Distribution of Petunia axillaris (Solanaceae) and its new subspecies in Argentina and Bolivia

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Abstract. Petunia axillaris subsp. subandina, a new subspecies found in northwestern Argentina and Bolivia, is described, and distributions of three infraspecific taxa of P. axillaris in South America are discussed.

Key words: Argentina, Bolivia, Paraguay, subsp. axillaris, subsp. parodii, Uruguay.

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Petunia axillaris (Lam.) Britton, Sterns & Poggenb., one of the parental species of the garden petunia (Ferguson & Ottley, 1932), comprises two subspecies, subsp. axillaris and subsp. parodii (Steere) Cabrera. Subspecies axillaris was initially found in Montevideo, Uruguay, by Philibert Commerson, and described as Nicotiana axillaris by Lamarck (1793). The genus Petunia was established later by Jussieu (1803), and P. axillaris was treated as the type species by Nicolson (1991). Subspecies parodii was initially found in the central part of Formosa Province, Argentina, by Lorenzo R. Parodi. It was originally described as a species by Steere (1931), and thereafter was treated as a subspecies of P. axillaris by Cabrera (1977).

According to Steere (1931), these two subspecies are readily distinguished from each other by the difference in the stamen features and corolla shape; subsp. axillaris has didynamous stamens (2 long, 2 medium, and 1 short stamens) with a short corolla tube and rounded corolla lobes at their apices (see Fig. 1 in Ando et al., 1995), whereas subsp. parodii has four stamens of equal lengths (4 long, and 1 short stamens) with a long, slender corolla tube and acute corolla lobes at their apices (see Fig. 2 in Ando et al., 1995).

By observing species of Petunia in their native habitats and by examining specimens in major herbaria, I have recognized a new subspecies of P. axillaris occurring widely in northwestern Argentina and Bolivia. Its characteristics are herein described, and the distribution is discussed.

Materials and Methods

In order to observe species of Petunia sensu Fries (1911), I drove 74,000 km through northern Argentina, southern Brazil, and the whole of
Uruguay during eight seasons from 1988 to 1995. I observed species of *Petunia* at 1,136 different localities, including 181 localities of *P. axillaris sensu lato*.

I studied 361 specimens of *Petunia axillaris sensu lato* from 20 major herbaria (BA, BAA, BAB, BAF, BM, HBR, ICN, K, L, LP, MBM, MVFA, R, RB, S, SI, SP, U, US, VT). Specimens with hardly observable stamens, however, were removed from the following consideration. For subsp. *axillaris* and subsp. *parodi*, specimens from very general collecting localities were also removed from consideration.

Fig. 1. *Petunia axillaris* (Lam.) Britton, Sterns & Poggenb. subsp. *subandina* T. Ando. (holotype: Ando & Iida A100, si).
Results and Discussion

*Petunia axillaris* (Lam.) Britton, Sterns & Poggenb. subsp. *subandina* T. Ando, subsp. *nov.* (Fig. 1)


Annual, 0.5–0.7 m tall. Stem erect, often branched at base, densely glandular pilose. Leaves linear-oblong to oblong, (25–)40–90 mm long, (12–)15–25 mm wide, base attenuate, apex acute to obtuse, densely glandular pilose. Peduncle (22–)33–48(–55) mm long at anthesis, densely glandular pilose. Calyx cleft, segments 5, base fused 5–6 mm, segments linear to broadly linear, 10–15(–17) mm long, 2–3 mm broad, rounded at apex, densely glandular pilose on both sides. Corolla (50–)63–92(–105) mm long including lobes; tube narrow, cylindrical (Fig. 2B), (41–)46–75 (–80) mm long, inner surface of tube glabrous, outer surface of tube densely glandular pilose, lobes white, divided into 5 segments, segments depressed orbicular; apex of upper 3 lobes acute to mucronate; apex of lower 2 lobes rounded to truncate (Fig. 2A). Stamens 5, strongly didynamous (2 long, 2 medium, and 1 short; Fig. 2C, D); distance between anthers of long and medium stamens 2–3 mm; filaments (41–)45–71(–79) mm long, glabrous, affixed to base of corolla tube. Ovary ovoid; style (37–)40–65(–75) mm long, slender; stigma bilobed, slightly extended beyond anthers of long stamens. Pedicel inflexed, (30–)50–80 mm long in fruit. Capsule ovoid, 12–15 mm long, 6–8 mm in diam., apex mucronate. Seeds minute, subglobose, 0.5–0.6 mm in diam. Chromosome number 2n = 14.

This subspecies is found exclusively in the sub-Andean mountains (Muscolo, 1970) and adjacent regions, hence the name.

