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Five new species of *Nolana* (Solanaceae-Nolaneae) from Chile

Cinco nuevas especies de *Nolana* (Solanaceae-Nolaneae) de Chile

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Abstract

In preparation for a systematic treatment of *Nolana* (Solanaceae), five new species are described from Chile: ***Nolana dianae* M.O. Dillon, *N. reichei* M.O. Dillon & Arancio**, ***N. onoana* M.O. Dillon & M. Nakaz.**, ***N. lachimbensis* M.O. Dillon & Luebert**, and ***N. philippiana* M.O. Dillon & Luebert**. The new species are described, illustrated and their distributions, ecology, and relationships are discussed.
Key Words: *Nolana*, new species, Chile, Solanaceae

Resumen

En la preparación para la publicación de un tratamiento monográfico de *Nolana* (Solanaceae-Nolaneae), cinco especies nuevas son descritas: ***Nolana dianae* M.O. Dillon, *N. reichei* M.O. Dillon & Arancio**, ***N. onoana* M.O. Dillon & M. Nakaz.**, ***N. lachimbensis* M.O. Dillon & Luebert**, y ***N. philippiana* M.O. Dillon & Luebert.** Las especies nuevas están descritas, e ilustradas y su distribución, ecología, y las relaciones son discutidas.
Palabras Clave: *Nolana*, especies nuevas, Chile, Solanaceae

Introduction

Nolana (Solanaceae-Nolaneae) is a genus of 89 species, including the five described here, which inhabits a variety of arid and semi-arid habitats throughout the Atacama and Peruvian deserts (Dillon 2005, Dillon et al., 2007a). No fewer than 49 species have been reported from Chile including four of which that have distributions reaching southern Peru. The greatest species diversity is confined to near-ocean localities termed *lomas* formations, usually between 50-800 m elevation and within 50 kms of the shoreline (Rundel et al., 1991; Dillon & Hoffmann 1997). A few species, such as *N. tarapacana* (Phil.) I.M. Johnst., and *N. sessiliflora* Phil., have distributions above 2000 m and at distances of 50-125 kms inland from the coast. Most species are narrow endemics, with small, restricted geographic ranges and apparently specific ecological requirements, but a few species have larger geographic distributions and occur over a wide elevation range, e.g., *N. leptophylla* (Miers) I.M. Johnst. (10-4000 m), and geographic ranges, e.g., *N. paradoxa* Lindl. (29°15'S-42°30'S or over 1400 kms).

Within the *lomas* formations, *Nolana* stands out as one of the most wide-ranging, conspicuous elements of the coastal Peruvian and Atacama flora (Dillon, 2005). *Nolana* species are often important members of their respective communities and can occur in large populations at very high densities. The component taxa form a well-defined and obviously monophyletic group (Dillon et al., 2007b) diagnosed by a unique ovary forming mericarps, a type of schizocarp with 1-7 seeds per segment (Knapp, 2002). Field and herbarium studies, over the last 20 years, have yielded several novelties that are morphologically and

ecologically distinctive. For a full discussion of relationships within *Nolana* as suggested by molecular studies consult Dillon et al. (2007b).

1. ***Nolana dianae*** M.O. Dillon, sp. nov. (Fig. 1-2, 10 A).

TYPE: CHILE. Región II (Antofagasta), Prov. Antofagasta, Quebrada above Playa de los Hornos, just N of Punta Hornos, 26 km S of Caleta Michilla, 51 km N of Tropic of Capricorn, 300-350 m, [22°55'S, 70°15'W], 20 Oct 1988, *M.O. Dillon & D. Dillon 5725* (holotype, SGO; isotype, F).

Species propria N. philippiana *maxime simile, sed differt foliis atropurpureoviridibus, piliis stipitatiglanduliferis, corollis albis, linea nectaribus conspicuis, purpureis.*

Succulent, spreading, rounded, facultative annual herbs, 30-100 cm in diameter; stems much-branched, 30-40 cm long, prostrate to decumbent, deep purple, stipitate-glandular. Leaves alternate, sessile, the blades oblong to oblanceolate, 10-20 cm long, 3-4(-5) mm wide, entire, strongly concave adaxially, stipitate-glandular, dark green, succulent, ovate to cordate in section, apically obtuse to rounded, bases cuneate, swollen, the margins revolute. Inflorescences of solitary flowers in upper leaf axils, peduncles erect, filiform, 10-15(-20) mm long; calyx campanulate, 7-10 mm long, the tube ca. 5 mm long, ca. 4 mm wide; 5-lobed, the lobes lanceolate, equal, ca. 4 mm long, ca. 1 mm wide; corollas narrowly infundibuliform, 18-24 mm long, white with deep purple guides, pubescent, trichomes stipitate-glandular, 5-lobed, the lobes obtuse, 2.5-3 mm long, 9-10 mm wide; stamens 5, included, filaments inserted on lower third of corolla, unequal, three 2-3 mm long, two 3.5-4.5 mm long, pilose at the bases; anther thecae 1.5-2 mm long, 1-1.5 mm wide, purple, glabrous; ovary glabrous, basal nectary, 5 carpels, the style included, the stigma capitate, green. Mericarps 4-5, spherical, 2.5-3 mm in diameter, included within the expanding calyx; each with 2-3 seeds.

Flowering: October.

Etymology: This species is named for the second collector of the type, Ms. Diane O'Donnell Moran Dillon, who accompanied the first author during several field seasons in coastal Chile and Peru. Her efforts with collecting and pressing herbarium vouchers, mericarps, and insect pollinators are acknowledged. She shared in the discovery of several new species during field seasons in Peru and Chile. In a moment of excitement at discovering this unusual species, I proclaimed that should it be new, I would name it for her, and nineteen years later the promise is fulfilled.

Distribution and ecology: This species has been recorded from two localities. The type was collected from the lower slopes of a quebrada above Playa de los Hornos (22°55'S, 70°15'W) at 300-350 m (Fig. 2A). This site is an alluvial fan at the base of the coastal mountains within 10 kms of the ocean. Only a few species were recorded from this locality, no fewer than four of them were *Nolana*, including *N. balsamiflua* (Gaudich.) Mesa, *N. linearifolia* Phil., and *N. peruviana* (Gaudich.) I.M. Johnst. Collecting in 1988 was remarkable due to blooming conditions stimulated by the 1987/88 El Niño event. Repeated visits to this locality during subsequent years has not yielded new collections of this taxon. Another collection, here considered conspecific, was encountered further north in a quebrada east of Tocopilla, *M.O. Dillon & D. Dillon 5707* (Fig. 3, 10 B).

Relationships: This species resembles, *N. philippiana*, another new species being described in this publication. Both these plants are similar in leaf form and pubescence, but the unusual floral coloration pattern and corolla form separate them. Material of these taxa have not been included in molecular studies to date and further speculation will await those results. Another collection, *Dillon & Dillon 5728* (F), was made at the same time at the type locality; field notes indicated the collection was considered similar to *Dillon & Dillon 5725*, with the exception of the former collection possessing light blue to lavender corollas.

