

# The littlest lophophora



February 2007 found us on yet another botanical expedition to Mexico, a never-ending treasure chest of exciting cactus species. While exploring the northern regions of the state of San Luis Potosí, we came across a truly extraordinary cactus locality where *Ariocarpus kotschoubeyanus* and the long-sought and highly prized *Mammillaria coahuilensis* (aka *Porfiria schwarzii*) grew side by side. Before we could recover from our shock at this lucky encounter, we discovered another unexpected marvel, *Coryphantha hintonianorum*, and, dazed by this multitude of successes, we were preparing to leave when our expedition colleague Grzegorz Matuszewski called us over to look at a small lophophora he had found. We must thank him for his persistence!

We hesitated at first to put a name to these plants, as they appeared to be too young (and small) to

clearly identify. We imagined they might be seedlings of *Lophophora williamsii* (the famous peyote plant) and set out looking for larger specimens. But with each tiny plant we found we became increasingly convinced this was something unusual, especially when, in slightly different terrain close by, we came across a large population of typical *L. williamsii* similar to the form from El Huizache.

Our new lophophora was in full bloom a few days later, and the appearance of the flowers indicated that they were related to *L. koehresii*, not *L. williamsii*, as we had first surmised. As with *L. koehresii*, the flower color ranged from almost white to pale pink with a darker midstripe inside each tepal, and other details of the flowers—length of the style, shape of the flower. Its size, and number of tepals—followed suit. But the puzzle was not complete, as here tips of the tepals tended to be rounded, and in exceptional cases were perfectly round, which is unusual in the *Diffusae* sec-

◀ Specimens of the miniature peyote, *Lophophora alberto-vojtechii*, that occur in the plains of northern Zacatecas are lighter flowered than those at the type locality. Plants wither and pull into the ground for protection during long dry spells. ▼ This is the first plant of *Lophophora alberto-vojtechii* discovered at the type locality. The stem color is similar to *L. williamsii*, but its miniature size at first had us searching for larger, mature plants.

J Šnicer





## THE SPECIES OF LOPHOPHORA

*Lophophora*, the infamous peyote cactus, is widely distributed throughout northern Mexico and extreme southern USA, and it is therefore not surprising that it is so variable. Recent work has expanded the number of species recognized to five, divided between two basic groups. These groups differ significantly in the composition of their alkaloids (chemicals contained in plant sap). The first group is called the *Lophophora* section, where the concentration of the psychotropic (mind-altering) alkaloid mescaline ranges from 15–30% of the total alkaloid content. Members of second group, *Diffusae*, contain a maximum of 1.3% mescaline.

Section *Lophophora* contains only one species:

*Lophophora williamsii*, with all its various forms. *Diffusae* contains *L. diffusa*, *L. fricii*, *L. koehresii*, and, provisionally, the new, miniature species, *L. alberto-vojtechii*.

## SECTION LOPHOPHORA

*L. williamsii* (SALM-DYCK) COULTER

## SECTION DIFFUSAE

*L. diffusa* (CROIZAT) BRAVO

*L. fricii* HABERMANN

*L. koehresii* (J. ŘÍHA) BOHATA, MYŠÁK & ŠNÍČER

*L. alberto-vojtechii* J. BOHATA, V. MYŠÁK & J. ŠNÍČER

tion. Indeed many details—the plants' unusually small size, most notably—pointed to the possibility that this was a new species, which we've named *L. alberto-vojtechii*.

