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Translated from the original in spanish

Original article

Phenology of flora components in the use of natural and traditional medicine in the community of Verraco, Santiago de Cuba, Cuba

Fenología de componentes de la flora en el uso de la medicina natural y tradicional en la comunidad de Verraco, Santiago de Cuba, Cuba

Fenologia de componentes da flora na utilização da medicina natural e tradicional na comunidade de Verraco, Santiago de Cuba, Cuba

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ABSTRACT

Based on ethnobotanical studies carried out in the community of Verraco, belonging to the Baconao Biosphere Reserve, province of Santiago de Cuba, the components of the flora used in natural and traditional medicine were identified *in situ*, and the reproductive phenology of each of the identified species was determined. The objective of the work was to present the flowering and fruiting patterns of flora species that are components of natural and traditional medicine in the coastal community of Verraco, which belongs to the Baconao Biosphere Reserve. A total of 82 species of flowering plants used by the community for natural and traditional medicine were recorded, which are grouped into 75 genera and 49 botanical families. Of the total species studied, 46 % (38) were recorded with flowers and fruits, while only 12 % (10) and 39 % (32) were determined in the flowering and fruiting stages, respectively. Of the total species, only four are endemic and 24 % are naturalized, while 19 % correspond to non-indigenous but possibly naturalized species. Forty species flowers, coinciding with the rainy season, while 36 bear fruit during the same period. In the dry or low rainfall stage, a total of 57 species were recorded to flower in this period. A total of 27 species present a flowering stage of more than four months, while 21 species bear fruit in a similar stage of time. Only one species was recorded that flowers and bears fruit all year round: *Heliotropium angiospermum*. A total of 21 species present synchrony, as both phenological periods coincide in the same reproductive stage.

Keywords: Ethnobotanical perception studies; Reproductive phenology; Medicinal plants.

RESUMEN

A partir de los estudios etnobotánicos efectuados en la comunidad de Verraco, perteneciente a la Reserva de la Biosfera Baconao, provincia Santiago de Cuba, se identificaron *in situ* los componentes de la flora que son utilizados en la medicina natural y tradicional, y se determinó la fenología reproductiva de cada una de las especies identificadas. El trabajo tuvo como objetivo dar a conocer los patrones de floración y fructificación de especies de la flora que son componentes de la medicina natural y tradicional en la comunidad costera de Verraco, perteneciente a la Reserva de la Biosfera Baconao. Se registraron un total de 82 especies de plantas con flores que son empleadas por los comunitarios para el uso de la medicina natural y tradicional, las que se agrupan en 75 géneros y 49 familias botánicas. Del total de especies estudiadas, el 46 % (38) se registró con flores y frutos, mientras que solo se determinaron en las fases de floración y fructificación el 12 % (10) y 39 % (32), respectivamente. Del total de especies, solo cuatro son endémicas y el 24 % son naturalizadas, mientras que el 19 % se corresponde con especies no indígenas, pero posiblemente naturalizadas. Florecen 40 especies, coincidiendo con la época lluviosa, mientras que 36 fructifican en igual período. En la etapa de seca o poco lluviosa, se registraron un total de 57 especies que florecen en este período. Un total de 27 especies presentan una etapa de floración superior a los cuatro meses, mientras que 21 especies fructifican en una etapa similar de tiempo. Solo se registró una especie que florece y fructifica todo el año: *Heliotropium angiospermum* (alacrancillo). Un total de 21 especies presentan sincronía, al coincidir ambos períodos fenológicos en la misma etapa reproductiva.

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Palabras clave: Estudios de percepción etnobotánica; Fenología reproductiva; Plantas medicinales.