Additional material examined: CHILE. Región II (Antofagasta), Prov. Antofagasta, Quebrada above

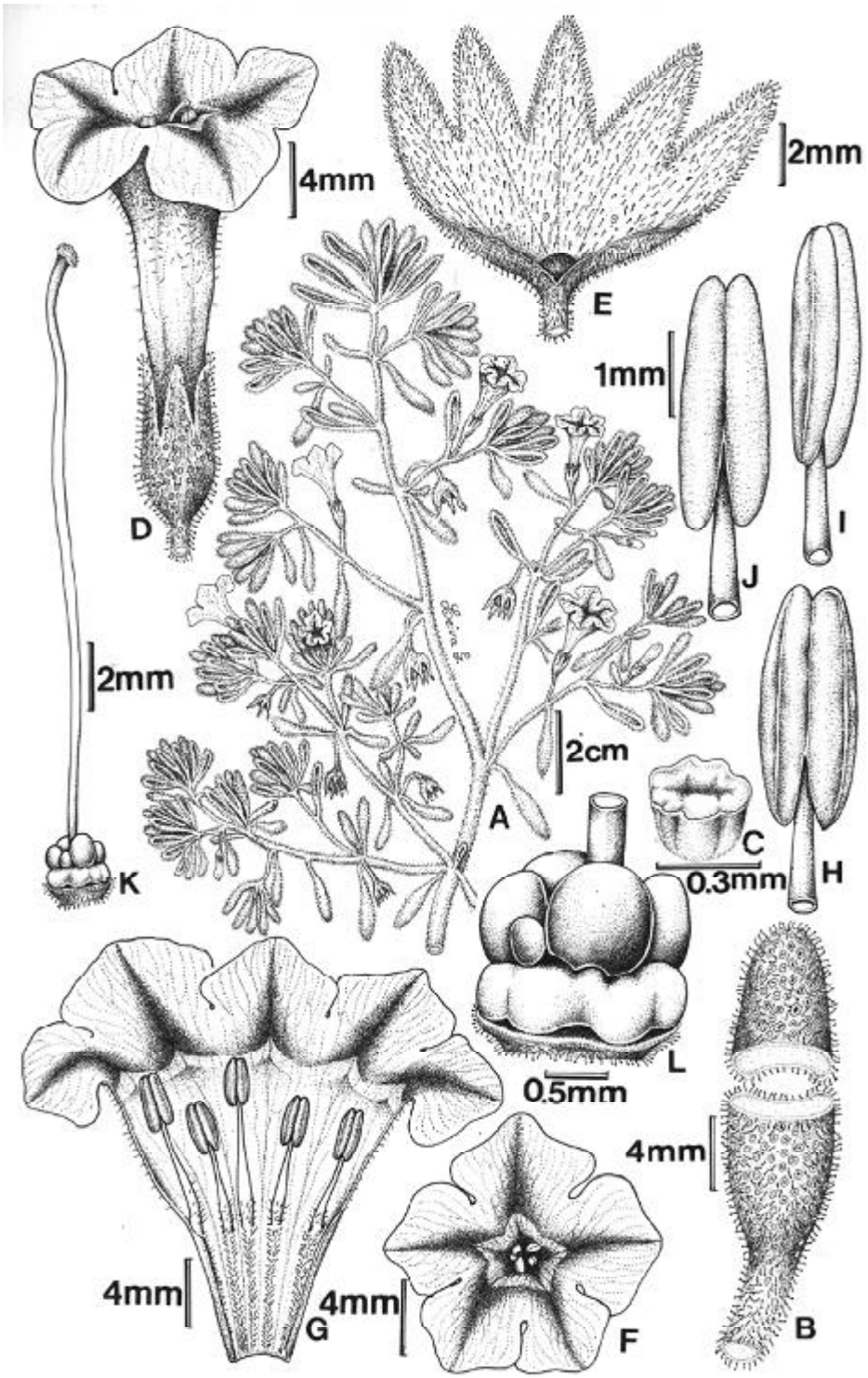

Fig. 1. *Nolana dianae M.O. Dillon*. A. Habit; B. Leaf; C. Foliar gland; D. Flower. E. Dissected calyx; F. Corolla. G. Dissected corolla; H. Anther ventral view; I. Anther lateral view; J. Anther dorsal view; K. Gynoecium; L. Ovary. (Drawing of *Dillon & Dillon 5725*, F).

Fig. 2. *Nolana dianae* M.O. Dillon. A. Type locality above Playa de los Hornos (¹) *N. dianae*, (²) *N. balsamiflua*, (³) *N. peruviana*; B. Close-up of leaves and habit; C. Close-up of corolla with star-shaped pattern formed by guides (Photographs of *Dillon & Dillon 5725*).

Fig. 3. *Nolana dianae* M.O. Dillon, Photographs of *Dillon & Dillon 5707*: A. Habit, B. Lateral close-up of stem apex with flowers; C. Close-up of zygomorphic corolla lobes.

Playa de los Hornos, just N of Punta Hornos, 26 km S of Caleta Michilla, 51 km N of Tropic of Capricorn, 300-350 m, (22°55'S, 70°15'W), 20 Oct 1988, *M.O. Dillon & D. Dillon 5728* (F). Prov. Tocopilla, quebrada ca. 15 km E of Tocopilla, 520-550 m, (22°05'S, 70° 09'W), 18 Oct 1988, *M.O. Dillon & D. Dillon 5707* (F).

2. ***Nolana lachimbensis*** M.O. Dillon & Luebert, sp. nov. (Fig. 4).

TYPE: CHILE. Región II (Antofagasta). Prov. Antofagasta, La Chimba, quebrada NE of Antofagasta, [23°32.27'S, 70°21.55' W], ca. 500 m, 21 Oct 2004, M.O. *Dillon & M. Finger C. 8591* (holotype: SGO, duplicates to be distributed).

Nolana ramosissima *simile, differt a statura minore, foliis minoribus ellipticis vel orbiculatis, 3-4 mm longis, 2-4 mm latis, piliis stipitatiglanduliferis.*

Small shrub to 50 cm tall, much-branched. Leaves alternate, sessile, the blades elliptic to orbicular, 3-4 mm long, 2-4 mm wide, terete, stipitate-glandular, the margins strongly revolute and forming an abaxial cleft. Inflorescences of solitary flowers in upper leaf axils, peduncles 1-3 mm long, erect, densely stipitate-glandular; calyx campanulate, 4-5 mm long, the tube ca. 2 mm long, ca. 2 mm wide, 5-lobed, the lobes 2-3 mm long, ca. 1 mm wide, equal; corollas narrowly infundibuliform, ca. 8 mm long, 10 mm wide distally, lavender, weakly zygomorpic, lobes ca. 3 mm long, ca. 3 mm wide, obtuse to rounded; stamens 5 included, filaments inserted on lower third of corolla, unequal, three ca. 4 mm long, two ca. 6 mm long, slightly exerted; anther thecae ca. 1-1.5 mm long, ca. 1 mm wide, purple, pollen white; ovary glabrous, basal nectary, 5 carpels, the style included, stigma capitate, green. Mericarps 4-5, immature.

Flowering October-December.

Etymology: This species is named for the type locality, Quebrada La Chimba, an historically important collecting locality immediately north of the city of Antofagasta. As an important collecting locality, the first author (MOD) visited the quebrada first in December 1987 and recorded nearly 40 species. A visit in 1988 yielded fewer species and returning over the ensuring years showed the quebrada increasingly disturbed, and largely abandoned with the encroachment of a large-scale garbage dump near the entrance. The quebrada walls were covered with graffiti and numerous feral dogs were encountered during the last visit in October and December 2004. The continued deterioration of the quebrada made its inclusion as «Reserva Nacional La Chimba» in 1988 (CONAF, 1993) seem rather laughable. Recently, plans were announced to move the dump and landfill operations and refocus attention on this natural resource and potential tourist attraction so near the city of Antofagasta.

