



The identity of the Chilean frog *Alsodes laevis* (Philippi 1902) (Cycloramphidae): Synonymy and generic partitioning of the type series

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Alsodes laevis was described by Philippi (1902) as *Telmatobius laevis* based on two specimens deposited in the National Museum of Natural History of Chile by Lataste in 1887, and became later emended by Lynch (1978) as *A. laevis*. After its initial description, no further specimens were collected and attributed to *A. laevis*; the site of collection of these specimens remained so far elusive due to labelling problems. Based on new historical material and more detailed insights about their origin I argue that the type material of *A. laevis* comprises two different taxa. I thus propose a synonymy, and a generic partitioning for the taxon. Firstly, I describe the revalidation of *T. laevis* based on one type specimen, representing the southernmost *Telmatobius* species of Chile. I also argue that the other type specimen is a member of *A. nodosus*, which is known to exist in the more refined area of origin of the original specimens, the pre-Andean mountains of Santiago Province, Chile.

Key words: Amphibia, Anura, Cycloramphidae, *Alsodes laevis* synonymization, taxonomic identity, *Telmatobius laevis* revalidation.

INTRODUCTION

Zoological collections associated with museums and academic institutions play a crucial role at the forefront of biological sciences (Suárez & Tsutsui, 2004; Mesa, 2005; Rau, 2005), and their value in for example allowing to clarify the identity of species is steadily increasing (Formas et al., 2008). Frogs native to Chile comprise 61 species from 14 genera (Correa et al., 2011; Nuñez et al., 2012), with the genus *Alsodes* accounting for the largest number of species (Cuevas, 2008; Formas et al., 2008). However, the currently 18 recognized species of this genus might overlook unrecognized cryptic species and synonymies, and problems of unresolved taxonomic descriptions originating from the 19th century still persist today (Stuart et al., 2006; Formas et al., 2008).

Alsodes laevis (Philippi, 1902) is a species which was initially described as *Telmatobius laevis* on the basis of two adult specimens (syntypes) deposited in the National Museum of Natural History of Chile (MNHNC) by Fernand Lataste in 1887. One syntype became lost, and the other type specimen (called cotype by Müller, 1938) was sent to the Field Museum of Natural History of Chicago (FMNHC, Schmidt, 1928), where it has been kept until present (FMNHC 9978). After Gallardo's (1970) resurrection of the genus *Alsodes* Bell 1843, Lynch (1978) allocated this taxon to *Alsodes*. However, the nomination of *A. laevis* presented some inconsistencies from its first recognition (Müller, 1938; Cei, 1962), and its type locality has so far

not been clearly established. Philippi (1902) stated that Lataste labelled its origin as "Potrero", omitting a more specific name for the specimen's locality and precluding the establishment of a precise type locality. After more than a century, specimens of *A. laevis* have never been collected again (Cuevas & Formas, 2005), posing doubts about the identity of this taxon.

Recently, a plate by Philippi (1902) was found which is composed of two pictures of a frog (dorsal and ventral view) identified as *T. laevis*. In addition, a copy of the Chart of Excursionism of the Central Range (Klatt & Fickensher, 1929) showing the locality Potrero (the type locality of *A. laevis*) in the Andes Range of Santiago City, was made available to me. These new antecedents allowed new insights to revise the taxonomic identity of *A. laevis*. Taking our current knowledge of *Alsodes* Bell 1843 and *Telmatobius* Wiegmann 1834 into account (Wiens, 1993; Formas et al., 1999; Cuevas & Formas, 2002; Formas et al., 2005; 2006), conclusions about the identity of *A. laevis* and the generic partitioning of this taxon are proposed and discussed.

MATERIALS AND METHODS

The following iconographic and biological material were consulted: i) a copy of the lithographic illustration representing one of the two syntypes of Philippi's (1902) *T. laevis*, (referred to as syntype A), which did not appear in the original work but was issued as a separate art print.

