

FOUR NEW TAXA OF *DELPHINIUM* (RANUNCULACEAE) FROM MEXICO

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ABSTRACT

Four taxa of Mexican *Delphinium* are described. A new subsection and two new series are characterized. Also described is a previously unrecognized subspecies of *D. bicornutum* Hemsley.

Delphinium is well known as a genus with complex patterns of speciation. Previous works have resulted in a less than satisfying delimitation of taxa. Much of the confusion in these studies has resulted from the close morphological similarity between taxa and the paucity of herbarium material for many taxa. All previous work with the Mexican taxa (Hemsley 1888, Huth, 1895, Ewan 1945) has been based solely on morphological analysis of herbarium specimens. Morphological studies were completed in this work in addition to extensive field studies, and cytological and chemical examination. Field work included measurement of morphological variation in living plants, pollination biology, and ecological preferences of the taxa (Warnock 1982). Forty-four populations were studied during nearly three months of field work. Supraspecific taxa recognized here are the only such taxa validly published for *Delphinium* in North America except for the two sections published by Huth (1895) and two series in a subsection published by Ewan (1936, 1942). The taxa treated here are only distantly related to the subsection named by Ewan (1936) but are provisionally placed in Huth's section *Diedropetala*. Placement of these taxa in *Diedropetala* reflects Huth's judgement in including the taxa treated here (at least those known at the time) in the section. *Diedropetala* (sensu Huth) also contains most of the rest of the North American species of *Delphinium* along with a large number of Old World species. Further work will likely show that the taxa treated here actually belong in a yet unnamed section.

Delphinium Subsection **Wislizenana** Warnock, subsect. nov.

Herbae perennes, 2–20 dm altis, glabris vel canescentibus; radices fibrosae infime abrupte tenuiter dissectae. Folia palmatisecta; petioli inferi longiores, superi breviores. Racemus 2–80-florus; pedicelli adscendentes vel adscendentes-effusi, 0.5–8 cm longi; bractae nullae

usque ad fere foliosae; bracteolae minutae usque ad 1.5 cm longae, oppositae vel suboppositae. Petala 4. Carpella 3(–4). Semina substriata; testae cellulae multituberculatae ceraceae, squamas plus minusve definitas formantes.

Perennial herbs, 2–20 dm tall; stems usually solitary, glabrous or puberulent, from a stout, fibrous rootstock, this abruptly dissected into many narrow, string-like segments below. Leaves palmatisect, round to semicircular, reduced upward; petioles spreading to spreading-ascending, shorter upward. Floral bracts absent to nearly leafy; bracteoles minute to 1.5 cm long, opposite or subopposite; calyx of five separate, yellow to blue or blue-purple sepals; sepal spur 9–28 mm long, apex acute to rounded; lateral and lower pair of sepals nearly identical to each other, apically rounded, basally cuneate. Petals 4, arranged in two pairs; upper pair enclosed in sepal spur, 14–37 mm long, elongated into acute, posteriorly nectariferous spurs. Stamens numerous; carpels 3(–4). Follicles glabrous to sparsely pubescent, seeds 6–21 per follicle, dark brown to black, trigonally pyramidal to crescent-shaped, appearing irregularly striate, cells of seed coat highly sculptured, possessing many short pustulate knobs, the knobs appearing to secrete waxy substances; seed coat cells aggregated into more or less well defined scales. $n = 8, 16$.

Based on *Delphinium wislizeni* Engelm. in Wislizenus, Memoirs of a Tour to Northern Mexico, U.S. Senate Misc. Publ. 22:106. 1848. TYPE: Mexico, Chihuahua, La Bufa Mt., above Cusihiuriachic, porphyritic rocks, 17 Sep 1846, A. Wislizenus 159 (MO!).

Comprised of *Delphinium bicornutum* Hemsley, *D. calcar-equitis* Standley, *D. pedatisectum* Hemsley, *D. subscandens* Ewan, *D. viride* Watson, and *D. wislizeni*, subsect. *Wislizenana* is characterized by abruptly dissected fibrous roots, usually branched racemes with immediately divergent (although often later parallel) pedicels, cells of seed coat with many pustulate, apparently wax-secreting knobs and these cells more or less aggregated into scales. Taxa of subsect. *Wislizenana* are found in the Sierra Madre Occidental from Chihuahua to Michoacan, the Sierra Madre Oriental from Queretaro to Puebla, and throughout the Sierra Madre del Sur. Populations are found in oak woodlands, pine forests, and subalpine forests from 1500–3000 m.

