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Characterization of melliferous species in the tropical dry forest oriented to their conservation

Caracterización de las especies melíferas en el bosque seco tropical orientada a su conservación

Caracterização de espécies de mel da floresta tropical seca visando sua conservação

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ABSTRACT

In the Quimis area of the Jipijapa Canton, an investigation was carried out related to the characterization of plant species that provide sustenance to bees in the production of honey that is used by local residents involved in the Aroma y Miel Association, among other uses, to market it. The objective of this study was based on characterizing the melliferous species of the tropical dry forest oriented to its conservation. Seven active apiaries distributed within the enclosure were selected, where four weekly samplings were made, with a total of 28 transects of 20 m x 50 m, taking as a starting point the

apiaries to identify and count the number of species of apicultural use. A total of 31 species, 1,527 individuals, belonging to 16 families were determined. The botanical family with the highest abundance was Fabaceae with 290 individuals, and the most abundant species were *Ceiba trichistandra* (A. Gray) Bakh and *Prosopis pallida* (Willd.) Kunth, due to the greater beekeeping use and commercialization. The most frequent biological types were trees, followed by shrubs, herbaceous and lianas, respectively. The months of greatest flowering are from March to the beginning of October.

Palabras clave: Trees; Dry forest; Bee flora; Flowers.

RESUMEN

En el recinto Quimis del Cantón Jipijapa, se realizó una investigación relacionada con la caracterización de las especies vegetales que proveen de sustento a las abejas en la producción de miel que es aprovechada por los residentes locales involucrados en la Asociación Aroma y Miel, para entre otros usos, comercializarla. El objetivo de este estudio se basó en caracterizar las especies melíferas del bosque seco tropical orientada a su conservación. Se seleccionaron siete apiarios activos distribuidos dentro del recinto, donde se realizaron cuatro muestreos semanales, con un total de 28 transectos de 20 m x 50 m, tomando como punto de partida los apiarios para identificar y contar el número de especies de aprovechamiento apícola. En total se determinaron 31 especies, 1 527 individuos, pertenecientes a 16 familias. La familia botánica con mayor abundancia fue Fabaceae con 290 individuos, y las especies más abundantes fueron Ceiba *trichistandra* (A. Gray) Bakh y *Prosopis pallida* (Willd.) Kunth, debido al mayor uso apícola y comercialización. Los tipos biológicos más frecuentes resultaron ser los árboles, seguidos de los arbustos, las herbáceas y las lianas, respectivamente. Los meses de mayor floración se enmarcan entre marzo hasta inicios de octubre.

Palabras clave: Árboles; Bosque seco; Flora apícola; Flores.

RESUMO

No recinto Quimis do Cantão de Jipijapa, foi realizada uma investigação relacionada à caracterização das espécies vegetais que fornecem sustento às abelhas na produção do mel que é utilizado pelos moradores locais envolvidos na Associação Aroma y Miel, entre outras. utiliza, comercializa. O objetivo deste estudo baseou-se na caracterização das espécies de mel da floresta tropical seca visando a sua conservação. Foram selecionados sete apiários ativos distribuídos dentro do recinto, onde foram realizadas quatro coletas semanais, totalizando 28 transectos de 20 m x 50 m, tendo os apiários como ponto de partida para identificação e contagem do número de espécies utilizadas na apicultura. No total, foram determinadas 31 espécies, 1 527 indivíduos, pertencentes a 16 famílias. A família botânica com maior abundância foi Fabaceae com 290 indivíduos, e as espécies mais abundantes foram *Ceiba trichistandra* (A. Gray) Bakh *e Prosopis pallida* (Willd.) Kunth, devido ao maior uso apícola e comercialização. Os tipos biológicos mais frequentes foram árvores, seguidas de arbustos, herbáceas e lianas, respectivamente. Os meses de maior floração vão de março até o início de outubro.

Palavras-chave: Árvores; Floresta seca; Flora apícola; Flores.

