscape levels of integration, and across temperate and tropical agroecosystems. While these benefits are a key target in future food production landscapes, such success requires well developed diagnostics of the plant-soil continuum (Isaac and Borden 2019).

Conclusions

Agroforestry systems are recognized as an alternative for land use planning on farms and interfluvial areas being considered as a sustainable example for the management of tree, shrub, soil, crops and animals’ resources. The system must integrate the function and interaction between its components, otherwise it may be a good association, but hardly adequate to protect the soil-crop-tree and produce sustainably. Many of the alternatives improve soil conditions, others influence water production or relate to crop protection (World Vision 2005). The high diversity in terms of cultivated and spontaneous species characterizing the systems object of the present paper allows a strong resilience of the systems themselves, tested after the impact of devastating hurricanes, changes in rainfall patterns and droughts. In addition, at the genetic, species, and farming systems levels, biodiversity provides valuable ecosystems services and functions for agricultural production (Thrupp 2000).

“Agroforestry” is a relatively new term, the traditional knowledge and practices underpinning these land use systems is ancient, having originated in the ancestral "shifting cultivation" practices of African peoples and indigenous peoples of the Americas (and elsewhere). Landscape structure, field area and margins, and polycultures that are part of the indigenous agricultural strategy appear to increase the biodiversity of traditional agroecosystems (Altieri et al. 1987; Oldfield and Alcorn 1987; Parrotta et al. 2015). Thus, there is increasing evidence that the mosaic structure of landscapes under indigenous management maintains and even improves biodiversity (Gonzalez-Bernaldez 1991; Brown and Brown 1992; Reichhardt et al. 1994), as well as preserving the associated cultural values (Agnoletti 2014; Agnoletti et al. 2015).

Furthermore, the complex system created thanks to the introduction of shade trees and other cultivated species contribute to obtain multiple benefits from both an ecological and economic point of view. In fact, shade trees play an important role in erosion control and in maintaining soil productivity by stimulating the decomposition of residuals while generating additional products, such as wood, firewood and fruits, providing important contributions to farmers’ livelihoods, especially in seasons where productivity it is low. It is increasingly clear that shade trees provide direct and indirect benefits, so it is difficult to fully quantify the total benefits. However, these benefits are expected to improve farmers’ livelihoods by stabilizing their income and increasing their ability to recover in general. Considering this and the fact that being system with no chemical inputs and completely
sustainable they can mitigate the effects of climate change by propitiating a favorable microclimate and increasing carbon storage it is clear that results important their preservation and protection in order to provide multiple benefits to the environment sustaining local communities. The present study, in this sense, has contributed to give a framework of the traditional structure of agroforestry systems for coffee production in Cuba providing at the same time the list of all the flora and fauna species involved in the systems themselves. This turns to be fundamental to understand the importance of maintaining and promoting traditional knowledge which, in this particular case, is the key to preserve the agrobiodiversity, sustain local communities and implement sustainable economic strategies. These systems are also an important alternative to intensive plantations of coffee, especially when we relate this production to the worldwide market of coffee consumed in many countries, for their sustainability and as an expression of a wider concept of food quality.

Appendix 1: Complete list of the useful species at Sierra Del Rosario, with the botanical family of each species

List of species used for animal feeding.

| Scientific name                  | Family              |
|----------------------------------|---------------------|
| 1 Commelina diffusa Burm. f      | Commelinaceae       |
| 2 Cynodon dactylon (L.) Pers     | Poaceae             |
| 3 Dendropanax arboreus (L.) Decne. & Planch | Araliaceae     |
| 4 Echinochloa colona (L.) Link   | Poaceae             |
| 5 Gerasanthus coloccocus (L.) Borhidi | Boraginaceae   |
| 6 Guazuma ulmifolia Lam          | Malvaceae           |
| 7 Helianthus annuus L.           | Asteraceae          |
| 8 Hypharrenia rufa Nees          | Poaceae             |
| 9 Pennisetum purpureum Schumacher | Poaceae             |
| 10 Roystonea regia (Kunth) O.F. Cook | Arecaceae    |
| 11 Saccharum officinarum L.      | Poaceae             |
| 12 Samanea saman (Jacq.) Merr    | Leguminosae         |
| 13 Sorghum bicolor (L.) Moench   | Poaceae             |
| 14 Sporobolus indicus (L.) R.Br  | Poaceae             |
| 15 Trophis racemosa (L.) Urb     | Moraceae            |