RESUMO

Com base em estudos etnobotânicos realizados na comunidade de Verraco, pertencente à Reserva da Biosfera de Baconao, província de Santiago de Cuba, foram identificados in situ os componentes da flora utilizada na medicina natural e tradicional, e foi determinada a fenologia reprodutiva de cada uma das espécies identificadas. O objectivo do trabalho era apresentar os padrões de floração e frutificação das espécies da flora que são componentes da medicina natural e tradicional na comunidade costeira de Verraco, que pertence à Reserva da Biosfera de Baconao. Foi registado um total de 82 espécies de plantas floríferas utilizadas pela comunidade para a medicina natural e tradicional, que estão agrupadas em 75 géneros e 49 famílias botânicas. Do total das espécies estudadas, 46 % (38) foram registadas com flores e frutos, enquanto apenas 12 % (10) e 39 % (32) foram determinadas nas fases de floração e frutificação, respectivamente. Do total das espécies, apenas quatro são endémicas e 24 % são naturalizadas, enquanto 19 % correspondem a espécies não indígenas, mas possivelmente naturalizadas. Quarenta espécies florescem, coincidindo com a estação das chuvas, enquanto 36 dão frutos durante o mesmo período. Na fase seca ou de baixa pluviosidade, foi registado um total de 57 espécies para florescer neste período. Um total de 27 espécies apresentam uma floração de mais de quatro meses, enquanto 21 espécies dão frutos numa fase semelhante no tempo. Apenas uma espécie foi registada que floresce e dá frutos durante todo o ano: Heliotropium angiospermum (escorpiãocinho). Um total de 21 espécies apresentam sincronia, já que ambos os períodos fenológicos coincidem na mesma fase reprodutiva.

Palavras-chave: Estudos de percepção etnobotânica; Fenologia reprodutiva; Plantas medicinais.

INTRODUCTION

The phenology of plant species is one of the main studies to be carried out to understand the flora of an ecosystem (Ortiz, 1990). Phenological studies in general, and especially the flowering and fruiting phases, are essential to determine the optimal time to collect seeds and thus guarantee the management of medicinal, forest, food, *melliferous* and other species, contributing to possible conservation programs (Albert-Puentes *et al*., 1995).

Several ethnobotanical studies have been carried out in various coastal communities in the country, with emphasis on the use of traditional medicine in Cuba, including those of Rosette *et al*. (2019) and Polanco *et al*., (2011), for the Guanahacabibes and Baconao Biosphere Reserves, respectively; among others Vilamajó (1984, 1985), Vilamajó and Menéndez (1988), Figueredo *et al*., (2010), Figueredo *et al*., (2013). The aim of the work was to publicize the flowering and fruiting patterns of flora species that are components of natural and traditional medicine in the coastal community of Verraco, part of the Baconao Biosphere Reserve.

The population's knowledge and monitoring of the phenology of flora components in the use of natural and traditional medicine enables them to make appropriate use of plants for the treatment and cure of different conditions, and allows them to draw up strategies for the appropriate sowing and cultivation of these species.

MATERIALS AND METHODS

Based on the ethnobotanical studies carried out in the community of Verraco by Polanco *et al.*, (2011), and on the floristic list of Figueredo *et al*., (2013), the components of the flora that are used in natural and traditional medicine were selected and their phenology was determined *in situ*, especially the flowering and fruiting phases of each of the identified species, according to the methodology of Albert-Puentes *et al*., (1993ª).

Monthly monitoring was carried out between 2015 and 2016 in the community of Verraco, located in the geographical coordinates X: 639 080, Y: 139 020, belonging to the Baconao Biosphere Reserve, province of Santiago de Cuba, and the phenological field observations were complemented with reviews of materials belonging to the Spermatophyte Section of the Herbarium BSC "Dr. Jorge Sierra Calzado" of the Centro Oriental de Ecosistemas y Biodiversidad of Santiago de Cuba, noting the phenological data.

As for the duration of flowering and fruiting, the species were classified according to Castillo and Carabias (1982) as:

- Short = species whose flowering or fruiting period is < 4 months.
- Long = species whose flowering or fruiting period is ≤ 4 months.