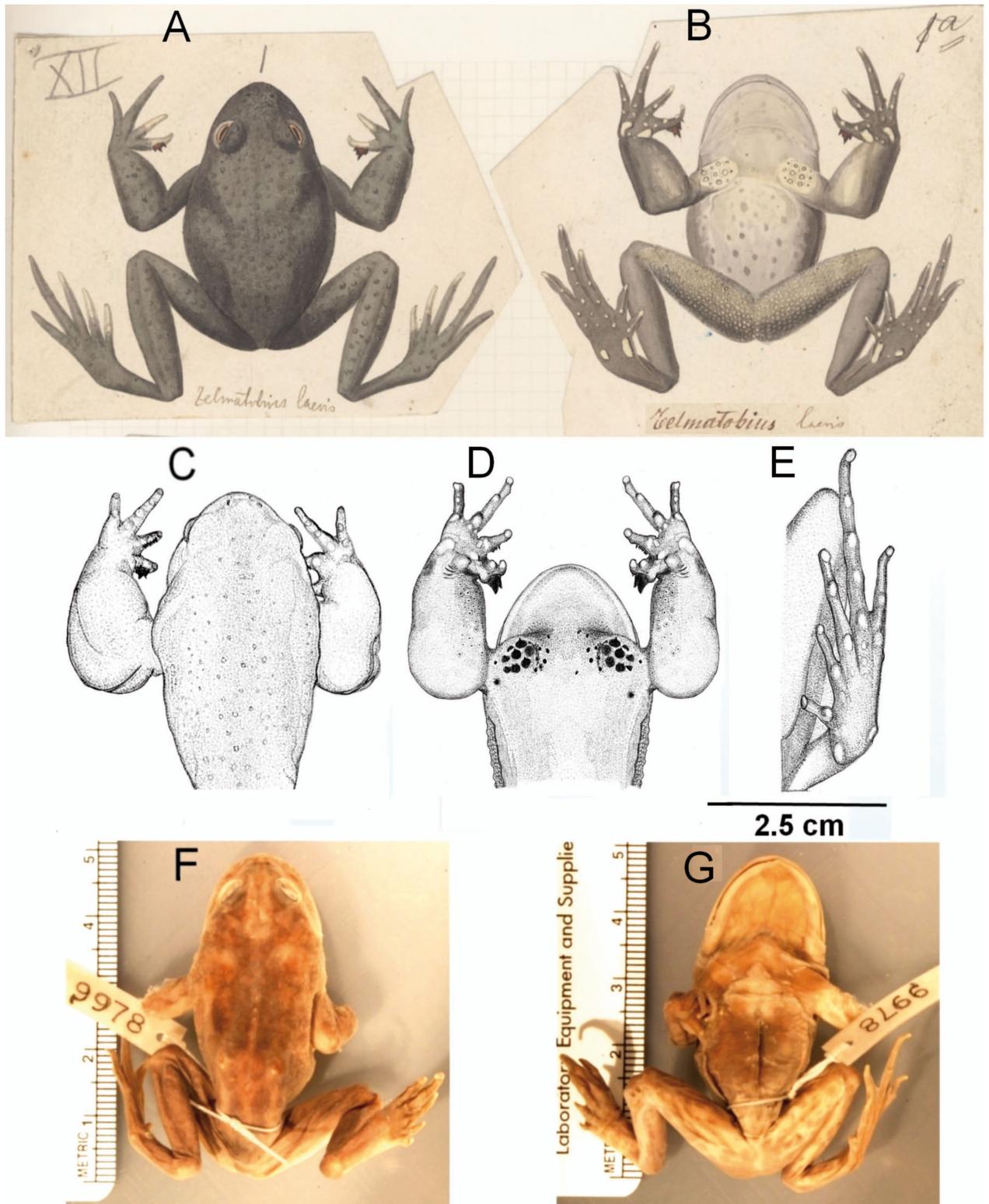


Fig. 1. Specimens of *Alsodes laevis* (Philippi 1902) (= *Telmatobius laevis* Philippi 1902). (A) dorsal view, (B) ventral view of the lost syntype referred to by Philippi (p. 43) as Pl. XII Fig. 1 and 5. (C) dorsal view, (D) ventral view, (E) foot of *Alsodes nodosus* Laguna Verde (Valparaíso Province) (CCCP 003): Note the similarity of the chest pads and foot with (B). (F) dorsal view, (G) ventral aspect of *Alsodes laevis* (Philippi 1902) (syntype FMNHC 9978), here resurrected as *Telmatobius laevis* Philippi 1902 and proposed as lectotype and the only available existing specimen.

