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Taxonomic revision of the genus *Tetraglochin* (Rosaceae, Rosoideae) and morphometric analysis of its species

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Abstract

Tetraglochin is a small genus distributed along the Andes from Perú to southern Argentina and central Chile, belonging to the family Rosaceae. Systematic studies in *Tetraglochin* are scarce, and circumscription of some members of this genus is controversial. In order to evaluate the degree of morphological differentiation between the species of this genus, we performed morphometric analyses using multivariate methods (non parametric ANOVA, phenetic analysis and canonical discriminant analysis) including those specimens with intermediate characteristics between *T. alata* and *T. ameghinoi*. The phenogram obtained showed two principal clusters; this picture suggested a clear grouping of the specimens of *T. alata, T. ameghinoi, T.* aff. *alata* and *T. andina*. In the canonical discriminant analysis five groups were found and in general terms all individuals of *T. alata*, *T.* aff. *alata* and *T. ameghinoi* were grouped together. When multivariate analyses were applied almost all specimens could be correctly assigned to its species. However, specimens of *T. alata*, *T.* aff. *alata* and *T. ameghinoi* , were not well discriminated. Following recent phylogenetic results on the genus, and morphometric analyses perfomed herein for the first time, we present an updated taxonomic revision of *Tetraglochin*, based on exomorphological, vegetative and reproductive characters, including a key to identify species and varieties, their associated synonymy, full descriptions, geographical distribution and illustrations. As result, a new combination, *T. alata* var. *ameghinoi* is proposed, *T. alata* var. *patagonica* is reduced to synonymy of *T. alata* var. *alata*, and *T. paucijugata* and *T. tragacantha* are reduced to synonymy of *T. cristata*. Lectotypes for *Margyricarpus acanthocarpus*, *Tetraglochin acanthocarpa* var. *lasiocarpa*, var. *dasycarpa*, var. *macropoda* and var. *lejocarpa* are designated. One species, *Tetraglochin buxifolia* is excluded from the genus.

Key words: morphological characters, multivariate analyses, taxonomic revision, *Tetraglochin*

Introduction

Tetraglochin Poepp. is a small South American genus comprising nine species distributed along the Andes from Perú to southern Argentina and central Chile, reaching high altitudes up to 5000 m in Bolivia and northern Argentina (Acosta *et al.,* 2016).

The genus belongs to the family Rosaceae, subfamily Rosoideae, tribe Sanguisorbeae, subtribe Sanguisorbinae (Eriksson *et al*., 2003). Although the Rosaceae includes many important fruit crops and ornamentals and have therefore received considerable attention, the Sanguisorbeae has been largely ignored, with the exception of some monographs and revisions on particular genera: *Acaena* Mutis ex L. was revised by Bitter (1911a), Grondona (1964, Argentinean species), and Marticorena (2006, Chilean species); *Polylepis* Ruiz & Pav. was studied by Bitter (1911b), Simpson (1979), and Kessler (1995, Bolivian species); *Cliffortia* L. was revised by Weimarck (1934); *Sanguisorba* L. and closely allied genera were studied by Nordborg (1966; 1967). The tribe, as currently defined, includes herbaceous, shrubby or arborescent plants, with flowers whose cup-shaped hypanthium encloses the fruit without being fused to it (Zardini, 1973), resulting in a perigynous position of the flower.

The shape of the hypanthium is highly variable within the tribe: rounded and smooth, fleshy, winged or thorny. Furthermore, the structure of flowers is also variable, i.e., petalous flowers are present, as in members of subtribe Agrimoniinae J. Presl, or apetalous flowers, characteristic of subtribe Sanguisorbinae Torr. & A. Gray (Eriksson *et al.,* 2003).

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The tribe comprises approximately 14 genera, which are mostly concentrated and diversified in the southern hemisphere; of these, *Tetraglochin*, *Polylepis*, *Margyricarpus* Ruiz & Pav. and *Acaena*, are present in South America (Pérez de Paz, 2004).

Tetraglochin has been usually defined by including shrubby plants, frequently thorny, with long branches (macroblasts) with deciduous leaves, and short branches (brachyblasts) few-flowered and with persistent leaves. The flowers are apetalous and the fruit is an achene enclosed by the dried receptacle or hypanthium. Regarding the hypanthium, it can vary in its shape, texture, and size, and generally is very useful to recognize species.

Most of the taxa now included in *Tetraglochin* were originally placed in the genus *Margyricarpus*, both genera comprising dwarf sclerophyllous shrubs, the latter differentiated by its fleshy hypanthium, including the achene, therefore classified as drupaceous (Zardini, 1974; Grondona, 1984). Similarities between both genera possibly led some authors (Spegazzini, 1897; Kalkman, 2004) to include *Tetraglochin* within *Margyricarpus.* In his revision of the southern patagonical plants, Spegazzini (1897: 512) treated the genus *Margyricarpus* and informally proposed three sections, based on fruit characters: *M.* sect. *Eumargyricarpus* Speg. with drupaceous fleshy fruits, *M.* sect. *Tetraglochin* Speg. with nut-shaped winged fruits, and *M.* sect. *Pseudacaena* Speg. with nut-shaped spinose or irregularly winged fruits. Although Spegazzini did not mention which species were placed in each section, he certainly expanded the genus *Margyricarpus* to comprise the species of *Tetraglochin* probably in the last two sections, both of them with dry fruits.

