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# EDIBLE BEGONIAS FROM THE NORTH OF PUEBLA, MEXICO<sup>1</sup>

FRANCISCO BASURTO-PEÑA, DELIA CASTRO-LARA, AND MIGUEL ANGEL MARTÍNEZ-ALFARO

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**Basurto-Peña, Francisco, Delia Castro-Lara, and Miguel Angel Martínez-Alfaro** (*Jardín Botánico, Instituto de Biología, Universidad Nacional Autónoma de México. Apartado postal 70-614, Coyoacán 04510, México, D. F. email abasurto@mail.ibiologia.unam.mx*). EDIBLE BEGONIAS FROM THE NORTH OF PUEBLA, MEXICO. *Economic Botany* 57(1):48–53, 2003. The Sierra Norte de Puebla, Mexico, is a region with biological and cultural diversity, where the use of local natural resources was increased by the relative isolation of the region until recent decades. There are more than 600 useful plants reported. In the Sierra Norte de Puebla at least six *Begonia* species are used as food. The objective of this paper is to report such species that are utilized for self-supply and for sale in local markets. The management includes gathering among wild populations, transplanting of rhizomes and vegetative propagation by leaves to establish and increase populations in home gardens and in coffee plantations.

BEGONIAS COMESTIBLES DE LA SIERRA NORTE DE PUEBLA, MEXICO. La Sierra Norte de Puebla es un espacio geográfico diverso desde el punto de vista biológico y cultural, donde el aprovechamiento de los recursos naturales es muy amplio. Se han reportado más de 600 especies de plantas usadas por los grupos humanos que la habitan. Entre las plantas útiles, las comestibles son unas de las más importantes en cuanto a número de especies. En la Sierra Norte de Puebla son utilizadas como alimento al menos seis especies de *Begonia* y el objetivo del presente trabajo es reportar estas especies, cuyos pecíolos son utilizados como alimento, con aprovechamiento para auto abasto y para venta en el mercado, con un manejo que incluye recolección en poblaciones silvestres, trasplante de rizomas y propagación vegetativa por plantación de hojas para establecimiento e incremento de las poblaciones en cafetales y huertos familiares.

**Key Words:** *Begonia*; edible plants; Puebla; Mexico.

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The Sierra Norte de Puebla is a diverse geographic area from biological and cultural points of view. The use of plant resources there has become enhanced because of the relative isolation of the region (until recent time). In this region, there exist the following vegetation types: tropical rain forest, mountain rain forest, *Pinus* and *Quercus* forests, and mixtures of the latter, these exhibit the impact of human activity over recent centuries.

The northern region of the State of Puebla has been inhabited for at least one millennium by Totonacs, Nahuas, Otomíes, Tepehuas and Mesquites (after the Spanish Conquest). More than 600 species of useful plants are reported from this area. Classified into anthropocentric categories, these can be medicinal, ornamental and

food plants, and another twenty categories (Martínez et al. 1995).

In the Sierra Norte de Puebla, there are about 200 species of plants that are used as food. Of these, about 80 are used as potherbs or “quellites.” Among these, 45 species are collected, 22 are tolerated and 32 are induced or planted (some species can have two or more types of management). These plants are grown in milpas, chilares (fields where chili pepper is grown), home gardens, coffee plantations, cattle ranches and acahuals, or sites with secondary vegetation. The Begoniaceae is one of the families with a great number of species consumed as “quellites” (Basurto, Martínez, and Villalobos 1998).

Begonias have been used as potherbs in Japan, India, Indonesia, and Myanmar (Burma) and in salads in China, Indonesia and Brazil. The roots and tubers of certain species have been used for colds, fever, fever sores, or stomachaches. Antibacterial properties have also

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been reported in New Guinea, Trinidad, India and Mexico (Breedlove and Laughlin 1993; Jain and Dam 1979; Johannes 1975; Laferriere 1990; Rao 1981; Roia and Smith 1977; Wong 1976). In Mexico there are reports of use of *Begonia* as food in historical sources (Acuña, 1996; De La Cruz 1552; Hernández 1942; Sahagún 1989), and at the present they are used in Chiapas, San Luis Potosí, Oaxaca and Veracruz (Alcorn 1988; Ibarra and Sinaca 1995; Katz 1990).