*Comparison of the floral morphology among subspecies*

My new subspecies of *Petunia axillaris* is characterized by didynamous stamens (like subsp. *axillaris*; Fig. 2C, D) and a long, slender corolla tube (like subsp. *parodii*; Fig. 2B). The degree of didynamy is stronger than in subsp. *axillaris*, and the distance between the anthers of the long and medium stamens is from two to three millimeters. Even though the stamen features are different, the floral morphology of subsp. *subandina* rather resembles that of subsp. *parodii*. Fortunately, the stamen features of subsp. *subandina* and subsp. *parodii* are easy to observe in dry specimens, probably because of the thin corolla tube. In contrast, the stamens are often hardly observable in subsp. *axillaris*.

The shape of the corolla lobes in subsp. *subandina* is different from the other infraspecific taxa of *P. axillaris*. The upper three corolla lobes are acute to mucronate at their apex, resembling subsp. *parodii*, but the lower two lobes are rounded to truncate at the apex, resembling subsp. *axillaris* (Fig. 2A).
As will be discussed later, Wijsman (1982) erroneously regarded my new subspecies as subsp. parodii. His “parodii” is actually subsp. subandina, except for two specimens from the northern edge of Buenos Aires Prov., Argentina, which may be true subsp. parodii. He proposed a critical length for the corolla tube (46 mm) to roughly distinguish his “parodii” from subsp. axillaris. In the paratypes of subsp. subandina, however, several specimens with corolla tubes shorter than 46 mm are also included as indicated by double asterisks in the Appendix. These flowers are on depauperate plants of overall smaller size.

**Distribution of infraspecific taxa of Petunia axillaris**

*Petunia axillaris sensu lato* is known to occur in Argentina, Bolivia, Brazil, and Uruguay (Ando et al., 1992; Figueroa Romero, 1994; Fries, 1911; Stehmann, 1985; Wijsman, 1982). It also occurs in Paraguay, as revealed in this study (Appendix).

Subspecies *parodii* and subsp. *subandina* are exclusive to Paraguay and Bolivia, respectively (Appendix). In Uruguay, subsp. *axillaris* and subsp. *parodii* are disjunctly distributed in the southeastern and northwestern departments respectively, and are roughly separated by the Rio Negro (Ando et al., 1994, 1995). In Rio Grande do Sul, Brazil, I also observed subsp. *axillaris* and subsp. *parodii* growing separately, as will be reported elsewhere.

It is interesting to note the distribution of the infraspecific taxa of *P. axillaris* in Argentina, because all of them occur there. Fortunately, important characters such as stamen features and length of corolla tube were
observable in 147 specimens collected in Argentina (Appendix). Even though further studies are necessary, the following points can be made about their distributions in Argentina:

As shown in Fig. 3, *Petunia axillaris sensu lato* grows in the northern half of Argentina, except in Misiones Prov. It is reasonable to say that the three infraspecific taxa of *P. axillaris* are allopatric.

Subspecies *axillaris* grows only in the central provinces such as in Buenos Aires and La Pampa (Fig. 3). In these regions, very flat, treeless grasslands of the lowland prairie, called Pampa, are predominant, and a limited number of hilly uplands occur scattered only in the southern Pampa. As shown in the Appendix, this subspecies seems to be restricted to such uplands (Sierra del Tandil, Sierra de Olavarría, Sierra de la Ventana, Sierra de Cura Malal and others in Buenos Aires Prov., and Sierras de Lihuel Calel in La Pampa Prov.), or otherwise to shores of large rivers (Río de La Plata in Buenos Aires Prov., and Río Negro in Río Negro Prov.).

As shown in Fig. 3, subsp. *parodii* is widely distributed in the northeastern provinces of Entre Ríos, Santa Fé, Corrientes, Chaco, Formosa, and northward to western Paraguay. It also occurs at the northern edge of Buenos Aires Prov. and in eastern Córdoba Prov. This region will be referred to as the *parodii* region. It seems to be especially abundant in Entre Ríos Prov. In Formosa Prov. (restricted type locality), however, it seems to be rather rare. The region including northern Buenos Aires, eastern Córdoba and Santa Fé provinces is a continuation of the Pampa. The region north of the Pampa, called Chaco, is a vast, wooded lowland plain, a continuation of the monotonous plain that extends to western Paraguay and southeastern Bolivia. It is also characterized by summer flooding along the rivers. The region lying between Río Paraná and Río Uruguay is called Mesopotamia, a rolling plain with grassy interfluves and forested vales. Notable mountains do not exist and swampy places are not rare (Muscolo, 1970).