According to the flowering period, the criteria of Sarmiento and Monasterio (1983) were followed, where:

- Species with continuous flowering, are those that bloom all year round.
- Early flowering species, those that bloom at the beginning of the rainy season (spring).
- Delayed-flowering species are those that begin in the second half of the rainy season, and extend through the end of that season.
- Late-blooming species are those that flower in the dry season.
- Opportunistic species: those that are able to flower in any period, as long as the environmental conditions are favorable to them.

For the analysis of the distribution of plant species and the updating of taxonomic nomenclature, the criteria of Greuter and Rankin were followed (2017).

RESULTS AND DISCUSSION

According to the ethnobotanical perception studies carried out in the community of Verraco, a total of 82 species of flowering plants (angiosperms) were recorded, which are used by the community for the use of natural and traditional medicine, which are grouped into 75 genera and 49 botanical families (Table 1).

Table 1. - Phenology of the species with medicinal use by the Verraco community

Family	Scientific name	Common name	Distribution	Phenology	
				Flowering	Fructification
Acanthaceae	*Dicliptera sexangularis* (L.) Juss.	árnica	Cu – Esp, Ja, PRc	Jan-Sep	Jan-Sep
	Justicia pectoralis Jacq.	carpintero	PCu – PEsp, PJa	Ap	
Aizoaceae	*Tetragonia tetragonioides* (Pallas) Kuntze	espinaca	NCu	May	
Amaranthaceae	*Chenopodium ambrosioides* L.	apasote	PCu – PEsp PJa	Ap-June	
Anacardiaceae	*Mangifera indica* L.	mango	NCu – PEsp PJa	Jan-Ap	Ap-Aug
Annonaceae	*Annona muricata* L.	guanábana	PCu – PEsp PJa		Nov
	Annona squamosa L.	anón	CCu – CEsp CJa	Jun	Aug-Sep
Apiaceae	*Petroselinum crispum* (Mill.) Nyman ex A.W. Hill	perejil	NCu	Jun	Aug-Sep
	Pimpinella anisum L.	anís	NCu	Jun	Aug-Sept
Arecaceae	*Acrocomia crispa* (Kunth) C.F. Baker ex Becc	corojo	˚Cu	Jun	
	Cocos nucifera L.	coco	PCu – PEsp PPRc	Nov-Mar	Nov-Mar

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Asteraceae	*Bidens pilosus* L.	romerillo	Cu – Esp Ja PRc	Mar	Oct
	Isocarpha oppositifolia (L.) Cass.	manzanilla	Cu – Ja AmN AmC AmS	Feb	
	Pluchea carolinensis (Jacq.) G. Don	salvia	Cu – Esp Ja PRc	Jan-Jun	Oct-Nov
	Vernonanthura havanensis (DC.) H. Rob.	rompezaragüey	˚Cu	Jan, Mar/Nov	
	Xanthium strumarium L.	guisazo de Baracoa	PCu – AmN NVM		Mar/May/Jul
Boraginaceae	*Heliotropium angiospermum* Murray	alacrancillo	Cu – Esp Ja PRc	Whole a year	Whole a year
Brassicaceae	*Nasturtium officinale* W. T Aiton	berro	NCu(CuW(Art May	May-Sep	Feb
Bromeliaceae	*Bromelia pinguin* L.	piña ratón	NCu – Esp Ja PRc	May-Oct	Nov-Feb
Burseraceae	*Bursera graveolens* (Kunth) Triana& Planch	sasafrás	PCu – AmN AmC	Dec-March	Dec-Mar
	Bursera simaruba (L.) Sarg.	almácigo	Cu – Esp Ja PRc	Feb-Sep	October-Mar
	Protium cubense (Rose) Urb.	copal	˚Cu		Apr
Cactaceae	*Nopalea cochenillifera* (L.) Salm-Dyck	tuna	NCu – PEsp PJa	Dec-Mar	Oct
Canellaceae	*Canella winterana* (L.) Gaertn.	cúrbana	Cu – Esp Ja PRc	Jun-Sep	
Capparaceae	*Capparis frondosa* Jacq	raíz de berraco	Cu (CuE(Ho Gu)) –	Jun	Aug
Caricaceae	*Carica papaya* L.	fruta bomba, papaya	CCu – CEsp CJa	Feb-Mar	
Commelinaceae	*Tradescantia spathacea* Sw.	barquito, cordobán	NCu – PEsp PPRc	Ap-Jun	
Costaceae	*Cheilocostus speciosus* (J. König) C. Specht	caña mexicana	NCu – PEsp PJa	May	
Crassulaceae	*Kalanchoe pinnata* (Lam.) Pers.	hoja de aire	NCu – PEsp PJa	Jan-Mar	Ap-Jun
Cucurbitaceae	*Momordica charantia* L.	cundeamor	NCu – PEsp PJa	Mar-Jun	Mar/Sep-Oct
Cyperaceae	*Cyperus rotundus* L.	caramaná	PCu – PEsp PJa	May-Oct	May-Oct
Erythroxylaceae	*Erythroxylum havanense* Jacq. var. *havanense*	jibá	Cu – Esp Men AmS	Jan-Ap	Mar-May
Euphorbiaceae	*Euphorbia serpens* Kunth	coronilla	Cu – Esp Ja PRc	Ap	

