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Plant species diversity of homegardens in humid and semiarid Cuba and its importance for self-sufficiency of households[1]

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Abstract

The cultivation of different plants in homegardens for self-sufficiency has a long tradition in Cuba, but knowledge about homegardens in Cuba is small. To analyse this more deeply, cultivated plants of 31 homegardens were surveyed in three villages in eastern Cuba in 2001. Two of the study villages were located in a humid area with an annual precipitation of about 2200 mm. The third village was situated in a semiarid area with about 450 mm precipitation. The plants studied in the homegardens included those for human consumption such as fruits, vegetables, tubers and cereals as well as spices and medicinal plants. In total, 101 different plant species were found with an average number of 18 to 24 species per homegarden for the three villages. A broad range of species was found in all villages, because irrigation is used under semiarid conditions, which lead to a relative high similarity in species composition between the villages. But, also differences due to the climatic situation became evident, particularly with the medicinal plants. In general, homegarden production provided a broad and diverse basis for self-sufficiency of the households. Although homegarden production showed to be only a small source of income, it is particularly important because of low-paid outside work and minimal food provision of the state.

2 Introduction

The production of fruits, vegetables and cereals in homegardens has a long tradition in Cuba (Esquivel and Hammer, 1992). In general, homegardens are characterised by different vegetation strata composed of trees, shrubs and herbs in association with annual and perennial agricultural crops and small livestock within the house compounds (Fernandez and Nair, 1986). Normally, the whole tree-crop-animal unit is intensively managed by family labour. Many homegarden systems around the world have been already analysed (Fernandes and Nair, 1986; De Clerck and Negreros-Castillo, 2000; Méndez et al., 2001), but knowledge about Cuban homegardens is small (Esquivel and Hammer, 1992; Orellana et al., 2001).

In many parts of the world homegarden systems provide an additional food supply for many people, which is also the case in Cuba. In rare cases it can be also a basic food supply if homegardens are large enough to sufficiently plant tubers or cereals. The importance of food supply has particularly to be seen with respect to the strong changes which have been taken place in Cuba in the last decades and which still carry on. Until 1989, homegarden products provided

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additional food to the basis provision such as bread, oil, flour, meat and others sold cheaply in government stores (Bähr et al., 1997; Deere, 1997). This situation changed dramatically after 1989 when the former Soviet Union collapsed and economic support for Cuba dropped abruptly (Deere et al., 1995). Since then, the economic situation in Cuba worsened to an extent that a "special period in time of peace" was declared by Fidel Castro in September 1990 (Alvarez, 2000). With different measures such as cutting subventions, increasing certain taxes and prices or promoting priority sectors like pharmacy and tourism, it was tried to improve the economic situation with a centralistic directed resource distribution in the country (Burchardt, 1994 cited in Bähr et al., 1997). The provision of nutrition rations from the state was reduced to an absolute minimum for example. This, together with low wages, created an enormous problem for many people to feed their families. One solution was the intensification of the homegarden production, another a growing number of people cultivating an increasing area of non-state land after the break-up of the state monopoly on land in 1993 (Alvarez, 2000). In 1992, still 85 % of the Cuban agricultural land belonged to the state and only 15 % to private persons, mainly for self-sufficiency (Bähr et al., 1997). In the following years, about 60 % of the state farm land (46 % of the total agricultural land in Cuba) was transformed to what is called Basic Units of Co-operative Production (UBPCs). In the UBPCs however, land remains national property, but former state farm workers have been given the opportunity to lease rent-free land from the state in permanent usufruct for collective production (Deere, 1997). Finally, at the end of 1997, the state accounted for 33 % of total agricultural land and the non-state sector for 67 % (Alvarez, 2000). Since 1994, also free agrarian markets were legalised where private persons were allowed to sell their products (Bähr et al., 1997; Deere 1997), e.g. from homegardens.
To contribute to the small knowledge about the Cuban homegarden systems, this study aims at surveying and analysing plant richness in these homegardens. It also investigates the diversity of plants cultivated according to different climatic conditions and discusses the significance of homegardens for household food supply.