Distribution and ecology: This species is known from the type locality within the Quebrada La Chimba (23°32.27'S, 70°21.55' W) just five kms from the ocean and immediately north of the city of Antofagasta. Within Quebrada La Chimba, several other *Nolana* species are to be encountered, including *N. linearifolia* Phil., *N. peruviana* (Gaudich.) I.M. Johnst. and *N. sedifolia*.

Another gathering of a very similar species has been made at the upper reaches of Cerro Moreno (*Luebert & García 2591/895*) the isolated mountain on the peninsula north of Antofagasta and just 20 kms WNW of Quebrada La Chimba (Fig. 5). The pubescence on this taxon is apparently stellate, rather than the simple, stipitate-glandular trichomes on foliar and floral surfaces of *N. lachimbensis*. Also occurring on Cerro Moreno were other *Nolana* species, including *N. peruviana*, *N. sedifolia*, and *N. villosa* (Phil.) I.M. Johnst.

Relationships: Utilizing the GBSSI or waxy marker (Dillon et al., 2007b), *N. lachimbensis* is shown to be in an clade containing *N. ramosissima* I.M. Johnst. and *N. salsoloides* (Lindl.) I.M. Johnst as sister species. The oval, terete, stipitate-glandular leaves and small lavender flowers with prominent lobes distinguish this species from *N. ramosissima* and *N. salsoloides*, and all other species of *Nolana*. Only *N. sedifolia* Poepp. has leaves smaller than *N. lachimbensis*, and those are

Fig. 4. *Nolana lachimbensis* M.O. Dillon & Luebert. A. Habitat growing in rock crevaces and shrubby habit; B. Habit close-up; C. Close-up of corolla showing slightly exerted purple anthers with white pollen; D. Close-up lateral view of flower (Photographs of *Dillon & Finger 8591*).

Fig. 5. *Nolana lachimbensis* M.O. Dillon & Luebert, Photographs of *Luebert & García 2591/985* taken on Cerro Moreno, 2 October 2005. A. Habitat and habit, B. Close-up of corollas.

spherical, terete, lacking an abaxial cleft, and covered with arachnoid-tomentose pubescence.

Additional material examined: CHILE. Región II (Antofagasta). Prov. Antofagasta, Cerro Moreno, (23.4873°S, 70.5888°W), 690-760 m, 2 Oct 2005, *F. Luebert & N. García 2591/ 985* (F, SGO).

3. ***Nolana onoana*** M.O. Dillon & M. Nakaz., sp. nov. (Fig. 6-7, 10 C).

TYPE: CHILE. Región II (Antofagasta), Prov. Antofagasta, 15-17 km S of La Negra near southern end of Quebrada de Mateo, ca. 32 km SSE of Antofagasta, ca. 600 m, (23°54'S, 70°18'W), 20 Oct 1988, *M.O. Dillon & D. Dillon 5729* (holotype, SGO; isotypes, F, MAK, US, duplicates to be distributed).

Herbae annuae, robusti, ad 1 m alti, ramosissimi, radici palari, foliis congesti, sessilibus, linearibus vel anguste obovati, piliis stipitaiglanduliferis, floribus N. aplocaryioides *similaribus.*

Robust annual tap-rooted herbs to 1 m tall; stems erect to ascending, but decumbent when densely leafy. Leaves cauline, fasciculate, simple, the blades linear to narrowly oblanceolate, sessile, entire, strongly revolute, terete, densely pubescent with stout, stipitate-glandular trichomes. Inflorescence of solitary flowers in the densely crowded, upper leaf axils, sessile; calyx narrowly campanulate, 5-7 mm long, the tube 3-5 mm long, ca. 5 mm wide, 5-lobed, the lobes lanceolate, 2-3 mm long, ca. 1 mm wide, equal; corollas narrowly infundibuliform, 18-24 mm long, 8-12 mm wide distally, lavender to light blue, pubescent, trichomes stipitate-glandular, 5-lobed, zygomorphic, the lobes obtuse, the largest 3-4 mm wide tubular, 3-4 mm long, rounded to obtuse; stamens 5, included, unequal, 3 long, 2 short; ovary glabrous, basal nectary, 5-carpels; style included, the stigma capitate, green. Mericarps 6-7, spherical, 2-3 mm in diameter.

Flowering: October-December.

Etymology: It is our pleasure to name this robust new species for Dr. Mikio Ono, Japanese plant systematist and biogeographer who explored the coasts of Peru and Chile for many years and was the first collector of this distinctive taxon. Dr. Ono is a former botany professor and head of the Makino Herbarium, Botany Section at Tokyo Metropolitan University (TMU). He edited two important works on the ecology and distribution of *lomas* formations (Ono, 1982, 1986).

The first author (MOD) met Dr. Ono in the *lomas* formations of Lachay, north of Lima, Peru in October of 1983; and this brief meeting began a long and enduring friendship and spirit of collaboration. The second author of this new species, Dr. Miyuki Nakazawa (M. Nakaz.), received her PhD under the direction of Dr. Ono at TMU in 1999 (Tago, 1999) and conducted the first molecular experiments with *Nolana* (cf. Tago & Dillon, 1999).

Distribution and ecology: This species has been recorded at a few localities in northern Atacama desert in Región II (Antofagasta). The locality of the type collection was a roadside depression ca. 32 kms south of Antofagasta in a place where moisture from the El Niño rains had gathered and evaporated over a period of several months (Fig. 8 B). When the individual collected for the type specimen was encountered in October of 1988, the water had all evaporated and the ground was quite dry and cracked (Fig. 7 A). In subsequent years, this species was encountered about a kilometer immediately to the west of the type locality at slightly higher sites in nearby quebradas. These sites are interior environments about 20 km east from the coastal fogs about of the other side of the coastal mountains. Another gatherings of this species was made north of Antofagasta and west of the coastal range at near Bahia de los Tres Compadres, *Dillon & Dillon 5724* (Fig. 10 D), and, in 1991, Ono and Masuzawa made a series of collections north of Antofagasta as well. This species has a geographic range of over 100 kms from just north of Antofagasta to south of Tocopilla.

Relationships: This species is distinctive among northern Chilean Nolana taxa with the densely crowded leaves and erect habit reaching over meter tall. The corollas suggest *N. aplocaryoides* but with wider leaves