It is referred in the text of “Suplemento a los Batraquios chilenos, descritos en la Historia Física i Política de Chile de Don Claudio Gay”, and permission to use it was obtained from the “Historical Library File Emilio Held Winkler” (Deutsch-Chilenischer Bund) in Santiago-Chile, through her Chief Librarian Mrs. Gerda Sommer; ii) a

photographic set of the syntype FMNHC 9978 of *A. laevis* (referred to as syntype B), combined with measures of the specimen; iii) a digitized copy of the “Chart of Excursionism of the Central Range” (Klatt & Fickensher 1929), obtained from the Deutscher Andenverein (DAV) of Santiago, Chile; iv) two male specimens of *A.*

Table 1. Comparative measurements of the type material (syntypes) of *Alsodes laevis* and a specimen of *Alsodes nodosus* from Valparaíso (Laguna Verde) province. All measurements in mm.

Characters	Specimens		
	Syntype <i>A. laevis</i> MNHNC (lost) ♂	Syntype <i>A. laevis</i> FMNHC 9978 ♂	<i>A. nodosus</i> CCCP 003 ♂
Snout vent length	50.00	47.60	75.00
Head length	17.00	15.50	27.40
Head wide	22.60	17.05	28.40
Eye snout dist	7.00	6.40	11.10
Inter-orbital dist	5.00	5.75	8.55
Thigh length	27.30	22.20	37.90
Forearm length	17.00	30.00	20.66
Tibia length	25.40	20.60	34.00
Tarsum length	12.25	4.75	23.40
Foot length	35.80	30.45	54.80

nodosus, one (CCCP 003) collected from Laguna Verde (33°05'29.51'S, 71°39'35.43'W, Valparaíso Province) by César Cuevas and Sandra Cifuentes (February 2008), and the other collected, photographed and released in Tunquén (April 2008) (33°16'19.52'S, 71°38'33.61'W); v) Consultations of Barbour & Noble (1920), Schmidt (1928, 1954), Müller (1938), and Cei (1962).

Measurements on syntype A were taken with Motic Image Plus v2.0 software. The software was calibrated with a metric rule, and a 100 x objective was used. Reference measurements from the original description of *T. laevis* (Philippi, 1902) were considered. Measurements of syntype B were taken by Alan Resetar at the Field Museum of Chicago under author indications. Measurements of a specimen of *A. nodosus* from Laguna Verde (Valparaíso, labelled as CCCP 003♂ for record purposes) and Lectotype NHMNP 763 of the same species were taken with a caliper to the nearest 0.1 mm. Vouchers and additional specimens analyzed in this study for comparative purposes are listed in the Appendix.

RESULTS

Plate (syntype A) Of *Alsodes laevis* (Philippi 1902; Fig. 1A, B)

State: Specimen location is unknown, apparently lost. Evidence: plate drawn by Philippi. The plate is identified with the Roman numeral XII handwritten and numbered 1 (dorsal view) and 1a (ventral view). Similarly, the specific assignation is made, which is clearly visible at the foot of both drawings (1 and 1a), identifying the specimens

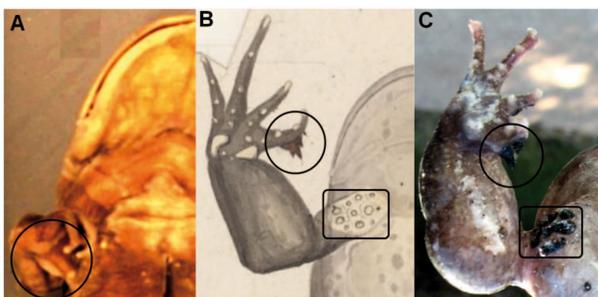


Fig. 2. Nuptial pad of examined specimens. (A) FMNH 9978, (B) MNHNC S/N, (C) CCCP 003 Adult male of *A. nodosus* from Laguna Verde (Valparaíso).

shown as *T. laevis* (Fig. 1 A, B). The reference *T. laevis* for the figure is given in Philippi (1902), page 43 for Plate XII fig. 4 and 5. The overall evidence suggests that these drawings by Philippi were based on syntype A which is currently lost in the MNHNC.

