

The Bulb Garden



~Gardening with Bulbs~

What's Inside...

The Mexican jahuites (Iridaceae: Tigridia)

Guadalupe Munguia-Lino, PhD

Announcements

THE MEXICAN JAHUITES (Iridaceae: Tigridia)

Guadalupe Munguia Lino was the recipient of a Mary Sue Ittner Grant for Bulb Studies in 2021. Professor Lino holds a PhD in Biosystematics, Ecology and Management of Natural and Agricultural Resources. Her research involves Cladistics Biogeography of the tribe Tigridieae (Iridaceae) in North America. She is a specialist in Tigridieae taxonomy, in the management of geographic databases and Geographic Information Systems at the University of Guadalajara, Guadalajara, Jalisco, Mexico.

Cátedras CONACyT – Universidad de Guadalajara, Laboratorio Nacional de Identificación y Caracterización Vegetal (LaniVeg), Departamento de Botánica y Zoología, Centro Universitario de Ciencias Biológicas y Agropecuarias, Universidad de Guadalajara, Camino Ramón Padilla Sánchez 2100, 45200 Las Agujas, Zapopan, Jalisco, Mexico. gmlinno@gmail.com. All photos by Guadalupe Munguia Lino unless otherwise noted.

The jahuites (genus *Tigridia*) belong to the tribe Tigridieae (Iridaceae), a group that includes 203 species of geophytes. Plants of the Tigridieae have bulbs, plicate and bilateral leaves, an inflorescence arranged as a rhipidium (a scorpioid cyme whose successive pedicels follow a zigzag path on the same plane), and two series of three tepals that are variable in shape, size and color. The tribe Tigridieae is characterized by the variability of the style branches. These, together with the stamens, form a complex and specialized structure adapted to certain pollinators. Such complexity and variability contrasts with the vegetative uniformity of the group (Rodríguez & Sytsma 2006, Munguía-Lino et al. 2017). The Tigridieae are unique to the Americas. Their greatest richness and endemism are found in the Brazilian subregion and the Mexican Transition Zone, which corresponds to the principal mountain chains of Mexico. Mexico is a botanically diverse country with 22,696 species of vascular plants, of which 12,069 are exclusive to its territory (Villaseñor 2016). In Mexico, the Tigridieae include 63 species, of which 46 are endemic (Munguía-Lino et al. 2017).

The jahuites, to give them their popular name, are plants with ovoid bulbs and reddish to brown, papyraceous tunics. Members of *Tigridia* may have basal leaves, cauline (stem) leaves, or both basal and cauline leaves. They have three outer and three inner tepals, which are highly variable in shape, color, and size. The inner tepals are smaller than the external ones and may have nectaries on the adaxial (upper) surface, which are exposed or covered by folds of the tepals. A particular characteristic of the group is the presence of spots at the base of the tepals. There are three stamens, whose filaments are fused to form a tube. The style is divided into three branches, each subdivided into two arms, and sometimes the two arms are separated by a mucro (sharply pointed structure). The fruit is a capsule with numerous piriform (pear-shaped), reddish brown seeds (Molseed 1970, Munguía-Lino et al. 2017; **Figure 1**).

Jahuites have other common names. In México, the most frequent are *oceloxochitl*, *flor del tigre* (“jaguar flower”) referring to the spots or stripes on the tepals. They are also commonly known as *flor de un día* because an individual flower lasts only a few hours. In other regions, they are called *cacomite*, *cebollaje*, *guaquique*, *jahuite*, and *juique*, names referring to the form of the bulbs. In San Luis Potosí they are called *palmita de tierra* or *palma fría*, and the Pame indigenous group knows them as *kopu stxioa*. *Tigridia pavonia* is named *flor de la Trinidad*, *flor de hueso*, *flor de pañuelo*, *jirafita*, and *rodilla de Cristo* due to its red, yellow, and orange colors and the tepal spots.

The affiliation of species within the genus *Tigridia* is subject to discussion. Based on DNA

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sequences, some authors have included the genera *Ainea*, *Cardiostigma*, *Colima*, *Fosteria*, *Rigidella* and *Sessilanthera* in *Tigridia* (Goldblatt et al. 2008).