List of species used for beverage elaboration.

| Scientific name                  | Family              |
|----------------------------------|---------------------|
| 1 Canavalia ensiformis L.        | Leguminosae         |
| 2 Cassia grandis L. f            | Leguminosae         |
| 3 Citrus x aurantifolia (Christm.) Swingle | Rutaceae    |
| 4 Coffea arabica L.              | Rubiaceae           |
| 5 Coffea canephora L.            | Rubiaceae           |
| 6 Passiflora edulis Sims         | Passifloraceae      |
| 7 Smilax dominguensis Willd      | Smilacaceae         |
| Scientific name                  | Family          |
|---------------------------------|-----------------|
| 8  \textit{Smilax havanensis}  | Smilacaceae     |
| 9  \textit{Smilax lanceolata}   | Smilacaceae     |
| 10 \textit{Smilax mollis}      | Smilacaceae     |
| 11 \textit{Vitis tilifolia}    | Vitaceae        |
| 12 \textit{Vitis vinifera}     | Vitaceae        |

List of the species used as condiments.

| Scientific name                  | Family          |
|---------------------------------|-----------------|
| 1 \textit{Allium cepa}          | Amaryllidaceae  |
| 2 \textit{Allium cepa var. aggregatum} | Amaryllidaceae |
| 3 \textit{Allium chinense}      | Amaryllidaceae  |
| 4 \textit{Allium fistulosum}    | Amaryllidaceae  |
| 5 \textit{Allium sativum}       | Amaryllidaceae  |
| 6 \textit{Allium tuberosum}     | Amaryllidaceae  |
| 7 \textit{Averrhoa bilimbi}     | Oxalidaceae     |
| 8 \textit{Bixa orellana}        | Bixaceae        |
| 9 \textit{Brassica juncea}      | Brassicaceae    |
| 10 \textit{Capsicum annuum}     | Solanaceae      |
| 11 \textit{Capsicum chinense}   | Solanaceae      |
| 12 \textit{Capsicum frutescens} | Solanaceae      |
| 13 \textit{Cinnamomum cassia}   | Lauraceae       |
| 14 \textit{Citrus x aurantium}  | Rutaceae        |
| 15 \textit{Citrus limon}        | Rutaceae        |
| 16 \textit{Eryngium foetidum}   | Apiaceae        |
| 17 \textit{Foeniculum vulgare}  | Apiaceae        |
| 18 \textit{Lippia micromera}    | Verbenaceae     |
| 19 \textit{Ocimum gratissimum}  | Lamiaceae       |
| 20 \textit{Plectranthus amboinicus} | Lamiaceae      |
| 21 \textit{Sinapis alba}        | Brassicaceae    |

List of the species used as fruits.

| Scientific name                  | Family          |
|---------------------------------|-----------------|
| 1 \textit{Anacardium occidentale} | Anacardiaceae  |
| 2 \textit{Ananas comosus}       | Bromeliaceae    |
| 3 \textit{Annona muricata}      | Annonaceae      |
| 4 \textit{Annona squamosa}      | Annonaceae      |
| 5 \textit{Carica papaya}        | Caricaceae      |
| 6 \textit{Chrysophyllum cainito} | Sapotaceae      |
| 7 \textit{Chrysophyllum oliviforme} | Sapotaceae     |
| 8 \textit{Citrullus lunatus}    | Cucurbitaceae   |
| 9 \textit{Citrofortunella microcarpa} | Rutaceae      |
| 10 \textit{Citrus reticulata}   | Rutaceae        |
| 11 \textit{Citrus x sinensis}   | Rutaceae        |
| Scientific name                      | Family                           |
|--------------------------------------|----------------------------------|
| *Citrus x paradisi* Macfad           | Rutaceae                         |
| *Cocos nucifera* L.                  | Arecales                         |
| *Cucumis melo* L.                    | Cucurbitaceae                    |
| *Dovyalis hebecarpa* (Gardner) Warb  | Salicaceae                       |
| *Flacourtia indica* (Burm. F.) Merr  | Salicaceae                       |
| *Malpighia emarginata* DC            | Malpighiaceae                    |
| *Malus domestica* L.                 | Rosaceae                         |
| *Mammea americana* L.                | Calophyllaceae                   |
| *Mangifera indica* L.                | Anacardiaceae                    |
| *Manilkara zapota* (L.) P. Royen    | Sapotaceae                       |
| *Melicocccus bijugatus* Jacq         | Sapindaceae                      |
| *Muntingia calabura* L.              | Muntingiaceae                    |
| *Musa x paradisiaca* L.              | Musaceae                         |
| *Persea americana* Mill              | Lauraceae                         |
| *Pouteria campechiana* Baehni        | Sapotaceae                       |
| *Pouteria sapota* (Jacq.) H.E. Moore & Stearn | Sapotaceae          |
| *Prunus persica* (L.) Stokes         | Rosaceae                         |
| *Psidium guajava* L.                 | Myrtaceae                         |
| *Punica granatum* L.                 | Lythraceae                       |
| *Spondias purpurea* L.               | Anacardiaceae                    |
| *Syzygium malaccense* (L.) Merr. & L.M. Perry | Myrtaceae              |

