Jaltomata chihuahuensis (Solanaceae): A New Combination and Observations on Ecology and Ethnobotany

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ABSTRACT. The new combination Jaltomata chihuahuensis (Bitter) Mione & Bye is based on Saracca chihuahuensis Bitter. This species is distributed in Mexico at the northern end of the Sierra Madre Occidental in the states of Chihuahua, Durango, and Sonora. Morphological characters, artificial hybridizations, and distinct names applied by the Tarahumara, all indicate that J. chihuahuensis is distinct from the more widely distributed but sympatric J. procumbens. Fruits of J. chihuahuensis are consumed raw by the Tarahumara people and are either purple or green at maturity. Chromosome number: $n = 12$.

Jaltomata is a diverse genus of about 30 species of herbs and small shrubs that are distributed from Arizona, U.S.A., to southern Bolivia, on the Galápagos Islands, and in the Greater Antilles. This paper is part of ongoing series of studies of the taxonomy, phylogeny, breeding biology, and ethnobotany of this genus (D'Arcy et al., 1992; Davis, 1986; Davis & Bye, 1982; Knapp et al., 1991; Mione, 1992; Mione & Coe, 1992; Mione et al., 1993; Mione et al., 1994).

Ethnobotany. There are two races of Jaltomata chihuahuensis, one with purple fruits and the other with green fruits. Without mature fruits the two races appear to be morphologically indistinguishable. Based on greenhouse and garden studies of three accessions, we are certain that plants do not produce both types of fruits, nor do the mature green fruits become purple with age or exposure to sunlight. Information obtained (by R. B.) from the Tarahumara during ethnobotanical studies in Chihuahua, Mexico, agrees with these observations. Based on greenhouse studies, fruits of the purple race are typically green when they drop and then become purple within a few days.

The two races may occupy different niches. Preliminary observations (by R. B.) are that the greenfruited race tends to occur among white volcanic rocks in soil with higher apparent organic matter. The purple-fruited race, however, is not found among white volcanic rocks nor in soil with high organic matter. The rootstock ("camote") of the purple-fruited race is eaten by the Tarahumara (Davis & Bye, 1982: 232). Further study is needed to explore the possibility of niche specificity of the two races.

Jaltomata procumbens (Cavanilles) I. L. Gentry, a widespread species that is common within the smaller range of J. chihuahuensis, is generally called "rurusi," "ruwusi," or "rurusii" by the Tarahumara (e.g., Bye 9875, 9889, COLO; Davis 1124, 1127, MO; Brambila, 1976; Pennington, 1963). Jaltomata chihuahuensis, on the other hand, is often referred to as "metárusi" or "me'táresi" (which is a "jaltomate rastreo" or creeping jaltomate, Brambila, 1976); these names are probably derived from the Tarahumara verb "me'tárema" ("to be creeping"). Some Tarahumara believe "metárusi" to be a class of "rurusii" (Bye, unpublished). Thus the Tarahumara recognize the distinction between J. procumbens and J. chihuahuensis.

In most Jaltomata species, at maturity fruits remain attached to the parent plant for at least a few days, and the accrescent calyx darkens when the fruit ripens. The color of the calyx (purple to brown) stands in contrast with the foliage and presumably serves, along with the brightly colored fruit, as a beacon to diurnal fruit consumers/dispersers. However, the fruits of J. chihuahuensis fall at maturity and the calyx remains green. Unlike most species of Jaltomata, which exhibit articulation at the base of the pedicel, articulation is at the attachment of the fruit; the calyx-pedicel unit remains attached to the plant for at least several days after the fruit drops. Human selection may result in a change from fruits falling free of the parent plant in wild species to fruits remaining attached to the parent.
plant at maturity (e.g., the nonshattering rachis of domesticated cereals, Heiser, 1990). The consumption of fruits by the indigenous people, perhaps subjecting the plants to human selection, has not had this effect on J. chihuahuensis.