Delphinium Series **Wislizenana** Warnock, series nov.

Caulibus 3–12 dm altis, glabris vel puberulis. Folia palmatisecta, segmentis 10–32. Bractee parvae vel nullae; pedicelli effusi 1.5–7 cm longi; sepali calcar 14–28 mm longum. Petala supera 22–37 mm longa; petalorum inferiorum laminae unguisque plus minusve uniplanares, laminis glabris vel subglabris.

Stems 3–12 dm tall, usually solitary, glabrous to puberulent. Leaves finely palmatisect, 10–32 segments. Floral bracts small to absent;

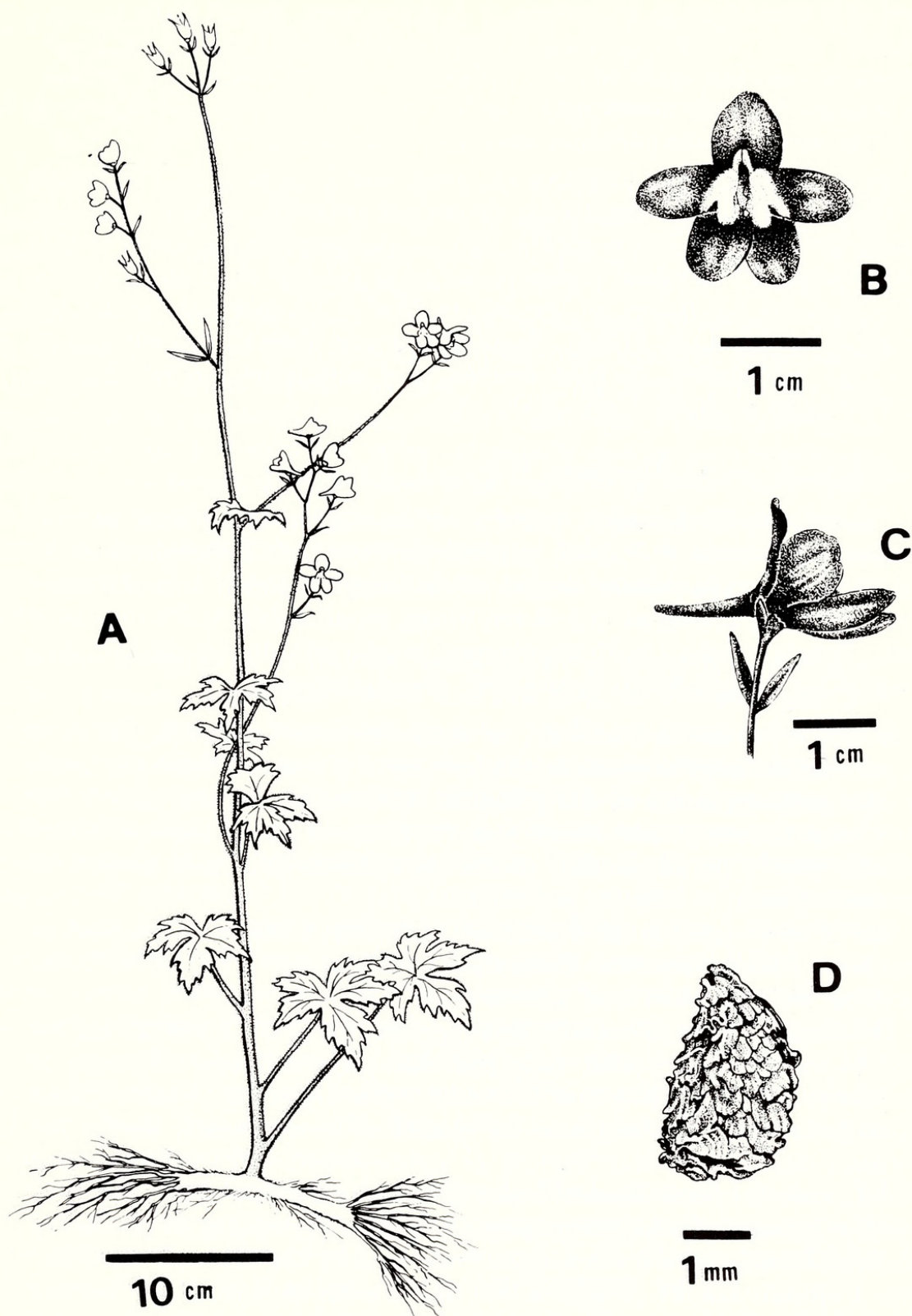


FIG. 1. Illustrations of *D. bicornutum* subsp. *oaxacanum*. A. Habit. B. Facing view of flower. C. Side view of flower. D. Seed. Scales as shown in figures.

pedicels spreading to ascending, 1.5–7 cm long; sepals dark blue or yellow, spur 14–28 mm long. Upper petals 22–37 mm long; lower petals clawed but blade nearly coplanar with claw, blade only sparsely if at all hirsute. $n = 8, 16$.