3 Materials and Methods

The study was conducted in September and October 2001 in eastern Cuba. In three villages, 31 homegardens were visited and plants used by the households noted (number of homegardens studied per village see Appendix 1). Two survey villages (Nibujon 74° 39'W, 20° 31'N; El Recreo 74° 41'W, 20° 31'N) which are located in the eastern sector of the Alexander von Humboldt National Park were first analysed. This area receives an annual precipitation of about 2200 mm as it lies in the luff of the Sagua de Baracoa mountains where the dominating northeast and east winds from the Caribbean Sea arrive (Instituto de Meteorologia de la Academia de Ciencias de Cuba 1987). The natural vegetation consists of submontane evergreen rain forests, dry Pinus forests as well as mangroves along the coastline. Most important soil types according to FAO-classification are Cambisols and Ferralsols on serpentine as well as Fluvisols. In a second step, a third village, Baitiquirí (74° 53'W, 20° 1'N), was chosen to investigate if species composition in the homegardens changes with a different climatic situation. Baitiquirí is situated in a semiarid area with 400-500 mm precipitation surrounded by different types of xeromorphic savannas. The aridity of this area is caused by its position in the rain shadow of the Sagua de Baracoa mountains which block the prevailing NE-trade winds. In this region, mostly Leptosols, but also Cambisols and Ferralsols on limestone as well as Fluvisols (according to FAO-classification) are found. The Nature Reserve Baitiquirí is situated adjacent to the third study village. The villages in the National Park and adjacent to the Nature Reserve are characteristic villages with typical land use systems for the respective regions and thus do not reflect a special situation because of their location in or near protected areas.
The size of the homegardens varied between 20x30 m to 40x50 m. The average size was about 25x35 m. The average household consisted of four household members. The plants studied in the homegardens included those for human consumption such as fruits, vegetables, tubers and cereals

as well as spices and medicinal plants. They were grouped in Appendix 1 according to their preferred uses in the households. Ornamental plants and timber species were not included in the study. Anyhow, tree species surveyed in this study included most of the tree species in the homegardens also used for timber production.
Plants which could not be directly identified in the homegardens, which was mainly the case for the medicinal plants, were collected for a field herbarium. Local names provided by the owner were translated to corresponding scientific names according to Roig y Mesa (1988), in fewer cases Fuentes et al. (1988) or Esquivel et al. (1989). The collected plant samples were then verified according to Leon and Alain (1946-1963). Some of the plant samples were determined with the help of botanists from CITMA (Ministerio de Ciencia, Tecnología y Medio Ambiente) in Guantánamo, Cuba. Scientific plant names follow Rehm and Espig (1996), except for the medicinal plants, which use nomenclature of Fuentes et al. (1988) and Roig y Mesa (1988). In addition to the plant survey, occurrence of domestic animals kept in the homegardens was also documented.
The Shannon-Wiener index was calculated to analyse the diversity of homegardens for each study village with $H' = - \sum (p_i \log p_i)$ where pi is the proportion of occurrence of the ith species in a study village (N_i) expressed as a proportion of total species occurrence (N) (Kent and Coker, 1992). From that, the Evenness was calculated by $E = H'/H'max$ with $H'max = \log N$ to estimate the homogeneous distribution of plants in the homegardens of a study village. In addition, the similarity of species composition between the three study villages was calculated with the Sørensen coefficient of similarity (Müller-Dombois and Ellenberg, 1974) with the formula (2A/B+C) x 100 % (A= number of species common to two villages; B=total number of species in village 1; C=total number of species in village 2).
Additional information about size of households, income, profession, actual work and sold homegarden products in the study villages was provided by interviews from another investigation (see Bender 2002).