Fruits falling free at maturity is among the features of the syndrome of saurochory (reptile dispersal) (van der Pijl, 1969), and saurochory is thus a possibility for J. chihuahuensis, if not now then possibly prior to extensive utilization by humans. Alternatively, fruits falling free at maturity may indicate no adaptation for dispersal, and may merely have become fixed by genetic drift at some time when population size was small. In any case, fruits falling free at maturity suggests that this species is not regularly bird dispersed, although it is possible that birds feed on the fruits that have fallen to the ground. The Tarahumara Indians consume the fruits that fall to the ground, and it is likely that seeds survive the human digestive tract and so become dispersed by humans (Davis & Bye, 1982; Davis, 1986).

Humans have selected for light color in diverse domesticates (e.g., white lupines, quinoa, sheep, and camels) (Heiser, pers. comm.; Zeuner, 1963). It is thus possible that green-fruiting mutant(s) within J. chihuahuensis were selected by humans, giving rise to the green-fruit race. Evidence that may be considered as strengthening this scenario is that to humans green fruits are sweeter than purple fruits (Bye, unpublished). Alternatively, humans may have had nothing to do with the establishment of the green-fruit race but may merely have begun to regularly consume the fruits.

Phylogenetic placement. Based on chloroplast DNA restriction sites there are two principal, sister phylogenetic groups within Jalotmata (Mione et al., 1994). The “Mesoamerican” group, having its center of diversity in Mexico, is widely distributed from the southwestern United States to Bolivia. The “South American” group is distributed in Andean South America, the Greater Antilles, and the Galapagos Islands. Within the Mesoamerican clade the rarest and most morphologically distinct species, J. grandiflora (Robinson & Greenmann) D'Arcy, Davis & Mione, forms the most basal branch, and J. chihuahuensis forms the second to most basal branch (Mione et al., 1994).

Artificial hybridizations. Crosses were made in a pollinator-free greenhouse (by T. M.). Flowers used as pollen recipients were emasculated prior to anther dehiscence. No fruits were set from 18 crosses of J. procumbens with J. chihuahuensis (pollen source), nor from 12 of the reciprocal crosses. Two accessions of J. chihuahuensis were used (Bye 14243 green fruits, Davis 1180 purple fruits). Six accessions of J. procumbens from Mexico were used (Davis 11894, 1191, 1124, MO; Bye 9899, 10033, 10034, COLO), the latter four from Chihuahua. The following observations may be considered controls for the above crosses. Both J. chihuahuensis and J. procumbens abundantly self-set fruit in a pollinator-free greenhouse. Within J. chihuahuensis an uncounted number of interaccession crosses have been successful (for study of the genetic control of fruit color), and within J. procumbens interaccession and interaccession crosses virtually always result in fruit set.

Taxonomy. Jalotmata chihuahuensis has been considered to be a synonym of J. procumbens (Morton, 1938; Davis, 1986, discussed as the prostate morphform of J. procumbens; Nee, 1986). Our decision to recognize this species and make the following new combination was based on morphological characters of both living plants (in the greenhouse and garden as well as in the field) and herbarium specimens, artificial hybridizations, and chloroplast DNA (Mione et al., 1994). Chromosome counts of n = 12 were obtained for both J. chihuahuensis (Davis 1180) and J. procumbens (Bye 10033). Meioocytes were stained by crushing immature anthers with a fine dissecting needle in a drop of filtered acetic carmine.

On pressed specimens of Jalotmata chihuahuensis the fruit is usually partially hidden by the calyx, because on living plants fruits are pendent and the calyx (an upside-down, five-lobed funnel) hides the fruit from side view (Fig. 1). On pressed specimens of J. procumbens, however, the calyx is more likely to lie flat against the sheet because on living plants the fruiting calyx is rotate (Fig. 1). Table 1 compares selected morphological characters of J. chihuahuensis and J. procumbens. Based on hundreds of measurements made on plants grown during several years, these two species cannot be distinguished (due to overlapping ranges) with any one of the following characters: number of flowers per inflorescence, peduncle length, pedicle length, calyx diameter, corolla diameter, stamen length, anther length, style width at midlength, fruit length or width, or seed length.