Taxonomy of *Tetraglochin* has been scarcely studied. Rothmaler (1939) carried out a synopsis of the genus. He referred to Spegazzini's sections in *Margyricarpus* and concluded that *Tetraglochin* should be reinstated at generic level due to differences in the receptacle. This author recognized eight species, grouped in two sections based on vegetative and fruit characters: *T.* sect. *Caulia* Rothmaler (1939: 430), including thorny plants, with thorns in the fruit and/or thorns coming from the induration of the petiole-rachis axis of leaves; and *T.* sect. *Johnstonia* Rothmaler (1939: 431), consisting of unarmed plants. He concluded that a special study of the genus was needed, as he could analyze scarce material of some taxa and also found intermediate forms between species.

Tetraglochin has been also accepted as a genus in regional floras. Grondona (1984), mentioned three species and two varieties of *Tetraglochin* for Patagonia in Argentina: *Tetraglochin alata* (Gillies ex Hook. & Arn.) Kuntze var. *alata* and var. *patagonica* Grondona, *T. caespitosa* Phil. and *T. acanthocarpa* (Speg.) Speg. Novara (1993: 22), when revising the flora of Valle de Lerma (Argentina, Salta), mentioned *T. ameghinoi* (Speg.) Speg. as part of the typical flora of "Prepuna" and "Monte", and cited another two species for Salta: *T. cristata* (Britton) Rothm. and *T. inermis* (I. M. Johnst.) Rothm. Kiesling (1994) cited *T. alata* for the province of San Juan (Argentina).

Species of *Tetraglochin* have also been cited in different catalogues: Foster (1958) mentioned *T. alata*, *T. cristata* and *T. ameghinoi* for Bolivia, Marticorena & Quezada (1985) included *T. alata*, *T. cristata* and *T. acanthocarpa* in the vascular flora of Chile, Brako & Zarucchi (1993) mentioned *T. cristata* and *T. tragacantha* Rothm. for Perú, and Marticorena (2008) included seven species and two varieties in the vascular flora of the Southern Cone: *T. acanthocarpa*, T. *alata* var. *alata* and var. *patagonica*, *T. ameghinoi*, *T. caespitosa*, *T. cristata*, *T. inermis* and *T. paucijugata* (I. M. Johnst.) Rothm.

Recently, morphological studies and phylogenetic analyses were carried out in six species of *Tetraglochin* (Acosta *et al.,* 2016) concluding that the genus is monophyletic with *Margyricarpus* as its sister group. Both morphology and phylogeny also led to recognize a new species, *T. andina*, segregated from *T. ameghinoi,* and characterized by its papyraceous and not membranaceous hypanthium and its more northern distribution.

Regarding the morphology, the hypanthium characters were the most useful to recognize species within the genus. However, *Tetraglochin alata* and *T. ameghinoi* appeared as morphologically closely related and sometimes difficult to identify, as they share several hypanthium and vegetative characters, and geographical distribution (Southern Andes and Patagonia). The molecular phylogeny agreed with this close relationship (Acosta *et al.,* 2016). Regarding these two species, their delimitations are therefore traditionally contentious. Rothmaler (1939) treated *T. alata* and *T. ameghinoi* as distinct species and considered the size of the hypanthium as the only character to separate both taxa (8 mm or longer in *Tetraglochin alata* and less than 8 mm in *T. ameghinoi*). On another hand, other authors (Grondona, 1984; Kiesling, 1994) treated them as a single entity, with the hypanthium ranging from 5 to 14 mm long.

Consequently, as the studies in the genus *Tetraglochin* are scarce and the separation between *T. alata* and *T. ameghinoi* is still controversial, the aims of the present study were to evaluate the degree of morphological differentiation between the species of this genus and to examine the taxonomic identity of *T. alata* and *T. ameghinoi*. Likewise, we present an updated taxonomic revision of the genus *Tetraglochin* based on vegetative and reproductive characters.