However, the phylogenetic relationships between *Tigridia* and related genera are not resolved, so we prefer to use the names shown in **Table 1**. In this sense, *Tigridia* includes nearly 41 species distributed mainly in Mexico and Guatemala. *Tigridia pavonia* is the exception, since its natural distribution extends to South America, and it has been introduced in other parts of

the world as an ornamental plant (Vázquez 2011).

We need more exploration to discover new species of jahuites in Mexico, and our

knowledge is incomplete, especially as regards pollination biology, and historical, ecological, and conservation biogeography. The first step in a biogeographic study is the recognition of the distribution patterns of the group. Species richness analysis is one of these paths. In this sense, the objective of the present study is to show the patterns of richness and distribution of jahuites in Mexico by state, vegetation type, and a grid cell of 50 × 50 km. We analyzed the distribution of *Tigridia* according to elevation, temperature, and precip-



Figure 1. Morphological characteristics of Mexican jahuites. (a) Bulb, (b) plant of *Tigridia maritinezii*, (c) leaf of *T. suarezii*, (d) flower of *T. chiapensis*, (e) inflorescence of *T. hallbergii*, (f) flower of *T. pavonia*, (g-h) flowers with exposed nectary of *T. meleagris* (g) and *T. hallbergii* (h), (i) stamens and stigma of *T. durangensis*, (j) fruit of *T. rzedowskiana*, (k) seeds of *T. pulchella*. Inner tepal (it), outer tepal (ot), mucro (m), arms (ar), branch (br) and anther (an).

itation. To do this, we used a data matrix with 1,356 georeferenced records (**Figure 2**). The data were obtained by reviewing herbarium specimens. The Mary Sue Ittner Bulb Grant was used for the review of the CIIDIR herbarium. The matrix was refined and analyzed using Geographic Information Systems, and the richness analysis was carried out in Biodiverse. Knowledge of areas of richness and geographic distribution is essential to identify areas of endemism and subsequently to determine priority areas for conservation. Knowing elevation, temperature, and precipitation ranges of jahuites is also useful for developing *ex situ* management plans.

Jahuites are very diverse and widely

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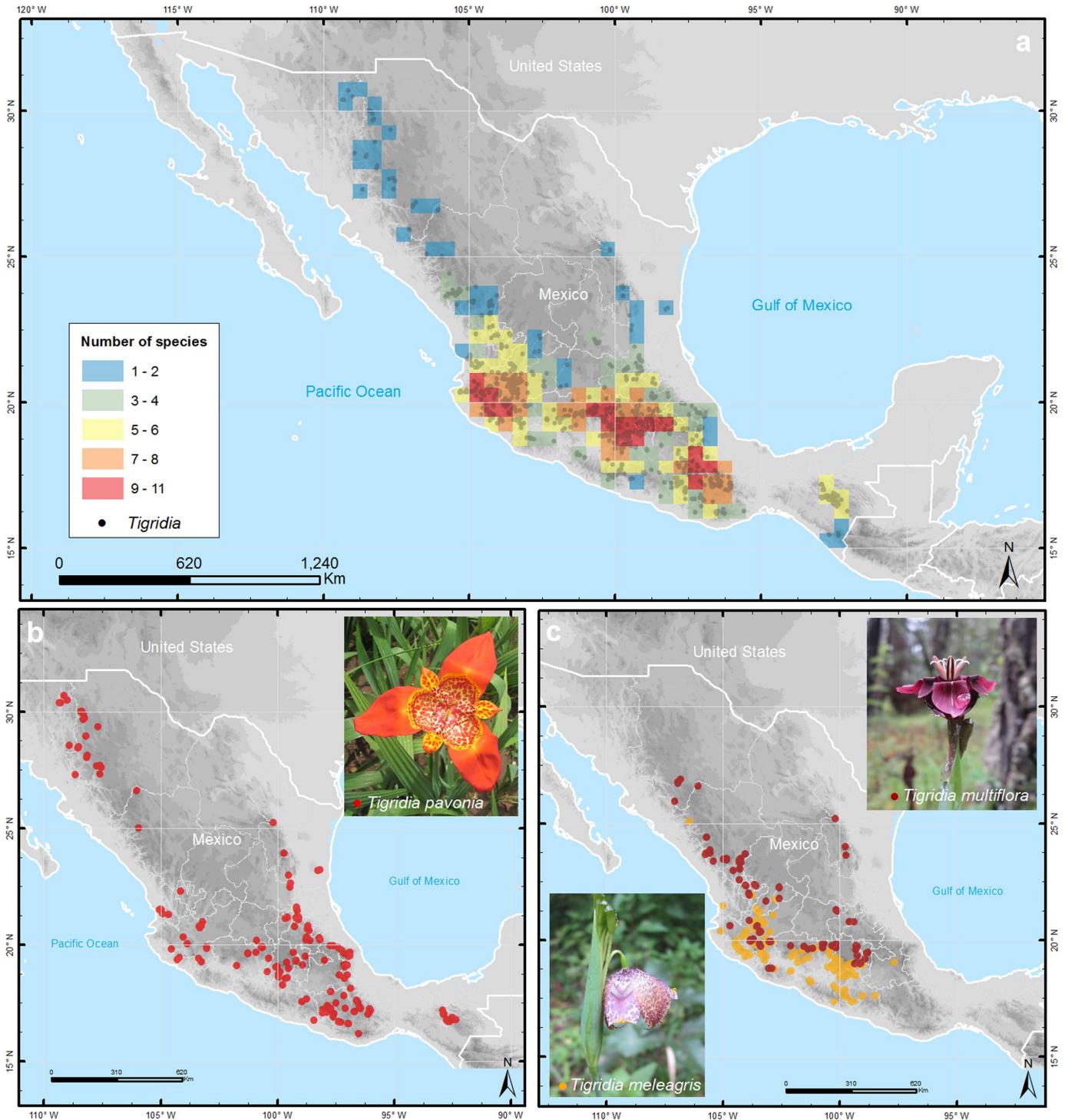