List of the species used as grains.

| Scientific name                      | Family         |
|--------------------------------------|---------------|
| *Arachys hypogaea* L.                | Leguminosae   |
| *Oryza sativa* L.                    | Poaceae       |
| *Phaseolus lunatus* L.               | Leguminosae   |
| *Phaseolus vulgaris* L.              | Leguminosae   |
| *Sesamum indicum* L.                 | Pedaliaceae   |
| *Vigna umbellata* (Thunb.) Ohwi & H. Ohashi | Leguminosae |
| *Vigna unguiculata* L. Walp          | Leguminosae   |
| *Zea mays* L.                        | Poaceae       |

List of wood and timber species.

| Scientific name                      | Family            |
|--------------------------------------|-------------------|
| *Abarema obovalis* (A. Rich.) Barneby & J.W. Grimes | Leguminosae       |
| *Acrocomia aculeata* (Jacq.) Lodd. ex Mart | Arecales          |
| *Alchornea latifolia* Sw             | Euphorbiaceae     |
| *Amphitoca latifolia* (Mill.) A. H. Gentry | Bignoniaceae     |
| *Amyris balsamifera* L.              | Rutaceae          |
| *Andira inermis* (W. Wright) DC      | Leguminosae       |
| *Boconia frutescens* L.              | Papaveraceae      |
| *Ehretia cassinifolia* A. Rich       | Boraginaceae      |
|   | Scientific name                  | Family                   |
|---|----------------------------------|--------------------------|
|10 | *Buchenavia capitata* (Aubl.) Howard | Combrataceae             |
|11 | *Calophyllum antillanum* Britton  | Calophyllaceae           |
|12 | *Calyptrotes capitulata* C. Wright | Myrtaceae                |
|13 | *Casearia hirsuta* Sw             | Salicaceae               |
|14 | *Cedrela odorata* L.              | Meliaceae                |
|15 | *Celtis trinervia* Lam            | Ulmaceae                 |
|16 | *Citarexylum caudatum* L.         | Verbanaceae              |
|17 | *Coelocula retusa* Griseb        | Polygonaceae             |
|18 | *Cojoba arborea* (L.) Britton & Rose | Leguminosae              |
|19 | *Colubrina arborescens* (Mill.) Sarg | Rhamnaceae               |
|20 | *Comocladia dentata* Jacq        | Anacardiaceae            |
|21 | *Cordia nitida* Vahl             | Boraginaceae             |
|22 | *Cupania americana* L.           | Sapindaceae              |
|23 | *Cupania glabra* Sw              | Sapindaceae              |
|24 | *Cupania macrophylla* C. Mart     | Sapindaceae              |
|25 | *Deherainia cubensis* (Radlk.) Mez | Primulaceae              |
|26 | *Dendropanax arboreus* (L) Decne. & Planch | Araliaceae                |
|27 | *Dichrostachys cinerea* (L.) Wight & Arn | Leguminosae             |
|28 | *Diospyros caribaea* (A. DC.) Standl | Ebenaceae                |
|29 | *Diospyros crassinervis* (Krug & Urb) Standl | Ebenaceae              |
|30 | *Drypetes alba* Poit             | Euphorbiaceae            |
|31 | *Drypetes serrata* (Maycock) Krug & Urb | Euphorbiaceae             |
|32 | *Ehretia cassinifolia* A. Rich   | Boraginaceae             |
|33 | *Ehretia tinifolia* L.           | Boraginaceae             |
|34 | *Erythroxylon alternifolium* M. Gomez | Erythroxylaceae         |
|35 | *Erythroxylon areolatum* L.       | Erythroxylaceae          |
|36 | *Eucaliptus resinifera* Sm        | Myrtaceae                |
|37 | *Eugenia glabra* Alston          | Myrtaceae                |
|38 | *Eugenia maleolens* Pers         | Myrtaceae                |
|39 | *Eugenia rigidifolia* A. Rich    | Myrtaceae                |
|40 | *Eugenia rimosana* C. Wright     | Myrtaceae                |
|41 | *Ficus aurea* Nutt               | Moraceae                 |
|42 | *Ficus cassinervia* Desf. ex Wild | Moraceae                |
|43 | *Ficus citrifolia* Mill          | Moraceae                 |
|44 | *Ficus combissi* Warb            | Moraceae                 |
|45 | *Ficus maxima* Mill              | Moraceae                 |
|46 | *Ficus membranacea* C. Wright    | Moraceae                 |
|47 | *Garcinia aristata* (Griseb.) Borhidi | Clusiaceae              |
|48 | *Garcinia serpentinii* Borhidi   | Clusiaceae               |
