

## ***Polianthes alboaustralis* (Asparagaceae, Agavoideae), a new species from the State of Oaxaca, Mexico**

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### **Abstract**

*Polianthes alboaustralis*, a new species endemic to the State of Oaxaca, Mexico, is described and illustrated. This species is morphologically similar to *Polianthes nelsonii*, which is distributed in Durango and Zacatecas, and *P. palustris* from Nayarit, but it differs from these by having larger leaves, first bract, inflorescence, anthers, and longer filaments; the perigone lobes are broadly ovate, the anthers are longer, and extrafloral nectaries are usually present. A dichotomous key to the species of *Polianthes* thus far described for the State of Oaxaca is included.

### **Resumen**

Se describe e ilustra a *Polianthes alboaustralis* como especie nueva, endémica del estado de Oaxaca, México. Esta especie es similar morfológicamente a *Polianthes nelsonii* con distribución en Durango y Zacatecas, y *P. palustris* propia de Nayarit, pero difiere de éstas por presentar hojas más largas, primera bráctea floral, inflorescencia, anteras y filamentos de mayor longitud; lóbulos del perianto anchamente ovados, anteras más largas y nectarios extraflorales generalmente presentes. Se incluye una clave dicotómica de las especies hasta ahora descritas para el estado de Oaxaca.

**Key words:** Agavaceae, Mixteca Alta, Sierra Madre del Sur

### **Introduction**

The type species of the genus *Polianthes* Linnaeus (1753: 316) *P. tuberosa*, was most likely described from plants already cultivated in Mexico during the pre-Cortesian period and introduced to Europe a few years after the Spanish conquest (Del Campo 1993). *Polianthes tuberosa* was one of the first Mexican ornamental plants known in Europe (Rzedowski 1995). However, all congeneric species have ornamental potential, and some are currently used for ceremonial purposes [*P. sessiliflora* Rose (1903: 10), *P. tuberosa* L. ‘Mexicana’, and *P. platyphylla* Rose (1903: 11)] (Solano 2000). *Polianthes longiflora* Rose (1903: 10) is used for medicinal purposes (Solano 2000).

According to Dahlgren *et al.* (1985), the genus *Polianthes* belongs to the family Agavaceae, although it has also been placed in Agapanthaceae (Endlicher, 1836–1840), Amaryllidaceae (Baker 1888, Rose 1899), and, most recently, in Asparagaceae, subfamily Agavoideae (APG III 2009). However, Stevens (2001, onward, 28 August 2013) recognizes that Asparagaceae *sensu* APG III is a family without morphological characteristics that define it and that some of its subfamilies have easily recognizable apomorphies, while the recognition is difficult in others. The author indicates that Asparagoideae, especially Nolinoideae and Agavoideae, are morphologically heterogeneous. In a nomenclatural review of the families of angiosperms, and considering the provisions of the Melbourne Code (McNeill *et al.* 2012), Reveal (2012) recognizes and accepts Agavaceae as a distinct family.

Based on morphological and molecular studies conducted by Hernández-Sandoval (1993, 1995) and Bogler & Simpson (1996), Thiede & Eggli (1999, 2001) transferred the species of *Manfreda* Salisbury (1866: 78), *Polianthes*, and *Prochyanthes* Watson (1887: 457) to the genus *Agave*; however, according to Hernández-Sandoval *et al.* (2008), it is preferred to treat *Polianthes* as a genus different from *Agave*.

Plants of the genus *Polianthes* are perennial herbs with a corm and bulb. Alternate, linear to lanceolate deciduous leaves, usually arranged in a basal rosette. Inflorescences in racemes or spikes like; usually geminate, rarely solitary flowers, tubular to infundibular and yellow, pink, orange, white, or with a combinations of these colors, six tepals, six stamens; a trilocular, inferior ovary. Capsular fruits, and black, shiny or opaque, ovate-depressed seeds (Solano 2000).