4 Results

In total 101 different plant species were found, which were grouped in Appendix 1 according to their preferred uses in the households. Most homegardens display three vegetation layers making them typical agroforestry systems. The top layer (3-10 m) consisted mostly of trees such as avocado (*Persea americana*), coconut (*Cocos nucifera*), mango (*Mangifera indica*) and bread fruit (*Artocarpus communis*). In a middle layer (1-3 m), smaller tress like guava (*Psidium guajava*), sour sop (*Annona muricata*), orange (*Citrus sinensis*) or papaya (*Carica papaya*) were found together with bananas and plantains (*Musa* x *paradisiaca*), sugar cane (*Saccharum officinarum*), pigeon pea (*Cajanus cajan*) and the climber yam (*Dioscorea* spec.). In the ground layer (0-1 m) different vegetables, spices and medicinal plants were cultivated, the latter also grew spontaneously.
Bananas were present in all homegardens and mostly with a high abundance (Appendix 1). In many homegardens also plantains were planted, but to a lower degree. Furthermore, orange trees, coconut palms, guava, sour sop, mango and avocado were frequently found in the homegardens of all villages studied. The most common tubers were yam and cassava (*Manihot esculenta*). Different species of beans (*Cajanus cajan*, *Phaseolus* spp.), chili (*Capiscum annuum*) and gourd (*Lagenaria siceraria*) were the preferred vegetables. Cereals such as maize (*Zea mays*) and sorghum (*Sorghum bicolor*) were rarely planted. Spices were not found in many homegardens, the most common were mint (*Lippia alba*), basil (*Ocimum basilicum*) and two types of oregano (*Lippia graveolens*, *Coleus amboinicus*). The highest diversity was found within the medicinal plants. However, a great number of medicinal plant species only occurred in one or two of the studied homegardens. Medicinal plants most frequently found in the different homegardens were *Jatropha gossypiifolia*, *Cassia occidentalis*, *Zanthoxylum pistacifolium* and *Pluchea odorata*.

The average number of plant species varied from 18 to 24 for the three villages analysed (Table 1). Lowest species number was found in Nibujon with seven plant species in a homegarden, highest in Baitiquirí with 49 different species. In average, about 50 % of the species richness in the homegardens consisted of fruit trees. Also diversity of this group is highest in all villages, followed by medicinal plants in Baitiquirí, as shown by the Shannon-Wiener index. In all study villages, evenness of total species distribution was similar. With respect to species groups, fruit trees were most, tubers and spices least homogeneously distributed. The highest differences of evenness were found for the medicinal plants.

Table 1. Species richness and diversity indices of homegardens in three villages of eastern Cuba

	Richness			Shannon-Wiener	Evenness	Total sum of occurrence
	Average	Min	Max		(in %)	
Nibujon (n=12)						
All species	18	7	29	1.67	71	220
Fruit trees	9	5	13	0.72	36	104
Tubers	2	0	4	0.15	12	20
Vegetables, beans and others	4	0	7	0.36	22	45
Spices	1	0	2	0.12	10	15
Medicinal plants	3	0	11	0.33	21	36
El Recreo (n=8)						
All species	22	15	33	1.63	73	174
Fruit trees	10	8	15	0.74	39	83
Tubers	2	0	5	0.15	13	15
Vegetables, beans and others	7	4	11	0.49	29	53
Spices	1	0	3	0.09	9	8
Medicinal plants	2	0	5	0.16	14	15
Baitiquirí (n=11)						
All species	24	12	49	1.79	74	260
Fruit trees	11	5	18	0.74	35	118
Tubers	1	0	3	0.08	8	11
Vegetables, beans and others	4	0	10	0.31	19	43
Spices	1	0	3	0.11	10	15
Medicinal plants	7	2	19	0.55	30	73

Occurrence and abundance of certain species showed to be different between the ‘humid’ homegardens in Nibujon and El Recreo and the ‘semiarid’ homegardens in Baitiquirí (Table 2). Exclusively found in the semiarid homegardens were the fruit trees tamarind (*Tamarindus indica*) and bullock’s heart (*Annona reticulata*), the cereals maize and sorghum, the spices *Cuminum cyminum* and *Lippia graveolens* as well as nine medicinal plants (plant species which occurred only in one single homegarden were not taken into account). On the other hand, Malay rose apple (*Eugenia malaccensis*), gooseberry (*Phyllanthus acidus*), taro (*Colocasia esculenta*), pineapple (*Ananas comosus*), coffee (*Coffea arabica*), basil, cocoa trees (*Theobroma cacao*), tomatoes as well as the medicinal plants *Costus rubber*, *Boldoa purpurescens* and *Kalanche pinnata* were only present in the humid homegardens. Species such as mango and lime (*Citrus aurantiifolia*) or the medicinal plants *Zanthoxylum pistacifolium* and *Rhoeo spathacea* occurred more frequently in semiarid homegardens compared to the humid homegardens (Table 2). In contrast, only three species were found more often in the humid homegardens.