INTRODUCTION

According to the Food and Agriculture Organization of the United Nations (FAO, 2018), forests are home to more than three quarters of the world's terrestrial biodiversity and constitute an invaluable resource for the socio-economic development of hundreds of millions of people, mainly in rural areas. Among the main causes of forest loss are conversion to other land uses, mostly agriculture, deforestation, degradation and illegal logging practices.

Additionally, the recovery of forested areas, the reduction of logging and proper forest management have become priority activities to restore forests, the biodiversity they harbor and the environmental services they provide, as a strategy to cope with the effects of climate change (Miranda 2019).

Ecuador is a country rich in natural resources, with a climatic and biological diversity such as tropical and Andean forests (Vivanco, Rosillo and Macias, 2020). Beekeeping enterprises at the level of the country and the province of Manabi, are generally at a medium level with techniques oriented for sustainable management in order to obtain a good production (Guallpa, Guilcapi and Espinoza, 2019).

Bee flora or melliferous flora is known as the set of plant species in a region that produce substances or elements that bees collect for their benefit, generally nectar and pollen (Tejeda *et al*., 2019).

Other authors such as May and Rodríguez (2012), state that, in order to know possible conservation and restoration needs of ecosystems and to be able to adapt apiary management to changes in natural potential, it is important to have a good knowledge of the plants whose flowers the bees use to obtain honey and pollen, in their flowering seasons, and of the landscape components in which they are present. Such knowledge can also be used to assess the potential for producing honeys of a particular floral origin, which is important for marketing in international markets.

According to the Agencia Ecuatoriana Aseguramiento de la Calidad del Agro [AGROCALIDAD] (2017), Ecuadorian beekeeping is distributed in 902 beekeeping farms, of which 63 % are located in the highlands, 27 % in the coast, and 4 % in the Amazon. The land registry operation registered 12,188 hives, distributed with 46% in two-story hives, 27 % in one-story hives, and 14 % in three-story hives.

The present investigation has been elaborated in the framework of the projects, "Components of the biological diversity used by the families of Manabí in the natural and traditional medicine", by the majoring on forest engineering, and "Biodiversity and Tourism in the coastal region of Ecuador", of the majoring on tourism, financed by the State University of the South of Manabí and has as objective to characterize the melliferous species that are in the Quimis enclosure, canton Jipijapa, oriented to its conservation.

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MATERIALS AND METHODS

Location of the area

The Quimis area belongs to the Jipijapa canton, it is located to the south of the Province of Manabí, it limits to the North with the parroquia La Pila; to the South with the Sancán community; to the East with the Cerrito la Asunción area and to the West, with the Membrillal parroquia.

Methodology

To characterize the melliferous species found in the Quimis enclosure, seven apiaries located in areas of the tropical dry forest described by the Ministry of Environment (MAE 2013) were investigated (Figure 1).