The genus *Polianthes* is endemic to Mexico. It is distributed from southern Chihuahua and southern Tamaulipas to south-central Oaxaca. The biogeographic provinces with the highest species richness are the Sierra Madre Occidental and the Trans-Mexican Volcanic Belt (Solano & Feria 2007), where six of the 14 native species that were recognized by Solano (2000) are found. The remaining species are divided between the following biogeographic provinces: Balsas River Basin, Mexican Pacific Coast, Mexican High Plateau, Tamaulipas, Sierra Madre Oriental, and Sierra Madre del Sur. In the latter provinces are distributed: *P. bicolor* Solano & García-Mendoza (1998: 473), *P. geminiflora* (Lex. 1824: 6) Rose (1903: 12) var. *clivicola* McVaugh (1989: 250), *P. geminiflora* (Lex. 1824: 6) Rose var. *geminiflora* McVaugh (1989: 250–251), *P. oaxacana* García-Mendoza & Solano (2007: 111) (Solano & Feria 2007), and, now, *P. alboaustralis* sp. nov.

The Sierra Madre del Sur has scarcely been explored from the botanical point of view, due to its rugged topography, lack of means for communication, and socio-political problems. The new species was collected for the first time in 2005, during a floristic study carried out in 2005, in Triqui-Mixteca Sierras, which is an area high in biotic diversity and rich in endemic species (García-Mendoza 2004).

## Materials and Methods

Herbarium specimens were prepared of plants belonging to the genus *Polianthes* that were collected during 2008 and 2009 in the Triqui-Mixteca Sierras of the State of Oaxaca, Mexico. Other *Polianthes* plants were completely fixed in formalin/acetic acid/alcohol (FAA), and the flowers were preserved in 70% alcohol. The vegetative and reproductive characteristics of dried and fixed specimens were evaluated. Some characters, such as the number of leaves in the rosette, leaf form, color, and smell of the flowers, were recorded in the field. To determine its status as a new species, the qualitative and quantitative characteristics were analyzed and compared with those belonging to other accepted species with white and fragrant flowers. In addition, the protoglosses and herbarium specimens of the morphologically similar species *Polianthes nelsonii* Rose (1903: 10) and *P. palustris* Rose (1903: 9) were reviewed, including the type specimens. The specimens were examined from the following herbaria FEZA, IEB, IBUG, MICH, MEXU, NY, UAMIZ, and US collections (acronyms according to Thiers 2014). Risk categories were based on Criterium D of the International Union for Conservation of Nature (IUCN 2001) and Criterium A of MER (Método de evaluación del riesgo de extinción, SEMARNAT 2002), according to estimates of the occupied area.