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	Jatropha gossypiifolia L.	túa túa	Cu – Esp Ja PRc	May-Sep	Jun-Oct
	Jatropha sp.	chaya	NCu	Nov	
Fabaceae	*Caesalpinia bahamensis* Lam.subsp. *bahamensis*	palo de brasil	Cu (CuW(Mat IJ)	Apr-Jun/Sep-Dec	
	Cassia grandis L.	cañándonga	Cu(CuW(Art) AmS	Feb-May	May-Aug
	Desmodium incanum DC.	amor seco	Cu – Esp Ja PRc Men Cay AmN AmC AmS	Jul	Jul
	Senna occidentalis (L.) Link	platanillo	DCu(CuW(PR* Art Hab* May Mat IJ)	Feb-Ap	Feb-Ap
	Tamarindus indica L.	tamarindo	PCu(CCuW CCuC	Dec-Mar	Mar-May
Lamiaceae	*Mentha spicata* L.	hierba buena	CCu(CuW(Hab*)) –	Mar	
	Ocimum basilicum L.	albahaca morada	NCu(CuW(PR* Art Hab* Mat)	Ap	
	Origanum majorana L.	mejorana	PCu(CCuW(Hab*)	Feb-Ap	
	Plectranthus amboinicus (Lour.) Spreng.	orégano	PCu(CCuW(PR* Art Hab* May Mat IJ)	Ap	
	Plectranthus tomentosus Benth.	meprobamato		Mar	Jun
	Rosmarinus officinalis L.	romero	PCu(CCuW CCuC	Mar	
	Vitex agnus-castus L.	vencedor	C Cu(CuW(Hab*)	Nov	
Lauraceae	*Persea americana* Mill.	aguacate	PCu(CuW(Art Mat) CuC(SS) CuE(Ho	Mar-May	Jun-Sept
Lythraceae	*Lawsonia inermis* L.	resedá	PCu – pHab* CEsp		Ap and Sep
	Bastardia viscosa (L.) Kunth var. *viscosa*	malva bruja	Cu(CuW(PR* Art Hab* May Mat IJ)	Nov	
Malvaceae	*Gossypium arboreum* L.	algodón	–Cu – VM		Feb/Ap/Jun/ Nov/Dec
	Guazuma ulmifolia Lam.	guásima	Cu(CuW(PR* Art Hab* May IJ)	Oct-Dec	Oct-Feb