Description of syntype A (refers to the specimen with nuptial keratinized structures on the thumbs and nuptial patches on the chest, which are shown in the plate by Philippi; Fig 1A, B).

Internarial distance equals the interocular. Nostrils situated nearer the tip of the snout than the anterior border of eyes. *Canthus rostralis* evident. Eyes dorsolaterally oriented. Head 1.33 times wider than long. Forearms are in a well developed form. Metacarpal tubercles well developed with the outer larger than the inner. Subarticular tubercles proximally positioned on each finger; distal subarticular tubercle present in all fingers; supernumerary palmar tubercle present. First and second finger with whitish dorsum. Fingers in order of increasing length II<I<IV<III. Tips of fingers and toes rounded, approximately equal in size and whitish in colour. Dorsum, including head, arms and legs are dark with minute warps resembling spots. The belly is whitish with some light grey spots, which are less copious at throat level. Ventral region of thighs are very granulose, and light grey in colour. Metatarsal fold well developed covering ¾ of the *tarsum*. Inner metatarsal tubercle ovoid and enlarged, larger than the outer. Toes in order of increasing length I<II<IV<III<V. The sole presents quite developed tubercles and its white colour contrasts with the gray colour of the rest of the specimen's body. Toes are well fringed, but without distinct inter-digital webbing. For dimensions see Table 1.

Status of syntype B (FMNHC 9978) of *Alsodes laevis* (Philippi, 1902; Fig. 1E, F)

State: Well conserved specimen, although the left forearm is separate from the body. The specimen has a ventral longitudinal cut, but conserves all internal organs (Fig. 1E, F) in apparent good form.

Description: The following description is based on a set of photographs and observations of syntype B, a male with well developed secondary sexual features with an evident *Telmatobius* habitus. Medium sized (47.6

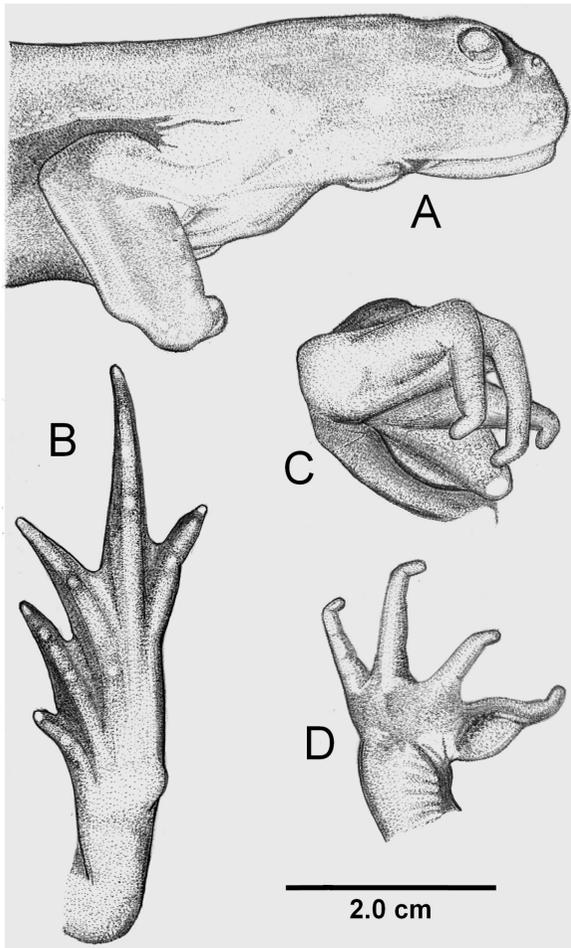


Fig. 3. *Telmatobius laevis* lectotype FMNHC 9978. (A) lateral view, (B) left foot, showing foot webbing, (C) right hand with sexual spines, (D) left hand with deformed thumb. Drawings based on photographs.