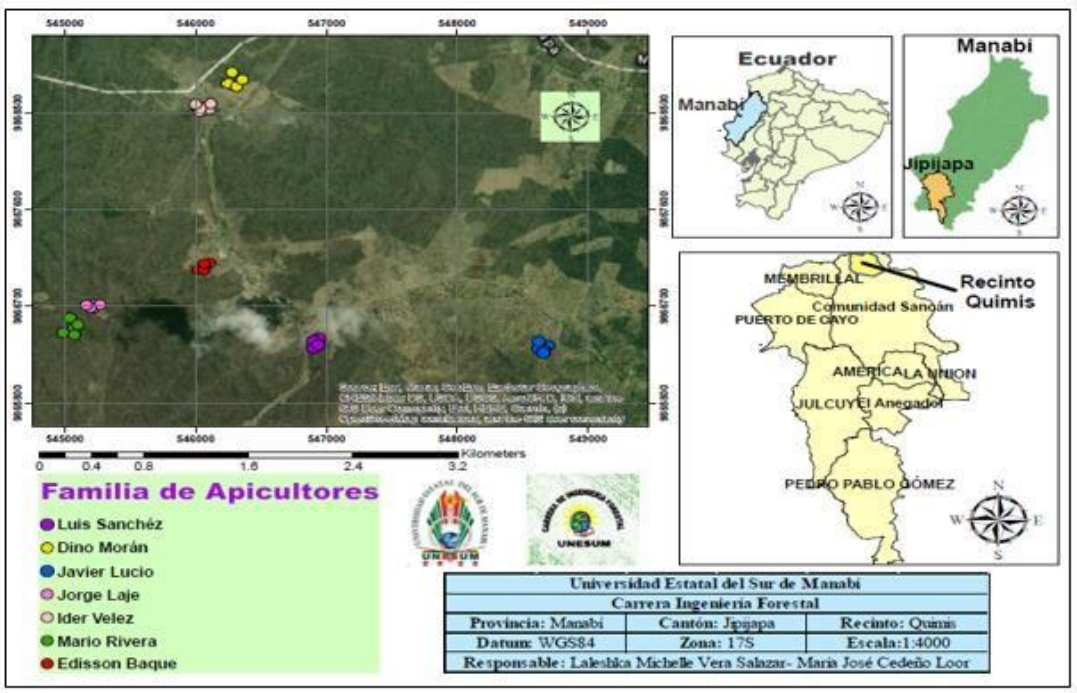

Figure 1. - Location of the transects carried out in the area of influence of the seven selected active apiaries in the tropical dry forest of the Quimis area

The collected species were grouped by families, analyzing aspects of each taxa such as biological type, texture, and leaf size; then the chorological types were classified according to Borhidi (1996); the biological types of Raunkiaer (1905) determined according to the key of Ellenberg and Mueller-Dombois (1966, 1967); as well as the morphological characteristics and texture of the leaves (Valdés and Paneque 2008; Aguirre 2012).

As a reference to the classification of pollen and nectar obtained from the species found in the study, the criteria of Insuasty, Martinez and Jurado (2016) were taken into account.

In order to know the threat status of the melliferous species found in the Quimis area the Red List of the flora of Ecuador (International Union for Conservation of Nature) was reviewed (IUCN 2020). In the identification and taxonomic classification of the bee flora, the criteria of Insuasty, Martínez, and Jurado (2016) were taken into account.

The nomenclature of the melliferous species cited in the Quimis area was determined by reviewing the Tropics database of the Botanical Information System at the Missouri Botanical Garden, and the Catalogue of Life (Roskov *et al*., 2019), as for the Quimis area (Tropics 2020) and the Catalogue of Life (Roskov *et al.,* 2019), while common names were provided by local guides (Jiménez 2012); (Jiménez *et al.*, 2016). On the other hand, the categories of cultivated, wild, endemic or introduced flora species were determined by reviewing the Red Book of the Flora of Ecuador (León *et al.,* 2011) and the Encyclopedia of Useful Plants of Ecuador (De la Torre *et al.,* 2008).

To carry out the transects, the methodology described by Aguilar *et al.,* (2019) was used, in which, after selecting the active apiaries, four weekly samples were taken per apiary using transects of 20 x 50 m, thus the apiaries were taken as a starting point to identify and count the number of beekeeping species. During the tours and visits to the site, an invitation was received to attend a honey harvest in the apiary of Mr. Mario Rivera.

Data analysis

Shannon's index and the reciprocal of Simpson's index were calculated, with the objective of determining the species with the highest diversity in the forest that supports the life of the studied apiaries; according to what was reported by Jiménez *et al.* (2021), beekeepers have knowledge about the existing vegetation in the Quimis area, however, they do not know the totality of the melliferous species that exist around their apiaries and at the same time it was confirmed that *Apis mellifera* bees obtain food from several species which were not mentioned by the interviewees in that study.

RESULTS

Characterization of melliferous species found in the Quimis area, Jipijapa canton

A total of 31 species were inventoried distributed in the seven apiaries established in Quimis (Table 1) with a total of 1527 individuals.