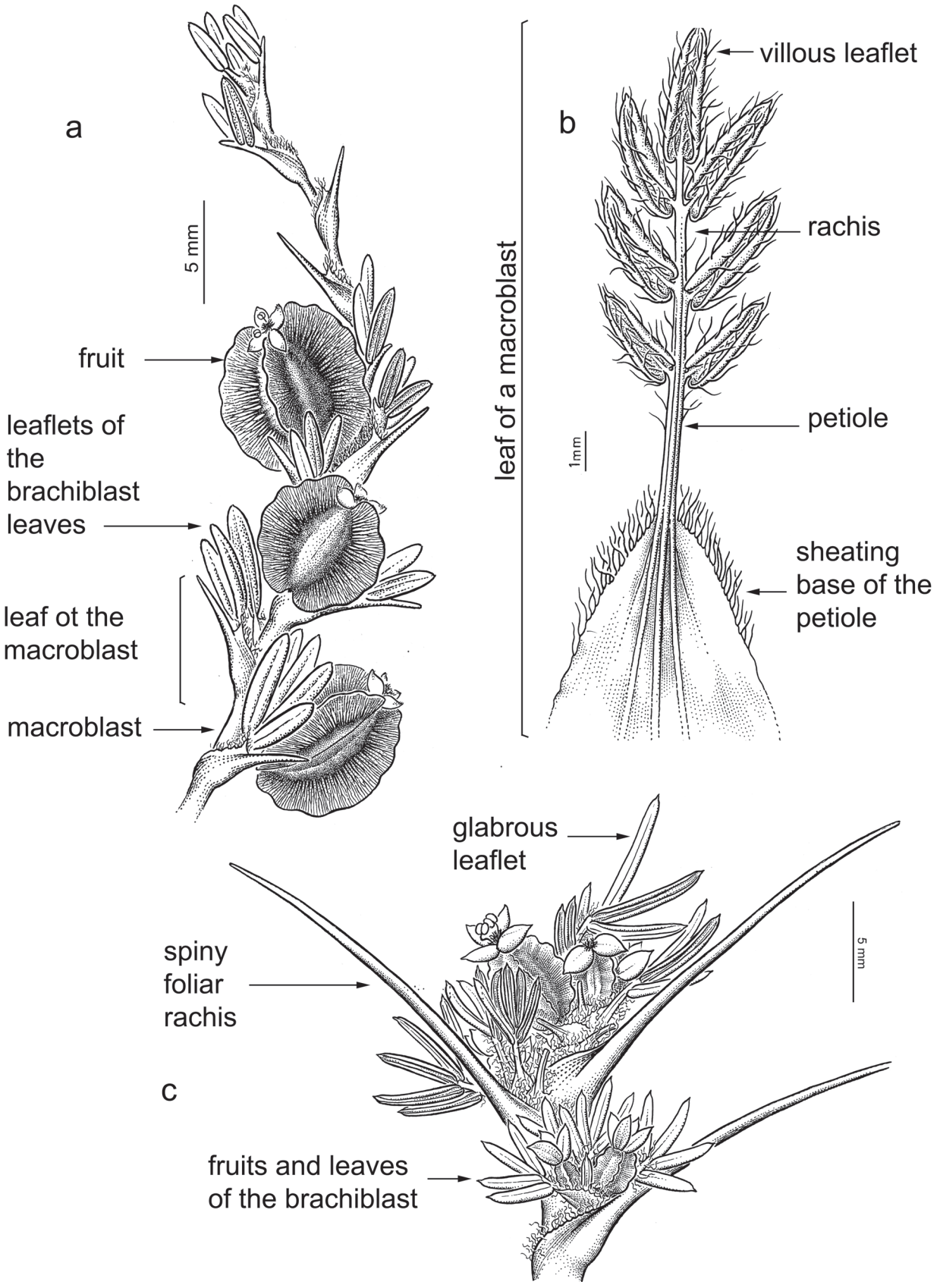

FIGURE 1. Details of some vegetative characters considered for morphometric analyses. a: sector of a macroblast in *Tetraglochin alata*; the leaves of the macroblast present sheating petiolar base and thorny petiole-rachis axis, as the leaflets are deciduous; b: leaf of a macroblast in *T. caespitosa*; c: sector of a macroblast in *T. andina*.

Materials and methods

Materials

In this work we studied seven species of *Tetraglochin*: *T. acanthocarpa*, *T. alata*, *T. ameghinoi*, *T. andina*, *T. caespitosa*, *T. cristata* and *T. inermis*. Also, we considered a group called *Tetraglochin* aff. *alata* which comprises all the specimens where the hypanthia show an intermediate size between *T. alata* and *T. ameghinoi*, as they vary from (5–)7 to 8(–11) mm long on the same plant. Seven qualitative and eight quantitative morphological traits were measured on 177 herbarium specimens (Appendix 1), which were selected from the specimens examined under each species, in order to cover the entire geographical range of the genus. The analyzed specimens were from the following herbaria: CONC, CORD, CTES, LP, LPB, and SI (Thiers, 2016).

Characters

Habit, fruit and foliar characters were selected to identify the species included here (Fig. 1). Flower characters were not included, as they are very uniform within the genus. The qualitative traits were: habit (HB), foliar rachis of the leaf of the macroblasts (FR), leaflets indumentum (LI), fruit shape (FS), fruit texture (FT), fruit indumentum (FI) and presence of rays in the wings of fruits (RW) (Table 1). The quantitative traits were: rachis length (mm) (RL), number of leaflets (NL), leaflets length (mm) (LL), leaflets width (mm) (LW), fruit length (mm) (FL), fruit width (mm) (FW), wing width (mm) (WW), thorn length of fruit (mm) (TF) (Fig. 1). Whenever the word "fruit" is mentioned in the text, we refer to the "hypanthium" i.e., the receptacle that covers the real fruit. For the statistical analysis whenever a quantitative trait was absent its measure was considered equal to 0.

Statistical Methods

The measurements of the quantitative traits were made with a millimetric ruler, and when necessary, under stereoscopic microscope with the appropriate magnification. All the measurements were made by the same person. The qualitative traits were coded as showed on Table 1.

The basic data matrix included discrete and continuous variables (mixed matrix). Data were transformed to standard deviation units, applying the following formula: $X_{ij\ standardized} = (X_{ij} - \tilde{X}_i)/S_i$; where X_{ij} is the value of the i trait for the study unit j, $\tilde{X}_i$ is the average of the i trait, and S_i is the standard deviation of the trait.

TABLE 1: Qualitative characters with their codes and meanings. HB: habit; FR: foliar rachis of macroblasts; LI: leaflets indumentum; FS: fruit shape; FT: fruit texture; FI: fruit indumentum; RW: presence of rays in the wings of fruits.