Figure 2. Distribution and species richness of the jahuites. (a) Richness by grid cell of 50 × 50 km, (b) geographical distribution area of *Tigridia pavonia*, (c) geographical distribution area of *T. meleagris* and *T. multiflora*.

distributed in Mexico (**Figure 2**), present in all the country’s states except Baja California, Baja Califor-

nia Sur, Campeche, Coahuila, Quintana Roo, Sinaloa, Tabasco and Yucatán. However, the geographical distribution of jahuites by state is irregular. The greatest species richness (13 species) is concentrated in the Estado de México, followed by Oaxaca with 12 species and Jalisco with 11. The

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greatest species richness by grid cell is also found in these states (**Figure 2a**). In contrast, in Colima and Sinaloa only *Tigridia meleagris* and *T. pavonia* are known, respectively (**Figure 2**). *Tigridia pavonia* is widely distributed in Mexico. *Tigridia meleagris* and *T. multiflora* have a similar distribution in 11 and 14 counties (**Figures 2b, c**). The Mexican jahuites are very special because they include 35 endemics. The endemism

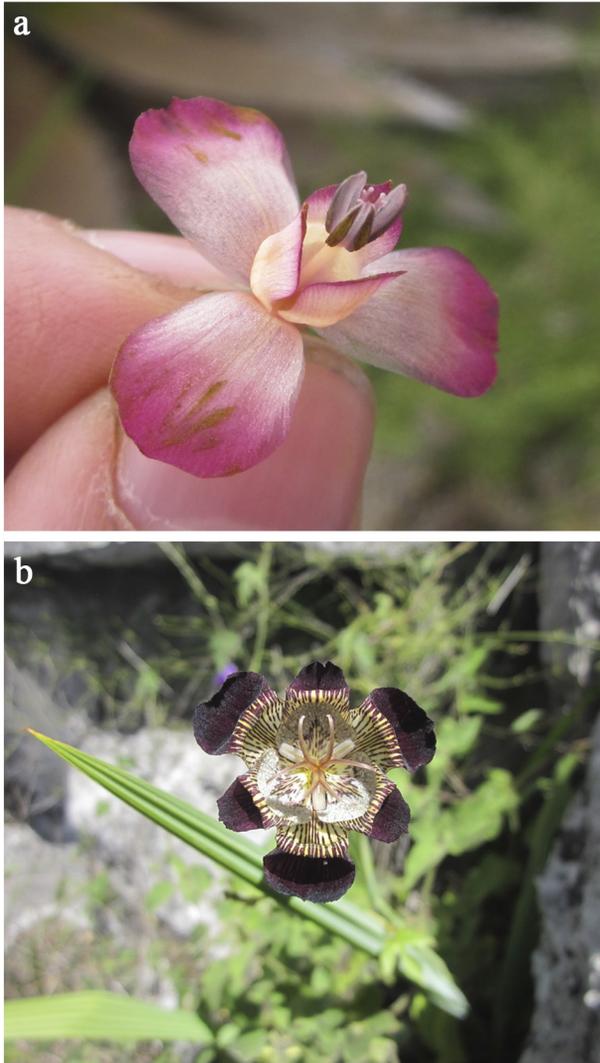


Figure 3. Flowers of two jahuites known only from their type localities. (a) *Tigridia nanchititlensis*, (b) *T. potosina*.

in this plants is very marked. For example, *T. amatlanensis*, *T. catarinensis*, *T. hintonii*, *T. nanchititlensis*, *T. pugana*, *T. mariaetrinitatis*, *T. potosina* and *T. purpusii* are known only from one county and a few records (**Figure 3**). Notably, *T. purpusii* was collected only by Carl Al-

bert Purpus in Tehuacán, Puebla, perhaps in October 1911 or 1912 (**Figure 4**).



Figure 4. Holotype of *Tigridia purpusii* collected by Carl Albert Purpus (6489: UC 169457) in Tehuacán, Puebla.

The distribution of jahuites coincides with the pine-oak forests and the mountains of Mexico. The pine-oak forest vegetation type is the most diverse in jahuites. However, they also grow in other vegetation types, such as tropical dry forest, cloud forest, grassland, thorn forest, tropical deciduous forest, and xerophytic scrub (**Figure 5**). The jahuites prefer an elevation range from sea level to 3700 meters, with most diversity between 2400 and 2600 meters. These elevations correspond with the Mexican Transition Zone, which is formed by the biogeographical provinces of Sierra Madre del Sur, Sierra

Opposite right: Table 1. The species of jahuites present in Mexico, with flower color and flowering period. The distributions were extracted from Munguía *et al.* (2017), and flower color and flowering period were obtained herbarium records and collections in the field. See next page.