Table 1. - Species identified in the Tropical Dry Forest of the Quimis site

Scientific name	Families
Prosopis pale (Willd.) Kunth	Fabaceae
Bonellia sprucei (Mez) B. Ståhl & Källersjö	Primulaceae
Caesalpinia paipai Ruiz & Pav.	Fabaceae
Ceiba trischistandra (A.Gray) Bakh .	Malvaceae
Trema micrantha (L.) Bl.	Cannabaceae
Croton rivinifolius Kunth	Euphorbiaceae
Acnitus arborencens (L.) Schltdl .	Solanaceae

Pithecellobium arboreum (L.) Urb.	Fabaceae
Sarcomphalus thyrsiflorus (Benth.) Haudenschild .	Rhamnaceae
Convolvulus arvensis L. _	Convolvulaceae
Ipomoea purpurea (L.) Roth	Convolvulaceae
Xenostegy medium (L.) DF Austin & GW Staples	Convolvulaceae
Vachellia macracantha (Humb. & Bonpl. ex Willd.) Seigler & Ebinger	Fabaceae
Guazuma ulmifolia the m.	Malvaceae
Eriotheca ruizii (K. Schum.) A. Robyns	Malvaceae
Leucaena trichodes (Jacq.) Benth.	Fabaceae
Coccoloba ruiziana Lindau	Polygonaceae
Mimosa acantholoba (Willd.) Poir .	Fabaceae
Cordy lutea The m.	Ehretiaceae
Muntingia calabura L.	Muntingiaceae
Bursera graveolens (Kunth) Triana & Planch.	Burseraceae
Guapira floribunda (Hook. fil.) Lundell .	Nyctaginaceae
Erythrina velutina Willd.	Fabaceae
Vallesia glabra (Cav.) Link	Apocynaceae
Jatropha curcas L.	Euphorbiaceae
Pithecellobium excelsum (Kunth) Mart.	Fabaceae
Cynophalla flexuosa (L.) J.Presl	Capparaceae
Capparicordis crotonoids (Kunth) Iltis & Cornejo	Capparaceae
Geoffroea spinosa Jacq.	Fabaceae
Pisonia aculeata L.	Nyctaginaceae
Colicodendron scabridum (Kunth) Hutchinson	Capparaceae

Among the most represented are the Fabaceae family with nine species, followed by the families Malvaceae, Capparaceae, Convolvulaceae with three species each one.

In Figure 2, the results of the abundance by families are presented, reaching the highest value Fabaceae, with 290 individuals, while the family Apocynaceae has only one individual (Figure 2).

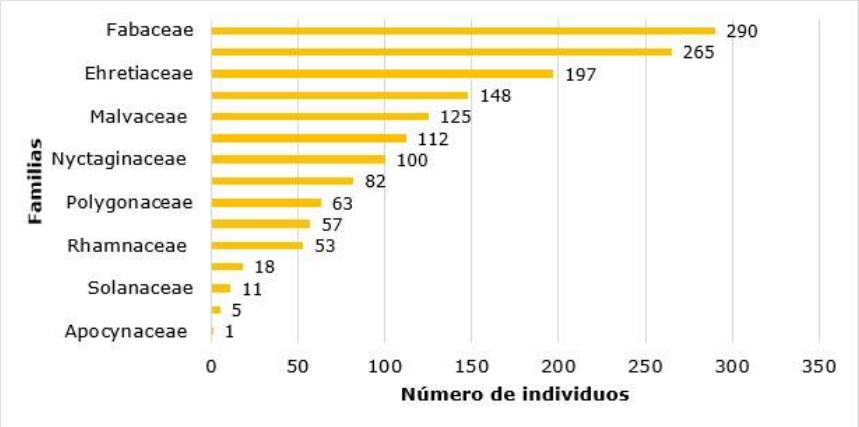

Figure 2. - Most represented families according to the number of individuals in the Tropical Dry Forest of the Quimis site

Conservation status according to IUCN

As mentioned in Table 2, the Red List Category, for the most part, the species found in the Tropical Dry Forest of the Quimis area are in a conservation status of least concern (LC) or species with insufficient data (DD). On the other hand, the species *Pithecellobium arboreum* is the only species in the fourth category called "Vulnerable (VU), likewise *Croton rivinifolius is* the only species that is "Endangered (EN)" (Table 2).