Character	HB	FR	LI	FS	FT	FI	RW
Codes							
0	--------	absent	glabrous	--------	--------	glabrous	absent
1	spread branches	thin and weak	glabrous to villous	regularly winged	membranaceous	glabrous to slightly pubescent	present
2	slightly contracted	thick and indurated	villous	irregularly winged	papyraceous	densely pubescent	--------
3	contracted branches	--------	--------	globose	coriaceous	--------	--------
4	cushion branches	--------	--------	globose with thorns	indurated	--------	--------

The data matrix is available from the corresponding author.

To evaluate the existence of significant differences for each trait between the studied species, a nonparametric Kruskal & Wallis (1952) ANOVA was used. As normality can not be assumed for all measured traits, we chose this test because it is a distribution-free method.

The relative similarities among the species were evaluated by cluster analysis. Each *Tetraglochin* species as well as the intermediate specimens between *T. alata* and *T. ameghinoi* were considered operational taxonomic units. Pairwise relationships were estimated by the Euclidean Distances. The obtained distance matrix was represented in a phenogram by the UPGMA clustering method (Sneath & Sokal, 1973).

Canonical discriminant analysis was applied to morphometric data to summarize variation between predefined classes (species/group) for classification variables.

These analyses were carried out with the software Statistica 5.5 (StatSoft Inc., 2000).

TABLE 2: Basic statistics: averages and standard deviation (in parentheses) of each trait in each species studied of genus *Tetraglochin*. N= sample size. A= absent structure (=0). HB*: habit, FR*: foliar rachis of macroblasts, LI*: leaflets indumentum, FS*: fruit shape, FT*: fruit texture, FI*: fruit indumentum, RW*: presence of rays in the wings of fruits, RL: rachis length, NL: number of leaflets, LL: leaflets length, LW: leaflets width, FL: fruit length, FW: fruit width, WW: wing width, TF: thorn length of fruit. Min.: minimum; max.: maximum. * For codes of this characters see Table 1.

Species	HB	FR	RL (min.)	RL (max.)	NL (min.)	NL (max.)	LL (min.)	LL (max.)	LW (min.)	LW (max)	LI	FL (min)	FL (max)	FW (min.)	FW (max.)	FS	FI	FT	WW (min.)	WW (max.)	TF (min.)	TF (max.)	RW
T. acanthocarpa	3.25	1.00	5.50	8.50	6.00 (1.15)	9.00	1.75	2.88	0.53	0.75	0.25	4.50	5.63	3.13	4.50	4.00	0.75	4.00	0.20	0.25	0.88	1.88	A
N=4	(0.50)	(0.00)	(1.73)	(3.00)		(2.83)	(0.29)	(0.25)	(0.05)	(0.13)	(0.50)	(0.58)	(0.95)	(1.03)	(1.00)	(0.00)	(0.96)	(0.00)	(0.40)	(0.50)	(0.25)	(0.25)	
T. alata	1.00	1.56	8.94	19.56	3.67 (1.50)	4.72	3.44	5.50	0.79	1.00	0.00	8.31	9.83	7.06	9.06	1.00	0.00	1.00	2.67	3.72	A	A	A
N=18	(0.00)	(0.51)	(5.09)	(9.17)		(2.95)	(1.27)	(2.04)	(0.23)	(0.28)	(0.00)	(0.52)	(0.86)	(0.95)	(1.37)	(0.00)	(0.00)	(0.00)	(0.97)	(1.15)			
T. aff. *alata*	1.02	1.74	8.07	21.62	3.49 (1.32)	5.13	2.93	4.37	0.70	0.88	0.00	6.20	8.70	5.36	7.23	1.00	0.00	1.04	1.96	2.69	A	A	A
N=47	(0.15)	(0.44)	(2.33)	(5.86)		(2.58)	(1.17)	(1.60)	(0.19)	(0.21)	(0.00)	(0.83)	(1.02)	(1.01)	(1.31)	(0.00)	(0.00)	(0.20)	(0.50)	(0.55)			
T. ameghinoi	1.03	1.90	7.24	23.00	3.93 (1.07)	5.34	2.59	3.83	0.58	0.72	0.00	4.79	5.91	3.86	4.97	1.00	0.00	1.00	1.26	1.72	A	A	A
N=29	(0.19)	(0.31)	(2.31)	(6.11)		(1.32)	(1.20)	(1.71)	(0.15)	(0.20)	(0.00)	(0.69)	(0.81)	(0.91)	(1.07)	(0.00)	(0.00)	(0.00)	(0.34)	(0.39)			
T. andina	1.14	1.73	8.91	22.23	3.18	4.73	3.77	5.57	0.51	0.65	0.09	5.18	6.45	3.64	4.77	1.00	0.00	2.00	1.14	1.62	A	A	A
N=22	(0.35)	(0.46)	(2.74)	(6.44)	(0.59)	(1.28)	(1.16)	(1.42)	(0.09)	(0.15)	(0.29)	(1.38)	(1.55)	(1.16)	(1.36)	(0.00)	(0.00)	(0.00)	(0.46)	(0.66)			
T. caespisosa	2.92	1.00	6.15	9.54	5.92 (1.04)	8.85	2.58	3.88	0.69	0.89	1.92	3.92	5.08	3.73	4.73	2.00	1.85	3.00	1.29	1.85	A	A	A
N=13	(0.28)	(0.00)	(1.63)	(2.50)		(1.52)	(0.53)	(0.85)	(0.17)	(0.14)	(0.28)	(0.49)	(0.64)	(0.88)	(1.20)	(0.00)	(0.55)	(0.00)	(0.35)	(0.63)			
T. cristata	1.44	1.94	7.76	15.35	2.91 (0.29)	3.41	3.37	5.71	0.51	0.71	0.91	4.78	6.22	4.54	5.76	1.00	0.00	3.00	1.23	1.84	A	A	1.00
N=34	(0.50)	(0.24)	(1.63)	(3.33)		(0.96)	(0.63)	(1.18)	(0.05)	(0.10)	(0.51)	(0.67)	(0.98)	(1.05)	(1.14)	(0.00)	(0.00)	(0.00)	(0.48)	(0.56)			(0.00)
T. inermis	3.50	A	A	A	2.30 (0.48)	3.00	2.00	3.45	0.53	0.73	0.30	3.80	4.65	2.85	3.55	3.00	0.00	2.00	0.87	0.95	A	A	A
N=10	(0.53)					(0.00)	(0.53)	(0.69)	(0.13)	(0.18)	(0.48)	(0.63)	(0.71)	(0.63)	(0.86)	(0.00)	(0.00)	(0.00)	(0.26)	(0.16)			