## Description of the new species

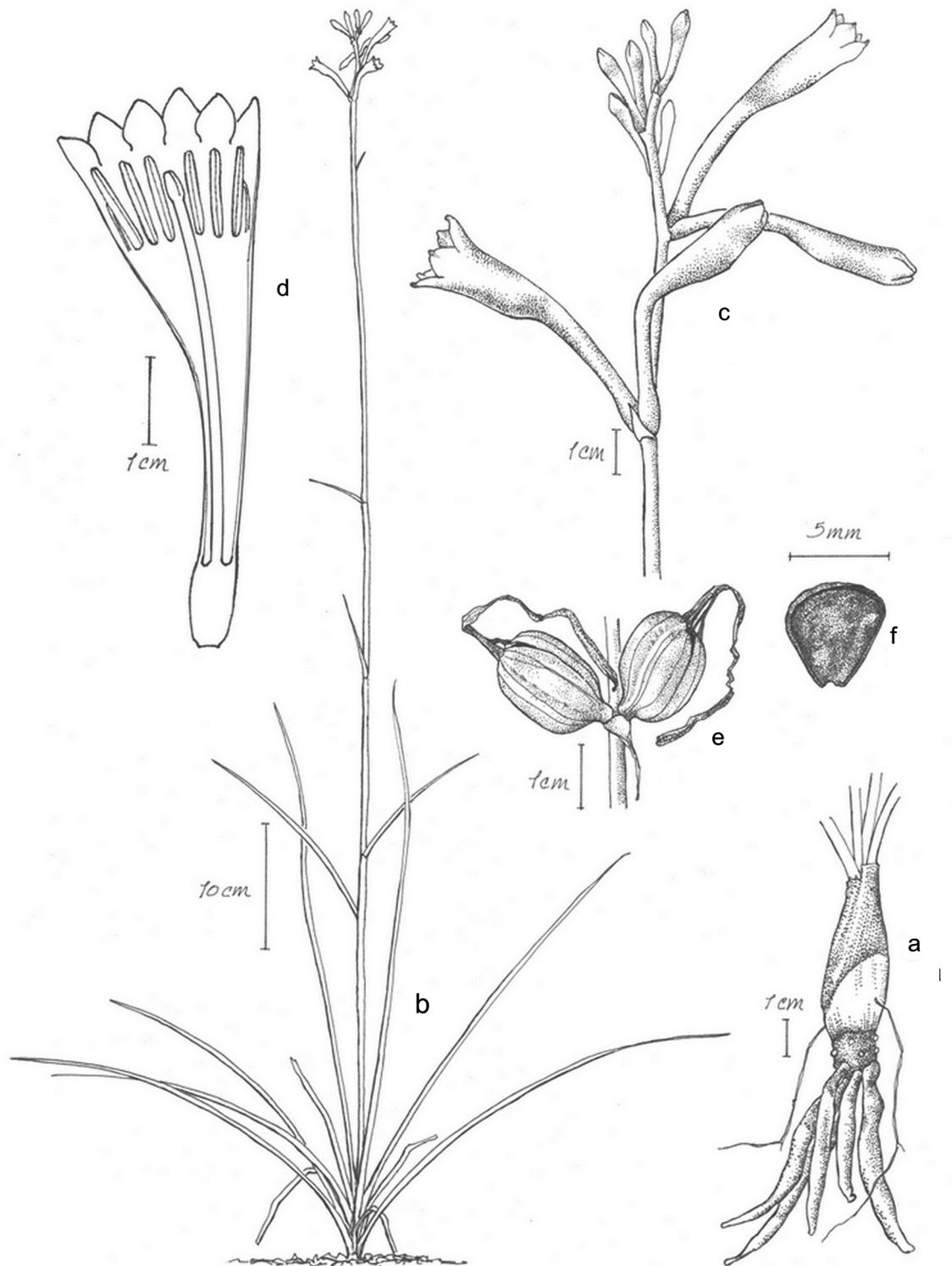
*Polianthes alboaustralis* E.Solano & Ríos-Gómez, sp. nov. (Fig. 1, 2).

This species is morphologically similar to *P. nelsonii* and *P. palustris*, but it differs from these by its longer leaves, longer sterile primary bract, and its much longer inflorescences (36–63 cm, 29–56 cm, and 94–160 cm, respectively), as well as its extrafloral nectaries that are usually present in the widest part of the tube, its broadly ovate lobes (Table 1).

**Type:**—MEXICO. OAXACA: Distrito Putla, municipio Putla Villa de Guerrero, 33 km al NE de Putla, carretera Putla-Tlaxiaco, 17° 11' 12" N, 97° 53' 00" W, 6 agosto 2009, 1945 m, E. Solano y R. Ríos, 2516 (holotipo, MEXU!, isotipes, CHAPA!, IEB!, UAMIZ!, FEZA!, OAX!).

Perennial herbaceous plant. Corm 1.5–3.6 × 1.0–2.2 cm, cylindrical, with growthbuds and thickened contractile roots. Bulb 1.7–4.0(–6.0) × 1.3–3.5 cm, ovoid, and covered by the bases of dried leaves. Leaves 2–6 per rosette in fertile plants; alternate, 36–63 cm × 0.4–0.7 cm, linear, cartilaginous, apex acute, thickened, margin papillose-toothed, upper and lower surface with papillae, unevenly distributed over the veins. Inflorescence spike-like, 94–160 cm long, internodes decreasing in size towards the distal portion, with 3–7 floral nodes; first sterile bract 29–56 cm × 0.3–0.8 cm, linear, margin papillose-toothed, apex acute, thickened, base truncated, fertile portion 7–25 cm, first floral bracts 4–34 mm × 2–10 mm, lanceolate or ovoid, flowers at base with two bracteoles, 0.7–3.0 mm × 0.3–2.0 mm, ovoid, margin hyaline, entire, base truncated, apex acute or acuminate. Flowers sessile, geminate, white at anthesis, white-pink at senescence, succulent, aromatic; mouth of tube regular, diffuse to divaricate at anthesis; perigone tube