|49 | *Garcinia ruscifolia* (Griseb.) Borhidi | Clusiaceae        |
|50 | *Genipa americana* L.            | Rubiaceae                |
|51 | *Geranacanthus geranacanthoides*  | Boraginaceae             |
|52 | *Guarea guidonia* (L.) Sleumer   | Meliaceae                |
|53 | *Guetarda combsii* Urb           | Rubiaceae                |
|54 | *Guetarda lindeniana* A. Rich    | Rubiaceae                |
|55 | *Guetarda valenzuelana* Rich     | Rubiaceae                |
|   | Scientific name                          | Family                  |
|---|------------------------------------------|-------------------------|
| 56| Gymnanthes lucida Sw                     | Euphorbiaceae           |
| 57| Hibiscus cordifolius Mill                | Malvaceae               |
| 58| Hibiscus elatus Sw                       | Malvaceae               |
| 59| Hibiscus tiliaceus L. var. pernambucensis (Arruda) I.M. Johnst | Malvaceae               |
| 60| Hura crepitans L.                        | Euphorbiaceae           |
| 61| Ilex cassine L.                          | Aquifoliaceae           |
| 62| Ilex repanda Griseb                     | Aquifoliaceae           |
| 63| Juglans jamaicensis D. DC               | Fagaceae                |
| 64| Khaya senegalensis (Desr.) A. Juss      | Meliaceae               |
| 65| Krugiodendron ferreum (Vahl) Urb        | Rhamnaceae              |
| 66| Laplacea curtyana A. Rich               | Theaceae                |
| 67| Licaria triandra (Sw.) Kosterm         | Lauraceae               |
| 68| Lonchocarpus pentaphyllus (Poir.) D.C   | Leguminosae             |
| 69| Lonchocarpus sericeus (Poir.) Kunth ex DC | Leguminosae             |
| 70| Lysiloma sabicu Benth                   | Leguminosae             |
| 71| Malpighia urens L.                      | Malpighiaceae           |
| 72| Manilkara albescens (Griseb.) Cronquist | Sapotaceae              |
| 73| Manilkara jaimiqui (C. Wright ex Griseb.) Dubard | Sapotaceae              |
| 74| Mappia racemosa Jacq                    | Icacinaceae             |
| 75| Margaritaria nobilis L.f               | Phyllantaceae           |
| 76| Matayba oppositifolia (A.Rich.) Britton | Sapindaceae             |
| 77| Melia azedarach L.                      | Meliaceae               |
| 78| Micropholis guayanesis (A. DC.) Pierre  | Sapotaceae              |
| 79| Myrica valenzuelana (A. Rich.) Griseb   | Rubiaceae               |
| 80| Myrica cerifera L.                      | Myricaceae              |
| 81| Nectandra coriacea (Sw.) Griseb         | Lauraceae               |
| 82| Nectandra hihua (Ruiz & Pav.) Rohwe     | Lauraceae               |
| 83| Nectandra minima Rohwer                 | Lauraceae               |
| 84| Neobracea valenzuelana (A. Rich.) Urb   | Apocynaceae             |
| 85| Ocotea cuneata (Griseb.) Urb            | Lauraceae               |
| 86| Ocotea floribunda (Sw.) Mez             | Lauraceae               |
| 87| Ocotea leucoxylon (Sw.) Laness          | Lauraceae               |
| 88| Peltophorum adnatum Griseb              | Leguminosae             |
| 89| Phoebe elongata (Vahl) Nees             | Lauraceae               |
| 90| Picramnia pentandra Sw                  | Leguminosae             |
| 91| Picramnia reticulata Griseb             | Leguminosae             |
| 92| Piscidia pissipula (L.) Sarg            | Leguminosae             |
| 93| Samanea saman (Jacq.) Merr              | Leguminosae             |
| 94| Pouteria dictyoneura (Griseb.) Radlk    | Sapotaceae              |
| 95| Pouteria dominigensis (C.F. Gaertn.) Baehni | Sapotaceae              |
| 96| Protium cubense (Rose) Urb              | Burseraceae             |
| 97| Primus myrtifolia (L.) Urb              | Rosaceae                |
| 98| Primus occidentalis Sw                  | Rosaceae                |
| 99| Pseudolmedia spuria (Sw.) Griseb        | Moraceae                |
|100| Psychotria horizontalis Sw              | Rubiaceae               |
|101| Psychotria undata Jacq                  | Rubiaceae               |
### Scientific Name Family