A further dissimilarity between the humid and semiarid sites was a low degree of soil cover in semiarid Baitiquirí. In these homegardens dead plant material for mulching was limited. Only under the humid conditions plant production was high enough to enable a high soil cover and thus a good soil protection to heavy rainfalls.

Table 2. Species occurrence according to different climatic locations of homegardens in Cuba

	Species presence (in (%)				
	Humid n=20	Semiarid n=11		Humid n=20	Semiarid n=11
Species found at either humid or semiarid locations					
Tamarindus indica	0	36	Eugenia malaccensis	15	0
Annona reticulata	0	18	Phyllanthus acidus	10	0
Zea mays	0	18	Colocasia esculenta	55	0
Sorghum bicolor	0	18	Ananas comosus	45	0
Lippia graveolens	0	45	Coffea robusta	45	0
Cuminum cyminum	0	18	Ocimum basilicum	30	0
Jatropha curcas	0	27	Theobroma cacao	10	0
Piper cf. wrightii	0	27	Lycopersicon esculentum	10	0
Bursera graveolens	0	27	Vigna spec.	10	0
Jasminum spec.	0	27	Costus ruber	25	0
Malvaviscus arboreus	0	18	Boldoa purpurescens	15	0
Stachytarpheta jamaicensis	0	18	Kalanche pinnata	10	0
Eupatorium odoratum	0	18			
Bidens pilosa	0	18			
Ricinus communis	0	18			
Species with at least 20 % difference in occurrence between humid and semiarid locations					
Mangifera indica	45	100	Citrus sinensis	95	64
Cocos nucifera	70	91	Carica papaya	60	36
Persea americana	55	91	Bixa orellana	50	18
Citrus aurantiifolia	30	73			
Melicocca bijuga	15	36			
Phaseolus lunatus	30	55			
Cassia occidentalis	30	55			
Zanthoxylum pistacifolim	15	55			
Rhoeo spathacea	5	45			
Piper macrophyllum	5	36			
Gossypium spec.	5	36			

In the villages of Nibujon and El Recreo, many people are farmers and own an area between 3 to 60 ha, but only part of their land is presently cultivated. Some of them own the land for already more than 100 years, others since the years after the revolution in Cuba in 1959, and few only for 6-7 years. In general, the farmers cultivate several fields with coconuts, plantains or sweet potatoes (*Ipomoea batatas*) and sell these products to a variable degree to the state or on free farmer markets. Most of these farmers have quitted their state job as forester, joiner or technician in the last years to become a farmer. Other residents with homegardens are pensioners or people having a regular job with very low wages or pensions. From the homegardens, few products of plants are sold because most species are exclusively used for self-consumption or as animal food. Many farmers in Nibujon and El Regreo sell plantains and coconuts in various amounts to the

Cuban state. Guavas (to the state) and papayas (to a hotel in Baracoa 40 km away) are each sold by one farmer, cacao by two farmers (to the state). Few farmers sell cassava, taro and sweet potatoes on local farmer markets, but only if they produce a surplus.
In semiarid Baitiquirí the situation is somewhat different. Most people in Baitiquirí are pensioners or have a regular job as technicians in road construction, hydraulic engineering or agriculture. For them, the homegardens are an important source of vegetable and animal food which is exclusively used for self-consumption. Only very few farmers cultivate fields because irrigation is necessary. Some farmers own livestock which they graze on the communal land.

Livestock kept at the compound were mainly pigs (*Sus scrofa domestica*) and chicken (*Gallus gallus*), in Nibujon in all homegardens surveyed (Appendix 1). Ducks (*Anas platyrhynchos*) and sheep (*Ovis ammon aries*) were kept to a lesser degree. In some cases the animals were kept exclusively within the homegarden, in other cases they had the possibility to roam outside the garden. Pigs were mainly fed with products from the homegarden: coconuts and bread fruit and to a lesser degree sugar cane, cassava, maize and sweet potatoes. An important source from outside the homegardens (in few cases from inside) were the fruits of the Cuban king palm (*Roystonea regia*). Among the animals kept at the compound, mostly pigs were sold to other farmers in the villages.