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Specie	Distribution	Flower color	Flowering
<i>Tigridia alpestris</i>	Mexico	Black purple	July-September
<i>Tigridia amatlanensis</i>	Mexico	Pink	July
<i>Tigridia augusta</i>	Mexico	Violet-blue	June-July
<i>Tigridia bicolor</i>	Mexico	Purple	July-August
<i>Tigridia catarinensis</i>	Mexico	Purple	August
<i>Tigridia chiapensis</i>	Mexico	White	June
<i>Tigridia chrysantha</i>	Mexico	Yellow, red	July
<i>Tigridia dugesii</i>	Mexico	Yellow	June
<i>Tigridia durangensis</i>	Mexico	Violet-blue	June
<i>Tigridia ehrenbergii</i>	Mexico	Yellowish-white or pale yellow	June-September
<i>Tigridia estelae</i>	Mexico	Pink	July-August
<i>Tigridia flammae</i>	Mexico	Red	July
<i>Tigridia galanthoides</i>	Mexico	Pink	July-August
<i>Tigridia graciela</i>	Mexico	Purple	August-September
<i>Tigridia hallbergii</i>	Guatemala and Mexico	Brown or purple	June-August
<i>Tigridia hintonii</i>	Mexico	White	August
<i>Tigridia huajuapansensis</i>	Mexico	Purple, white	June-July
<i>Tigridia illecebrosa</i>	Mexico	Pale yellow	August-September
<i>Tigridia immaculata</i>	Guatemala and Mexico	Red	July
<i>Tigridia inusitata</i>	Mexico	Red	June-July
<i>Tigridia mariaetrinitatis</i>	Mexico	Pink	June-July
<i>Tigridia martinezii</i>	Mexico	Yellowish-white	June-July
<i>Tigridia matudae</i>	Mexico	Violet	August-September
<i>Tigridia meleagris</i>	Guatemala and Mexico	Pink	July-September
<i>Tigridia mexicana</i>	Mexico	Yellow, violet, white	June-July
<i>Tigridia molseediana</i>	Guatemala and Mexico	Purple	August
<i>Tigridia mortonii</i>	Mexico	Red	July-August
<i>Tigridia multiflora</i>	Mexico, Venezuela	Purple	July-August
<i>Tigridia nanchititlensis</i>	Mexico	Pink	July-August
<i>Tigridia orthantha</i>	Guatemala and Mexico	Red	June-August
<i>Tigridia pavonia</i>	Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Peru, El Salvador, Guatemala, Honduras, Mexico	White, yellow, blue, red, pink	May-October
<i>Tigridia potosina</i>	Mexico	Purple	July
<i>Tigridia pugana</i>	Mexico	Purple	September
<i>Tigridia pulchella</i>	Mexico	Purple	July-September
<i>Tigridia purpusii</i>	Mexico	Violet	No determined
<i>Tigridia rzedowskiana</i>	Mexico	Purple	July-August
<i>Tigridia seleriana</i>	Guatemala and Mexico	Blue	July
<i>Tigridia suarezii</i>	Mexico	Black purple	August-October
<i>Tigridia tepoxtlana</i>	Mexico	White	August-September
<i>Tigridia vanhouttei</i>	Mexico	Yellowish green	July-September
<i>Tigridia venusta</i>	Mexico	Black purple	August

