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Research note

New records of *Heliconia* (Heliconiaceae) for the region of Chajul, Southern Mexico, and their potential use in biodiversity-friendly cropping systems

Nuevos registros de *Heliconia* (Heliconiaceae) para la región de Chajul, sur de México, y su uso potencial en plantaciones amigables de la biodiversidad

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Abstract. We report 4 new records of *Heliconia* species (Heliconiaceae) for the region of Chajul, one of the most studied sites of the Mexican Lacandona. Records are for *H. champneiana* Griggs cv. Maya Gold, *H. latispatha* Bentham cv. Orange Gyro, *H. vaginalis* Bentham, and *H. wagneriana* Petersen. We provide a brief description of morphological and ecological traits of the species and demonstrate the high potential they have to be cultivated in biodiversity-friendly cropping systems. We suggest the use of *Heliconia* in the enrichment of secondary forests and forest fragments as an alternative of combining forest management with biological conservation.

Key words: *Heliconia aurantiaca*, *Heliconia champneiana*, *Heliconia collinsiana*, *Heliconia latispatha*, *Heliconia librata*, *Heliconia spissa*, *Heliconia vaginalis*, *Heliconia wagneriana.*

Resumen. Se registran por primera vez 4 especies de *Heliconia* (Heliconiaceae) para la región de Chajul, uno de los sitios más estudiados de la lacandona mexicana. Los nuevos registros son para *H. champneiana* Griggs cv. Maya Gold, *H. latispatha* Bentham cv. Orange Gyro, *H. vaginalis* Bentham, y *H. wagneriana* Petersen. Se presenta una breve descripción acerca de las características morfológicas y ecológicas de las especies y se demuestra el alto potencial que tienen para ser cultivadas en plantaciones amigables de la biodiversidad. Se sugiere el uso de *Heliconia* en el enriquecimiento de bosques secundarios y fragmentos de selva como una alternativa de combinar manejo forestal con conservación biológica.

Palabras clave: *Heliconia aurantiaca*, *Heliconia champneiana*, *Heliconia collinsiana*, *Heliconia latispatha*, *Heliconia librata*, *Heliconia spissa*, *Heliconia vaginalis*, *Heliconia wagneriana.*

Heliconiaceae is a plant family represented by a unique tropical genus, *Heliconia*. These perennial herbs belong to the order Zingiberales and are phylogenetically close to Musaceae, Strelitziaceae, Marantaceae, Cannaceae, Zingiberaceae, and Lowiaceae (Berry and Kress, 1991). *Heliconia* traditionally belonged to Musaceae with the genera *Musa* and *Ensete*. The unique combination of inverted flowers, presence of a single staminode, and peachlike fruits led taxonomists to place *Heliconia* into a new family, Heliconiaceae Nakai. The overwhelming majority of the 180 known species of *Heliconia* are in the Neotropics, while only 6 are native to the Old World tropics, especially from Samoa in the Pacific Ocean to the Indonesian island of Sulawesi (Berry and Kress, 1991).

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Heliconia interacts with a vast number of organisms in tropical forests. Hummingbirds pollinate their colorful flowers in the Neotropics, while bats pollinate their pale green flowers in the Paleotropics (Berry and Kress, 1991). Fruits are blue in the Neotropics and red in the Paleotropics, but both are dispersed by many bird species (Berry and Kress, 1991). Viruses, bacteria, and fungi are known to infect their roots, shoots, leaves, inflorescences, fruits, and seeds (Assis et al., 2002). A myriad of insects including flies, hispine and flattened carabid beetles, caterpillars, and ants feed on or live inside their water-filled floral bracts and young rolled leaves (Seifert, 1982). Such biotic interactions involving *Heliconia* demonstrates its ecological value in tropical communities.

Heliconia is also an important ornamental genus. It has been long commercialized in European and American

markets as cut flowers, potted plants, and in interior landscape. To give an example, Hawaiian *Heliconia* production generated about 2.8 million dollars between 1987 and 1988 with a production of 370 000 stems (Berry and Kress, 1991). In 2000 and 2001, Colombia exported 16 species, cultivars, and varieties of *Heliconia* to 44 countries, with incomes reaching about 440 million dollars (Diaz et al., 2002). Both Hawaiian and Colombian *Heliconia* where produced in small cultivation areas (<1 km^2 for Hawaii), indicating how these plants can maximize the use of space. Despite their ecological and economic values, geographic distribution of native *Heliconia* remains poorly understood in Mexico.