In contrast, subspecies *subandina* is evidently a northwestern taxon exclusively occurring in mountainous regions from northern La Pampa, San Luis, Mendoza, northward to Salta and Jujuy provinces (“*subandina* regions”) (Fig. 3), and to central Bolivia. The distribution area is not the Andean Cordillera itself, but the mountainous systems lying between the Andes and the central plain. In Salta, Jujuy and Tucumán provinces, these regions are called the Sub-Andean mountains (Sierras Subandinas). The remaining, more southern regions are called the Sierras Pampeanas (Muscolo, 1970).

In the regions in which *Petunia axillaris sensu lato* grows the annual rainfall decreases westward from more than 1,000 mm to practically rainless conditions near the Andean Cordillera on the Chilean border (Muscolo, 1970). Most of the paratypes of subsp. *subandina* with a corolla tube shorter than 50 mm were collected from La Rioja and Mendoza provinces close to the Andes (Appendix). Further research will be necessary, but the possibility that the arid climate influences plant size and corolla morphology should be considered.

The habitats of subsp. *axillaris* and subsp. *parodii* are very close
Fig. 3. Distribution of the three infraspecific taxa of *Petunia axillaris* (Lam.) Britton, Sterns & Poggenb. in Argentina. subsp. *axillaris* (●), subsp. *parodii* (Steere) Cabrera (○), and subsp. *subandina* T. Ando. (△). Abbreviations of provinces: BA, Buenos Aires; CC, Chaco; CM, Catamarca; CO, Córdoba; CR, Corrientes; ER, Entre Ríos; FA, Formosa; JJ, Jujuy; LP, La Pampa; LR, La Rioja; MS, Misiones; MZ, Mendoza; NQ, Neuquen; RN, Río Negro; SA, Salta; SE, Santiago del Estero; SF, Santa Fé; SJ, San Juan; SL, San Luis; TM, Tucumán.
around Buenos Aires (Fig. 3). It will be necessary to examine features of overlapping, as suggested by Wijsman (1982).

The reason for confusion

There is a long history of confusion in recognizing infraspecific taxa in *Petunia axillaris*. If subsp. *subandina* is not recognized, the confusion remains.

Even though the four stamens of equal length were emphasized as important features in the original description of subsp. *parodii* (Steere, 1931), the most important character to distinguish subsp. *parodii* from subsp. *axillaris* has been quantitative, that is, the length of the corolla tube (Cabrera, 1977, 1979, 1983; Wijsman, 1982).

All paratypes of subsp. *subandina* (Appendix) were previously determined as subsp. *parodii* or solely as *P. axillaris*. Wijsman (1982), the most recent reviewer of *P. axillaris sensu lato*, also regarded them as subsp. *parodii*; he studied specimens in four major European herbaria (BM, K, L, and U), and presented a distribution map of *P. axillaris sensu lato* in South America. However, collecting localities in Entre Ríos, Santa Fé, Corrientes, Chaco, and Formosa provinces of Argentina are not shown on his map (see Fig 3. in Wijsman, 1982), even though subsp. *parodii* occurs there, as shown in the present study.

Subspecies *parodii* was originally described from Formosa Prov., Argentina, as mentioned earlier. I have studied typical plants with four stamens of equal length and very long corolla tube (around 75 mm in length) collected from Formosa Prov. (A. Cabral et al. 579; A. Cabral 607, 608 in BAB). A considerable number of specimens collected from *parodii* regions are also available in South American herbaria (BA, BAB, BAF, LP, SI), as shown in the Appendix. However, specimens of subsp. *parodii* do not exist in European herbaria visited by Wijsman (1982), except for one specimen from Entre Ríos Prov. (S. A. Renvoie et al. 2950 in K) and a few others from very general collecting localities.

Wijsman (1982) noted the remark of an Argentinean botanist, that “no *Petunia* can be found in the extremely inhospitable area (=Formosa Prov.)”. On the other hand, Cabrera (1977, 1979, 1983) mentioned the occurrence of subsp. *parodii* in *subandina* regions, from Jujuy to San Luis provinces, without comment on stamen features.

Parodi sent seeds of *P. axillaris sensu lato* collected in Formosa Prov. to Steere, and the plants grown from them are the type specimens of subsp. *parodii* (Steere, 1931). Parodi also sent seeds of a different source to Ferguson and Ottley, who thereafter illustrated the fine floral structure of plants grown from them to re-describe subsp. *axillaris*. Unfortunately, the plant was not subsp. *axillaris* but again typical subsp. *parodii* having four stamens of equal length, a long slender corolla tube, and acute corolla lobes (see plate 33 in Ferguson and Ottley, 1932).