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Figure 5. Vegetation types where jahuites grow. (a) Pine-oak forest in Sierra of Nanchititla, Estado de México, (b) Oak forest in Mirador de Volcanes, Jalisco, (c) Pine forest in Llano de las Flores, Oaxaca, (d) Population of *T. mexicana* subsp. *mexicana* in the roadside, Rancho Santo Tobias, Estado de México.

Madre Occidental, Sierra Madre Oriental, Chiapas Highlands, and Transmexican Volcanic Belt (Morrone *et al.* 2017). We used this grant to do field exploration along the Mexican Transition Zone, in order to collect herbarium specimens and tissue for DNA extraction, to observe species in their habitats, to analyze floral structures, to obtain photographs of pollinators, and to record phenology (Figure 6). We also obtained live plants, bulbs, and seeds and cultivated these.

The jahuites bloom in the rainy season from June to October, depending on when the rains begin in a given region. Most species flower between June and August, and fruits ripen in July through November. The seeds can be harvested from August, in early species such as *Tigridia*

mexicana and *T. augusta*, to November and December for late species such as *T. nanchititlensis* and *T. suarezii*. Precipitation determines the stages of development. In the rainy season, humidity activates the meristem and the aerial part emerges. In the dry season, plants lose their leaves and go dormant. Jahuites grow in zones with a range of 400 to 2500 mm of rainfall annually; however, most are found in areas of 1000-1400 mm. *Tigridia pavonia* tolerates both drought and high humidity. Jahuites survive in areas with temperatures from 8° to 25° C, but most are found where average temperatures range between 15° and 16° C. *Tigridia alpestris* subsp. *obtusata* grows at 8° C in Cerro de Tacintaro in the state of Michoacán; *T. meleagris* tol-