1. **Rauvolfia cubana** A. DC  
   Apocynaceae

2. **Rauvolfia nitida** Jacq  
   Apocynaceae

3. **Reynosia wrightii** Urb  
   Rhamnaceae

4. **Richardia brasiliensis** Gomes  
   Rubiaceae

5. **Sabal parviflora** Becc  
   Arecaceae

6. **Sapindus saponaria** L.  
   Sapindaceae

7. **Savia bahamensis** Britt  
   Euphorbiaceae

8. **Savia clusiifolia** Griseb  
   Euphorbiaceae

9. **Schefflera morototoni** (Aubl.) Maguire, Steyerm. & Frodin  
   Araliaceae

10. **Sideroxylon foetidissimum** Jacq  
    Sapotaceae

11. **Simarouba glauca** DC  
    Simaroubaceae

12. **Tabebuia shaferi** Britton  
    Bignoniaceae

13. **Trichilia havanensis** Jacq  
    Meliaceae

14. **Trichilia hirta** L.  
    Meliaceae

15. **Trichospermum grewiifolius** (A.Rich.) Kosterm  
    Malvaceae

16. **Zanthoxylon cubense** P. Wilson  
    Rutaceae

17. **Zanthoxylon fagara** (L.) Sarg  
    Rutaceae

18. **Zanthoxylon martinicense** (Lam.) DC  
    Rutaceae

19. **Zuelania guidonia** (Sw.) Britton & Millsp.  
    Salicaceae

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### List of medicinal species.