## Relationships

*L. alberto-vojtechii* shares with *L. koehresii* the same type of habitat, the same form of growth, the same shape of the body and fruit, the same composition and color of the flowers, and the

same tendency to lose its trichomes as the areoles age and radiate from the apical meristem. It differs from *L. koehresii* in being smaller in stature, having fewer ribs, and bearing differently shaped flower buds. Moreover, the color of the aerial part of its stem can be mauve or greenish violet, colors commonly found in *L. fricii* or *L. williamsii*, but never in *L. koehresii*, which has a bold, dark green epidermis. Moreover *L. koehresii* grows more than 100 km to the southeast of our new find. Microscopically, *L. alberto-vojtechii* seeds are distinctive as well, with a broadly V-shaped hilum, nodulated testa, and with the outer cell walls protruding and individual testa cells clearly demarcated compared with those of *L. koehresii*. *L. alberto-vojtechii* is somewhat similar to *L. fricii* in the shape of the flower buds and the color of the epidermis, but differs from that species in the size and structure of the stem, preferred habitat, shape and color of the fruit, and morphology of the seed surface. For all these differences, our find was described as new to science in a recent issue of *Cactus & Co.*

These plants are incredibly tiny. Many start flowering when they are only 10 mm in diameter, and specimens more than 25 mm wide are exceptional, which is perhaps why they are almost always divided into only five (often indistinct) ribs. In contrast, all other *Lophophora* species from section *Diffusae* support more ribs—as many as 21. The

number of ribs clearly depends on the size of the body, in keeping with the concept of the Fibonacci series (1, 1, 2, 3, 5, 8, 13, 21...) as a space-filling function. It is hard to imagine that more than five ribs could fit on such a small plant. Nevertheless, in exceptions cases *L. alberto-vojtechii* may have eight ribs.

▶ *Lophophora alberto-vojtechii*, here being photographed by Vojtěch Myšák (for whom the plant is named) in northern Zacatecas, rarely exceeds 2.5 cm (1 inch) in diameter.



Z Jiruše



J. Sinceri

**TOP LEFT** A typical specimen of *Lophophora alberto-vojtechii* at the type locality in San Luis Potosí. Out of flower it would be hard to find. **TOP RIGHT** The *L. alberto-vojtechii* flower, here in Zacatecas, has wide and markedly rounded tepals, a trait otherwise uncommon in the *Diffusae* section of the genus. **BOTTOM LEFT** Beautifully colored flowers can be found at the type locality. The two-peso coin is 23 mm in diameter. **BOTTOM RIGHT** In Zacatecas flowers can on rare occasion reach over 3 cm in diameter, totally obscuring the plant below.

Although these plants flower (with multiple flowers in a single wave), and are thus mature, they are completely bare of trichomes. Silky hairs *are* produced, but they're deciduous, falling from the areoles shortly after being formed. We normally associate woolly areoles with mature lophophoras, so flower buds emerging from the center of such a smooth, tiny stem look a bit odd, because the plant appears to be immature. But that immaturity (or juvenility, if you prefer) is merely an illusion. The age of the plants is readily revealed by inspection of the underground parts of the

stem. As the areoles grow out radially, their remnants accumulate at the stem's base, and hence give some indication of the plant's age. The tiny plants found in habitat are certainly not young, yet they remain small.

## Ecology and companion succulent flora

Our mini-peyote is found growing in flat, alluvial sediments, which transform during rain periods into greasy mud flats. *L. alberto-vojtechii* has a distinctively geophytic lifestyle: in dry periods it

### KEY TO THE SPECIES OF *LOPHOPHORA*

- 1 15–30% mescaline in total alkaloids, epidermis tough and thick ..... Section ***Lophophora***, *L. williamsii*
- 1 Maximum 1.3% mescaline in total alkaloids; thin, fine epidermis ..... Section ***Diffusae***, 2
- 2 Seed hilum wide (almost circular), testa not nodulated but reticulated ..... ***L. koehresii***
- 2 Seed hilum V-shaped, testa nodulated (outer cell walls protruding), individual testa cells clearly demarcated ..... 3
- 3 Usually five (rarely eight) ribs, stem solitary in nature, miniature (rarely exceeding 25 mm in diameter) .... ***L. alberto-vojtechii***
- 3 Up to 21 ribs, stem solitary or branching in nature ..... 4
- 4 Flowers dirty white with touch of yellow (rarely pinkish); fruits white to dark pink, usually pale pink; occurring in Queretaro, Mexico ..... ***L. diffusae***
- 4 Flowers usually light pink to dark purple-pink, also white; fruits pink to dark purple-pink (when flower is white the fruit is always dark purple-pink); Coahuila, Mexico ..... ***L. fricii***