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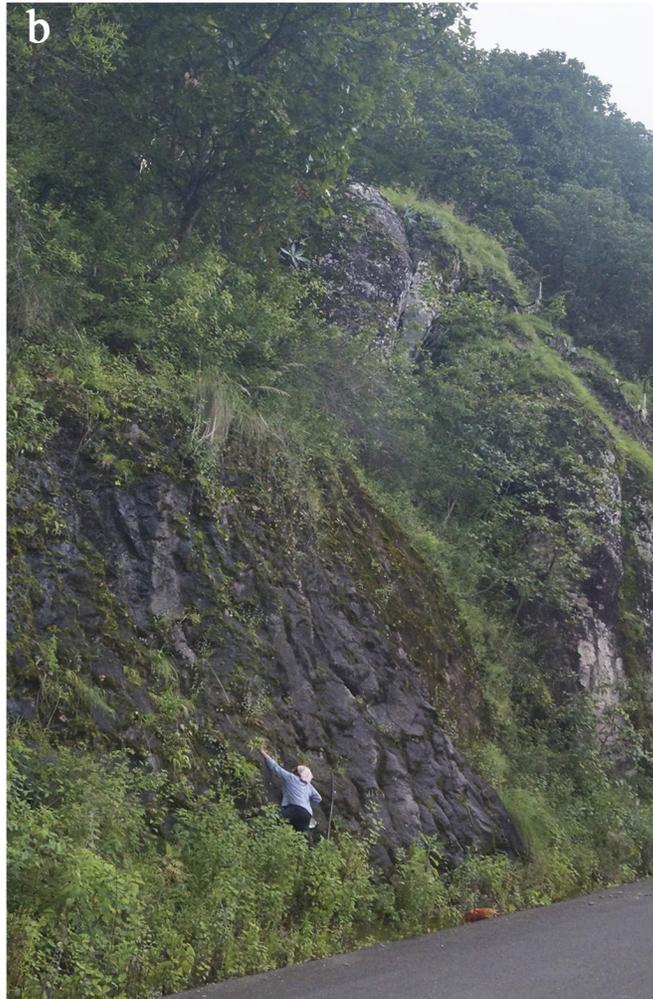


Figure 6. Field work along the Mexican Transition Zone. (a) Dissections of ja-huites, (b) collection of herbarium specimens, (c) bee visiting flowers of *Tigridia mexicana* subsp. *mexicana*, (d) bumblebee consuming nectar in flowers of *T. durangensis*, (e) collection of bulbs. Photograph (b) by Jorge David López-Pérez and (e) by Virginia Ramírez-Cruz.

people in some communities in the Estado de México, Oaxaca, and Puebla. Medicinal use of *T. pavonia* has been recorded, and this species is cultivated as an ornamental owing to its showy flowers (Munguía-Lino *et al.* 2017). Other species of ja-huites also have potential as ornamentals in gardens (e.g. *T. augusta*, *T. melea-*

erates temperatures of up to 25° C in Coacoyula, Guerrero.

The jahuites are a potentially useful group (Figure 7). In Mexico, the bulbs of *Tigridia ehrenbergii* subsp. *ehrenbergii*, *T. augusta*, *T. mexicana* subsp. *mexicana* and *T. pavonia* are consumed by

(e.g. *T. augusta*, *T. mexicana* and *T. martinizii*). Jahuites are not recommended as cut flowers, since they remain open just one day or even only a few hours. Nonetheless, their inflorescences have

Continued on next page

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Figure 7. Ornamental use of jahuites. (a-b) Cultivation of *Tigridia pavonia* in Conservation Center of *Tigridia* in the UAEMex, (c-h) some species of jahuites grown in pots ((c) *T. augusta*, (d) *T. mariaetrinitatis*, (e) *T. matudae*, (f) *T. molseediana*, (g) *T. mortonii*, (h) *T. venusta*).

from 6 to 18 flowers and anthesis occurs every third day, so it is possible to have a beautiful pot blooming for a month. Another important aspect is that they are a source of nectar and oil for bees, bumblebees, flies, and hummingbirds.

Some species of jahuites are at risk. *Tigridia bicolor*, *T. flammea*, *T. hintonii*, *T. huajuapensis*, *T. inusitata*, and *T. orthantha* are protected

by the Mexican government (SEMARNAT 2010). According to the International Union for Conservation of Nature (IUCN 2019) criteria, all Mexican jahuites are in a threatened category. For example, *T. catarinensis* was evaluated as Critically Endangered; it is a microendemic species of the Sierra de Álvarez, a protected natural area in San Luis Potosi, *T. mariaetrinitatis*

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a



b



c

is in the same category; its population in Chalcatongo, Oaxaca is threatened by corn plantations (**Figure 8a**). The growth of cities, changes in land use, and agricultural production are all constant threats to the conservation of jahuite populations (**Figure 8**). Thus, it is essential to know the geographical distribution areas to identify potential collection sites, and to recognize the habitats, phenology, precipitation, and temperature where they grow. Later, it will be necessary to designate them for protection, establish a gene bank, and develop propagation methods for bulbs and seeds.