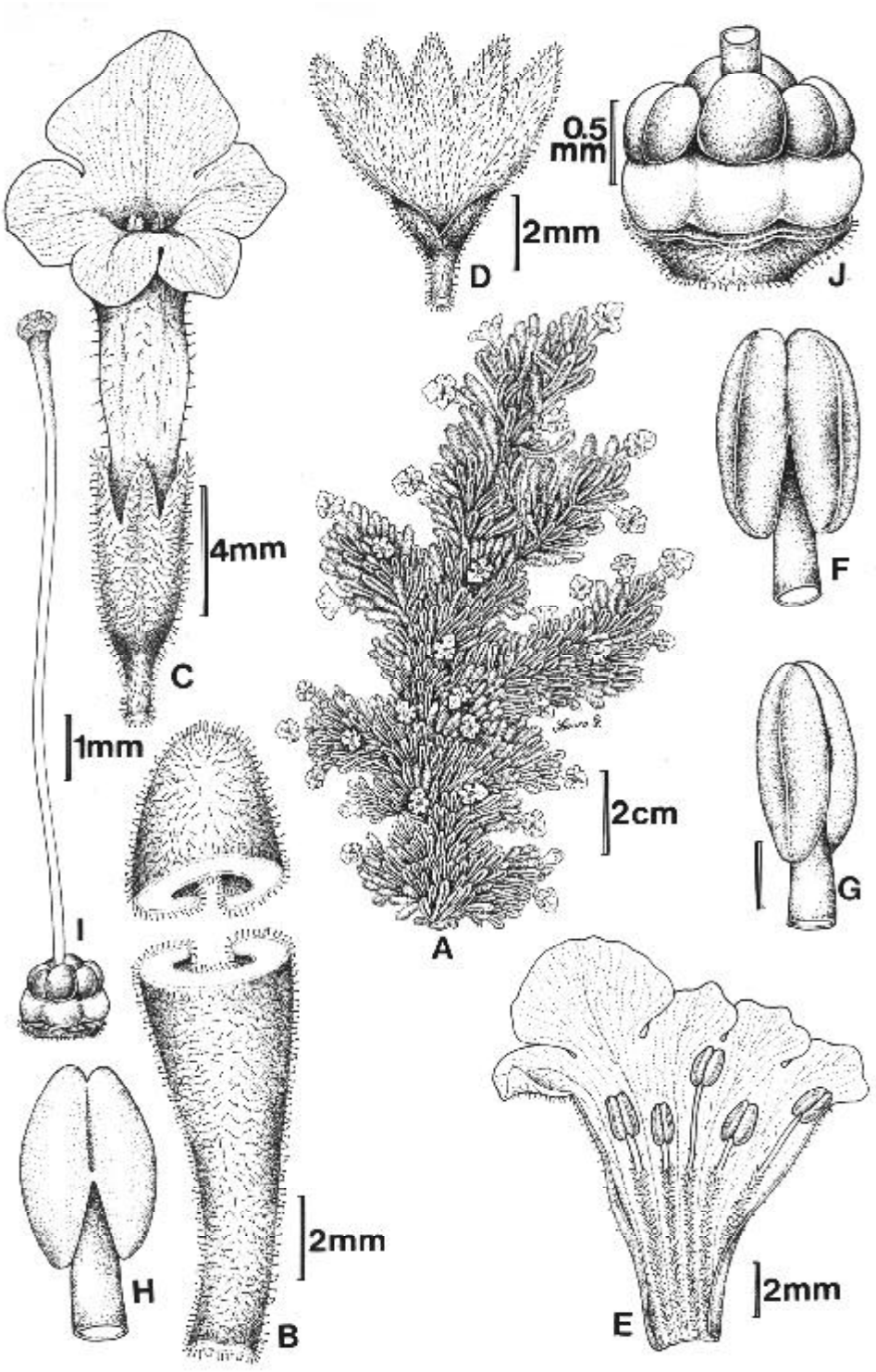

Fig. 6. *Nolana onoana* M.O. Dillon & M. Nakaz. A. Habit; B. Leaf with dissected blade to illustrate revolute margins; C. Flower; D. Dissected caylx. E. Dissected corolla; F. Anther dorsal view; G. Anther lateral view; H. Anther ventral view; I. Gynoecium (Illustration by S. Leiva G. drawn from *Dillon & Dillon 5729*, F).

Fig. 7. *Nolana onoana* M.O. Dillon & Nakaz. A. Robust herb growing in roadside runoff area at type locality; B. Zygomorohic corolla; C. Calyx and mericarps. D. Densely faciculate leaves and lateral view of flowers (Photographs of *Dillon & Dillon 5729* A-B, *Dillon 9050* C-D).

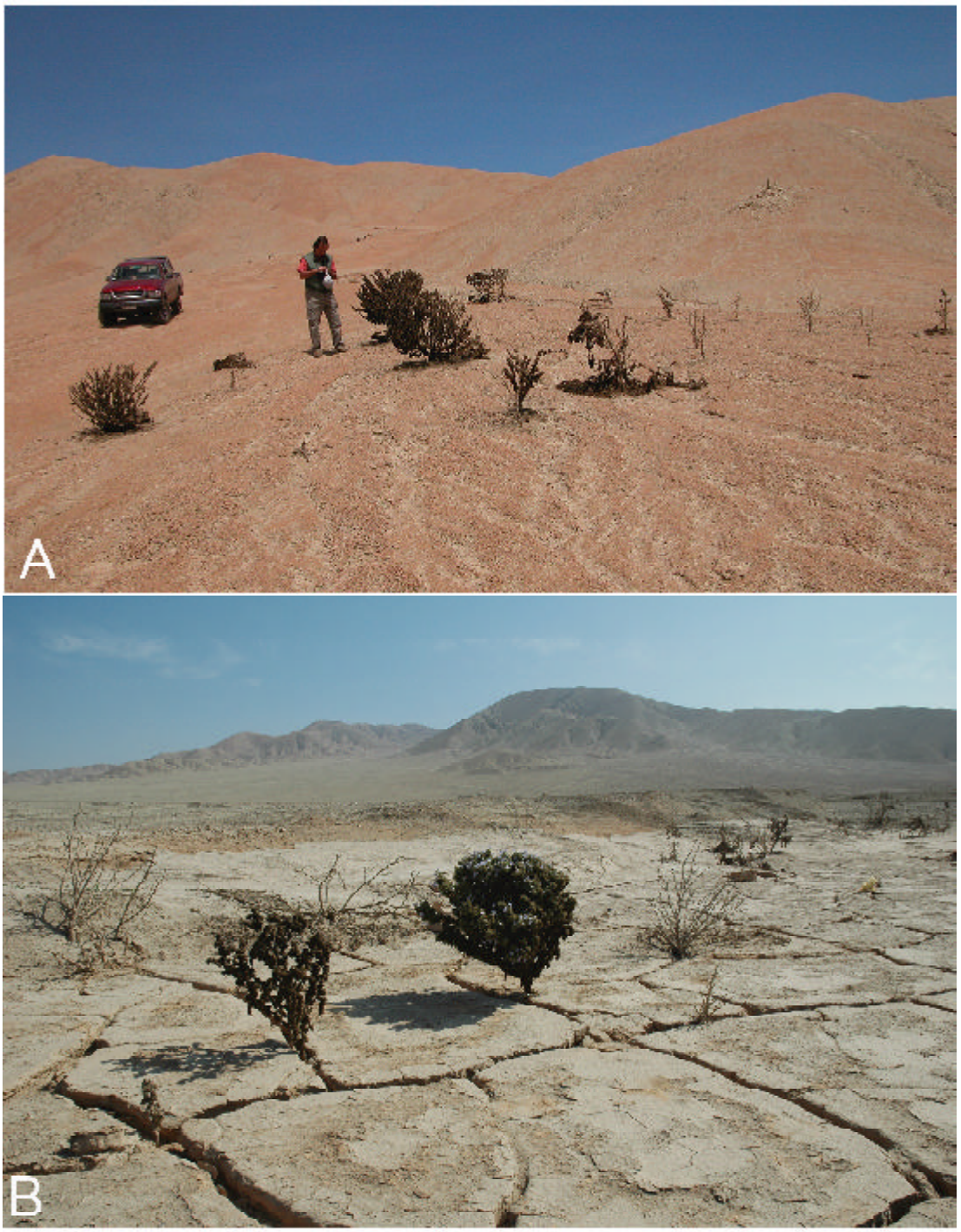

Fig. 8. *Nolana onoana* M.O. Dillon & M. Nakaz. Habitats. A. Photograph of area immediately west of Hwy 5 south of La Negra, photo taken on 18 October 2004. B. Roadside habitat at the locality where the type was collected in 1988, photo taken on 29 October 2007.

and only 3-5 mericarps that species is easily distinguished. Further, utilizing the GBSSI or waxy marker (Dillon et al., 2007b) *N. onoana* does not share sister taxon relationships with *N. aplocaryoides* included in the analysis. In that study, *N. onoana* is retrieved in a clade including *N. villosa*, *N. peruviana*, and *N. sphaerophylla*, all species with very different habits, leaves and floral morphologies and not to be confused with this new species.