4–6 cm × 0.4–0.8 cm at the base of the lobes, curved almost in half and subsequently infundibular, with widening between the curvature of the tube and the base of the lobes, broadest part usually with extrafloral nectaries, internal and external lobes much shorter than the tube, extended, apex pink, purplish, or reddish, succulent, papillose on both sides, almost equal, 2–6 × 2.0–3.7 mm, broadly ovate, margin hyaline; apex cucullate, obtuse to rounded, papillose. Stamens included, filaments white, filiform, 2–10 mm from their insertion into the perigon tube, inserted 3–6 cm above the apex of the ovary; anthers 5–10 × 1–2 mm, linear, yellow to green-yellowish, in anthesis surrounding the mouth of the tube. Style 3.9–4.5 cm, filiform, white, included at anthesis; stigma trilobed, papillose; ovary 4–10 × 1.5–3.0 mm, cylindrical. Fruit a loculicidal capsule, 1.6–2.3 × 1.0–2.1 cm, globose, crowned by the remains of the dried perigone. Seeds 5–6 × 4–5 mm, ovate-depressed, flat, black, and opaque (Figs. 1 and 2).



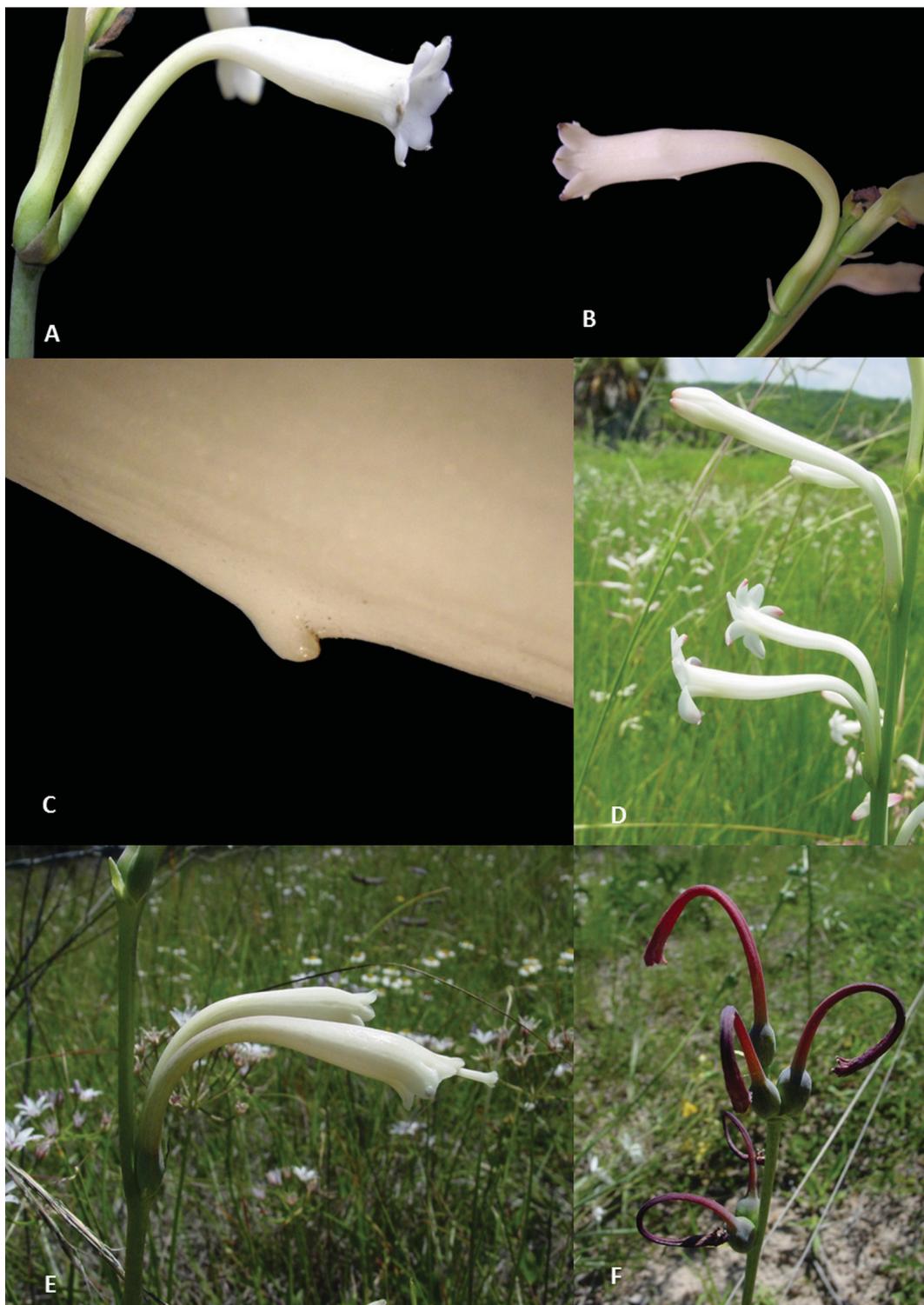
**FIGURE 1.** *Polianthes alboaustralis*. a) Contractile roots, corms with growth buds and bulb, b) complete plant, c) inflorescence, d) dissected flower, e) fruit, and f) seed. Illustration by Elvia Esparza.