	Hibiscus rosa-sinensis L.	marpacífico rojo	NCu	Mar-Jun	
	Taliparititi elatum (Sw.) Fryxell	majagua	NCu	Ap-Jun	
Meliaceae	*Azadirachta indica* A. Juss.	árbol del nim	PCu(CuW(Hab*)) –		Sep
	Trichilia hirta L.	jubabán	Cu(CuW(PR* Art Hab* May Mat	Jan-June	Jan/Ab/Jun/May/Dec
Moringaceae	*Moringa oleifera* Lam.	moringa	NCu(PCuW(Art cHab*) CCuC(Ci SS)	Mar	May
Myrtaceae	*Eucalyptus* sp.	eucalipto		Jan/May	Jan-Feb/Oct
	Psidium guajava L.	guayaba	DCu – Esp Ja PRc	May/Jun	Ap-Jul
Oleaceae	*Jasminum fluminense* Vell.	jazmín de 5 pétalos	NCu(CuW(Mat) CuC(VC LT)	Jan/Sept Aug	
Papaveraceae	*Argemone mexicana* L.	cardo santo	DCu(CuW(PR* Hab* Mat) CuC(VC Ci)	Feb-Ap	
Pasifloraceae	*Turnera ulmifolia* L.	marilope o tapón	PPRc Men Bah Cay	Mar/Ap	Mar/Nov
Phyllanthaceae	*Phyllanthus tenuicaulis* Müll. Arg. subsp. *tenuicaulis*	fruta o huevo escondido	˚Cu	Feb-Ap	Feb-June
Phytolaccaceae	*Petiveria alliacea* Lin.	anamú	Cu(CuW(PR* Hab* May IJ) CuC(VC Ci SS	Ab/Jun/Ago/ Nov/Dec	
Piperaceae	*Piper auritum* Kunth	anizón	DCu(CuW(Hab*) CuC(Ci SS) CuE(Gr	Ap-June	Jun-Aug
Plantaginaceae	*Plantago major* L.	llantén	NCu(CuW(PR* Art Hab* May Mat)	Feb-Jun	Feb-Jun
Poaceae	*Cymbopogon citratus* (D. C.) Stapf.	caña santa, hierba de calentura	CCu – CEsp CJa CPRc CMen CBah	Oct	Dec
Polygonaceae	*Coccoloba uvifera* (L.) L.	uva caleta	Cu – Esp Ja PRc	Feb-Ap	
Punicaceae	*Punica granatum* L.	granada	C Cu – C Esp C Ja C PRc C Men		Oct-Dec

Rhamnaceae	*Colubrina elliptica* (Sw.) Brizicki & Stern	carbonero	Cu – Esp Ja PRc Men Bah Cay AmN	Ap-Jun	
Rutaceae	*Citrus x aurantium* L.	naranja agria	NCu(CuW(Hab* Mat) CuC(Ci Cam)		Jan-May
	Citrus x limon (L.) Osbeck	limón	CCu – CEsp CJa		Jan/Jun/Oct/ Nov
	Citrus reticulata Blanco	mandarina	CCu – CEsp CJa CPRc CAmN		Dec-Jan
	Ruta chalepensis L.	ruda	(C)Cu – CEsp CPRc CMen VM	Mar	Jun
Sambucaceae	*Sambucus canadensis* L.	sauco blanco	NCu	Feb-May	
Solanaceae	*Solanum americanum* Mill.	yerba mora	Cu(CuW(PR* Art Hab* May Mat IJ)	Mar-May/Oct	Mar-May/Jul/Oct-Nov
	Solanum torvum Sw.	prendejera	Cu (CuW(PR* Art Hab* May Mat IJ) CuC(VC Ci SS	May/Nov	Jan/May Oct/Nov
Urticaceae	*Pilea depressa* (Sw.) Blume	lloviznita	CPRc CMen CAmC CAmS Cu – Esp Ja	Ap	
Verbenaceae	*Lippia alba* (Miller) N. E. Br.	menta americana	Cu (CuW(PR* Art Hab* May Mat)	Ap/Jun-Jul	
	Stachytarpheta jamaicensis (L.) Vahl.	verbena	Cu (CuW(PR* Art Hab* May Mat IJ)	Feb-May	Jan/Jul/Oct-Nov
Vitaceae	*Cissus verticillata* (L.) Nicolson & Jarvis subsp. *verticillata*	bejuco ubí	Cu – Esp Ja	Ap	
Xanthorrhoeaceae	*Aloe vera* (L.) N. L. Burm.	sábila	PCu – PEsp PJa	Feb-May	Ap-Jun