| Scientific Name                        | Family          |
|----------------------------------------|-----------------|
| Abrus precatorius L.                   | Leguminosae     |
| Adenoropium multifidum (L.) Poh        | Euphorbiaceae   |
| Adianthus capillus veneris L.           | Adianthaceae    |
| Agalinis albida Britton & Pennell      | Orobancheaceae  |
| Ageratum conyzoides L.                 | Asteraceae      |
| Allophyllus cominia (L.) Sw             | Sapindaceae     |
| Aloe vera (L.) Burm.f                  | Xanthorrhoeaceae|
| Alternanthera caracasana Kunth         | Amaranthaceae   |
| Ambrosia artemisiifolia L.             | Asteraceae      |
| Andropogon glomeratus (Walter) Britton | Poaceae         |
| Argemone mexicana L.                   | Papaveraceae    |
| Scientific Name              | Family              |
|------------------------------|---------------------|
| **12** Artemisa absinthium L. | Asteraceae          |
| **13** Arthrostylidium capillifolium Griseb | Poaceae          |
| **14** Asclepias curassavica L. | Asclepiadaceae      |
| **15** Asclepias nivea L. | Asclepiadaceae      |
| **16** Bahuinia cumanensis Kunth | Caesalpinaceae    |
| **17** Bahuinia divaricata L. | Caesalpinaceae      |
| **18** Banksea speciosa J. König | Proteaceae        |
| **19** Bidens pilosa L. | Asteraceae          |
| **20** Blechum pyramidatum (Lam.) Urb | Acanthaceae    |
| **21** Byrsonima spicata (Cav.) DC | Malpighiaceae   |
| **22** Caesalpinia vesicaria L. | Leguminosae        |
| **23** Caesalpinia pulcherrima (L.) Sw | Leguminosae    |
| **24** Cassia diphylla (L.) Greene | Leguminosae     |
| **25** Catharanthus roseus (L.) G. Don | Apocynaceae    |
| **26** Cayaponia racemosa (Mill.) Cogn | Cucurbitaceae  |
| **27** Cecropia schreberiana Miq | Urticaceae       |
| **28** Celtis iguanea (Jacq.) Sarg | Ulmaceae        |
| **29** Chromolaena odorata (L.) R.M. King & H. Rob | Asteraceae    |
| **30** Cissus verticillata (L.) Nicolson & C.E.Jarvis | Vitaceae      |
| **31** Citrus x bergamia Risso & Poit | Rutaceae        |
| **32** Cladium jamaicensis Crantz | Cyperaceae      |
| **33** Clematis dioica L. | Ranunculaceae      |
| **34** Clidemia hirta (L.) D.Don | Melastomataceae |
| **35** Clusia minor L | Clusiaceae         |
| **36** Coix lacryma-jobi L. | Poaceae            |
| **37** Costus sp. | Costaceae          |
| **38** Costus scaber Ruiz & Pav | Costaceae      |
| **39** Crescencia cujete L. | Bignoniaceae       |
| **40** Cymbopogon citratus (DC) Stapf | Poaceae        |
| **41** Dalbergia ecastaphyllum (L.) Taubert | Leguminosae |
| **42** Davilla rugosa Poir | Dilleniaceae      |
| **43** Echites umbellatus Jacq | Apocynaceae       |
| **44** Elephantopus scaber L. | Asteraceae        |
| **45** Erigeron quercifolius Lam | Asteraceae      |
| **46** Faramea occidentalis (L.) A.Rich | Rubiaceae |
| **47** Gaya occidentalis (L.) Sweet | Malvaceae   |
| **48** Gossypium sp | Malvaceae         |
| **49** Guzmania monostachya Rusby ex Mez | Bromeliaceae |
| **50** Hamelia patens Jacq | Rubiaceae         |
| **51** Hedychium coronarium J. Koening | Zingiberaceae |
| **52** Heliotropium indicum L. | Asteraceae        |
| **53** Hibiscus sabdariffa L. | Malvaceae         |
| **54** Hippobroma longiflora (L.) Don | Campanulaceae |
| **55** Hohenbergia penduliflora (A. Rich.) Mez | Bromeliaceae |
| **56** Imperata brasiliensis Trin | Poaceae          |
| **57** Ixora floribunda (A. Rich.) Griseb | Rubiaceae      |
| Scientific Name                  | Family                  |
|---------------------------------|-------------------------|
| Jacquinia brunnescens Urb       | Primulaceae              |
| Justicia pectoralis Jacq        | Acanthaceae              |
| Koanophyllum dolicholepis (Urb.) R.M. King & H. Rob | Asteraceae |
| Lantana camara L.               | Verbenaceae              |
| Lantana involucrata L.          | Verbenaceae              |
| Lepidium virginicum L.          | Brassicaceae             |
| Lippia alba (Mill.) N.E. Br. Ex Britton & Wilson | Verbenaceae |
| Matricaria recutita L.          | Asteraceae               |
| Mentha sp.                      | Lamiaceae                |
| Mentha spicata L.               | Lamiaceae                |