Results

The basic statistic of all the characters measured is summarized on Table 2.

Analysis of variance

The traits presence of rays in the wings of fruits (RW), fruit shape (FS) and thorn length of fruit (TF) did not vary within species and showed qualitative differences among groups of species. The remaining characters were statistically compared and showed significant differences among species (Table 3).

TABLE 3: Non parametric Kruskal-Wallis ANOVA. N: sample size, H : values of test statistic, DF: degrees of freedom , *p*: statistical significance. HB: habit, FR: foliar rachis of macroblasts, LI: leaflets indumentum, FT: fruit texture, FI: fruit indumentum, RL (min.): minimum rachis length , RL (max.): maximum rachis length, NL (min.): minimum number of leaflets, NL (max.): maximum number of leaflets, LL (min.): minimum leaflets length, LL (max.): maximum leaflets length, LW (min.): minimum leaflets width, LW (max.): maximum leaflets width, FL (min.): minimum fruit length, FL (max.): maximum fruit length, FW (min.): minimum fruit width, FW (max.): maximum fruit width, WW (min.): minimum wing width, WW (max.): maximum wing width.

VARIABLE	N	H	DF	*p*
HB	177	128.72	7	<0.01
FR	177	88.33	7	<0.01
LI	177	133.22	7	<0.01
FT	177	172.53	7	<0.01
FI	177	150.48	7	<0.01
RL (min.)	177	44.29	7	<0.01
RL (max.)	177	89.51	7	<0.01
NL (min.)	177	70.23	7	<0.01
NL (max.)	177	69.85	7	<0.01
LL (min.)	177	38.44	7	<0.01
LL (max.)	177	48.06	7	<0.01
LW (min.)	177	46.42	7	<0.01
LW (max.)	177	42.62	7	<0.01
FL (min.)	177	112.70	7	<0.01
FL (max.)	177	126.73	7	<0.01
FW (min.)	177	94.98	7	<0.01
FW (max.)	177	108.12	7	<0.01
WW (min.)	177	97.01	7	<0.01
WW (max.)	177	111.75	7	<0.01

Phenetic relationships among species

In the phenogram of Fig. 2, two principal clusters were observed: the first one contained the species *T. acanthocarpa, T. caespitosa* and *T. inermis*; the second one included all the remaining species. Inside this second group, *T. alata* joined together with *T*. aff. *alata* while *T. ameghinoi* was grouped with *T. andina*; *T. cristata* was found outside these sub-groups. This result suggests a clear grouping of the specimens of *T. alata, T. ameghinoi, T.* aff. *alata* and *T. andina*.

Canonical discriminant analysis

According to this analysis, the traits that contributed most to the morphometric differentiation were WW (max.), RW, LW (max.), LI, FL (min.), FL (max.), FS, FI, FT, TF (max.) ($P \leq 10^{-3}$) and NL (min.) (P=0.02) (Table 4). The correct classification of individuals into their respective species ranged between 80% in *T. inermis* and 100% in *T. acanthocarpa* and *T. cristata*, with an average of 93.78% (Table 5). The first, second and third canonical axes accounted for 76.7%, 15.8% and 5.1% of variations respectively, explaining a cumulative 97.6% of the morphological variation. The figures (Fig. 3a and b) represent five groups well discriminated: one group comprises all specimens of *T. alata*, *T. ameghinoi* and almost all specimens of *T.* aff. *alata*; the second one is composed by all specimens of *T. andina*, *T. inermis* and some of *T.* aff. *alata*; the third group consists of all specimens of *T. cristata;* the fourth group is conformed by specimens of *T. caespitosa*; and the fifth group is composed by all specimens of *T. acanthocarpa*.