TYPE SPECIES: *Delphinium wislizeni* Engelm.

Series *Wislizenana* includes *D. viride* and *D. wislizeni*. The series is characterized by long spurs, spreading pedicels, nearly coplanar blade and claw of lower petals, lack of pubescence on lower petals and absence of flavonol 7-rhamnosides in the leaves. Taxa of series *Wislizenana* are found in the Sierra Madre Occidental from Chihuahua to San Luis Potosi. Populations are found near springs in dry oak woodlands, in pine forests, and subalpine forests of pine and douglas fir from 1500–3000 m.

Delphinium Series **Bicornuta** Warnock, series nov.

Caulibus 2–20 dm altis; glabris vel canescentibus. Folia palmatisecta, segmentis 3–7(–14), superis parvioribus. Inflorescentia 2–80-flora, bractee parvae usque ad foliosae; pedicelli adscendentes vel adscendentes-effusi, 0.5–8 cm longi; sepali calcar 9–25 mm longum. Petala supera 14–35 mm longa; petalorum inferiorum laminae unguisque angulo recto formantes, laminis hirsutis.

Stems 2–30 dm tall, solitary or rarely in twos or threes, glabrous to canescent. Leaf blades with fewer than 10 segments (rarely more in one species); calyx of dark blue or blue-purple sepals, spur 9–25 mm long. Upper petals 14–35 mm long; lower petals clawed, blade usually nearly perpendicular to the claw, blade adaxially hirsute to hirsute-villous. $n = 8$.

Based on *Delphinium bicornutum* Hemsley, Diagnoses plantarum novarum Mexicanarum et Centrali-Americanarum 2:17. 1879. TYPE: Mexico, Oaxaca, 1841, A. Ghiesbreght s.n. (K!).

Distinguished by relatively short spurs (except in *D. calcar-equitis* and *D. subscandens*), ascending pedicels, perpendicular structure of the lower petals, presence of flavonol 7-rhamnosides in leaves, and usual presence of pubescence on blades of lower petals. Series *Bicornuta* includes *D. bicornutum*, *D. calcar-equitis*, *D. pedatisectum*, and *D. subscandens*. Taxa of series *Bicornuta* are found in the Sierra Madre Occidental south from southwestern Chihuahua, in the Sierra Madre Oriental south from Queretaro and in the Sierra Madre del Sur. Populations are found in wet oak forests and pine-oak forests from 1800–3000 m.

A new taxon of *Delphinium* was discovered in the mountains of the Sierra Madre del Sur in Oaxaca. The new taxon is included in series *Bicornuta* subsect. *Wislizenana* as a second subspecies of *D. bicornutum*. Subspecies *bicornutum* is also formalized here to avoid possible future difficulties of priority.

Delphinium bicornutum Hemsley subsp. **bicornutum** stat. nov.
BASIONYM: *Delphinium bicornutum* Hemsley.

Delphinium bicornutum Hemsley subsp. **oaxacanum** Warnock, subsp. nov.

Caulibus simplicibus, 6–12 dm altis; subpilosis vel pilosis. Folia basalia 4–8 cm longa, 6–12 cm lata, segmentis 3–7, canescentia; petioli 15–35 cm longis, pilosis, folia caulina 2–6 cm longa, 4–9 cm lata, segmentis 3–7, subcanescentia; petioli 0.5–8 cm longis, subpilosis. Floris 5–22; pedicelli 1.5–8 cm longis; bracteolae lanceolatae, 3–12 mm longae, 2–12 mm infra receptaculum insertae; sepali calcar 10–18 mm longum; sepala lateralalia 11–16 mm longa, 5–10 mm lata; sepala infera 11–19 mm longa, 4.5–11 mm lata. Petala supera 15–25 mm longa, 2–3 mm lata, alba vel pallide azurea, ad apicem sino 0.0–1.2 mm longo; petala infera alba vel azurea, 9–14 mm longa, 2.5–4.5 mm lata, ad apicem sino 2–4 mm longo. Stamina 24–31, carpella 3; styli pallide azurei. Folliculi 12–15 mm longi, 3–4 mm lati. Semina 9–15 in quoque folliculo, 1.9–2.7 mm longa, 1–1.6 mm lata.