Under such circumstances it is reasonable to view subsp. *subandina* as subsp. *parodii*, and to erroneously conclude that “no additional characters (other than corolla tube length) differentiating the two taxa (subsp. *axillaris* and subsp. *parodii*) have been found” (Wijsman, 1982).
In his distribution map, Wijsman (1982) illustrated two localities in the northern edge of Buenos Aires Prov. of *P. axillaris* whose plants have corolla tubes longer than 46 mm. Even though he did not list specimens, they may be subsp. *parodii*, since they are not in the *subandina* region, but in the *parodii* region.

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References


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Appendix

Among specimens of Petunia axillaris sensu lato collected in Argentina, Bolivia, and Paraguay, stamen conditions and length of corolla tube were observable to me only in the following specimens. Double and single asterisks for subspp. subandina and subspp. parodii indicate specimens with a corolla tube shorter than 46 mm and between 46 mm and 50 mm, respectively.

Paratypes of Petunia axillaris (Lam.) Britton, Sterns & Poggenb. subspp. subandina T. Ando


Córdoba Prov.: ? (Dec. 1924, W. Lossen 4, k); ? (30 Oct. 1878, G. Hieronymus s.n., k); La Hoyada (2 Feb. 1908, s.c. s.n., s); Dept. Capital, Córdoba (20 Oct. 1898, G. Hieronymus s.n., BM); Dept. Colón, Ascochinga (26 Oct. 1935, M. L. Giardelli 54, s); Dept. Punilla, Cruz Chica (9 Dec. 1952, M. M. Job s.n., lP); Dept. Tunilla, Villa del Lago (4 Nov. 1978, A. L. Cabrera et al. 30862, s); Dept. San Alberto, Mina Clavero (9 Nov. 1950, Capuro s.n., BA); Dept. San Alberto, Mina Clavero (26 Jan. 1940, Carl s.n., BA)**; Dept. San Javier, San Javier (1 Dec. 1927, Castellanos s.n., BA); Dept. San Javier, San Javier (12 Jan. 1939, Castellanos s.n., BA); Dept. San Javier, Villa Dolores (6 Dec. 1958, V. R. Perrone s.n., BA); Dept. Santa María, La Calera (10 Dec. 1908, Puysegur s.n., s); Dept. Santa María, Alta Gracia, Puesto del Cura (27 Jan. 1944, S. A. Pierotti s.n., s); Dept. Tulumba, entre Sauce Puncu y Villa Tumbula (11 Dec. 1949, A. E. Rágones 7387, BAB).


La Rioja Prov.: Velasco, Puesto Viejo (Jan. 1934, A. S. de Yepes s.n., BA); Dept. Chilecito, Nonogasta (15 Nov. 1927, Castellanos s.n., BA)*; Dept. Famatíná, Famatíná, camino al Alto Carrizal (9 Dec. 1951, Buchinger & Dawson s.n., BA); Dept. Famatíná, Los Corrales (13 Jan. 1976, A. L. Cab-
Boelcke et al. 27222, BAA, BAB, SI); Dept. Gral. Belgrano, Olta (1 Feb. 1940, Castellanos s.n., BA)*; Dept. Sanagasta, Vila Sanagasta (6 Dec. 1950, Buchinger s.n., BA)**.


Tucumán Prov.: cuesta de Mala-Mala (8 Feb. 1903, M. Lillo 3212, U); Dept. Capital, Parque 9 de Julio (10 Oct. 1922, Schreiter s.n., BA); Dept. Chiligasta, Alto Verde (7 Dec. 1945, E. Villa 663, BM); Dept. Famalaí, Quebrada de Lules (9 Nov. 1949, G. Dawson & A. M. Calastremé 1856, BAB); Dept. Leales, Río Salí (Nov. 1919, S. Venturi 518, BA); Dept. Leales, Río Salí (Nov. 1919, S. Venturi 578, S, SI); Dept. Leales, Río Salí (24 Nov. 1946, E. Wall & B. Sparator s.n., S); Dept. Monteros, ca. 60 km S.W. of Tucumán (23 Nov. 1967, J. de Haas 833, U); Dept. Tafi del Valle (10 Dec. 1946, E. Wall & B. Sparator s.n., S); Dept. Tafi del Valle (Mar. 1951, C. C. Olotg s.n., S); Dept. Tafi del Valle, Río de las Juntas (Schreiter 1920, BA); Dept. Tafi del Valle, Valle del Tafi (Nov. 1932, Schreiter 8827, U); Dept. Trancas, Tapia (Dec. 1902, G. A. Baer 141, S); Dept. Trancas, Tapia (28 Dec. 1911, Rodríguez 242, BA, SI, U); Dept. Trancas, Río Tapia (20 Oct. 1907, M. Lillo 7126, U); Dept. Trancas, San Pedro de Colalao (Jan. 1940, G. Meyer 3132, U).