In this work we include 4 species of *Heliconia* that represent the first records for one of the most studied sites of the Mexican Lacandona: the Chajul Biological Station (16°08' N, 90°55' W) and its vicinity in the southern limit of the Montes Azules Biosphere Reserve (hereafter region of Chajul). Species were observed in the localities of Chajul (16°07' N, 90°55' W), Loma Bonita (16°06' N, 90°59' W), Playón (16°10' N, 90°53' W) and in both margins of the Lacantún River. A brief description of morphological and ecological traits of species is provided and its potential use in biodiversity-friendly cropping systems is discussed. New records were observed during a long-term research on *Heliconia*-pathogen-herbivore interaction.

To guarantee that findings were actually new records, we searched the recorded species in Berry and Kress (1991), Martínez et al. (1994), and Gutiérrez-Baéz (1996, 2000). These publications provide useful information on the botany and ecology of *Heliconia,* permit accurate species identification in the field, and join the available information on *Heliconia* distribution in Mexico. Because these studies are more than 10 years old, we used ISI Web of Science, Google Scholar, the Missouri Botanical Garden database (Mesoamerica projects), and the CONABIO database (World Biodiversity Information Network – REMIB) to search for recent records of *Heliconia* in Mexico. Since it is easy to identify reproductive individuals of *Heliconia* in the field (see Berry and Kress, 1991), no botanical collection was done. Nevertheless, species determination was also supported by specialists in Heliconiaceae (W. J. Kress) and by reviewing specimens in herbaria. Botanical nomenclature followed Berry and Kress (1991).

We found 8 species of *Heliconia* in the region of Chajul (Table 1). Four of them had already been listed by Martínez et al. (1994) and Gutiérrez-Baéz (1996) for the region of Chajul: *H. aurantiaca* Ghiesbreght ex Lemaire (Castillo 3688 – CHAPA, XAL), *H. collinsiana* Griggs var. *collinsiana* (Sinaca and Ibarra 1102 – MEXU, XAL; Castillo 3953 – XAL), *H. librata* Griggs (Sinaca and Ibarra 1093 – MEXU), and *H. spissa* Griggs cv. Mexico Red (Castillo 3779 – XAL). Our results highlight the occurrence of 4 other species in the same region: *H. champneiana* Griggs cv. Maya Gold (see Stevens 25585 – MO, Davidse 36370 – BRH, MO), *H. latispatha* Bentham cv. Orange Gyro (see Ibarra 265 – MO), *H. vaginalis* Bentham (see Breedlove 47357 – MO), and *H. wagneriana* Petersen (see Stevens 25115 – MO).

According to Kress (2001), *H. champneiana* is found from Southern Mexico to Nicaragua, but no detailed information on the species distribution in Mexico was provided. Here, we complement his data by demonstrating that the species is found in the region of Chajul, Chiapas. *Heliconia latispatha* occurs throughout the Neotropics, from Mexico to South America (Berry and Kress, 1991; Gutiérrez-Baéz, 2000). In Mexico, this species can be found in the states of Veracruz, Tabasco, Oaxaca, Campeche, and Chiapas (Gutiérrez-Baéz, 2000). In the state of Chiapas, particularly, there are records for the localities of Ostuacan, Tonalá, Escuintla, Yajalón, Tres Picos, Huixtla, and Tapachula (Gutiérrez-Baéz, 2000). We add the region of Chajul to this list. *Heliconia vaginalis* is found from Mexico to Colombia (Berry and Kress, 1991; Gutiérrez-Baéz, 2000). In Mexico, it has been recognized in Veracruz, Tabasco, Guerrero, and Chiapas. In Chiapas, there are records for Palenque, Ursulo Galván, La Libertad, and now for the region of Chajul. *Heliconia wagneriana* has the same distribution as *H. vaginalis* (from Mexico to Colombia) (Martínez et al., 1994; Berry and Kress, 1991), but in Mexico it has been only documented in Tacotalpa (Tabasco) and La Libertad (Chiapas) (Martínez et al. 1994; CONABIO database). We expand southward its distribution in Chiapas.