mm SVL) adult male. Specimen robust, with flat head slightly wider than the body. Head wider than long (HLEN 1.36 times HWID). Head length 40.54% of SVL. Head width of 29.72% SVL; slightly short and flattened. Snout perfectly rounded in dorsal view. Tympanum hidden under skin (Fig. 3A). Nostrils barely protuberant, oriented toward the front and slightly laterally. Eyes obliquely oriented; inter-orbital gap equal to that of the top eyelid. Vomerine teeth absent or reduced (Fig. 3B), but a barely protuberant region like two horizontal fleshy crests between the choanae is present; choanae ovoid with anterior border extending towards lateral region of the roof of the mouth. Tongue oval and free behind; its transverse diameter is the same as the mouth gap. Legs short, with fringed toes but with much notched foot webbing (Fig. 3C). Skin entirely smooth and soft (without wrinkles, Fig. 3A). Lateral extremities well developed, fingers in order of decreasing length: 3-4-1=2 (Fig. 3D, E). Feet totally webbed but notched up to a third of its height. Webbing formula: I 1-2 2/3 II 1 2/3- 3 1/3 III 2 2/3-3 2/3 IV 3 2/3-2 V (Fig 3C); webbing diminishing distally to form narrow fringes along lateral margins of toes. Sub-articular tubercles barely evident; metatarsals tubercles: outer small, inner reduced and oval; tarsal fold evident and covering until three third of *metatarsus*. The tibiae - metatarsal joint reaches the eye.

Secondary sexual characters, adult male: keratinous granulations in the first finger in pad like form (Fig. 1D, E; Fig. 2A). No keratinous structures on the chest. The belly is smooth with minute granules towards the axillaries regions. The colouration is dorsally dark grayish, diffuse in colour with brown spots. The belly is grayish, with yellow spots on the thighs.

Comparison between both syntypes A (MNHNC) and B (FMHC 9978) of *A. laevis* (Fig. 1A, B and E, F)

Comparing the description by Philippi (1902) with the observations done on the syntype of *A. laevis* reveals evident differences. The drawing of syntype A (MNHNC) present two rounded bilateral patches on the chest (absent in syntype B), which was omitted in the description of Philippi (1902). Another character omitted in the original description is the package of nuptial spines in the thumb, also insinuated in the second finger, which are clearly drawn by Philippi but absent in syntype B. Syntype B presents nuptial asperities only on the first finger and they are homogeneously distributed, differing from the configuration present in the other type. The foot of the syntype drawn by Philippi presents toes slender and well fringed without distinct webbing, whereas syntype B presents the foot with slender toes and well developed inter-digital webbing. Syntype A possesses distinct whitish tubercles on the palmar hand and ventrally on the toes, whereas syntype B possesses small nodes on the palms and toes.

Comparison between the Sytypes (A and B) of *Alsodes laevis* and a specimen of *A. nodosus* (Fig. 1A, B; C, D and Fig. 2)

Specimen CCCP 003 of *A. nodosus* is an adult male with well developed secondary sexual features from Laguna Verde, close to the species' type locality (Valparaíso). When syntype A and the specimen of *A. nodosus* are compared, it becomes evident that they share similar external features. Both present the dorsum without pattern of drawing in dorsal view (Fig. 1). In addition, the dorsum appears with granulations distributed uniformly through the body and with minor frequency on arms and legs. In both specimens the arms are in a well developed state. Both animals present the belly whitish coloured, with two bilateral chest patches consisting of at least eleven spines, each one in a paintbrush-like form which is characteristic of *A. nodosus* (Ceï, 1960, 1962). The spines located on the thumb also share the same pattern in both specimens. Measurements of the *A. nodosus* specimen from Laguna Verde and those given by Philippi (1902) in the original description of *A. laevis* are shown in Table 1.