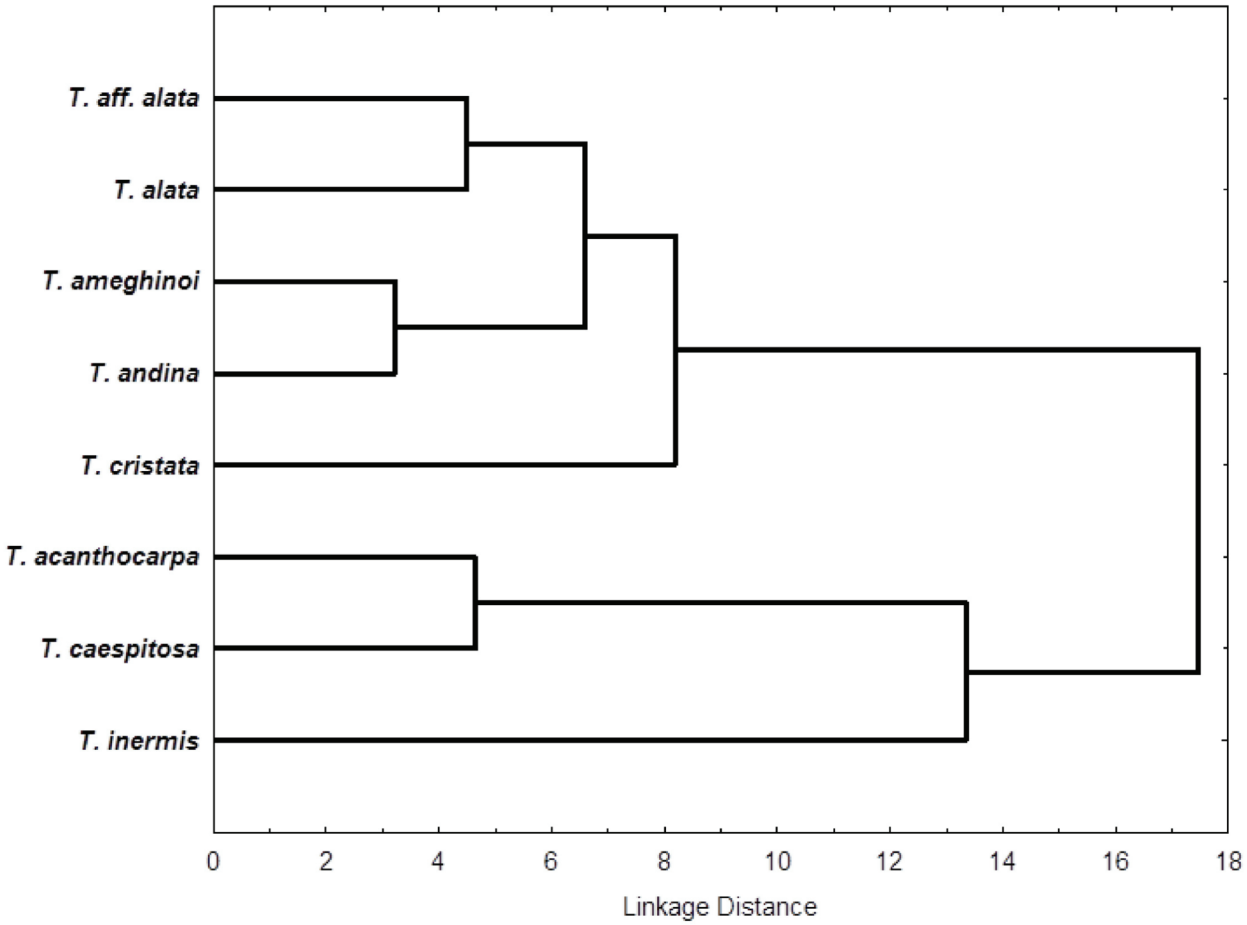

FIGURE 2. Phenogram representing the Euclidean distances obtained by UPGMA among species of *Tetraglochin.*

TABLE 4: Morphological traits and the standardized canonical coefficients (CV1, CV2 and CV3) from a discriminant analysis used to separate *Tetraglochin* species.

Trait	CV1	CV2	CV3
HB	0.00	0.00	0.00
FR	0.00	0.00	0.00
RL (min.)	0.00	0.00	0.00
RL (max.)	0.00	0.00	0.00
NL (min.)	0.10	-0.18	0.40
NL (max.)	0.00	0.00	0.00
LL (min.)	0.00	0.00	0.00
LL (max.)	0.00	0.00	0.00
LW (min.)	0.00	0.00	0.00
LW (max.)	-0.08	-0.07	0.29
LI	0.14	0.31	0.26
FL (min.)	0.17	0.02	-0.09
FL (max.)	-0.30	-0.06	0.05
FW (min.)	0.00	0.00	0.00
FW (max.)	0.00	0.00	0.00
FS	0.00	0.00	0.00
FI	0.06	0.54	0.73

...Continued on next page

TABLE 4. (Continued)

Trait	CV1	CV2	CV3
FT	1.00	0.08	-0.19
WW (min.)	0.00	0.00	0.00
WW (max.)	-0.09	0.13	0.10
TF (min.)	0.17	-1.02	0.22
TF (max.)	0.00	0.00	0.00
RW	0.00	0.00	0.00