5 Discussion

Many plants found in the Cuban homegardens with high frequency are typical plants of homegardens throughout the Tropics, e.g. bananas and plantains, coconuts, bread fruit, guava, mango, avocado, papaya, *Citrus* spp. and *Annona* spp., the tubers yam, cassava, taro and sweet potatoes as well as others such as pigeon pea, *Phaseolus* spp., chilli, gourd or sugar cane (Jensen, 1993; De Clerck and Negreros-Castillo, 2000; Méndez et al., 2001; Orellana et al., 2001). They provide a broad basis for self-sufficiency of the households.
A broad range of medicinal plants occurred in the different homegardens studied, mainly with a small number per homegarden. Some of them such as *Jatropha gossypiifolia* or *Pluchea odorata* are mainly planted, but most of the species grow spontaneously in the homegardens. This explains the high variability of occurrence, which is also due to the different climatic environment. However, this is not true for all of the medicinal species listed in Appendix 1. Examples are *Stachytarpheta jamaicensis* or *Bidens pilosa* which were never mentioned in Nibujon or El Recreo as medicinal plants, although they were observed in some of the homegardens of these villages. They were not listed in the survey until they were mentioned as medicinal plants by the farmers in the third study village Baitiquirí. Here, local people's knowledge seem to play an important role. Only few people seem to have a broad knowledge about medicinal plants. Some people were not aware that a lot of spontaneous medicinal plants (weeds, ruderal plants) grew in their homegardens. When they were asked for medicinal plants, they often mentioned only one to four species, but during the surveys up to 19 different medicinal plants could be found. Although not mentioned as medicinal plants, almost all plants found in the homegardens such as fruit trees, tubers, vegetables, beans or spices have a potential medicinal use according to Roig y Mesa (1945) (see last column in Appendix 1). 50 species out of the 101 plant species surveyed in the homegardens of this study are cultivated as medicinal plants in Cuba (Hammer et al. 1989).

According to the different climatic situation of the study villages, some species were only found under humid or under semiarid conditions because of their preferred growth conditions. But, also species which prefer more humid climates such as bananas and plantains were found under semiarid conditions because irrigation is used in many homegardens of Baitiquirí. This is reflected by the Sørensen coefficients of similarity which were calculated for the comparison of

the three villages (Table 3). The similarity between humid Nibujon and semiarid Baitiquirí is 65 %, that between humid El Recreo and Baitiquirí is 57 %, whereas the similarity between the two humid villages is not very much higher (70 %). Highest similarities were found for fruit trees and tubers, whereas spices and medicinal plants were lowest in the comparison between the humid and semiarid villages. Nevertheless, certain plant species such as taro, pineapple, coffee or cacao were never planted in the semiarid homegardens. Very few planted species such as maize or basil which were only recorded for homegardens in Baitiquirí, were also observed in the villages of Nibujon and El Recreo, but not in the studied homegardens, and thus do not indicated climatic differences.
The higher diversity of plants found under semiarid conditions in Baitiquirí (Table 1) seems to be related to two factors: plants which could be planted due to irrigation and the higher number of medicinal plants found in the homegardens. In the humid homegardens it were 22 medicinal plants, in semiarid homegardens 32 medicinal plants could be listed (Apenndix 1). Also average and maximum numbers of medicinal plants in semiarid homegardens are significantly higher (Table 1), and they occur more homogenously in these homegardens (see evenness in Table 1). To a certain degree the higher number of medicinal plants might be influenced by a former survey in Baitiquirí by Cuban biologists which could have increased the knowledge of some owners about spontaneous growing medicinal plants in their homegardens.