Table 2. - Conservation status of melliferous species of the tropical dry forest in the Quimis area

	IUCN Category							
Scientific name	**D.D.**	**L.C.**	**N.T.**	**VU**	**IN**	**C.R.**	**E.W.**	**EX**
Mimosa acantholoba		x						
Pythecellobium arboreum				x				
Caesalpinia paipai		x						
Pithecellobium excelsum		x						
Geoffroea spinosa		x						
Erythrina velutina								
Prosopis pale								
Vachellia macracantha								
Leucaena trichodes								
Jatropha curcas		x						
Croton rivinifolius					x			
Pisonia aculeata		x						
Guapira floribunda		x						
Bursera graveolens		x						
Muntingia calabura								
Trema micrantha								
Ceiba trichistandra		x						
Eriotheca ruizii								
Guazuma ulmifolia		x						
Cordy lutea		x						
Medium Xenostegia								
Convolvulus arvensis								
Ipomoea purpurea								
Acnitus arborencens								
Sarcomphalus thyrsiflorus								
Coccoloba ruiziana								
Vallesia glabra		x						
Cynophalla flexuosa		x						
Colicodendron scabridum		x						
Capparicordis crotonoids								
Bonellia sprucei								

Note: DD= data deficient; LC= Least Concern; NT= Near Threatened; VU= Vulnerable; EN= Endangered; CR= Critically Endangered; EW=Extinct in the Wild; EX=Extinct from the Wild.

Chorological classification

The results of the chorology are presented in (Table 3, Table 4 and Table 5).

Table 3. - Biological types and forest types of the melliferous species inventoried in the Quimis area

Scientific name	biological type	Forest type
Mimosa acantholoba	Mcp	Bsp
Pithecellobium arboreum	msp	Bsp
Caesalpinia paipai	McMsp	Bsp
Pithecellobium excelsum	M- Mcp	Bsp
Geoffroea spinosa	msp	Bsp / Bsa
Erythrina velutina	msp	Bsp
Prosopis pale	McMsp	Bsp / Bsa
Vachellia macracantha	McMsp	Bsp / Bsa
Leucaena trichodes	M- Mcp	Bsp
Jatropha curcas	M- Mcp	Bsp / Bsa
Croton rivinifolius	Mcp	Bsp / Bsa
Pisonia aculeata	Mcp	Bsp / Bsa
Guapira floribunda	msp	Bsp
Bursera graveolens	msp	Bsp / Bsa
Eriotheca ruizii	msp	Bsp
Muntingia calabura	msp	Bsp / Bsa / Bsap
Trema micrantha	Mcp	Bsp / Bsa / BsvtbC
Ceiba trichistandra	Mgp	Bsp / Bsa
Guazuma ulmifolia	McMsp	Bsp / Bsa
Cordy lutea	Mcp	Bsp / Bsa
Medium Xenostegia	Q	Bsp / Bsa
Convolvulus arvensis	h	Bsp / Bsa
Ipomoea purpurea	h	Bsp / Bsa
Acnitus arborencens	Mcp	Bsp / Bsa
Sarcomphalus thyrsiflorus	msp	Bsp
Coccoloba ruiziana	Mcp	Bsp
Vallesia glabra	M- Mcp	Bsp / Bsa
Cynophalla flexuosa	McMsp	Bsp / Bsa
Colicodendron scabridum	msp	Bsp / Bsa
Cappariocordis crotonoids	M- Mcp	Bsp
Bonellia sprucei	McMsp	Bsp

Legend: biological types: microphanerophytes (Mcp)= small between 5- 10 m; mesophanerophytes (Msp)= trees 15- 30 m; micromesophanerophytes (McMsp)= small to medium-sized trees 8- 15 m; micronano-panerophytes (M-

Mcp)= woody plants between 2- 5 m; hemicryptophytes (H)= perennial herbs with buds on the soil surface; phanerophytes (P)= plants with woody stems, shrubs or herbs with stems over 50 cmtall; mega-phyanerophytes (Mgp)= large trees, over 30 m; dry forest type: Bsp= pluvio-seasonal dry forest; Bsa= Andean dry forest; Bsap= piedmont Andean evergreen forest; BsvtbC= lowland evergreen forest Chocó.