Expanding the geographic distribution of plant species in highly diverse tropical rain forests is a significant contribution toward the success of conservation initiatives. With accurate geographic distributions we are able to identify local biodiversity hotspots and conserve more species in smaller areas. Our bibliographic review revealed that the Mexican Lacandona houses 14 native species of *Heliconia* (*H. adflexa*, *H. aurantiaca*, *H. champneiana*, *H. collinsiana*, *H. dielsiana*, *H. latispatha*, *H. librata*, *H. psittacorum*, *H. rostrata*, *H. schiedeana*, *H. spissa*, *H. uxpanapensis*, *H. vaginalis*, and *H. wagneriana*). The region of Chajul, as defined here (~100 km^2), accounts for 57% (8 species) of this diversity in less than 1.5% of the Mexican Lacandona area (~8 000 km^2). This makes the region of Chajul a priority site for conservation of these ecologically and economically important plants.

Because of its high local diversity of *Heliconia*, the region of Chajul is a highly suitable site for the sustainable management of the genus in Mexico. Morphological differences in the inflorescences its 8 species confer a

Table 1. Morphological and ecological traits of eight native species of *Heliconia* recorded in the region of Chajul, Chiapas, Southern Mexico. Species descriptions were based on Berry and Kress (1991), Gutiérrez-Baéz (1996, 2000) and on our field observations. Asterisks represent new records for the region of Chajul

Species	*Height (m)*	*Growth habit*	*Inflorescence orientation*	*Bract arragement*	*No. of bracts*	*Bract color*	*Habitat*	*Blooming*
H. aurantiaca	0.5-2.0	zingiberoid	erect	Spiral	3-6	orange, with pale green tip	MF, FR, SF	Dec-Jun
*H. champneiana**	2.0-5.0	musoid	erect	Distichous	5-13	gold to yellow, green along distal keel and at tip	TG	Apr-Nov
H. collinsiana	1.7-5.5	musoid	pendent	Spiral	6-14	dark-red to orange-red	SF, TG, OA	All year
*H. latispatha**	1.7-5.5	musoid	erect	Spiral	7-17	orange	SF, TG, OA	All year
H. librata	1.3-3.3	musoid	erect	Distichous	11-18	yellow	MF, FR SF, TG	May-Dec
H. spissa	1.3-2.7	musoid	erect	Spiral	5-7	red or pink, greenish distally	FR	Feb-Sep
*H. vaginalis**	1.0-5.0	cannoid	erect	spiral or distichous	3-7	red to red-orange	MF, TG	Jun-Dec
*H. wagneriana**	1.7-5.0	musoid	erect	Distichous	6-20	colorful, from the keel to the cheek: green, yellow, and red	SF, TG, OA	Jan-Sep

MF= mature, old growth, continuous forests; FR= forest fragments; SF= early secondary forests (< 20 yrs old); TG= large, early treefall gaps embedded in the continuous forest; OA= open areas.

variety of cut flowers for the grower (Table 1). Successive periods of blooming guarantee production throughout the year (Table 1). Differences in growth habit and plant size give additional variety to the products to be commercialized as potted plants or in interior landscapes (Table 1). Such natural variety of ornamental products demonstrates the high potential of the region of Chajul for the market of ornamental plants.

Considering the ongoing scenario of deforestation and forest fragmentation in the Mesoamerican biodiversity hotspot, the major challenge for the conservationists is to design efficient strategies that combine species use with biodiversity conservation (Harvey et al., 2008). Mexican fragmented landscapes are usually dominated by small private fragments that still sustain a large subset of the original biota (Arroyo-Rodríguez et al., 2009). By encouraging the enrichment of forest fragments with native *Heliconia* species, we may add an economical value to forest remnants and increase the likelihood of their protection. Because the huge majority of *Heliconia* species are shade-intolerant, forest enrichment can be done without logging in natural treefall gaps. The same can be done in secondary forests that regenerate after the abandonment of unproductive agricultural lands. Nonetheless, growers should be technically assisted in order to maintain the genetic, functional and taxonomic diversity of the managed forests.

To summarize, few regions in the tropics have the local diversity of native *Heliconia* species that the region of Chajul has. Such biological heritage has potential to be rationally exploited through the implementation of biodiversity-friendly cropping systems, combining economical activities with nature conservation. Further studies should evaluate the use of *Heliconia* in disturbed forests from an economic perspective. Special attention should be paid to find potential consumers in the competitive internal and external markets of ornamental plants, especially in Europe and the USA, to identify logistic bottlenecks in the commercialization of these perishable products, such as costs of infrastructure and

transportation toward distribution and sale centers, and to quantify financial benefits for local people in order to insure economic and social development for the region.

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