In the Sierra Norte de Puebla, agriculture is mainly of the traditional kind, with the use of manual tools or animal traction. It is performed by a scheme of multiple crops in which there are plant associations of annual with annual (as in the case of maize-bean), annual with perennial (as cornfield with fruit trees), or perennial with perennial (as the home gardens, and with some frequency coffee plantations) (Cruz 1995; Mapes, Basurto, and Bye 1997).

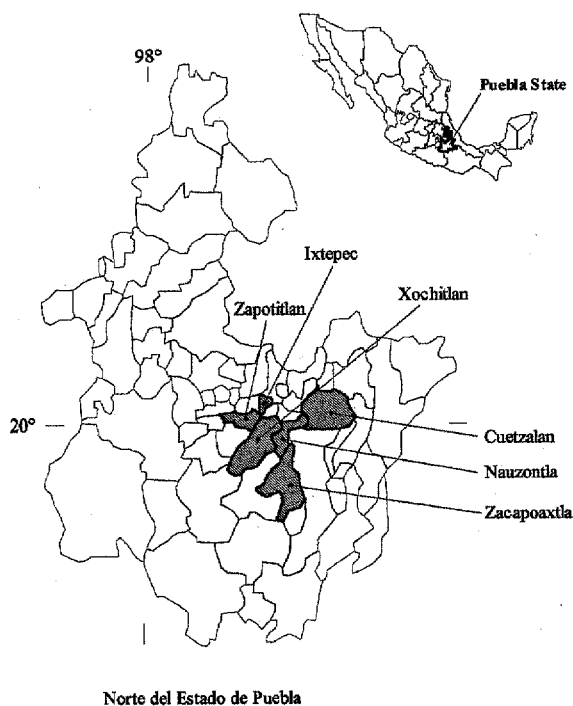
The use of the food plants includes wild species, weeds (agrestal or arvenses) and domesticated, in a continuum of management that goes from gathering, to cultivation, through tolerance and encouragement of useful plant populations in natural habitats as well as in agro habitats.

This scheme of management and use of the flora is a constant that is repeated along many regions of Mexico among several human groups (Bye 1979; Casas et al. 1996; Colunga, Hernández, X., and Castillo 1986; Davis and Bye 1982; Williams 1986;).

The objective of this paper is to report the *Begonia* species of which the petiole is used as food. The collection of these can be for self-supply or sale in local markets. The management practices can include gathering in natural populations, encouragement and propagation in situ by planting leaves, and transplanting individuals or rhizomes for their establishment in coffee plantations and home gardens where they would be more available, more often utilized, and more productive.

## METHODS

In the context of the ethnobotanical exploration that is being made in the Sierra Norte de Puebla for the study of the traditional agricultural systems (Hernandez X. 1971), the ethnobotany of the milpa has focused on the use of weeds and "quelites." Monthly visits were made during 1996 and 1997, to the study zone in the municipalities of Zacapoaxtla, Cuetzalan,



Norte del Estado de Puebla

Fig. 1. Zone of study.

Xochitlán, Nauzontla, Ixtepec and Zapotitlán de Méndez (Fig. 1) for recording the information concerning the use as of "quelites" food and the management; in this case the use of the genus *Begonia*.

The information was obtained from producers, merchants, and housekeepers by means of open interviews, and was complemented by visits to markets and field crops or gathering plots. The information included the local name of the plant and its meaning when they are names in native languages. We asked about the way that the begonias are prepared for consumption and their preferences for any particular species. We also investigated about the way the methods of collection, the collection sites, and whether some practice of propagation and management was followed and, if so, how it is done.

In the regional markets of Zacapoaxtla, Cuetzalan and Ixtepec, monthly visits were made throughout one year (April 1996 to March 1997) to record the presence and temporality of these plants, to determine the species of *Begonia* that are sold, their site of origin, and price to consumers.

In order to estimate the *Begonia* density in a coffee plantation and in two zones of natural populations, transects of 300 m were made in

TABLE 1. *BEGONIA* SPECIES USED AS QUELITE.