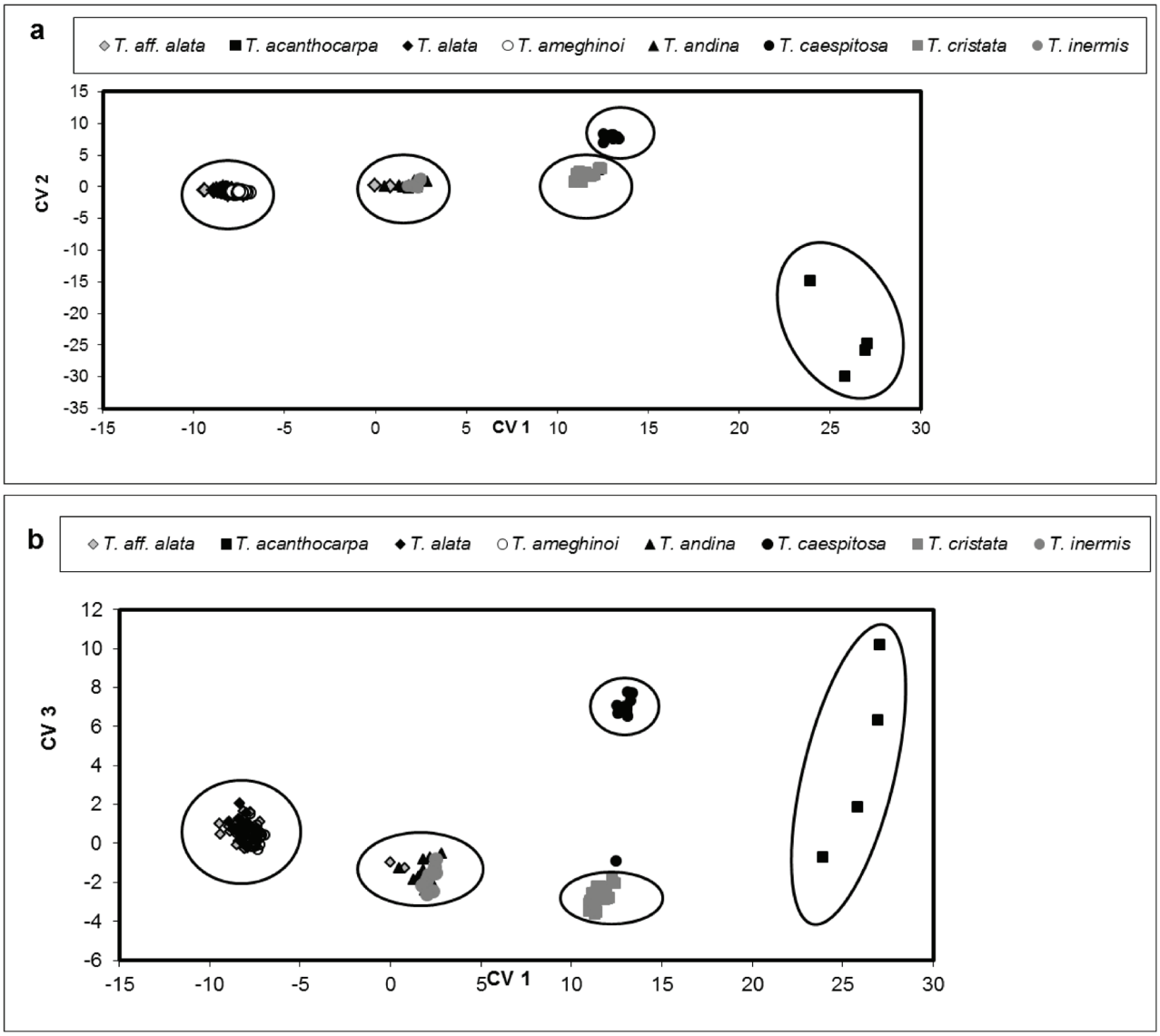

FIGURE 3. Plot of the canonical discriminant analysis from the morphometric data. a: plot of the canonical axis 1 vs. canonical axis 2; b: plot of the canonical axis 1 vs. canonical axis 3.

Discussion

The analyses performed in this work provided support for the recognition of seven entities, six of them corresponding to a single species, and one of them constituted by *T. alata* and *T.* aff. *alata*.

In the present study, the ANOVAs indicated that all the morphometric characters used were useful in the differentiation among species of *Tetraglochin,* so they can be used as key characters to distinguish them.

TABLE 5. Classification matrix of individuals of *Tetraglochin* comparing predefined classes (species) with observed classes in the canonical discriminant analysis.

Species	% Correct assignation	*T.* aff. *alata*	*T. acanthocarpa*	*T. alata*	*T. ameghinoi*	*T. andina*	*T. caespitosa*	*T. cristata*	*T. inermis*
T. aff. alata	93.62	44	0	0	1	2	0	0	0
T. acanthocarpa	100.00	0	4	0	0	0	0	0	0
T. alata	94.44	1	0	17	0	0	0	0	0
T. ameghinoi	100.00	0	0	0	29	0	0	0	0
T. andina	81.82	0	0	0	0	18	0	0	4
T. caespitosa	92.31	0	0	0	0	0	12	1	0
T. cristata	100.00	0	0	0	0	0	0	34	0
T. inermis	80.00	0	0	0	0	2	0	0	8
Total	93.79	45	4	17	30	22	12	35	12