## AN EXPANDED DESCRIPTION OF *LOPHOPHORA ALBERTO-VOJTECHII* J. BOHATA, V. MYŠÁK & J. ŠNÍČER

**The stem** is grayish green with a touch of mauve and is for the most part concealed below ground. The aboveground part (the crown) is flat to slightly convex and 10–50 mm wide in adult plants (average 18 mm, well under an inch). The subterranean part of the stem is cylindrical, extending 25 mm down from the base of the crown (the depth in adult plants increasing with age). The stem is distinctively small and divided into five ribs, or eight in exceptional cases. Trichomes (fine epidermal outgrowths which might be called fuzz or hair) are visible only near the growing point and drop off early, leaving the areoles inconspicuous. The **root** is thick and bulbous, up to 30 mm long, and typically 16 mm in diameter where it joins the subterranean stem. It is smooth and a dirty white to creamy yellow color.

**The flower** is 15–35 mm (average 23 mm) wide. The style is longer than anthers and overtops them, and the petals are long relative to their width, both traits in accord with other members of the *Diffusae*. Filaments are white, anthers a yellowish orange. The style is white and topped by a white to yellowish or pinkish stigma. Tepals are white to dirty pink, rarely creamy yellowish, and bear a lengthwise stripe in a brownish, salmon, or darker pink shade. The **fruit**, dirty white, yellowish, or pinkish, is round to slightly claviform and dries out over time. **Seeds** are black, round, 1.15–1.45 mm long × 1.0–1.45 mm wide with the hilum compressed into a broad V-shape. The perimeter of the hilum consists of a pronounced edge. The testa is nodulated, and individual cells of the testa are clearly demarcated.

**Type locality:** northern San Luis Potosí, Mexico, 1700 meters above sea level. The type specimen was collected by GS Hinton on 1 August 2007 and is kept at the GB Hinton herbarium filed under number 28642.

We have named the plant *Lophophora alberto-vojtechii* in honor of two people: the late prominent Czech traveler and cactus-hunter Alberto Vojtěch Frič and the living lophophora enthusiast Vojtěch Myšák.

withers and withdraws into small cavities below ground, where wind covers them over with dust and dry leaves, which protect the plants from harsh sunlight. When rains arrive, the plants absorb water and swell, pushing the photosynthetic crown back up above ground level.

The succulent community at this locality is unique in composition, though clearly associated with the flora of the Matehuala region. Most surprising among the companion cactus flora are *Coryphantha hintoniorum* and *Mammillaria coahuilensis*, which are rare and totally unexpected