Legend: AmC: Central América, AmN: North América (including México), AmS: South América (including Trinidad, Tobago, Curazao, Margarita, etc.), Art: Artemisa province, Bah: Bahamas, CA: Ciego de Ávila province, Cam: Camagüey province, Cay: Islas Caymán, Ci: Cienfuegos province, CuC: central Cuba, CuE: Easter Cuba, CuW: Western Cuba, Esp: Hispaniola, Gr: Granma province, Gu: Guantánamo province, Hab*: La Habana province, Ho: Holguín province, IJ: Pine Island, Ja: Jamaica, Mat: Matanzas province, May: Mayabeque province, Men: minor Antillas (including Virgens Island), PR*: Pinar del Río province, PRc: Puerto Rico, SS: Sancti Spíritus province, VC: Villa Clara province, VM: Old World (including Australia e Pacific Island), Endemic in Cuba, pointing by error, D: Present but doubtfully indigenous, N: naturalized, P: no indigenous but likely naturalized, C: widely cultivated, (C): Occasionally Cultivated or currently not cultivated, Jan: January, Feb: February, Mar: March, Ap: April, May: May, Jun: June, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December.

These results are congruent with Polanco *et al.*, (2011), Rosete *et al*., (2019), and Nina (2017), who in different ethnobotanical studies on the use of biodiversity for medicinal purposes report that community members use mainly curative and aromatic plant species to address certain health conditions, using not only those available in the natural environment, but also those grown in home gardens and farms, largely using arvenous species.

From the total number of species studied, 46 % (38) were recorded with flowers and fruits, while only 12 % (10) and 39 % (32) were determined in the flowering and fruiting stages, respectively (Table 1). According to Polanco *et al*., (2011), the fruits and flowers of medicinal plants represent, after the leaves, the organs most used by the inhabitants of this community to combat the various conditions and diseases.

The best represented botanical families are: *Lamiaceae* with seven species, followed by *Asteraceae* and *Fabaceae* with five, while the genera with the largest number of infra-generic taxa were *Citrus* (Rutaceae) with three species, followed by the genera *Annona* (Annonaceae), *Bursera* (Burseraceae), *Jatropha* (Euphorbiaceae), Plectranthus *(Lamiaceae*), and *Solanum* (Solanaceae), with two in each case. In ethnobotanical studies conducted in the community of Gran Piedra, Hernández (2001) reported the *Fabaceae* and *Asteraceae* families as the most represented for their medicinal uses.

From the total of species, only four are endemic: *Acrocomia crispa C.F. Baker ex Becc, Vernonanthura havanensis* (DC.) H. Rob., *Protium cubense* Urb. and *Phyllanthus tenuicaulis* Müll. Arg. subsp. *tenuicaulis*. 24 % of the identified species are naturalized (many of them are fruit trees), while 19 % correspond to non-indigenous but possibly naturalized species, according to Greuter and Rankin (2017). A total of eight species are cultivated.

There is a report on the floristic diversity of Verraco (Figueredo *et al.,* 2013), where 57 % of the total plant species grow in the surroundings of the community and only 44 % are cultivated by the inhabitants.

Pelicié and Hernández (1985) obtained 91 % of endemism at the ethnobotanical level in that coastal sector (Verraco-Cazonal); later, in 1988, they updated the list of medicinal plants for that locality, identifying 59 species with 27 % of endemism.