Table 3. Sørensen coefficient of similarity (in %) of selected plant groups of homegardens in three study villages in eastern Cuba

	Nibujon - El Recreo	Nibujon - Baitiquirí	El Recreo - Baitiquirí
Overall	70	65	57
Fruit trees	92	86	84
Tubers	80	67	89
Vegetables, beans and others	70	64	64
Spices	89	50	55
Medicinal plants	37	50	26

Homegardens in the study villages are an important factor for the economy and self-sufficiency of many households. The degree to which the homegardens contribute to the provision of the household food varies a lot and can only be tentatively answered. The fact that many farmers have quitted their state job in the last years for being a farmer is not surprising as state worker's income are generally very low. Compared to state workers' households, farmer households income, either private or as members of production co-operatives, is 61 % and 42 % higher, respectively (Deere et al. 1995). For farmers households, the homegardens produce many fruits and vegetables for self-consumption which are not cultivated on their fields as well as livestock products such as meat and eggs. For other owners of homegardens such as pensioners or people with a regular job, the homegardens can significantly improve the provision of the household with food because regular wages or pensions are very low. In homegardens of Nicaragua, home consumption was 100 % for most fruit trees and herbaceous food species (Méndez et al., 2001). In general, production in homegardens is year-round, unlike the seasonal harvest of farmers' fields. Although yields are normally low, this is more than compensated by the diversity and nutritious nature of the products (Fernandez and Nair, 1986; Torquebiau, 1992).
In general, most people in the study villages rely on the products from their homegardens for food supply. This was especially important for the period from 1989 to 1993, where the average daily supply for calories was very low (1.780 kcal per capita) and three quarters of the Cuban

people suffered from malnutrition (Dirmoser, 1996 cited in Gaese and Preuss, 1999). Many Cuban people impoverished to an extent that small variations in the provision with vital products press them at the border of existence (Gaese and Preuss, 1999). In the last years the situation in Cuba improved, but still food supply from homegardens is vital. Agricultural households rely on multiple sources of income to generate their livelihood (Deere et al., 1995). Here, homegardens in eastern Cuba showed to be a diverse, although small source of income, which seems particularly important because of the low-paid outside work (Bender, 2002). In Nicaragua, homegardens can contribute up to 100 % as a source of income, although the average income from homegardens was 35 %, followed by 33 % from outside work and 27 % from handcrafting (Méndez et al., 2001).

Homegardens systems are an important contribution to sustainable agricultural production, because of their potential to meet several economic, social, ecological and institutional conditions for sustainability (Torquebiau, 1992; Nair 2001). Thus, promotion of homegardens can also be an important subject for agricultural production in or adjacent to protected areas. In the study villages in the Alexander von Humboldt National Park, homegardens could facilitate a decrease or an abandonment of agricultural activities which were found in crucial areas such as steep slopes, along rivers or mangrove areas (Wezel and Bender in press). In Baitiquirí, homegardens could as well facilitate an enhanced fuel wood production to decrease encroachment into natural forested areas, because illegal firewood logging and charcoal production is, besides overgrazing, the main factor for the degradation of the surroundings, including the adjacent Nature Reserve Baitiquirí (Wezel and Bender, submitted). With respects to grazing, it is doubtful that homegardens can contribute to an improvement of the present situation because only small quantities of fodder can be produced in the homegardens.

6 Conclusions

Homegardens in Cuba contribute to food supply for many people in rural areas because of a high diversity of cultivated plant species which include species for human and animal nutrition. To obtain precise figures about the degree of the food supply more detailed studies are necessary. Although the extent of household's self-sufficiency from homegardens varies considerably, its significance is eminent for the people because of low-paid outside work and minimal food provision by the state. For some people, homegarden products offer even a source of income. Moreover, homegardens contribute to in situ conservation of plant genetic resources and evolutionary processes in Cuba (Esquivel and Hammer, 1992; Orellana et al., 2001), which is particularly true for the high diversity of medicinal plants in the homegardens studies. Further, they can contribute to sustainable land use in protected areas because pressure on fragile land or forested areas can be reduced or minimised.