Additional collections examined: CHILE. Región II (Antofagasta), Prov. Antofagasta, Bahia de los Tres Compadres, ca. 64 km N of Tropic of Capricorn, 32 km S of Michilla, ca. 100 m, (22°52'S, 70°16'W), 20 Oct 1988, *M.O. Dillon & D. Dillon 5724* (F); 15-17 km S of La Negra near southern end of Quebrada de Mateo, ca. 32 km SSE of Antofagasta, ca. 600 m, (23°52.517'S, 70°18.804'W), 18 Oct 2004, *M.O. Dillon & M. Finger C. 8582* (F); ca. 5 km S of Fundición Alto Norte, 29 Oct 2007, ca. 600 m, *M.O. Dillon 9050* (F); between Tocopilla & Antofagasta, 8 Nov 1991, *M. Ono & T. Masuzawa* (MAK#274958, MAK#274959, MAK#274960); N of Antofagasta, 9 Nov 1991, *M. Ono & T. Masuzawa* (MAK#274950, MAK#274953).

4. ***Nolana philippiana***, M.O. Dillon & Luebert, sp. nov. (Fig. 9, 11 A).

TYPE: CHILE. Region II (Antofagasta), Prov. Antofagasta, ca. 15 km SE of Caleta El Cobre, below the mirador, 700 m, (24°20'S, 70°26'W), 4 Oct 1988, *M.O. Dillon & D. Dillon 5625* (holotype, SGO; isotype, F).

Herbae annuae rotundatis ad 50 cm alti, ramosissimi, foliis 20-30 mm longis, 5-7 mm latis, oblongis vel oblanceolatis, valde revolutis, piliis sitipitatiglanduliferis, floribus N. aplocaryoides *similaribus.*

Succulent, rounded annual herbs, to 30 cm tall; stems prostrate to strongly decumbent to procumbent, 50 cm long, much-branched, purplish, villous. Leaves erect, sessile, the blades oblong to oblanceolate, 20-30 mm long, 5-7 mm wide, strongly concave adaxially, succulent, entire, villous with stipitate-glandular trichomes, apically rounded, bases cuneate, the margins strongly revolute. Inflorescences of solitary flowers in upper leaf axils, peduncles filiform, glabrous, (5-) 9-13 mm long; calyx campanulate, 4-4.5 mm wide at anthesis, glabrous, the tube 4-4.5 mm long, 5-6 mm wide; 5-lobed, the lobes lanceolate, equal 6-7 mm long, 3.5-4.5 mm wide; corollas narrowly infundibuliform, 35-40 mm long, 30-40 mm wide distally, pale lavender, inner throat white, without guides, externally pubescent, the trichomes uniseriate and glandular, the tube ca. 30 mm long, 5-lobed, the lobes obtuse, ca. 10 cm wide; stamens 5, included, filaments inserted on lower third of corolla, unequal, three 6-7 mm long, two 7-10 mm long, pilose at the bases; anther thecae white, pollen white; ovary glabrous, basal nectary, carpels 5, the style included, the stigma capitate, green. Mericarps 6-10, spherical, 2-4 mm in diameter, each with 2-3 seeds, included within the expanding calyx.

Flowering: October.

Etymology: The specific epithet honors Rudolph Amandus Philippi (1808-1904) was a doctor by training but a naturalist by inclination. R.A. Philippi began his career in Chile as a Professor of Botany and Zoology at the Universidad de Chile and in 1853, was named Director of the Museo Nacional de Historia Natural, a job he held until 1897. His wide ranging interests in natural history have had an enduring influence on the disciplines of archaeology, anthropology, botany, malacology, paleontology, and zoology in Chile. Philippi collected throughout Chile and resulted in the publication of over 3000 named species of plants, including over 50 species of *Nolana*, of which 13 are currently recognized. Perhaps one of his most important efforts was the publication of his observations and the plants he encountered during an extended trip into the northern Atacama Desert (Philippi, 1860). The plants described by R. A. Philippi have been the focus of important publications by C. Muñoz P. (1960) and M. Muñoz S. (1973).

Distribution and ecology: Known from the region of the type locality from near Caleta El Cobre, at ca. 700 m along the road that turns southeast at the mine headquarters near the coast and abruptly climbs

Fig. 9. *Nolana philippiana* M.O. Dillon & Luebert. A. Habit and habitat above El Cobre; B. Close-up of procumbent stem apices and corollas; C. Close-up showing zygomorphic corollas (Photographs of *Dillon & Dillon 5625).*