Species	Common name	Locality	Altitude (msnm)	Market	Habitat
<i>B. aff. barkeri</i>	Tepexocoyolli	Tahitic	1000–1200	Cuetzalan	Cloud forest
	Xocoyolli criollo	Xocoyolo		Zacapoaxtla	Acahuals
	Xocoyolli	Totolchan Huahuaxtla			Coffee plantations Home gardens
<i>B. fusca</i>	Xocoyolli cimarrón	Tahitic	1000–1200	Cuetzalan	Cloud forest
	Mazatxocoyolli	Xocoyolo		Zacapoaxtla	Acahuals Coffee plantations
<i>B. heracleifolia</i>	Xocoyolli	Tuxtla	800–1300	—	Cloud forest
	Pesoxocoyolli	Totolchan			Acahuals
	Spililixcutni	Huapalejcan			Coffee plantations
<i>B. incarnata</i>	Quiquiriqui	Zoatecpán	1600	—	Cloud forest
					Acahuals Home gardens
<i>B. manicata</i>	Tecosxocoyolli	Tahitic	800–1000	—	Cloud forest
	Mantecaxocoyolli	Tuxtla			Coffee plantations
	Stalangaxcutni				
<i>B. nelumbiifolia</i>	Xocoyolli	Zapotitlán Yancuictlalpan	500–800	—	Cloud forest Tropical rain forest Coffee plantations Acahuals

each site. Along each transect, three 100 m<sup>2</sup> (10 × 10 m) quadrants were established; one in Xocoyolo (Cuetzalan municipality), zone with natural populations, and two in Tahitic (Zacapoaxtla municipality), zone with natural populations and coffee plantations. The density of begonias (individuals/area) and the number of useful petioles per individual were recorded.

Because the distribution patterns of begonias are a consequence of environment factors and of human activity, the sampling was directed with the establishment of the quadrants along the transect in points where there are xocoyoli populations. The specie that grows on the referred sites is *B. aff. barkeri* Knowles and Wetsc. which is the most often sold on markets.

Collection of herbaria samples for botanical determination and back up of the information was made in the company of local informers in the plant's growing sites as well as in local markets. In these places we could locate different collecting sites for future visits. Vouchers were deposited at the Herbario Nacional of the Instituto de Biología in the Universidad Nacional Autónoma de México (MEXU). The data of density and the number of useful petioles/individual was analyzed with Analysis of Variance and a test of Tukey ( $P \leq 0.05$ ) (Olivares 1989).

## RESULTS

In the Sierra Norte de Puebla petioles of *Begonia aff. barkeri* Knowles and Wetsc., *B. fusca* Liebm., *B. heracleifolia* Cham. and Schldl., *B. incarnata* Link and Otto, *B. manicata* Cels. and *B. nelumbiifolia* Cham. and Schldl. are used as "quelite" or potherbs. *B. aff. barkeri*, *B. fusca* and *B. incarnata* are mainly found in semi-warm or temperate zones; *B. manicata* and *B. nelumbiifolia* are found in warmer zones; and *B. heracleifolia* ranges in an intermediate altitudinal gradient (Table 1).

These species are generally named "xocoyolli" or "agrios." The first name is derived from the nahuatl language and its meaning is sour heart, in totonaco language they are called "xcutni" that also means acid.

Some species are named by adding an epithet that makes reference to some morphological or ecological feature of the plants. For example, Tepexocoyoli means mountain-sour; Mazatxocoyoli means deer-sour; Pesoxocoyoli, badger-sour; Spililixcutni, spotted-sour; Stalangaxcutni, melting-sour; "Manteca xocoyoli" is softer; and "Xocoyoli cimarrón" is wild sour (Table 1).

The petioles of all these *Begonia* species are eaten. Additionally the foliar blade of *B. incar-*

*nata* is employed and prepared in dishes with pig. The foliar blade of *B. manicata* and *B. heracleifolia* can also be used in the making of "paxnikak," a dish made on the basis of "mafafa" (*Xanthosoma robustum* Schott) leaves.