I therefore conclude that the syntype drawn by Philippi (1902) and the *A. laevis* syntype B represent two different genera. The drawn syntype of *A. laevis* by Philippi is suggested as synonymous with *A. nodosus*. Moreover, syntype B represents *T. laevis* Philippi 1902, and is designated as a lectotype herein (Fig. 3).

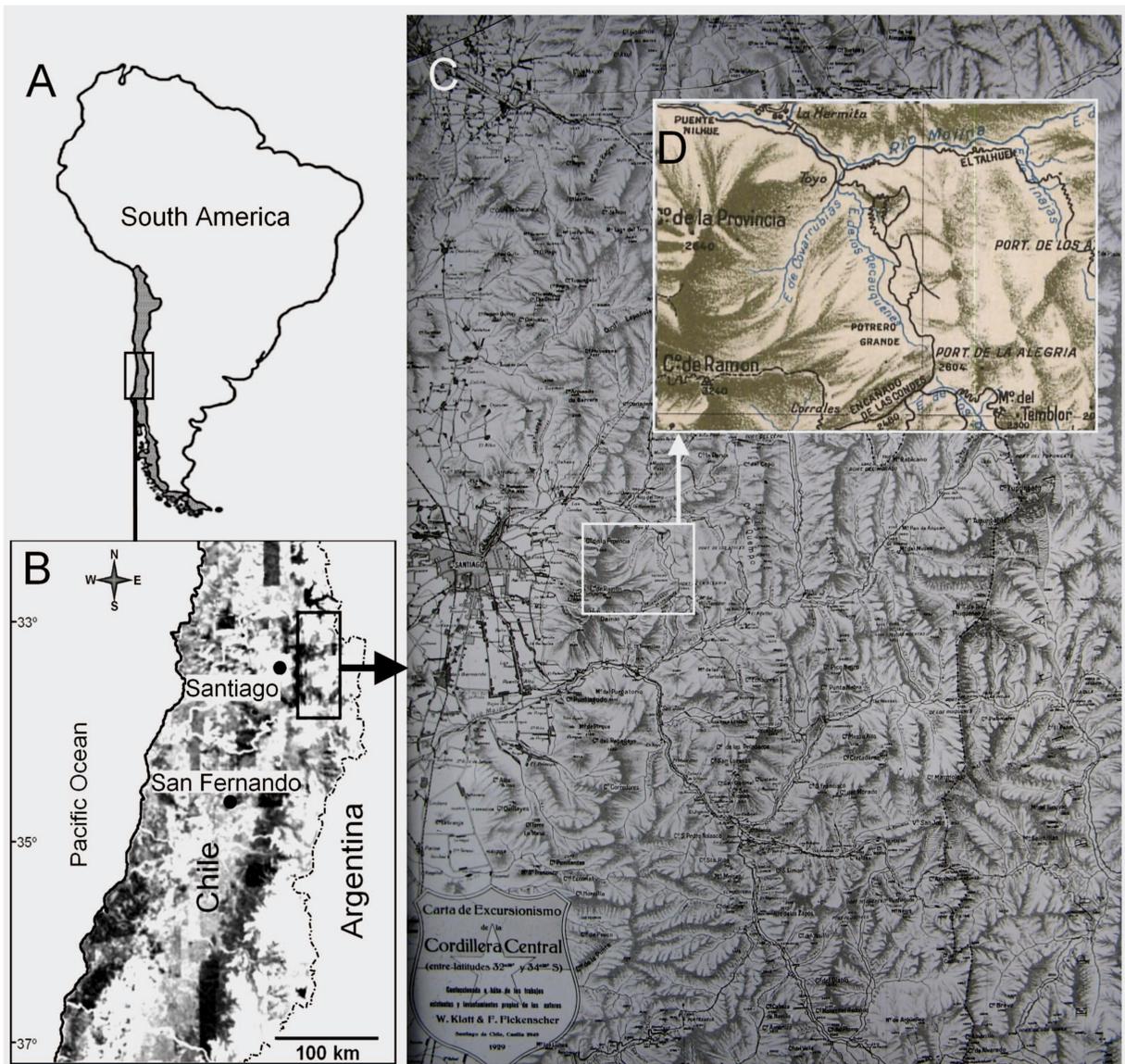


Fig. 4. Location of the type locality of *Telmatobius laevis* Philippi 1902 in Central Chile. (C) and (D) map by Klatt & Fickensher (1929). Locality named as Potrero Grande.