**TABLE 1.** Morphological comparison of *Polianthes nelsonii*, *P. palustris*, and *P. alboaustralis*. Data from *P. nelsonii* are from Solano (2000), and those of *P. palustris* are from the protologue (Rose 1903), from the type specimen (US!) and from A. Rodríguez and A. Castro-Castro 5796 (IBUG!, FEZA!).

Character	<i>P. alboaustralis</i>	<i>P. nelsonii</i>	<i>P. palustris</i>
Corm	1.5–3.6 × 1.0–2.2 cm	1.2 × 1.0 cm	0.5 × 1.6 cm
Bulb	1.7–4.0(–6.0) × 1.3–3.5 cm	1.0–3.0 × 0.6–1.5 cm	3.0 × 2 cm
Number of leaves per rosette	2–6	(2–)4–5(–7)	2–6
Leaves	36–63 cm × 0.4–0.7 cm	12–26(–29) cm × 0.1–0.7 cm	20–30 × 1.2–1.5 cm
First sterile bract	29–56 × 0.3–0.8 cm	(3.5–)7.0–20.0 × 0.1–0.5 cm	17 × 0.7 cm
Inflorescence	94–160 cm	(20–)25–54(–61)	37–58 cm
Number of fertile nodes	3–7	(1–)2–6	3–8
Nectaries in the widest part of the perigone tube	Generally present	Absent	Absent
Perigone tube	4–6 × 0.4–0.8 cm	3–6.6 × 0.2–0.5 cm	3–6 × 0.4 cm
Color of senescent flowers	White-pink	Red	White-pink
Mouth of the perigone tube	Regular	Irregular	Irregular
Lobes of the perigone tube	2–6 × 2.0–3.7 mm, broadly ovate, extended	2–5 × 1.5–4.0 mm, ovate, erect	5–6 × 3–4 mm, ovate, extended
Filaments	2–10 mm	3–9(–16) mm	1 mm
Insertion of the filaments from apex of the ovary	3–6 cm	2.5–5.0(–6) cm	4 cm
Anthers	5–10 mm	4.5–8.0(–9.0) mm	7 mm
Style	3.9–4.5 cm, included in anthesis	3.5–6 (–7.3) cm, generally exserted in anthesis	3.5 cm included in anthesis