Table 4. - Characteristics of the leaves of the species of the Tropical Dry Forest of the Quimis site

Scientific name	Blade type	Composite blade type	Sheet size	leaf edge	leaf shape	leaf texture
Mimosa acantholoba	hc	Cbi	Nan	Be	Fli	car
Pithecellobium arboreum	hc	Cbi	Lep	Be	Fli	car
Caesalpinia paipai	hc	Cbi	Nan	Be	Fova	Meme
Pithecellobium excelsum	hc	Cbi	microphone	Be	Fova	car
Geoffroea spinosa	hc	Cbi	Lep	Be	Fli	car
Erythrina velutina	hc	Ctri	Not	Bl	Faith	Meme
Prosopis pale	hc	Cbi	Nan	Be	Fli	Meme
Vachellia macracantha	hc	Cbi	Nan	Be	Fob	Meme
Leucaena trichodes	hc	Cimp	microphone	Be	FL	car
Jatropha curcas	hs		Not	Bl	ft	Meme
Croton rivinifolius	hs	Ctri	Not	Be	FL	car
Pisonia aculeata	hs		microphone	Be	FL	Meme
Guapira floribunda	hs		Not	Be	Faith	Meme
Bursera graveolens	hc	Cimp	Not	bd	FC	Meme
Eriotheca ruizii	hs		Not	Bl	Faith	Meme
Muntingia calabura	hs		Not	bd	FL	Succ
Trema micrantha	hs		Not	Be	Faith	Meme
Ceiba trichistandra	hc	cpa	Month	Be	Faith	car
Guazuma ulmifolia	hs		Not	bd	FL	Meme
Cordy lutea	hs		Not	bd	Faith	Cor
Medium Xenostegia	hs		Not	Bl	FC	Meme
Convolvulus arvensis	hs		Not	Bl	ft	Succ
Ipomoea purpurea	hs		Not	Bl	ft	Meme
Acnitus arborencens	hs		Not	Be	Faith	Succ
Sarcomphalus thyrsiflorus	hs		Not	bd	Fob	car
Coccoloba ruiziana	hs		Not	Be	fov	car
Vallesia glabra	hs		microphone	Be	FL	Succ
Cynophalla flexuosa	hc	Cimp	microphone	Be	Fa	Cor
Capparicordis crotonoids	hs		Not	Be	FL	Cor
Colicodendron scabridum	hs		Not	Be	fz	Cor
Bonellia sprucei	hc	Cimp	Month	Be	Fo	Cor

Legend: leaf type: Hs= simple leaf; Hc= compound leaf; compound leaf type: Cbi= compound bifolate leaves;

Cimp= compound imparipinnate leaves; Ctri= compound trifolate leaves; Cpa= compound palmate leaves; leaf size: nanophyllous (Nan)= area up to 0.25 cm^2 and length 0.5 - 1cm; notophyllous (Not)= area up to 12.5 cm^2 and length 6-23cm; microphyllous (Mic)= area 1.75 cm^2 and length 1- 6 cm; leptophyllous. (Lep)= small leaves with an area of less than 0.25 cm^2 and length of 1-5 mm; mesophilic (Mes)= area up to 2.5 cm^2 and length of 13- 20 cmapophyllous. (Af)= leafless; leaf margin: Be= entire margin; Bl= lobed margin; Bd= serrated margin; leaf shape: Fli= linear shape; Fe= elliptic shape; Fl= lanceolate shape; Fova= ovate shape; Fob= oblong shape; Ft= triangular shape; Fc= cordate shape; Fo= oblanceolate shape; Fz= tendril shape; Fov= ovate shape; Fa= acicular shape; leaf texture: cartaceous (Car)= like cardboard or paper; membranous (Mem)= extremely soft in texture; coriaceous (Cor)= leather-like hard; succulent (Suc)= fleshy.