The Chart of Excursionism of Klatt & Fickensher (1929) (Fig. 4)

Based on information by Lataste, Philippi (1902, p. 44) designated Potrero as the type locality of *A. laevis*. However, Potrero is a very commonly used name referring to pasture land (Astaburuaga, 1867; Riso-Patrón, 1924). Müller (1938) identified the locality as “Potrero Grande” of the Province of Aconcagua (Riso-Patrón, 1924), and Ceï (1962) assumed Potrero Grande as the type locality of *T. laevis*.

In 1929, two members of the Deutscher Andenverein (DAV) described an uplifting of the Central Range of Chile with the help of a map (Chart of Excursionism of the Central Range, Klatt & Fickensher 1929, Fig. 4). They refer to a plateau “Potrero Grande” (33°28’33”S, 70°23’54”W), limited in the north-east by the stream Recauquenes and in the north-west by the stream Covarrubias; to the south, this plateau is limited by La Encañada de las Condes (Fig. 4D). Potrero Grande is located to the west of Cerro de Ramón, in straight line with the city of Santiago (Fig. 4C). Remarkably, the locality Potrero Grande by Klatt & Fickensher (1929) coincides with records for *A. nodosus*

by Bogart (1970), Díaz & Valencia (1985) and Penna et al. (1983), providing evidence that it is the locality mentioned by Lataste (see also Busse, 1980; Penna et al., 1983). *Alsodes nodosus* has also been reported for Lagunillas (33°22’S, 70°21’W) and Yerba Loca (33°20’S 70°18’W), neighbouring Potrero Grande (Bogart, 1970; Cuevas, unpublished data). I therefore suggest that *A. laevis* is synonymous with *A. nodosus*.

Taxonomic accounts

Telmatobius laevis Philippi, 1902. Supl. Batr. Chil. Descr. Hist. Fis. Polit. Chile: 43. Syntypes: MNHNC (2 specimens) according to the original publication; one of these now FMNH 9978 (on exchange from MNHNC according to Schmidt, 1928, Rev. Chil. Hist. Nat., 32: 103). Type locality: “Potrero”, Chile (Potrero Grande, near Santiago, Chile). Ceï, 1962; Batr. Chile: 63, noted that the type locality had not been located with certainty. *Alsodes laevis* (Philippi 1902), Lynch, 1978. Occas. Pap. Mus. Nat. Hist. Univ. Kansas, 72: 50. *Telmatobius laevis* Philippi 1902, Cuevas, 2013. This paper.

DISCUSSION

Most of Philippi's (1902) species were regarded as doubtful since they were often representing different morphs (Formas et al., 1974; Formas & Veloso, 1982). This can be clearly exemplified by the fact that *Telmatobius* (= *Alsodes*) *laevis* was described by Philippi (1902) in the same book where he performed a review of *Cystignathus* (= *Alsodes*) *nodosus* Duméril & Bibron 1841, using specimens from the Cordillera de los Andes of Santiago (*Cystignathus nodosus*, variety "granulatus", pp. 98). Thus, morphological variability and differences in reproductive stages between the two syntype specimens of *T. laevis* likely caused Philippi not to assume that one of the syntypes was a member of *C. nodosus*. Moreover, the descriptions given by Philippi (1902) were not supported by figures, which led to confusion among later authors. Consequently, the rediscovery of drawings by Cei (1958) resolved several taxonomic problems originated from Philippi's descriptions. This is however not the case for *A. laevis*.