Editor's note: From time to time Tigridia seed appears on the PBS Seed Exchanges. Bibliography follows on page 10.

Figure 8. Threats to conservation of some jahuites. (a) Threatened by corn plantations, Chalcatongo, Oaxaca, (b) risk due to cattle grazing in Llano de las Flores, Oaxaca, (c) endangered by change of land use and agricultural production, Peñuelas, Estado de México.

The Mexican Jahuites: Bibliography

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Editor's note: If you are interested in contacting Professor Lino, please contact her at the email address listed at the beginning of the article.

ANNOUNCEMENTS

NEW PBS FORUM As many of you know, PBS has had a Discussion List for quite some time; however there have always been difficulties posting photos which have often required the intervention of our volunteer webmasters. The PBS Board decided some time ago to transition to a forum format and that has now been accomplished. The software is the same as that of the Scottish Rock Garden Society and many of our initial bugs have been resolved.

We encourage all members to begin using the Forum if you have not yet done so. The Forum is available to everyone whether you are a PBS member or not. You must log in, however, if you want to participate in discussions.

At some point in the next few months, the PBS Discussion List (email format) will no longer be used. Seed and Bulb Exchange announcements will be made on the PBS Forum and will remain open for three days to give everyone a chance to order. There is lots of help available to assist you in joining, so please don't hesitate to ask! Here is the link:

<https://www.pacificbulbsociety.org>

FORUM HELP Contact the following web experts: David Pilling david@davidpilling.com; Martin (Garak) Bohnet garak@code-garak.de; Diane Whitehead ldiane.whitehead@gmail.com

BACK ISSUES of *The Bulb Garden* older than the current two years are now available to read or download from the PBS website. There is no charge for this service whether you are a member or not.

<https://www.pacificbulbsociety.org/pbswiki/index.php/TheBulbGarden>

ANNOUNCEMENTS *continued***ANNOUNCEMENT**

The Pacific Bulb Society is pleased to announce publication of
The Genus *Hippeastrum*
(Amaryllidaceae) in Bolivia

As part of the Society's commitment to its members and to the public, and after nearly four years' effort, it is with great pleasure that the Society now has available copies of The Genus *Hippeastrum* in Bolivia. Please see also the ad on the back page of The Bulb Garden. Publications Director Arnold Trachtenberg is in charge of shipping the books, and payment can be made easily through PayPal. Arnold can provide details by emailing him at

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**ATTENTION
PBS Members****CALL FOR SPECIAL GRANT APPLICATIONS
FOR MICROWAVE POLLEN STUDIES**

A PBS member has donated funds to be used specifically for the study of microwaving pollen to enhance or encourage pollination of difficult to cultivate bulbs, those in particular that rarely set seed, are self-sterile or set seed so poorly as to be unreliable to propagate by normal methods; in addition it is also suggested that a comparison of the genomes of parent and progeny, especially regarding expected increased homozygosity in the progeny. A link to further information which will provide some background information is at

<https://www.pacificbulbsociety.org/pbswiki/index.php/Microwave>

There are some specific requirements for this grant, including a requirement to write an article for the *Bulb Garden* at the end of the study. For further information, including conditions, please contact Robin Hansen at robin@hansennursery.com

Our standard grant application will be required. Please go to the Pacific Bulb Society website at:

<https://www.pacificbulbsociety.org/pbsforum/index.php?page=grant>

Applications should be emailed to:
Robin Hansen, President, PBS robin@hansennursery.com

[The application for this special grant is due October 1, 2022.](#)

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and worst of all, NEITHER will your
seed and bulb orders.**

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Pacific Bulb Society, *The Bulb Garden*, Volume 19, No. 4



Species and hybrids of South African *Lachenalia* blooming in April. Most are hybrids of *L. vanzyliae*. Photos: Colin Davis.



Moraeas in exquisite colors.

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Guadalupe Munguia-Lino, PhD

Announcements

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The Bulb Garden is the newsletter of the Pacific Bulb Society (PBS). It is published, if enough articles are submitted, around the third week of each quarter and is available to PBS members. This newsletter provides gardening or bulb related articles, news of interest to members, and announcements of the PBS organization.

Editor: Robin Hansen, robin@hansennursery.com

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