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Appendix 1. Used plant species and domestic animals in homegardens of three villages in Cuba

	Species presence (in %)			Local name	Family	Med.[€]
	Nibujon n=12	El Recreo n=8	Baitiquirí n=11			
Fruit trees[#]						
Musa x paradisiaca (banana)	100	100	100	guineo	Musaceae	x
Musa x paradisiaca (plantain)	75	50	64	plátano	Musaceae	x
Citrus sinensis	100	88	64	naranja	Rutaceae	x
Cocos nucifera	67	75	91	coco	Palmae	x
Psidium guajava	83	75	73	guayaba	Myrtaceae	x
Annona muricata	67	63	55	guanábana	Annonaceae	x
Mangifera indica	33	63	100	mango	Anacardiaceae	x
Persea americana	42	75	91	aguacate	Lauraceae	x
Annona squamosa	50	25	55	anon	Annonaceae	x
Carica papaya	67	50	36	fruta bomba	Caricaceae	x
Terminalia catappa	8	50	18	almendra	Combretaceae	x
Citrus aurantiifolia	25	38	73	limón	Rutaceae	x
Spondias mombin	33	13	27	ciruela	Anacardiaceae	x
Artocarpus communis	8	50	9	fruta de pan	Moraceae	
Artocarpus communis	33	88	36	guapen	Moraceae	
Citrus x paradisi	25	0	9	toronja	Rutaceae	
Crescentia cujete	8	38	18	guira	Bignoniaceae	x
Melicocca bijuga	17	13	36	anancillo	Sapindaceae	x
Tamarindus indica	0	0	36	tamarinde	Mimosaceae	x
Cassia grandis	8	50	36	cañandonga	Caesalpinaceae	x
Eugenia malaccensis	0	38	0	pera	Myrtaceae	
Phyllanthus acidus	17	0	0	grosella	Euphorbiaceae	x
Annona reticulata	0	0	18	chirimoya	Annonaceae	x
Citrus limetta	0	0	9	lima	Rutaceae	
Cinnamomum spec.	0	0	9	canela	Lauraceae	
Ficus carica	0	0	9	ficus	Moraceae	x
Tubers						
Dioscorea spec.	50	75	45	ñame	Dioscoreaceae	
Manihot esculenta	25	38	36	yuca	Euphorbiaceae	x
Colocasia esculenta	58	25	0	malanga	Araceae	
Ipomoea batatas	17	25	9	boniato	Convolvulaceae	x
Maranta arundinacea	0	25	9	sagu	Morantaceae	x
Colocasia esculenta[$]	17	0	0	malanga	Araceae	
Vegetables, beans and others						
Cajanus cajan	25	88	55	frijoles guandul	Fabaceae	x
Phaseolus lunatus	33	25	55	frijoles caballero	Fabaceae	x
Phaseolus vulgaris	25	50	18	avichuela	Fabaceae	x
Vigna spec.	0	25	0	frijoles divorci	Fabaceae	
Capiscum annuum	58	75	45	ahí	Solanaceae	x
Lagenaria siceraria	58	50	36	calabaza	Cucurbitaceae	x