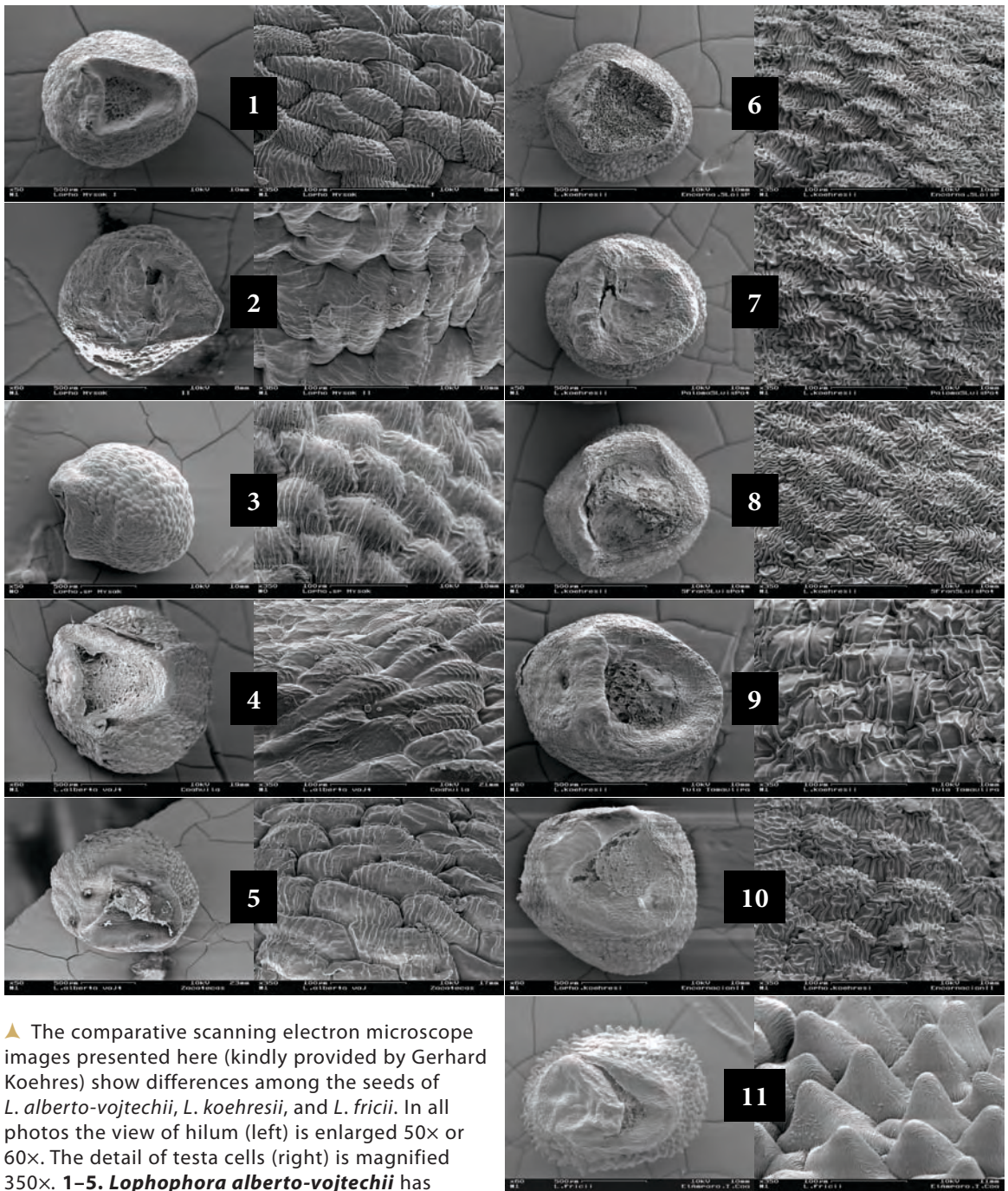
here. *Mammillaria coahuilensis* was previously known only from distant areas of Coahuila state, such as at Laguna de Meyrán, and there are no published reports of it appearing so far to the south. Interestingly, *Mammillaria coahuilensis* has a flower so similar to that of *L. alberto-vojtechii* in shape, color, and size that it is impossible to tell which is which at first glance. The two even flower at the same time, and it is therefore likely that both are oriented towards the same pollinator. *Coryphantha hintoniorum* usually grows in sandy-loamy alluvial plains associat-

▼ **LEFT** *Mammillaria coahuilensis*, previously known only from distant areas of Coahuila state, is a common companion plant at the type locality of *L. alberto-vojtechii*. These two species have nearly identical flowers, so that they are impossible to distinguish from a distance. This probably indicates that they are oriented toward the same pollinator. **RIGHT** Three insects (two bees, one large and one small, and this odd creature, an unidentified diptera) have been observed visiting flowers of *Lophophora alberto-vojtechii*. This plant, from the second-known locality in San Luis Potosí, has exceptionally numerous tepals.