| Mentha x piperita L.            | Lamiaceae                |
| Miconia laeviagata (L.) D.Don    | Melastomataceae          |
| Mikania cordifolia (L. f.) Wild  | Asteraceae               |
| Mikania hastata (L.) Wild       | Asteraceae               |
| Mikania ranunculifolia A. Rich  | Asteraceae               |
| Mimosa pudica L.                | Leguminosae              |
| Momordica charantia L.          | Cucurbitaceae            |
| Morinda royoc L.                | Rubiaceae                |
| Mucuna pruriens (L.) DC         | Leguminosae              |
| Neurolaena lobata (L.) R.Br. ex Cass | Asteraceae |
| Ocimum basilicum L.             | Lamiaceae                |
| Ocimum sanctum L.               | Lamiaceae                |
| Olyra latifolia L.              | Poaceae                  |
| Origanum majorana L.            | Lamiaceae                |
| Oxandra lanceolata (Sw.) Baill  | Lauraceae                |
| Parthenium hysterophorus L.     | Asteraceae               |
| Paspalum conjugatum             | Poaceae                  |
| Paspalum notatum Fluggé         | Poaceae                  |
| Passiflora sexflora Juss        | Passifloraceae           |
| Passiflora suberosa L.          | Passifloraceae           |
| Pavonia fruticosa (Mill.) Fawc. & Rendle | Malvaceae |
| Petiveria alliacea L.           | Phytolacaceae            |
| Phylla scaberrima (Trevir.) Moldenke | Verbenaceae |
| Piper aduncum L.                | Piperaceae               |
| Piper auritum Kunth             | Piperaceae               |
| Piper peltatum L.               | Piperaceae               |
| Piper umbellatum L.             | Piperaceae               |
| Pisonia aculeata L.             | Nyctaginaceae            |
| Plantago major L.               | Plantaginaceae           |
| Platygine hexandra (Jacq)       | Euphorbiaceae            |
| Plectranthus sp                 | Lamiaceae                |
| Pluchea carolinensis (Jacq.) G. Don | Asteraeae |
| Pleopeltis polypondioides (L.) E. G. Andrews & Windham | Poly podiaceae |
| Psychotria grandis Sw           | Rubiaceae                |
| Psychotria revoluta DC          | Rubiaceae                |
| Renealmia aromatica L.f         | Zingiberaceae            |
| Scientific Name      | Family                  |
|---------------------|-------------------------|
| Rondeletia odorata  | Rubiaceae               |
| Rosmarinus officinalis | Lamiales              |
| Ruta graveolens     | Rutaceae                |
| Securidaca virgata  | Polygalaceae            |
| Senna alata         | Leguminosae             |
| Senna occidentalis  | Leguminosae             |
| Setaria geniculata  | Poaceae                 |
| Sida aculeata       | Malvaceae               |
| Sida rhombifolia    | Malvaceae               |
| Sloanea curatelifolia | Malvaceae             |
| Solanum torvum     | Solanaceae              |
| Stachytarpheta jamaicensis | Verbenaceae   |
| Stevia rebaudiana   | Asteraeace              |
| Stygmaphyllum sagreanum | Malpighiaceae       |
| Satureja brownii    | Lamiaceae               |
| Tabernaemontana citrifolia | Apocynaceae |
| Tagetes erecta      | Asteraeace              |
| Tagetes lucida      | Asteraeace              |
| Dysphania ambrosioides | Amaranthaceae        |
| Tillandsia usneoides | Bromeliaceae           |
| Tillandsia valenzuelana | Bromeliaceae       |
| Turneortia hirsutissima | Bromeliaceae        |
| Tradescantia spathacea | Commelinaceae         |
| Turnera ulmifolia   | Passifloraceae          |

List of species used as roots and tubers.

| Scientific Name                          | Family     |
|------------------------------------------|------------|
| Colocasia esculenta (L.) Schott          | Araceae    |
| Dioscorea alata L.                       | Dioscoraceae|
| Ipomoea batatas (L) Lam                  | Convolvulaceae|
| Manihot esculenta Crantz                 | Euphorbiaceae|
| Xanthosoma sagittifolium (L.) Schott     | Araceae    |

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Declarations

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Consent for publication  Not applicable.

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