Saccharum officinarum	33	63	27	caña	Poaceae	x
Bixa orellana	33	75	18	achiote	Bixaceae	x
Ananas comosus	33	63	0	ananas	Bromeliaceae	x
Coffea arabica	25	75	0	cafe	Rubiaceae	x
Cymbopogon citratus	17	0	18	lemon grass	Poaceae	x
Lycopersicon esculentum	8	13	0	tomate	Solanaceae	x
Gossypium spec.	0	13	36	algodón	Malvaceae	
Abelmoschus esculentus	0	13	18	quimbonbo	Malvaceae	x
Allium porrum	0	13	9	ajo porro	Liliaceae	
Theobroma cacao	17	0	0	cacao	Sterculiaceae	x
Zea mays	0	0	18	maiz	Poaceae	x
Sorghum bicolor	0	0	18	sorghum	Poaceae	
Spinacia oleracea	8	0	9	espinaca	Chenopodiaceae	x
Beta vulgaris	0	13	0	acelga	Chenopodiaceae	
Passiflora quadangularis	0	13	0	maracuyá	Passifloraceae	x
Sesamum indicum	0	0	9	ajonjoli	Pedaliaceae	x
Spices						
Origanum majorana	8	13	9	majoran	Lamiaceae	x
Lippia alba	67	25	36	menta	Verbenaceae	x
Ocimum basilicum	17	50	0	albahaca	Lamiaceae	x
Cuminum cyminum	0	0	18	cumino	Apiaceae	
Coleus amboinicus	25	13	9	oregano	Lamiaceae	x
Lippia graveolens	0	0	45	oregano, oreganito	Verbenaceae	
Zingiber officinale	8	0	0	gingible	Zinigberaceae	x
Eryngium foetidum	0	0	9	culantro	Apiaceae	x
cf. Elettaria cordamomum	0	0	9	caracolillo[µ]	Zingiberaceae	
Medicinal plants						
Jatropha gossypiifolia	50	25	55	tuva-tuva	Euphorbiaceae	x
Cassia occidentalis	25	38	55	edionda	Caesalpinaceae	x
Zanthoxylum pistacifolium	17	13	55	vencedor	Rutaceae	x
Pluchea odorata	33	38	18	salvia	Asteraceae	x
Costus ruber	8	50	0	cañuela santa	Zinigberaceae	x
Rhoeo spathacea	8	0	45	cordoban	Commelinaceae	x
Piper auritum	8	0	36	anison, caisimón	Piperaceae	x
Solanum nodiflorum	17	0	27	hierba mora, goruru	Solanaceae	x
Pilea microphylla	17	0	18	lluvisnita	Urticaceae	x
Aloe barbadensis	8	0	18	sabila	Liliaceae	x
Turnea ulmifolia	8	0	9	marilopez	Turneraceae	x
Ambrosia artemisifolia	8	0	9	agengo, artemisia	Asteraceae	x
Viola linearifolia	8	0	9	pensamiento	Violaceae	x
cf. Croton stenophyllus	8	0	9	tilo	Euphorbiaceae	
Pedilanthus tithymaloides	0	13	18	itamoreal	Euphorbiaceae	x
Boldoa purpurescens	25	0	0	nitro	Nictaginaceae	x
Kalanche pinnata	17	0	0	hoja de aire	Crassulariaceae	x
Pogostemon patchouli	8	0	0	pachuli	Lamiaceae	
Lepidium virginicum	8	0	0	mastuerzo	Scrophulariaceae	x
Plantago major	8	0	0	yanten	Plantaginaceae	x
Salvia tenella	8	0	0	amargoza	Lamiaceae	
Euphorbiaceae	0	13	0	tapón[µ]	Euphorbiaceae	
Jatropha curcas	0	0	27	piñon (lechoso)	Euphorbiaceae	x
Piper cf. wrightii	0	0	27	guayuyo	Piperaceae	
Bursera graveolens	0	0	27	sasafras	Burseraceae	x
Jasminum spec.	0	0	27	jazmín	Oleaceae	
Eupatorium odoratum	0	0	18	rompezaraguey	Asteraceae	
Stachytarpheta jamaicensis	0	0	18	verbena	Verbenaceae	x

Malvaviscus arboreus	0	0	18	amapola	Malvaceae	x
Bidens pilosa	0	0	18	romerillo	Asteraceae	x
Ricinus communis	0	0	18	ricinus	Euphorbiaceae	x
Opuntia ficus-indica	0	0	9	tuna de castilla	Cactaceae	x
Gliricidia sepium	0	0	9	piñon	Fabaceae	x
Mirabilis jalapa	0	0	9	maravilla	Nyctagynaceae	x
Caprosia biflora	0	0	9	maguira	Scrophulariaceae	x
Justica pectoralis	0	0	9	carpintera	Acanthaceae	x
Peperomia pellucida	0	0	9	corazon de hombre	Piperaceae	x
Melia azadirachta	0	0	9	pulsiana	Meliaceae	x
Petiveria alliacea	0	0	9	anamú	Phytolaccaceae	x
?	0	0	9	yo puedo mas que tu		

Animals

Sus scrofa domestica	100	88	91	cerdo	Suidae
Gallus gallus	100	63	55	gallinas	Phasianidae
Anas platyrhynchos	42	13	18	patos	Anatidae
Ovis ammon aries	8	13	9	ovejas	Bovidae

[€] medicinal plants after Roig y Mesa (1945)
[#] inclusive Musa x paradisiaca, a herbaceous species
[$] subspecies along water
[µ] local name does not correspond to scientific determination of the plant species