The petioles are prepared by removing the cuticle. Subsequently, they are cut into little pieces and cooked in boiling water with sodium carbonate or a spoonful of the cooking stove ash. Some interviewed say that the petioles must not be boiled because they are destroyed instead they must be soaked in hot water, with several water changes. Once the petioles are cooked, they are drained, and washed. These may be added to the boiling beans with the "tequelite" (*Peperomia* spp) leaves, for preparing chili beans, or they are fried with lard, or cooked with eggs. The petioles can also be used as a substitute for husk tomato (*Physallis* spp.) in the making of some sauces. *Begonia* petioles can be consumed practically throughout the whole year, although there is a decline in production during the flowering period of these plants. This occurs from November to April. People interviewed said that the same plant can be harvested every two months.

The commercial xocoyolis are: *B. aff. barkeri*, *B. fusca* and *B. heracleifolia*. The former two are sold on local markets in Cuetzalan and Zacapoaxtla, and the latter is sold in some towns house by house. The remaining species *B. incarnata*, *B. manicata* and *B. nelumbiifolia*, are used only for self-supply.

Of the two species of xocoyoli that can be found on sale in the Zacapoaxtla and Cuetzalan markets, *B. aff. barkeri* is considered of better quality than *B. fusca* and is more abundant. Both begonias are sold in four to six petiole bundles 30 to 70 cm long at the rate of one to four bundles for \$1.00 Mexican peso (=USD \$0.10). The xocoyoli are also products subject to barter, in exchange for fruit or other articles and, according with some merchants, in one market day they can sell between \$50 (=USD \$5) and \$70 (=USD \$7) of xocoyoli. This xocoyoli have been collected the previous day or during the first hours of the day they are sold. These amounts add up to a monthly income of between \$200 (=USD \$20) and \$280 (=USD \$28).

The yearly average price of xocoyoli that is sold in the Cuetzalan and Zacapoaxtla markets is of \$6.13/100 g dry weight (=USD \$0.61/100 g dry weight) and \$5.85/100 g dry weight

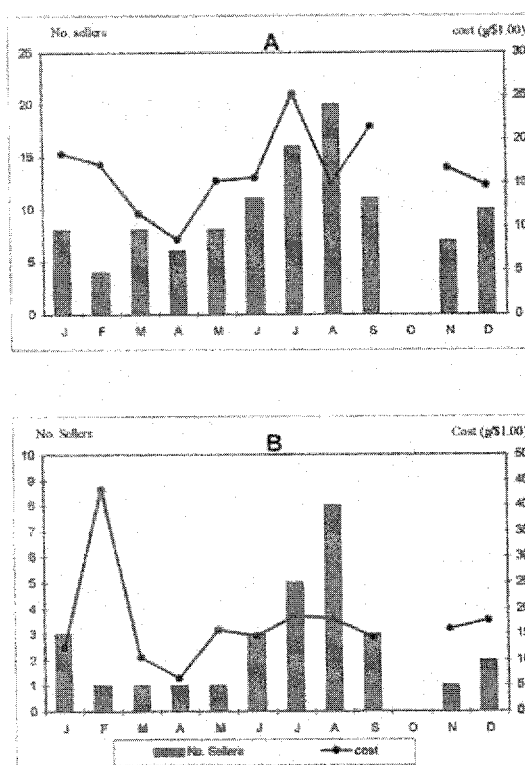


Fig. 2. Number of Sellers and Price to consumers of Xocoyolli in the markets of Cuetzalan (A) and Zacapoaxtla (B).

(=USD \$0.58/100 g dry weight) respectively. Such amounts of dry weight represent about 500 g fresh weight. The number of merchants ranges from zero through eight in Zacapoaxtla and from zero through twenty in Cuetzalan, throughout the different months of the year (Fig. 2).

There is some variation in the xocoyoli prices that are sold on the markets, depending on the season, although the sale unit is always \$1.00. The petiole number and of course the weight that is given for this amount varies notably, from four petioles when they are scanty to more than twenty when they are abundant; with a variation on fresh weight between 250 g and more than 1500 g.

Xocoyoli sales were recorded only in the two above mentioned markets, but not in the Ixtepec market, which is smaller and predominantly indigenous, unlike the former that are more crowded and with a high proportion of non-indigenous people as buyers.

Xocoyoli sold in Cuetzalan comes from two relatively close localities, located in the same municipality: Xocoyolo and Couatichan, where they are obtained by collecting from wild pop-

TABLE 2. XOCOYOLI DENSITY AND PETIOLE NUMBER USABLE IN TAHITIC, ZACAPOAXTLA AND XOCOYOLO, CUETZALAN, PUEBLA.