Table 5. - Characteristics of the trunks of the species of the Tropical Dry Forest of the Quimis site

Scientific name	stem type	bark texture
Mimosa acantholoba	Tl	Tr
Pithecellobium arboretum	Tl	Tr
Caesalpinia paipai	Tl	Tli
Pithecellobium excelsum	Tl	Tr
Geoffroea spinosa	Tl	Tr
Erythrina velutina	Tl	Tli
Prosopis pale	Tl	Tr
Vachellia macracantha	Tl	Tr
Leucaena trichodes	Tl	Tli
Jatropha curcas	Tl	Tli
Croton rivinifolius	Tl	Tli
Pisonia aculeata	Tl	Tli
Guapira floribunda	Tl	Tli
Bursera graveolens	Tl	Tli
Eriotheca ruizii	Tl	Tli
Muntingia calabura	Tl	Tli
Trema micrantha	Tl	Tr
Ceiba trichistandra	Tl	Tli
Guazuma ulmifolia	Tl	Tr
Cordy lutea	Tl	Tr
Xenostegy medium	Th	Tli
Convolvulus arvensis	Th	Tli
Ipomoea purpurea	Lia	Tli
Acnitus arborencens	Tl	Tli
Sarcomphalus thyrsiflorus	Tl	Tli
Coccoloba ruiziana	Tl	Tli
Vallesia glabra	Tl	Tr

Cynophalla flexuosa	Tl	Tr
Capparicordis crotonoids	Tl	Tr
Colicodendron scabridum	Tl	Tr
Bonellia sprucei	Tl	Tr

Legend*:* stem type: Tl=woody stem; Th=herbaceous stem; Lia= liana; stem texture: Tli=smooth stem; Tr= rough stem.

The results of melliferous species according to pollen supply, nectar supply or both (Table 6).

Table 6. - Distribution of melliferous species according to their contribution of pollen and nectar to bees in honey production

honey species	Pollen	Nectar	Pollen/Nectar
Acnitus arborencens		x	
Vachellia macracantha			x
Pithecellobium excelsum			x
Ceiba trichistandra			x
Guazuma ulmifolia			x
Capparicordis crotonoids			x
Colicodendron scabridum			x
Prosopis pale			x
Eriotheca ruizii			x
Convolvulus arvensis		x	
Bursera graveolens			
Guapira floribunda			x
Erythrina velutina			x
Pithecellobium arboreum			x
Mutingia calabura			x
Medium Xenostegia		x	
Cordy lutea		x	
Cynophalla flexuosa		x	

Table 7 shows the categories of flora species according to whether they are cultivated, native, endemic, introduced or wild (Table 7).

Table 7. - Plants categorized according to their management category

Scientific name	c	N	AND	Yo	Yes
Mimosa acantholoba					
Pithecellobium arboreum		x			
Caesalpinia paipai		x			
Pithecellobium excelsum		x			
Geoffroea spinosa		x			
Erythrina velutina		x			
Prosopis pale		x			
Vachellia macracantha		x			
Leucaena trichodes		x			
Jatropha curcas	x			x	
Croton rivinifolius		x	x		
Pisonia aculeata		x			
Guapira floribunda					
Bursera graveolens		x			
Muntingia calabura		x			
Trema micrantha		x			
Ceiba trichistandra		x			
Eriotheca ruizii		x			
Guazuma ulmifolia		x			
Cordy lutea		x			
Medium Xenostegia	x	x			
Convolvulus arvensis				x	
Ipomoea purpurea					
Acnitus arborencens					
Sarcomphalus thyrsiflorus		x			
Coccoloba ruiziana		x			x
Vallesia glabra		x			
Cynophalla flexuosa					
Colicodendron scabridum					
Capparicordis crotonoids					
Bonellia sprucei		x			

Note*:* C (cultivated); S (wild); E (endemic); I (introduced); N (native).