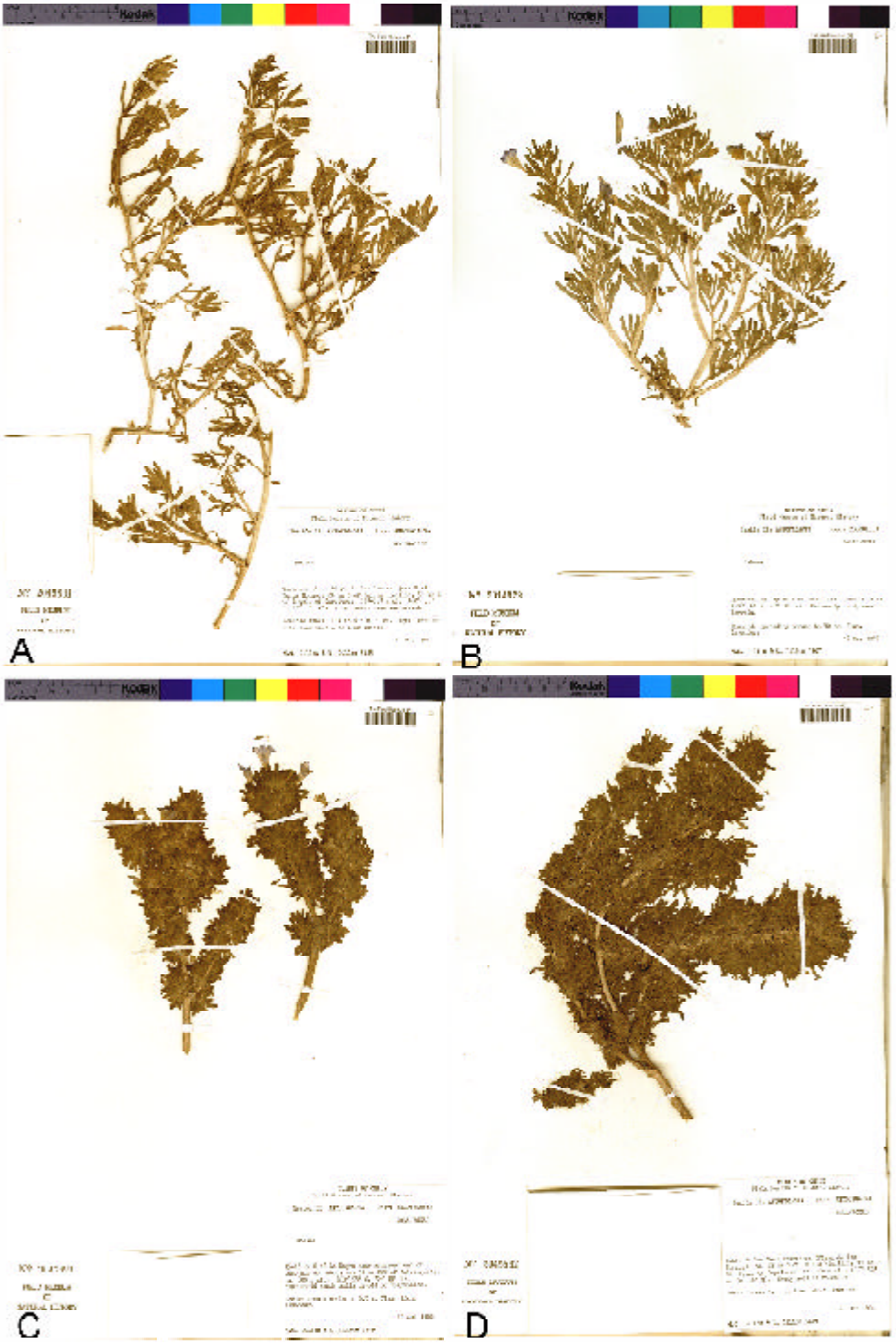

Fig. 10. Herbarium sheets. A. *Nolana dianae* M.O. Dillon, isotype collection of *Dillon & Dillon 5725* (F); B. *N. dianae*, *Dillon & Dillon 5707*(F). C. *N. onoana* M.O. Dillon & M. Nakaz., isotype collection *Dillon & Dillon 5729* (F); D. *N. onoana*, *Dillon & Dillon 5624* (F).

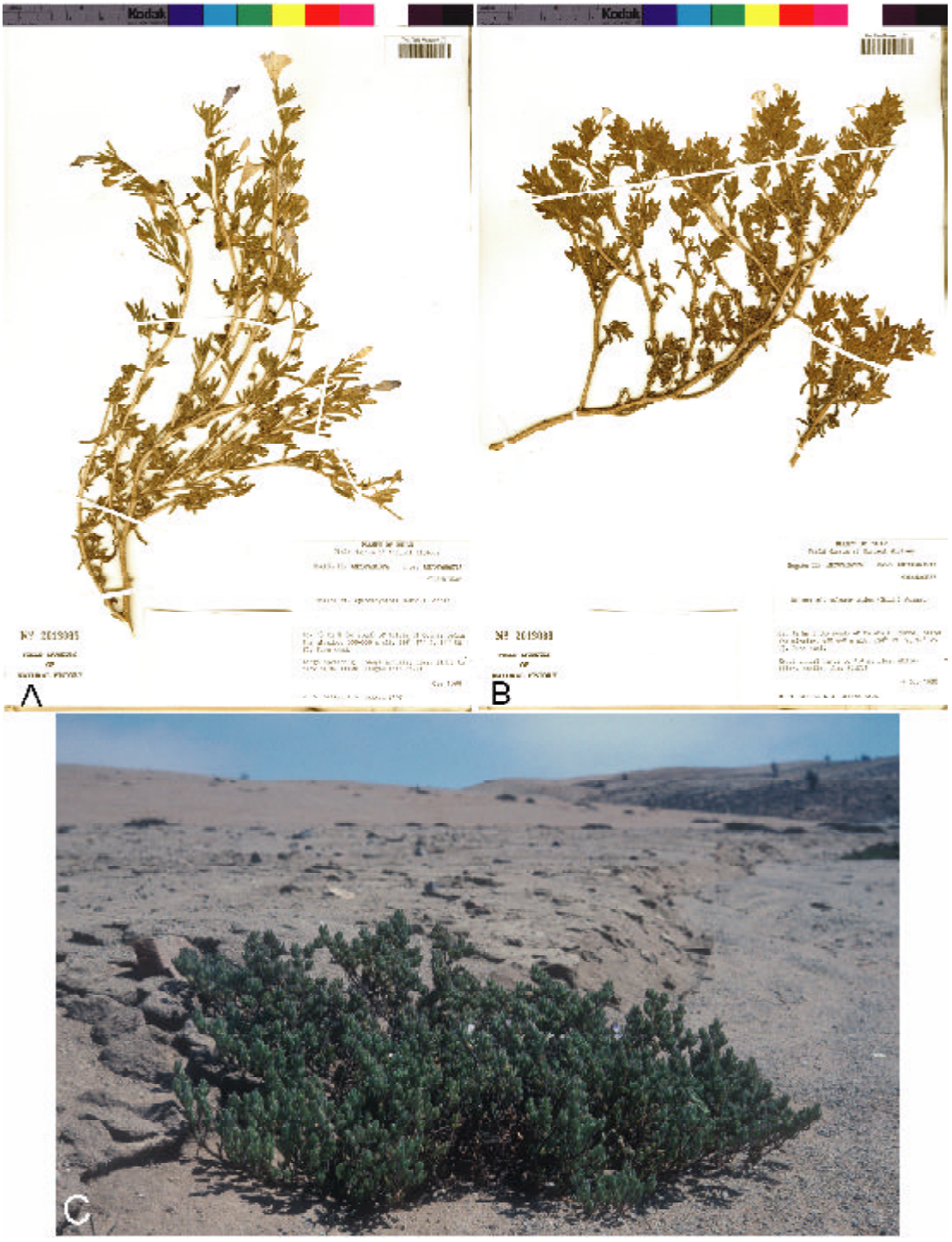

Fig. 11. Herbarium sheets. A. *Nolana philippiana* M.O. Dillon & Luebert, isotype collection of *Dillon & Dillon 5625* (F); B. *N. philippiana*, topotype collection, Dillon & DIllon 5624 (F); C. Photograph of habit of *Dillon & Dillon 5624* (F) taken on 4 October 1988.

up to over 1600 m. The only other plants recorded from this locality was *Copiapoa solaris* Ritter. The last time this species was during the 1987/88 El Niño event when additional precipitation stimulated an unprecedented blooming event; this taxon has not been recorded since, despite repeated visits to the type locality. A second collection, *Dillon & Dillon 5624*, was made just below the type locality at 600-660 m; field notes indicate that it was considered similar to *Dillon & Dillon 2625*, but possessing shorter, white corollas (Fig. 11 B-C).

Relationships: This species was initially considered to be a morphological variant of *Nolana aplocaryoides*, however, with increased knowledge of the variation exhibited by that taxon, it seems prudent to record this unusual species. While data from ongoing molecular studies are not currently available, relationships with *N. dianae* is predicted from shared morphological characters of terete succulent leaves, pubescence of stipitate-glandular trichomes, and tubular or narrowly infundibuliform corollas.

Additional material examined: CHILE. Region II (Antofagasta), Prov. Antofagasta, ca. 15 km E of Caleta El Cobre, below the mirador, 600-660 m, (24°20'S, 70°26'W), 4 Oct 1988, *M.O. Dillon & D. Dillon 5624* (F).

5. ***Nolana reichei*** M.O. Dillon & Arancio, sp. nov. (Fig. 12, 13, 14 A,B, C, D).

TYPE: CHILE. Región IV (Coquimbo). Prov. Limarí, Caleta El Toro, desembocadura de Río Limarí. [30°44.098'LS, 71°41.965'LO], 40 m, 11 Dec 2004, *M.O. Dillon & G. Arancio 8690* (holotype: ULS, isotypes: F, SGO).