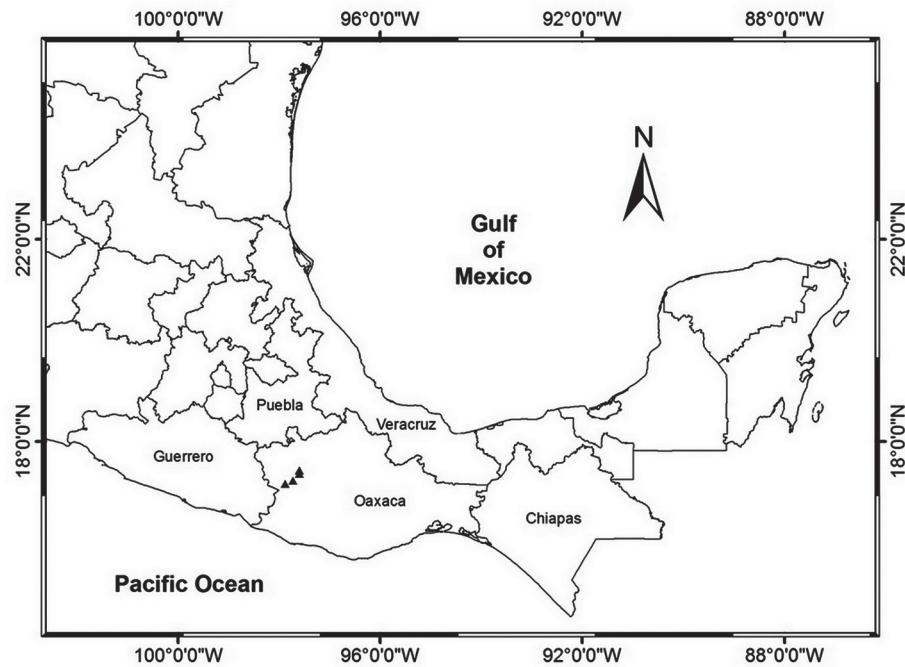
**Distribution and habitat:**—*Polianthes alboaustralis* is the only species of the genus with fragrant and white flowers, that is distributed south of the Trans-Mexican Volcanic Belt. It grows in restricted areas in the western part of the State of Oaxaca, in the districts of Tlaxiaco and Putla and most likely Juxtlahuaca, on the Sierra Madre del Sur (Fig. 3), in *Juniperus* Linnaeus (1753: 1038) forests, montane cloud forests, and *Quercus* Linnaeus (1753: 994) and *Pinus* Linnaeus (1753:1000) forests, with *Bidens* Linnaeus (1753: 831), *Calochortus* Pursh (1814: 240), *Cuphea* Browne (1756: 216), *Desmodium* Desvaux (1813: 122), *Dahlia* Cavanilles (1791: 56), *Echeandia* Ortega (1800: 135), *Mimosa* Linnaeus (1753: 516), *Passiflora* Linnaeus (1753: 955), *Penstemon* Schmidel (1762: 2), *Salvia* Linnaeus (1753: 23), and *Tagetes* Linnaeus (1753: 887). It grows in black or brown Leptosol soils with a texture that is sand loam, loam or clayey, and also in clayey chromic Luvisols. The elevation is 1945 to 2130 m.

**Phenology:**—*P. alboaustralis* flowers from August to September and fruits from September to October.



**FIGURE 2.** *Polianthes alboaustralis*: A. Flower, B. Perigone with extrafloral nectary, C. Detail of the nectary. D. *P. palustris*. E, F. *P. nelsonii*: E. Flowers during anthesis, and F. Senescent flowers (Photos: Eloy Solano, A, B and C; Aarón Rodríguez, D, E and F).

**Additional specimens examined (paratypes):**—MÉXICO. Oaxaca: Distrito Tlaxiaco, Mun. Santa María del Rosario, 3–5 km al NE de la desviación a Santa Catarina Tayata, [17° 22' 10"N, 97° 36' 01"W], 2322 m, 13 agosto 2009, E. Solano y R. Ríos 3162 (CHAPA!, IEB!, FEZA!, MEXU!, UAMIZ!); Mun. Heroica Ciudad de Tlaxiaco, 2 km después de Tlaxiaco, sobre la carretera 125 hacia Putla, [17° 13' 32"N, 97° 43' 10"W], 2037 m, 5 agosto 2008, E. Solano y R. Ríos 2512 (CHAPA!, IEB!, FEZA!, MEXU!, UAMIZ!); Mun. San Pedro Mártir Yucuxaco, Llano Grande, carretera 125 Yolomecatl-Tlaxiaco, [17° 25' 29"N, 97° 35' 47"W], 2130 m, 26 agosto 2008, E. Solano y R. Ríos 2511, 2610 (CHAPA!, IEB!, FEZA!, MEXU!, UAMIZ!).