As detailed in the table above, most of the species are native to the Tropical Dry Forest, on the other hand, the species *Croton rivinifolius* is endemic to the Quimis area.

Shannon and Simpson Index (D)

According to the results, the diversity of species according to the Shannon index is classified as a high diversity in the area of the Quimis area, evidenced by the result

obtained H=4.2656. In this same sense, *Cordia Lutea* species stand out; while *Pithecellobium arboreum* and *Vallesia glabra* present low dominance in the study area.

The results of the reciprocal of Simpson's Dominance (λ) = 0.06 and Simpson's (1-λ) = 0.93 show a high expectation for a random selection of two or more individuals of the same species in the established research area.

DISCUSSION

According to the results of the diversity of species inventoried in the Quimis enclosure through sampling it was found that these results differ with those obtained by Aguilar *et al.,* (2019), who reported 89 species, 39 families, and 2 394 individuals. Likewise, the results of the botanical species mentioned coincide with those reported by (MAE 2013).

On the other hand, the IUCN reported the species *Croton rivinifolius as endangered* (EN), i.e. it has a high risk of extinction in the wild, which agrees with the reports of AstudilloSánchez *et al.,* (2019), while the species *Pithecellobium arboreum* is considered vulnerable (VU), being evaluated in 2020, as presented in the IUCN Red Book (IUCN 2020). In this sense, both species face a risk of extinction or population decline in the medium term.

The species *Colicodendron scabridum* and *Bursera graveolens,* according to the IUCN Red Book, are categorized as LC (least concern), i.e. they are not critically endangered. On the other hand, Carrillo (2015) does not agree with the threat status of those two species, as he considers them to be categorized as critically endangered (CR).

According to the chorological classification of each species mentioned in the Quimis area, which was carried out with the aim of obtaining data on the structural characteristics of individuals, ie: root, stem, leaves, fruits, it was found that this coincides with that reported in other studies, such as those of REDMIC (2019), which briefly ensure the concept of chorology as a study that occupies the area of distribution of organisms associated with the date of sampling or observation, in addition to introducing the species with the date of sampling in the locality indicated, other data of interest is incorporated, i.e., the depth, degree of uncertainty of the coordinates, reliability of the identification and location, author of the collection or observation, number of specimens and a field of notes where it can be commented on relevant information associated with the data. Other works with different results mention the elaboration and chorological classification from a single specimen (Salas and Déniz, 2019).

The polliniferous and nectariferous species observed in the Quimis area, that in effect there are about 23 species of plants visited by the bees and that not only focus on the most common such as; the *Ceiba trichistandra* and *Prosopis pallida* that are the most used by the beekeepers, if not that these travel around the other species that are in the forest; such as the rastrearas and the shrubs managing to obtain their own food.

On the other hand, Insuasty, Martínez and Jurado (2016), indicated that certain species can be used by *Apis mellifera* as alternative polliniferous resources, when there is a low availability of pollen contributing species around the apiaries, which coincides with this study.

Likewise, the species with the highest number of individuals was *Cordia lutea*, while *Vallesia glabra* presented the lowest number of individuals in relation to the data cited by Jiménez *et al.,* (2017), who mentioned that these species have flowers useful for the production of pollen and honey due to their long flowering, aroma or chemical properties, among them: *Acacia macracantha*, *Terminalia valverdeae*, *Tabebuia chrysantha*, *Cordia lutea* and *Eriotheca ruizii*.

For continuity, it should be added that the Shannon index obtained with the data collected in Quimis reflects a high diversity of 4.26; differing from the analysis conducted by Muñoz, Erazo and Armijos (2014), in southwestern Ecuador who reported a value of 2.51 indicating a medium diversity. Similarly, Simpson's index showed a high dominance (S=0.93); similar to that reported by a study of the floristic composition and structure of the dry forests of the Province of Loja, Ecuador Aguirre *et al.*, (2013), who reported a high dominance (S= 0.89).

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