Habitati et habitu N. paradoxa *similaribus, differt a foliis linearibus villosis corillis annulis concentricus purpureis, lazulinis, nigris, ad finum intus luteis.*

Succulent, perennial herbs; stems prostrate, flexulose, to 50 cm long, much-branched from thick tap-root, minutely glandular pubescent, reddish. Basal leaves spathulate, long-petiolate, 10-12 cm long; cauline leaves alternate, the blades lanceolate, 23-33 mm long, 2-3 mm wide, succulent, apically acute, bases cuneate, the margins entire, undulate. Flowers solitary in leaf axils, peduncles filiform, 5-6 cm long, villous; calyx campanulate, ca. 5 mm wide at anthesis, glabrous, the tube ca. 10 mm long, 5-6 mm wide; 5-lobed, the lobes lanceolate, 5-7 mm long, 3-4 mm wide; corollas broadly infundibuliform to campanulate, 3-4 cm long, 4-5 cm wide distally, 5-lobed, the lobes obtuse, 2.5-3 mm long, 9-10 mm wide, distinctive coloration pattern with concentric rings of purple distally, blue, black and ultimately deep yellow at the base, externally pubescent, the trichomes uniseriate, stipitate-glandular; stamens 5, included, the filaments inserted on lower third of corolla, unequal, three 5-7 mm long, two 8-10 mm long, pilose at the bases; anther thecae ca. 4 mm long, 1-1.5 mm wide, cream-white to yellow; ovary glabrous, basal nectary, 5 carpels, the style included, the stigma capitate, green. Mericarps ca. 15, angular, 3.5-4.5 mm long, joined at the faces, included within the expanding calyx, each with 1-2 seeds.

Flowering: October-December.

Etymology: This species is named to honor Dr. Karl Friedrich Reiche (1860-1929), the first botanist to classify the species described here as *N. reichei*. In his treatment of the Nolanaceae for the *Flora of Chile* (Reiche, 1910, p. 418), Reiche clearly describes this plant from the mouth of the Río Limarí near Fray Jorge, calling attention to the large corollas over 4 cm wide with prominent dark coloration in the throat. He referred the species with doubts *(«con duda refiero a esta especie»)* to *Sorema (Nolana) lanceolata* Miers ex DC. (1845, p. 498) with its type (*Cuming 856*, K-Herb. Hook.!) from Coquimbo. An examination of the type collection by I.M. Johnston convinced him that Miers' new species was identical to *N. acuminata* (Miers) Miers ex Dunal, and he cited Miers' *Sorema (Nolana) lanceolata* under the synonymy of *N. acuminata* Miers (Johnson, 1936, p. 42). Reiche was also familiar with *N. paradoxa* and recognized the differences between these taxa. We agree with these determinations, and therefore, find it necessary to validly publish this distinctive species and provide it with a fitting epithet. Karl F. Reiche was also known as «Carlos» in Chile and publications are sometimes cited under that name.

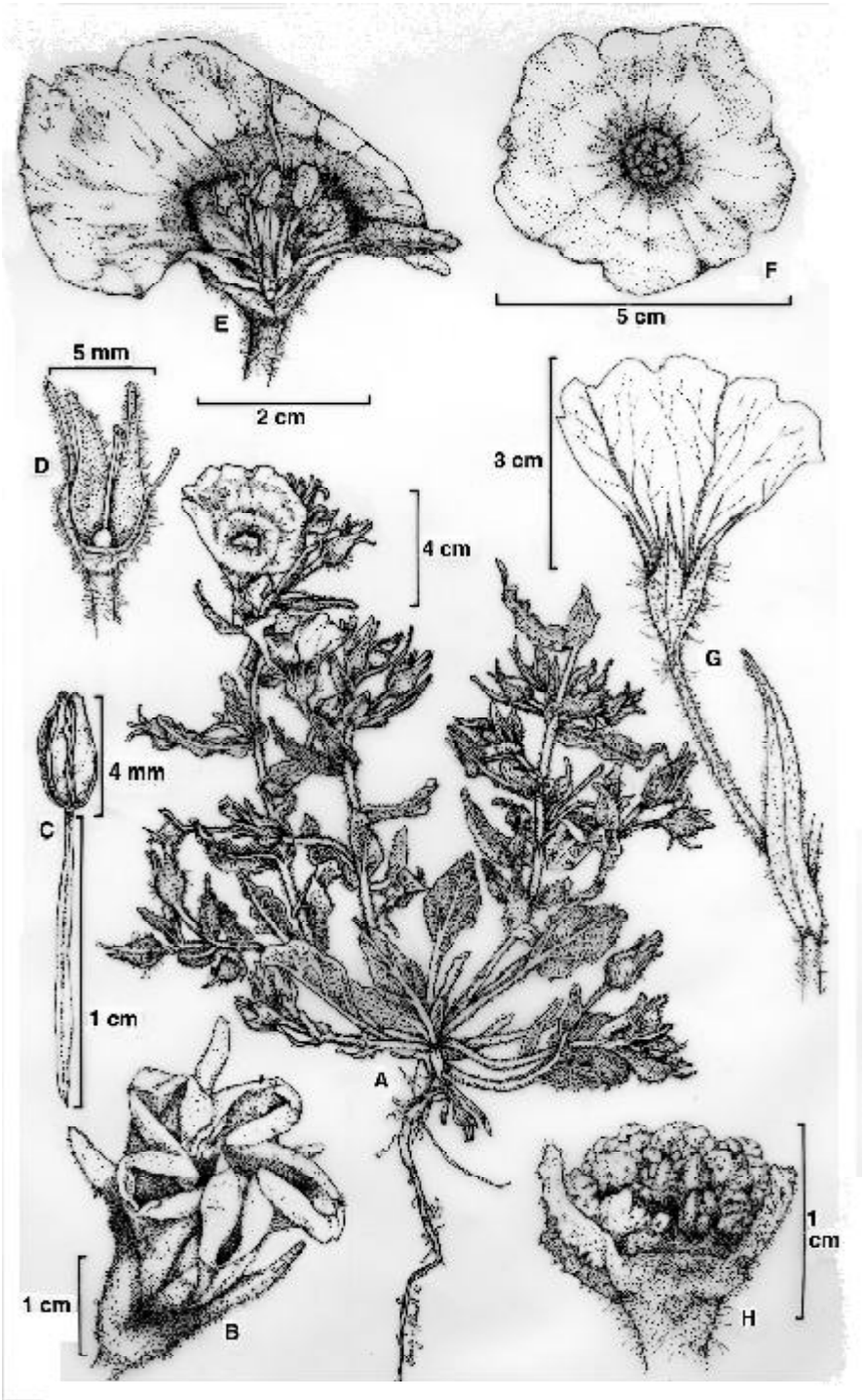

Fig. 12. *Nolana reichei* M.O. Dillon & Arancio. A. Habit; B. Openning corollas; C. Stamen; D. Calyx openned to expose gynoecium; E. Corolla dissected to expose bans of colors; F. Corolla; G. Flower and peduncle; H. Gynoecium with angular mericarps (Illustration of *Dillon & Arancio 8690*, F by Nancy Klaud).

Fig. 13. *Nolana reichei* M.O. Dillon & Arancio. A. Type locality at south side of Río Limarí (Caleta El Toro); B. Close-up of corolla displaying the bans of colors in the throat; C. Habit of prostrate to decumbent stems radiating from central tap-root and basal rosette.