According to Albert-Puentes *et al*., (1993), 40 species flowers during the rainy season from May to October, including *Bromelia pinguin L*. and *Cyperus rotundus L*., while 36 species bear fruit during the same period, such as *Solanun torvum Sw*. and *Solanum americanum Mill*., both of the family *Solanaceae.*

In the dry or low rainfall stage, a total of 57 species were recorded that bloom during this period, although many of them overlap this phenophase during the months of April and May, which mark the end of the dry stage and the beginning of the rainy stage (Bermúdez and Durán, 1991). The possible dependence of the phenological patterns on environmental factors, as well as their relationship with other plants and animals was pointed out by Ramírez and Brito (1987).

Figure 1 shows the categories of species according to the period in which they bloom, highlighting in this aspect the Late Blooming (FTA) with 31 species, followed by the opportunistic species (CP) with 24, those that bloom at any stage of the year.

For Opler *et al.*, (1976), the phenological phases are closely related to rainfall, given that the seasonality in the tropics is fundamentally given by this climatic factor. Bawa *et al.*, (1990) reported spatial and temporal variations in phenological patterns revealed in individual and community studies over two decades; however, the factors determining these patterns remain unknown (Bawa and NG., (1990).

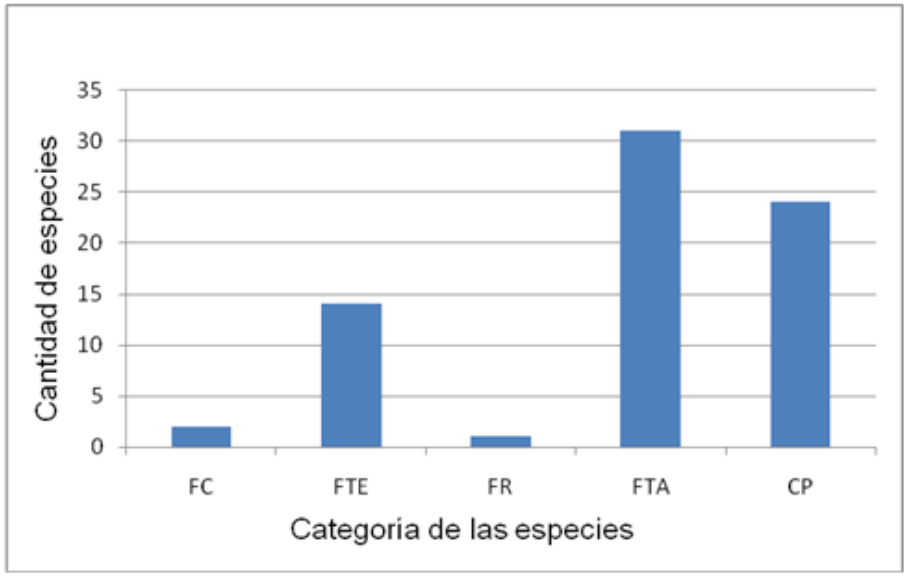

Figure 1. - Species categories according to flowering period, FC: continuous flowering, FTE: early flowering, FR: delayed flowering, FTA: late flowering, CP: opportunistic species

A plant may not develop all its phenological stages if it grows in different climatic conditions than its region of origin. Abu-Asab *et al*., (2001) report extensions of the flowering period in 89 species in the Washington DC area, analyzing 30-year records; correlating these observations directly with local increases in minimum temperatures.

According to Castillo and Carabias (1982), and as shown in Figure 2, a total of 45 species (55 % of the total recorded) were identified that bloom in a period of less than four months, as is the case of *Argemone mexicana* L. (Figure 3); that is, they could be defined as short-lived species. In the same category there are 26 species (32 % of the total recorded), whose fruiting stage does not exceed the same number of months.