Photos by V Myšák except where indicated.







▲ The comparative scanning electron microscope images presented here (kindly provided by Gerhard Koehres) show differences among the seeds of *L. alberto-vojtechii*, *L. koehresii*, and *L. fricii*. In all photos the view of hilum (left) is enlarged 50x or 60x. The detail of testa cells (right) is magnified 350x. **1–5. *Lophophora alberto-vojtechii*** has round black seeds, 1.15–1.45 mm long and 1.0–1.45 mm wide. The hilum (the scar where the seed was attached to its base) is compressed into a broad V shape. The perimeter of the hilum consists of a pronounced edge. The testa is nodulated with the outer cell walls protruding. The individual cells of the testa are clearly demarcated. Seeds shown are from type locality in San Luis Potosí (1–3), Coahuila (4), Zacatecas (5). **6–10. *Lophophora koehresii*** has a seed testa structure completely different from the other lophophoras. The hilum is open and almost circular. The testa is reticulated, not nodulated. The individual cells of the testa almost merge. The seeds shown are from San Francisco (8), Encarnación (6, 10), and Palomas (7), San Luis Potosí; and Tula (9), Tamaulipas. **11. *Lophophora fricii*** (El Amparo, Coahuila) has oval seeds, 1.5 mm long and 1.2 mm wide, with the hilum compressed into a V shape. The testa is black, coarsely nodulated, and has an oval tubercle structure with tubercles becoming smaller near the hilum. The individual cells of the testa are clearly demarcated.





J. Šnicher

The aerial part (photosynthetic crown) of the *L. alberto-vojtechii* stem (a) is flat to slightly convex. The cylindrical subterranean part of the stem (b) can be very long. The root (c) is bulbous.

ed with the grass communities of Nuevo León to the southwest. In addition we found *Ariocarpus kotschoubeyanus* ssp *kotschoubeyanus*, *Ferocactus pilosus*, *F. hamatacanthus*, *Mammillaria heyderi* ssp *heyderi*, *Echinocereus enneacanthus* ssp *enneacanthus*, *Ancistrocactus uncinatus* ssp *uncinatus*, and *Opuntia moelleri* growing in close association with *L. alberto-vojtechii*.

We spent our trips in 2008 and 2009 searching for further populations of *L. alberto-vojtechii*. It now appears that this new species is relatively widespread. Several new localities were discovered: one in the state of San Luis Potosí, two in Zacatecas, one in Coahuila, and one in Nuevo León. The plants were similar at all localities. The largest plant found, a completely exceptional specimen, was 5 cm in diameter. The primary difference we found among these populations was in flower color, with flowers at the newly discovered populations tending to be lighter than those at the type locality. These localities were pockmarked with holes left by dead plants (mostly *Ariocarpus kotschoubeyanus*, but also our

new lopho), which we assumed to have perished after being injured by rodents or insects. We also found plants flowering on days when morning temperatures had fallen to  $-3^{\circ}\text{C}$ .

In order to complete our analysis of this new species it will be necessary to analyze its alkaloid composition, which will confirm its classification in the *Diffusae* section. In the meantime, we've prepared a key to the species of *Lophophora* (see sidebar) with the assumption that this species is allied with the non-mescaline-prevalent species. Biotic and abiotic stress factors, which force these plants to be so unimaginably small, require further investigation. And we will certainly undertake further adventure in the kingdom of nature before we have a clearer picture of the life of this wonderful plant. But please do not say anything to our wives about these future plans! 🌵

#### FURTHER READING

1 Šnicher J, Bohata J, Myšák V. *Lophophora alberto-vojtechii*. *Cactus & Co.* 2(II) 2008: 105–117. 2 Bohata J, Mysak V, Šnicher J. Genus *Lophophora* Coulter. *Kaktusy special* 2, 2005: 3–5.