Dept. Santa Cruz: Prov. Cordillera, Choreti, 3 miles from Camiri S20°00’ W43°50’ (16 Sep. 1949, W. M. A. Brooke 5646, BM, U).


Abbreviation: Ando = private collection of Toshio Ando.

* Petunia axillaris (Lam.) Britton, Sterns & Poggenb. subsp. axillaris

** ARGENTINA: Buenos Aires Prov.: Dept. Balcarce, La Brava (9 Nov. 1941, P. Moreau s.n., BA); Part. Balcarce, Sierra del Volcán (11 Oct. 1934, P. Boffa 337, LP); Part. Balcarce, Sierra Bachica, 6 km N. of the town (2 Nov. 1946, E. Wall & B. Sparator s.n., S); Dept. Castelli, on road to Mar del Plata, 2 km S of Río Salado (9 Dec. 1938, W. J. Eyerdam & A. A. Beetle 23198, K); Part. Cnl. de Marina Leonardo Rosales, Punta Alta (5 Nov. 1940, A. L. Cabrera 6624, LP); Part. Cnl. Suárez, Peralta, Campo “La Susana” (6 Feb. 1944, R. Huidobro 1153, BM); Part. Gral. Pueyrredón, Cerro la Pergamino, 20 km N of Mar del Plata (11 Dec. 1938, W. J. Eyerdam et al. 23687, K); Part. La Plata, Alrededores de La Plata, Abasto (19 Oct. 1932, A. L. Cabrera 2369, LP); Part. La Plata, Estancia Malúdon (12 Oct. 1939, G. Dawson 743, LP); Part. Magdelena, Magdelena, proximidades de Pipinas (17 Oct. 1983, R. Rossow 1815, BAB); Part. Magdelena, entre Verónica y Monte Veloz, en el camino al Rincon de Nuario (12 Nov. 1931, A. L. Cabrera 1659, LP); Part. Magdelena, Monte Veloz (25 Oct. 1936, M. M. Job 1380, LP); Part. Magdelena, camino entre Punta Piedra y Rancho de Barreto (22 Feb. 1973, O. Boelcke et al. s.n., BAA); Part. Magdelena, along camino de la Costa beyond Magdelena, opposit Punta Piedras (6 Nov. 1938, T. H. Goodspeed 23201, K); Part. Olavarría, Sierra de Olavarría (25 May...
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*Petunia axillaris* (Lam.) Britton, Sterns & Poggenb. subsp. *parodii* (Steere) Cabrera


Santa Fé Prov.: Dept. Castellanos, Rafaela (8 Feb. 1935, *Romani s.n., BA*).

安藤敏夫：Petunia axillaris (ナス科) の分布とアルゼンチンとボリビア産の新亜種

ベチュニア品種の片親である Petunia axillaris には、花筒が短く、花冠が大きく、花冠裂片が円頭ないしは切形で、2 強雄ずい (2 長雄ずい + 2 中雄ずい + 1 短雄ずい) をもつ亜種 axillaris (タイプ地：ウルグアイ・モンテヴィデオ) と、花筒が長く、花冠が小さく、花冠裂片が鋭形ないしは微凸形で、4 強雄ずい (4 長雄ずい + 1 短雄ずい) をもつ亜種 parodii (タイプ地：アルゼンチン・フォルモーサ州) が知られている。ところが、自生地を探査し、20 標本所蔵の標本を調べた結果、アルゼンチン北西部の山岳地域からボリビアにかけて、亜種 parodii に似て花筒が長い反面、雄ずい形態が亜種 axillaris に類似する新亜種が認識できたので、それを亜種 subandina として記載した。分布域はアンデス山脈そのものではなく、その東にあるサブアンデス山脈 (sierras subandinas) とその近傍であった。Wijsman (1982) は、欧州の 4 大標本館 (BM, K, L, U) 所蔵の P. axillaris を調べたが、そこには亜種 parodii の標本が 1 点しかなかったこともあり、亜種 subandina を亜種 parodii と混同して、亜種 axillaris と亜種 parodii は、花筒の長さにしか違いがないと報告していた。しかし、筆者の調べた南米の標本館には、亜種 parodii の標本が豊富にあり、これら 3 亜種の分布域を明確にし、互いに仕分けている実態を把握してきたかった。亜種 subandina を認識することにより、P. axillaris の亜種に関する誤解が解けたものと思われる。

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摘　要