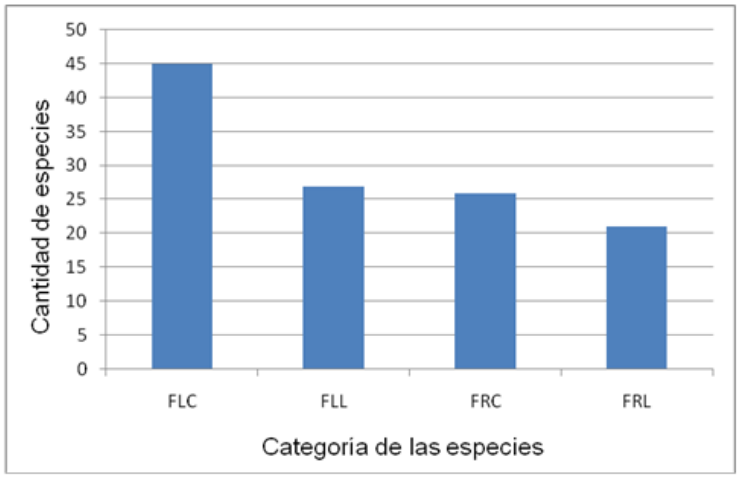

Figure 2. - Species categories according to flowering and fruiting time. FLC: short period flowering, FLL: long period flowering, FRC: short period fruiting, FRL: long period fruiting

A total of 27 species have a long flowering period and 21 species bear fruit over a period of more than 4 months, as they are: *Nasturtium officinale* W. T Aiton, *Cassia grandis* L., *Mangifera indica* L., among others; many of them are edible and cultivated. Only one species has been recorded that flowers and bears fruit all year round: *Heliotropium angiospermum* Murria.

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Some species are recorded that overlap both phenological periods: *Dicliptera sexangularis* (L.) Juss, from January to September and *C. rotundus*, from May to October; both are herbaceous species. Other species, such as *Cocos nucifera Lin*., and *Trichilia hirta* L. (Figure 4), present their flowering and fruiting phases in the same period, although the latter presents several fruiting peaks (Table 1).

Figure 3. - *Argemone mexicana* L.

Figure 4. - *Trichillia hirta* L.

Other authors, such as Albert-Puentes *et al.* (1993), carried out phenological studies where they obtained similar results of overlapping with *T. hirta* (Figure 4) and other tree species such as: *Prunus occidentalis* Sw. and *Matayba apetala* f. *oppositifolia* (A. Rich.) Radlk. Similar fruiting patterns were found by Sánchez *et al.* (2009) for species analogous to those reported in these localities.

A total of 21 species are synchronized, that is, they flower and bear fruit at the same time, at the same time, as they are: *Bursera graveolens* Triana & Planch, and *Plantago major* L.; Augspurger (1983) defined synchronism as an escape of plants from flower predators and then from seeds, so it is an adaptive strategy for successful pollination and seed dispersal (Steven *et al*., 1987).

For Castillo and Carabias (1982), one aspect to take into account is the variability of phenological patterns (not only between species and years, but between individuals of the same species, so that not all individuals belonging to the same species flower and bear fruit simultaneously, and sometimes not even in the same year).

Bursera simaruba (L.) Sarg. (seedling), extends its flowering for nine months, while fructification is recorded for six months. These results show a very different behavior to the ones obtained by Hechavarría *et al*. (2000), in Itabo, Matanzas, where fruits are harvested only in July.

It is known that many species, such as *Carica papaya* L., are able to revert their reproductive habits in extreme conditions, which probably is a mechanism for the perpetuation of the species; for that reason it is important to complement the phenological observations in the field with the herbarium records, because according to Croat (1969) individuals can bloom in a year out of season, producing a lengthening of the period of the observed phenophase.

CONCLUSIONS

In the community of Verraco, Baconao Biosphere Reserve, 87 % and 61 % of the components of the flora for medicinal and traditional use are recorded with flowers and fruits, which enables the inhabitants, based on their knowledge of these plant phenophases, to make appropriate use of them for the treatment and cure of various conditions, and to be able to trace strategies for the planting and cultivation of these medicinal species

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