Figure 1. Mature fruits of *Jaltomata chihuahuensis* (left, R. Bye 18329) and *J. procumbens* (right, R. Bye 10084). Photos taken in Connecticut from plants grown from seed collected in Chihuahua, Mexico. Bar = 1 cm.

Other specimens examined. **MEXICO. Chihuahua:***
Mpio. Bocoyna, Bocoyna valley, between Bocoyna and Credel, 2200 m, 13 July 1973, **R. A. Bye 4201H** (ECON); Credel, railroad crossing, 20 July 1973, **R. A. Bye 4295** (COLO); Credel and Rio Oteros, along the mesa ridge, 19 Sep. 1973, **R. A. Bye 5253** (COLO); Credel and San Ignacio, 7300', 15 Sep. 1973, **R. A. Bye 5689** (COLO, ECON, MEXU); Credel, 7200', 29 June 1977, **T. Davis 700** (MO); Credel, rd. from Credel to Casarare, 19 Aug. 1984, **T. Davis 1182** (MO); Gonogochic, 7400', 23 May 1973, **R. A. Bye 3832** (ECON); Gonogochic, 7400', 19 July 1973, **R. A. Bye 4286** (ECON); Gonogochic region E of Credel, 7400', 21 July 1973, **R. A. Bye 4309** (COLO, ECON); Gonogochic, 7400', 7 Sep. 1973, **R. A. Bye 4910** (ECON); Gonogochic, E of Credel, 2250 m, 13 Oct. 1980, **R. A. Bye 9865** (COLO); Gonogochic school, 12 July 1974, **R. A. Bye 6286** (COLO); Gonogochic, 2200 m, 12 Aug. 1977, **R. A. Bye 7931** (COLO, MEXU); Gonogochic, ejido San Ignacio Arareco, 2500 m, 17 Oct. 1980, **R. A. Bye 10007** (COLO, MO); Gonogochic, ejido San Ignacio Arareco, 2500 m, 23 Oct. 1980, **R. A. Bye 10094** (COLO, MO); Rio Oteros, 2194 m, 29 June 1977, **T. Davis 705** (MO); San Ignacio Arareco, near Credel airstrip, 7300', 9 Aug. 1972, **R. A. Bye 2699** (COLO, MEXU); San Ignacio, 17 Oct. 1977, **R.

<table>
<thead>
<tr>
<th>Character</th>
<th><em>J. chihuahuensis</em></th>
<th><em>J. procumbens</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit</td>
<td>prostrate</td>
<td>erect</td>
</tr>
<tr>
<td>Vesture</td>
<td>hirsute stems, leaves and buds</td>
<td>variable</td>
</tr>
<tr>
<td>Calyx (fruiting) color</td>
<td>green</td>
<td>green and purple</td>
</tr>
<tr>
<td>Calyx (fruiting) lobe shape</td>
<td>obtuse or obtuse-acuminate</td>
<td>triangular to broadly triangular</td>
</tr>
<tr>
<td>Corolla lobing</td>
<td>5 lobes</td>
<td>5 lobes alternatang with 5 lobules rotate</td>
</tr>
<tr>
<td>Position of corolla lobes during hermaphroditic phase</td>
<td>often retrorse</td>
<td>0° to 15°</td>
</tr>
<tr>
<td>Outward angle of filaments relative to style, during day of anther dehiscence</td>
<td>45°</td>
<td>45°</td>
</tr>
<tr>
<td>Mature fruit color</td>
<td>purple or green</td>
<td>black/dark purple</td>
</tr>
<tr>
<td>Time of fruit drop</td>
<td>at or just before fruit maturity</td>
<td>at least several days after fruit maturity</td>
</tr>
</tbody>
</table>

1 Specimens studied for this table were all collected in Chihuahua, Mexico.
2 Flowers are pistillate with very short filaments and undehisced anthers during their first day open. During the next day filaments elongate and anthers then dehisce, the flower becoming functionally hermaphroditic.

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Literature Cited