**FIGURE 3.** Geographic distribution of *Polianthes alboaustralis*.

**Etymology:**—The specific epithet refers to the white color of the flowers and the southern geographical distribution of this species (*albus* = white, *australis* = southern).

**Uses:**—In the Tlaxiaco district, the inflorescences are used for ceremonial purposes in the adornment of altars.

**Taxonomic relationships:**—According to Solano & Feria (2007), species of the genus *Polianthes* with white and fragrant flowers are distributed along the Trans-Mexican Volcanic Belt biogeographic province and towards northern Mexico, mainly in the northwestern portion, and, less frequently, in the northeast, in the Sierra Madre Occidental and Sierra Madre Oriental biogeographic provinces. No species of the genus *Polianthes* with the above characteristics were previously known from the southern part of the Trans-Mexican Volcanic Belt province which, according to Morrone (2010), is a center of diversification, endemism, and biogeographic transition for many taxa. *Polianthes alboaustralis* is the first record with white and fragrant flowers that is distributed to the south of this biogeographic province, occurring the western part of the State of Oaxaca, in the districts of Tlaxiaco and Putla, and most likely Juxtlahuaca. The Trans-Mexican Volcanic Belt has functioned as a physical and climatic barrier for the dispersal of this species and other genera of plants. All *Polianthes* south of the chain are endemic to the area. One of them, *Polianthes bicolor*, has orange flowers with green perigone lobes, while *P. oaxacana* has flowers that are yellowish-pink; both species are endemic to the State of Oaxaca (Solano & García-Mendoza 1998; García-Mendoza & Solano 2007). *Polianthes alboaustralis* grows sympatrically with *P. bicolor*, but they differ in their flowering time. The new species described here belongs to the subgenus *Polianthes* due to its spike-like inflorescences and white and fragrant flowers (Solano 2000). Within this subgenus, *P. alboaustralis* has longest corms and bulbs and largest leaves and inflorescences; its extrafloral nectaries, which are located in the second third of the floral tube, are noteworthy. This type of nectary is described here for the first time for the genus.

**IUCN conservation status:**—The conservation status is VU (Vulnerable) in accordance with the D2 criterium of the IUCN (2001) because *Polianthes alboaustralis* covers a surface area of less than 4 km<sup>2</sup>. It is restricted to four localities in the western part of the State of Oaxaca, forming localized populations with few individuals in disturbed habitats that are near roads and rural or urban areas.

**MER conservation status:**—The MER conservation status is T (Threatened). *Polianthes alboaustralis* covers a surface area of less than 5% of the Mexican territory (SEMARNAT 2002).

#### Identification key to *Polianthes* from the State of Oaxaca.

1. Perigone orange or orange-yellow, non-fragrant; inflorescence a raceme or spike-like; flowers 2–5.2 cm long.....2
- Perigone white, fragrant; inflorescence spike-like, flowers 4.0–6.6 cm long .....*P. alboaustralis*

2. Inflorescence a raceme; flowers 2–2.6 cm long, perigone tube slightly widened between the curvature and the base of the tepals; perigone tube orange, perigone lobes green ..... *P. bicolor*  
 - Inflorescence spike-like; flowers 4.5–5.2 cm long, perigone tube abruptly widened between the curvature and the base of the tepals; perigone tube pink on the exterior, yellowish inside ..... *P. oaxacana*

## Acknowledgements

Abisaí García-Mendoza and Aarón Rodríguez reviewed the final manuscript and made important comments that substantially improved it. Elvia Esparza prepared the illustrations, and Miguel Rivera the map of the geographical distribution. Aarón Rodríguez provided the photographs of *Polianthes nelsonii* and *P. palustris*. The authors also thank the IEB, IBUG, MICH, MEXU, NY, UAMIZ, and US herbaria for the consultation of their specimens. This project was funded by DGAPA PAPIIT, UNAM, Contract IN225210.

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