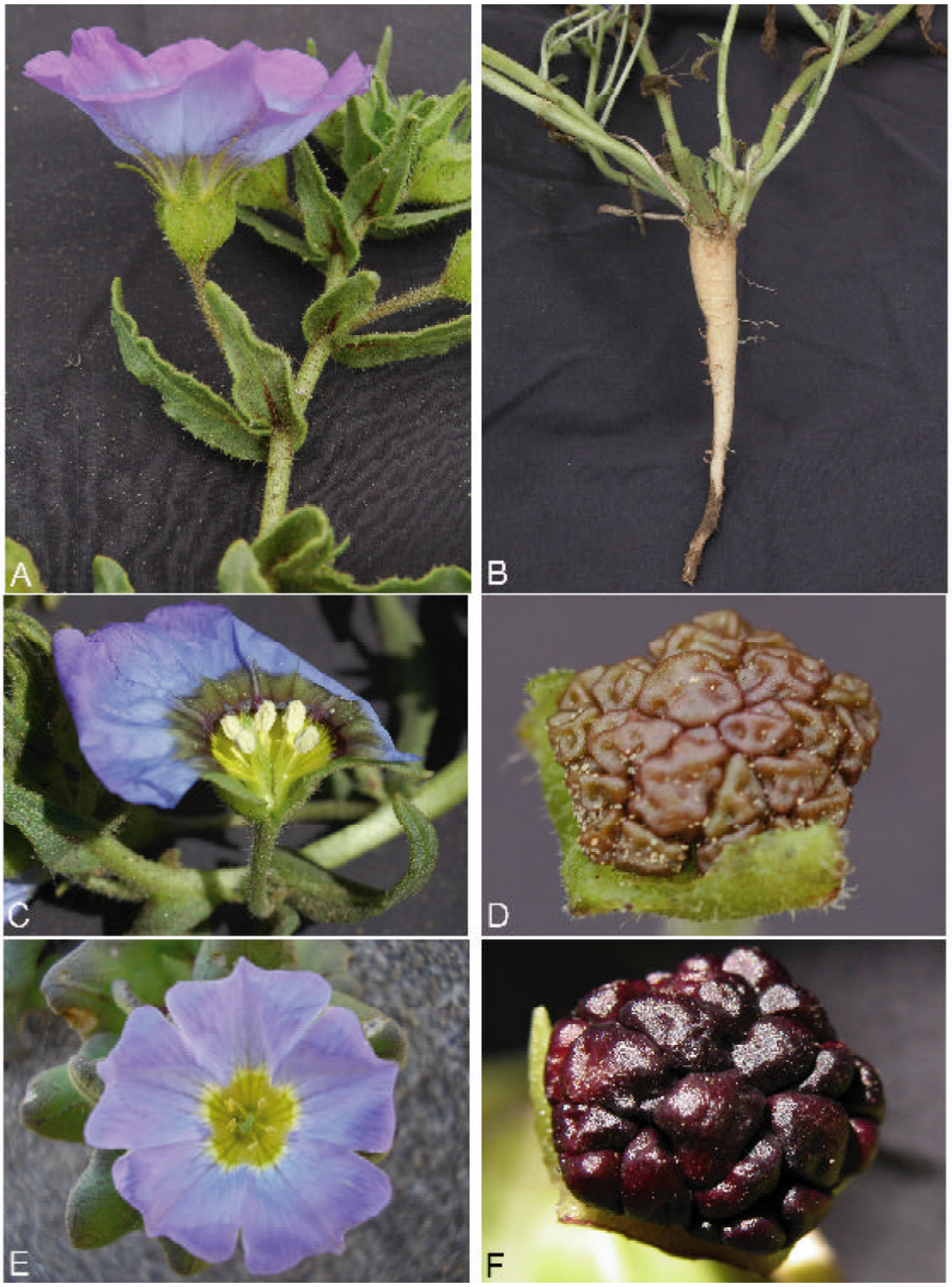

Fig. 14. *Nolana reichei* M.O. Dillon & Arancio. A. Calyx and corolla; B. Tap-root; C. Dissected corolla showing color patterns; D. Angular mericarps. *Nolana paradoxa*. E. Corolla; F. Rounded mericarps.

Distribution and ecology: Known only from the type locality, here designated as on the southern bank of the Río Limarí where it meets the ocean and at the site of Caleta El Toro (30°44.1'S, 71°41.9'W). This near-shore site is home to no fewer than five species of *Nolana* occur in close sympatry, including *N. crassulifolia, N. werdermannii, N. rupicola*, and *N. sedifolia*, all found with *N. reichei* at the type locality.

Relationships: In Miers' description (1845, p. 498) of *N. lanceolata*, he states that the corolla «much resembles» that of *N. paradoxa* (Fig. 14 E, F); however, the corolla of *N. reichei* (Fig. 13 B) is decidedly different in both lobe shape and coloration pattern. Further, the former species has more petiolate leaves with ovate leaf blades and corollas with only a yellow spot in the throat. Utilizing the GBSSI or waxy marker (Dillon et al., 2007b), *N. reichei* is shown to be in an unresolved clade as the sister species to *N. paradoxa*.

Both *N. paradoxa* and *N. reichei* are members of a clearly monophyletic clade within *Nolana*, that includes nine species essentially confined to Chile, including *N. acuminata, N. baccata, N. elegans, N. jaffuelii, N. pterocarpha, N. rupicola, N. parviflora, N. paradoxa*, and now, *N. reichei*. This group, termed the «*acuminata*» complex, has been recovered using several molecular markers, including ITS and *matK* (Tago-Nakawaza & Dillon, 1999) and GBSSI or waxy marker (Dillon et al., 2007b). Further, this group has a suite of morphological characters that unite them, including being facultative annuals or short-lived perennial herbs with a basal rosettes of leaves arising from a thick tap-root, the corollas are relatively large and showy at 3-5 cm in diameter, and gynoecium containing 10-35 mericarps.

The recognition of *N. reichei* comes after detailed study of the variation exhibited within *N. paradoxa* from throughout its distributional range. Of the five species of *Nolana* which were found co-occurring at the type locality, i.e., *N. crassulifolia, N. werdermannii, N. rupicola*, and *N. sedifolia*, only *N. rupicola* actually could be considered to be closely related as a member of the same clade (Dillon et al., 2007b). The latter species is immediately distinguished from *N. reichei* by possessing thick, succulent, ovate leaves and cream-colored corollas lacking bands of colors. Further sampling and analysis within the «*acuminata*» complex will be necessary to fully resolve its relationships and test character evolution in this most showy of the *Nolana* species.

Additional material examined: CHILE. Región IV(Coquimbo). Prov. Limarí. Caleta El Toro, desembocadura del Río Limarí. (30°44.152'LS, 71°42.028'LO), 20 m, 22 Oct 2005, *M.O. Dillon, G. Arancio, P. Ossa, & J.M. Fariña 8747* (F). Caleta El Toro [30,7315 ºS, 71,6973 °W], 10 m, 22 Oct 2005, *F. Luebert & C. Becker 2913* (SGO, F) .

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Hoffmann for sharing her beautiful painting of *N. reichei* executed by Chilean artist, Andrés Jullián. On first sight, I was inclined to reject the idea that it was a *Nolana*, but visiting the locality where Adriana had originally photographed this species confirmed its taxonomic position. The photograph of the corollas of *N. paradoxa* (Fig. 14 E) was kindly provided by Paulina G. Ossa-Zazzali. Illustrations for this work were done by Nancy Klaud (Fig. 12, *N. reichei*) and Segundo Leiva Gonzáles (Figs. 1, *N. dianae* and Fig. 6, *N. onoana*). We also wish to acknowledge and thank the Biodiversity Heritage Library for providing digital access to Reiche's *Flora de Chile* (http://www.biodiversitylibrary.org).

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