Collecting zone	No. individuals	Usable petioles	Petioles/individual
Tahitic			
Coffee plantation			
100 m <sup>2</sup>	33	179	5.4
100 m <sup>2</sup>	63	672	10.7
100 m <sup>2</sup>	48	318	6.6
Average	48a	390a	7.6a
Native vegetation			
100 m <sup>2</sup>	24	34	1.4
100 m <sup>2</sup>	28	102	3.6
100 m <sup>2</sup>	64	160	2.5
Average	39a	99b	2.5b
Xocoyolo			
Native vegetation			
100 m <sup>2</sup>	37	38	1.0
100 m <sup>2</sup>	15	26	1.7
100 m <sup>2</sup>	26	66	2.5
Average	26a	43b	1.7b

In each column, equal letters mean not significant difference; unequal letters mean significant difference.

ulations. Xocoyoli is taken to Zacapoaxtla from Tahitic, Zacapoaxtla municipality, and from Huahuaxtla, Xochitlan municipality. There plants are collected from wild populations, home gardens, and populations in coffee plantations. In all cases populations are maintained and increased by means of leaf planting. This practice is made during commercial collection season during which the foliar blade is discarded, since only the petioles are sold. Some of these foliar blades, with a little piece of petiole are planted singly or in groups of three in a small cavity that is made by removing handful of soil. This soil is deposited again over the planted leaf. This will produce a new individual in two months that can be harvested after approximately a year. Bowes and Curtis (1997) report a high percentage of explant regeneration and recovery of pot plants in *B. barkeri*.

The recorded xocoyoli density on the sampled quadrants is similar in coffee plantations and in natural growing areas, but the number of useful petioles per individual is significantly larger on coffee plantations (Table 2).

## DISCUSSION

Xocoyoli is a consumption article that can be obtained by self-supply or by buying it in local

markets. A quality scale can be recognized of the different species based on the xocoyoli acrid flavor intensity, texture, and aspect in such a way that the better species are those with a not very accentuated acrid flavor, soft to the taste and without scales or hairs in the petiole. According to this scale, comparing xocoyoli that grows in the same zone, *B. aff. barkeri* is preferred over *B. fusca* and *B. heracleifolia*, and *B. manicata* over *B. nelumbiifolia*. Some people say that *B. manicata* is the most tasteable xocoyoli, and of softer texture.

Variations on the price of xocoyoli in the markets depends on the supply and demand of the product. At the same time, its greater or lesser presence on the markets is determined mainly by the plant reproductive event, and by the number of sellers that are present at the markets. In months of less work on the cornfield (July and August) the number of sellers can become doubled or tripled with respect to the average (Fig. 2). This oversupply, along with the high production and xocoyoli collecting lowers the product's price.

Xocoyoli collecting and selling in the markets represents an income for a population sector, especially when there is no work on the cornfields. These activities yield an income in a critical time of the year. According to merchants references, the income from xocoyoli sales in the markets during one day per week could be from \$200 to \$280 a month, this amount represents between 42 and 52% of the total income of a month of work as agricultural laborer (based on a wage of \$20 (=USD \$2) at day working six days a week).

Management of these plants includes collecting, spontaneous population increase, transplanting, and cultivation on home gardens and coffee plantations. This is in relation with its value of change and its value of use. *B. incarnata* and *B. nelumbiifolia*, that are only for self-supply, are collected from spontaneous populations. *B. manicata* that is considered as a high quality xocoyoli, is not collected for commerce but is grown in home gardens and coffee plantations. *B. aff. barkeri*, *B. fusca* and *B. heracleifolia* are also collected for commerce. In addition, attempts are made to increase or at least maintain the populations with plant propagation techniques (like leaf planting and individual transplant to home gardens or coffee plantations, sites where they are closer and where it can be pos-

sible to give more care to the plants). This results in a greater number of usable petioles per individual (Table 2). This increase could be due to better conditions for plant development in the coffee plantations than in sites with spontaneous vegetation by elimination of the competition and predators and agro ecosystem fertilization. Also, selection processes of these plants could be occurring to satisfy human needs.

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