The present results are based on photographs of syntype B as well as Cei's (1962) description of the same specimen, and allow to conclude that the specimen can be assigned to *Telmatobius*. Sexual features of mature adult males are markedly different between *Alsodes* and *Telmatobius* (Wiens, 1993; Cuevas & Formas, 2001, 2002), and the size and distribution of keratinized nuptial excrescences on the thumbs and chest of adult males provide diagnostic characters to distinguish among species of both genera (Wiens, 1993). *Alsodes nodosus* possesses bilateral nuptial patches on the chest composed by at least nine small clusters of spines forming a rounded patch (Fig. 1B, 3B); the remaining *Alsodes* species possess rounded patch characterized by homogeneously distributed spines. This confirms that syntype A is synonymous with *A. nodosus*, and does not represent other *Alsodes* species. Mature males of *Telmatobius* do not present patches on the chest, and only a pad of homogeneous spines on the first finger is evident (Fig. 2C). This conclusion is corroborated by Cei's (1962) comment on syntype B: "It has been supposed next to *T. hauthali*, of the Andes of La Rioja and Catamarca, in Argentina. But, according to Schmidt, it is of course different to *T. peruvianus*, and in accordance with the numbered characters it would be well recognizable from *Alsodes* (= *Telmatobius*) *montanus* for the head shape, the natatorium membrane and the secondary sexual characters".

The final controversial aspects derived from the original description of *A. laevis* are related to its type locality. Unlike suggested by Müller (1938) and Cei (1962, plate XI), the locality is in the pre-Andean mountains of Santiago Province rather than in Aconcagua. The Aconcagua Province was an administrative subdivision in Chile between 1826 and 1974, extending from the Choapa River in the north (30°27'S) uphill to Chacabuco (32°59'S, 70 km north of Santiago de Chile) in the south, and from the Andes Range to the Pacific Ocean in the west. Therefore, Potrero Grande was not included. This data coincides with the northern range of *A. nodosus*,

which is in the Petorca Province (32°15'S, 72°55'W, Cei, 1962). If both syntypes were collected from the same locality (Potrero Grande, Andes Mountain, Santiago de Chile, Fig. 2), as is hypothesized herein, then the specimen FMNHC 9978 represents the southernmost distribution of *Telmatobius* in Chile (33°46'S, 70°41'W). Previously, Formas et al. (2006) described *T. chusmisensis* from Chusmisa (19°41'S, 69°13'W), 92 km northeast of Huara, Iquique Province, I Región of Tarapacá, Chile, at approximately 3650 m elevation. Cei (1977) previously described *T. contrerasi* from Valle del Rio Gualcamayo (about 30°45'S, 68°38'W) north of Cerro Madrid, San Juan Province, Argentina (Fig. 2) as the species with the southernmost distribution.

The present work suggests that the genus *Alsodes* only comprises 17 species (*A. australis*, *A. barrioi*, *A. coppingeri*, *A. hugoi*, *A. gargola*, *A. igneus*, *A. kaweshkari*, *A. montanus*, *A. monticola*, *A. nodosus*, *A. norae*, *A. pehuenche*, *A. tumultuosus*, *A. valdiviensis*, *A. vanzolinii*, *A. verrucosus* and *A. vittatus*), whereas the revalidation of *T. laevis* Philippi 1902 increased the members of this genus in Chile to 11 species (*T. peruvianus*, *T. halli*, *T. dankoi*, *T. marmoratus*, *T. vilamensis*, *T. fronteriensis*, *T. philippi*, *T. chusmisensis*, *T. pefauri*, *T. laevis*). The clarification of the identity of a species which was seen as problematic for a long time confirms the necessity of morphology-based taxonomic investigations when DNA and chromosomal studies are not possible, enabling further ecological and evolutionary investigations (Wiens & Servedio, 2000; Wiens & Penkrot, 2002).

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APPENDIX

Alsodes laevis (Philippi 1902). One specimen. Adult male. Syntype FMNHC 9978. Locality: Potrero, Santiago Province, Chile.

Alsodes nodosus (Duméril & Bibron 1841). One specimen. Adult male. César Cuevas & Sandra Cifuentes, Catalogo Provisorio (CCCP) 003. Locality: Laguna Verde, Valparaíso province, Chile.

Alsodes nodosus (Duméril & Bibron 1841). One specimen. Adult male. César Cuevas & Sandra Cifuentes, Photographs (released). Locality: Tunquén, Valparaíso province, Chile.