Stems solitary, 6–12 dm tall; puberulent to sparsely puberulent. When present, basal leaf blades 4–8 cm long, 6–12 cm wide, 3–7 segmented, variably canescent; petioles 15–35 cm long, puberulent; cauline leaf blades 2–6 cm long, 4–9 cm wide, palmatisect into 3–7 segments, sparsely canescent; petioles 0.5–8 cm long, sparsely puberulent. Flowers 5–22; pedicels 1.5–8 cm long, bracteoles subtending each flower lanceolate, 3–12 mm long, 2–12 mm below the receptacle; spur sepal 10–18 mm long; lateral sepals 11–16 mm long, 5–10 mm wide; lower sepals 11–19 mm long, 4.5–11 mm wide. Upper petals 15–25 mm long, 2–3 mm wide, apex cleft 0.0–1.2 mm deep, upper petals white near the nectary, becoming blue to dark blue or remaining white apically; lower petals white or blue, 9–14 mm long, 2.5–4.5 mm wide, blade cleft 2–4 mm deep. Stamens 24–31; carpels 3; styles blue. Pollen light yellow to yellow. Follicles 12–15 mm long, 3–4 mm wide. Seeds 9–15 per follicle, 1.9–2.7 mm long, 1–1.6 mm wide. $n = 8$.

TYPE: Mexico: Oaxaca, Municipio de Miahuatlan, 11.5 mi s. of Miahuatlan Pemex on Rt 175, s. of road; steep n.-facing slope in oak-pine woods, 19 Oct 1981, *M. J. Warnock* 2536 (Holotype: TEX!; isotypes: ENCB! ILL! MEXU! MO! PSU! SHST! TEX!).

PARATYPES (all known specimens): Mexico, Oaxaca, Meratlau, San Andres, Oct 1842, *F. M. Liebmann* 1035 (BM! C-5! US!); Municipio de Pochutla, Pluma Hidalgo, 10 Jan 1967, *T. MacDougall* s.n. (MEXU!); Municipio de Santa Catalina Quieri, Cerro de Quieri, 17 Jan 1964, *T. MacDougall* s.n. (MEXU!).

Delphinium bicornutum subsp. *oaxacanum* is characterized by large size of the plants (relative to most *D. b.* subsp. *bicornutum* and

D. pedatisectum), 7 or fewer leaf segments, often completely white upper and lower petals, and puberulent to canescent pubescence on stems and leaves. Root structure and seed morphology place *D. b.* subsp. *oaxacanthum* in subsect. *Wislizenana*. Pedicels paralleling rachis of the inflorescence for most of their length, hirsute lower petals, nearly perpendicular parts of lower petals, and presence of flavonol 7-rhamnosides in leaves place *D. b.* subsp. *oaxacanthum* in series *Bicornuta*. Short spurs and wet montane habitat ally subsp. *oaxacanthum* with subsp. *bicornutum* and *D. pedatisectum* within the series. Crest and upper Pacific slopes of the Sierra Madre del Sur south of the city of Oaxaca are the principal habitat for *D. b.* subsp. *oaxacanthum*. Plants are found on north-facing slopes of oak-pine woodlands, at elevations of 2500–2800 m. Flowering occurs from September to January.

The subspecies is known from only four collections on steep, north-facing slopes often in ravines. Plants are found scattered under and around shrubs under oaks with occasional pines. Possibly it once was more common but it occurs in an area of intense pressure from grazing, lumbering, and marginal cultivation. The single population visited covered approximately 400 m² on a 50–60 degree slope between a cornfield and a road. This population contained 90–100 flowering individuals.

ACKNOWLEDGMENTS

This paper represents part of the results of a dissertation submitted to the Department of Botany, University of Texas at Austin in partial fulfillment of the requirements for the Doctor of Philosophy. Special thanks are offered to Dr. M. C. Johnston and Dr. D. H. Nicolson, the former for reviewing the latin diagnoses and the latter for clarification of endings for taxonomic names. Comments on the manuscript by two anonymous reviewers are appreciated. Support was provided by NSF Grant No. DEB 80-23657. Illustrations were done by Regina Levoy.

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(Received 14 Feb 1983; accepted 26 Apr 1984.)



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