The phenogram showed two main clusters: one composed by *T. acanthocarpa*, *T. caespitosa* and *T. inermis*, and the other one constituted by the remaining species. The most important character that defines these two clusters seemed to be the fruit shape (FS), since *T. alata, T.* aff. *alata, T. ameghinoi, T. andina* and *T. cristata* have winged fruits with wings of entire or toothed margin, while the remaining species present other fruit shapes (Table 1). In the first cluster, two groups could be found: one composed by *T. acanthocarpa* and *T. caespitosa*, both distributed along the southern Andes (Southern Chile and Patagonia), and the other one constituted by *T. inermis,* growing in southern Bolivia and northern Argentina. The most important character that defines these two clusters seemed to be the fruit indumentum (FI), since *T. acanthocarpa* and *T. caespitosa* have mainly pubescent fruits while *T. inermis* presents glabrous fruits. Within the second cluster, three groups could be found: one formed by *T. cristata* in which the fruits have wings with toothed margin, while in the other two groups the fruits have wings with entire margin; the second group comprised *T. alata* and *T.* aff. *alata* with mature fruits up to 12 mm long*,* and the third group comprised *T. ameghinoi* and *T. andina* with mature fruits up to 9 mm. Within the second cluster, these groups are apparently not related to geographical distribution of the species, as *Tetraglochin cristata* is found from central and southern Perú to northern Argentina and Chile, *T. andina* grows in northern and central Argentina, and *T. alata*, *T*. aff. *alata* and *T. ameghinoi* are found in central and southern Chile and Argentina, from San Juan to Santa Cruz.

Although we studied quantitative and discrete data, we used here canonical discriminant analysis being aware of its pitfalls. However, they were offset standardizing the data matrix. This analysis differentiated all the studied species, with a few exceptions. One of them was the case of *T. andina,* species in which the specimens studied grouped together with those of *T. inermis*; a possible reason could be that all these specimens presented the status "papyraceous" for the character fruit texture (FT). Another case was the group of *T. alata, T.* aff. *alata* and *T. ameghinoi*, where almost all specimens belonging to these species grouped together, with exception of two specimens of *T*. aff. *alata* that joined with *T. andina*. This fact could be explained by the presence of some fruits with slightly more indurated texture in these two specimens.

Conclusion

The present study indicated that seven species of the genus, *Tetraglochin acanthocarpa*, *T. caespitosa*, *T. cristata*, *T. inermis, T. andina, T. ameghinoi* and *T. alata* can be differentiated from one another on the basis of the selected morphological characters. When multivariate analyses were applied almost all specimens could be correctly assigned to their identified species. However, specimens of *T. alata*, *T.* aff. *alata* and *T. ameghinoi* were not well discriminated. Our morphometric analyses showed that both species and the intermediate material (*Tetraglochin* aff. *alata*) seems to represent a single species within which varieties can be recognized based on fruit size: *Tetraglochin alata* var. *alata*, including specimens here considered as *T.* aff. *alata* and strongly related to the type variety, and *T. alata* var. *ameghinoi*, a variety with smaller fruits even when they are mature.

Taxonomic treatment

Tetraglochin Poeppig (1833: 26). Type species: *Tetraglochin stricta* Poepp.

Chamaephytes or dwarf-shrubs highly branched, branches erect to postrate, with heteroblastic development: vegetative long branches or macroblasts during the first year which give rise to short flowering branches or brachyblasts afterwards. Leaves stipulate, petiolate, alternate, with the stipules fused to the base of the petiole and partially embracing the branch; leaf blade compound, imparipinnate, dimorphic: those on the macroblasts with persistent petiole-rachis axis, conspicuously to slightly indurated, frequently whitish, straight to somewhat curved, and with deciduous leaflets, while those on the brachyblasts with very short petiole-rachis axis, rarely absent, slightly or not indurated, and with persistent crowded leaflets still present at flowering time. Flowers small, inconspicuous, solitary, axillary on the brachyblasts, perfect, chasmogamous or cleistogamous. Hypanthium urceolate enclosing the ovary. Sepals 4-5, free, persistent, arising from the hypanthium rim. Petals absent. Stamens 1-2, inserted in the hypanthium rim, deciduous, with short filaments and small anthers. Ovary 1-carpelar. 1-ovulated; style short and filiform; stigma flabelliform. Fruit achene, enclosed in the hypanthium but not fused to it, this structure called cupela; hypanthium membranous to indurated, glabrous to pubescent, frequently coloured and enlarged at maturity, thorny and/or (2–)3–4-winged, the wings longitudinal, mostly well developed, with entire to dentate margin.

A genus of six species and two varieties distributed along the Andes, from Perú to southern Argentina and central Chile.

Key to identify the species of *Tetraglochin*

1. Hypanthium indurated, tetragonal or pentagonal, each angle expanded in a developed wing, with conspicuously irregular margin and densely pubescent surface, or with reduced or absent wings, replaced by conspicuous thorns with pubescent or glabrous surface 2
- . Hypanthium membranous, papery or coriaceous, winged, with 4–5 wings, mostly well developed, with dentate or entire margin, or hypanthium globose or inflated, angular, each angle very slightly indurated, entire or toothed, sometimes expanded in a reduced wing. 3
2. Hypanthium with narrow wings or without them, with conical indurated pricking thorns, up to 3 mm long, longer than the wings width. Upper surface of leaflets glabrous. ..... *T. acanthocarpa*
- . Hypanthium with (2–)3 developed wings of conspicuously irregular margin, and 1–2 wings reduced to small, non pricking teeth. Upper surface of leaflets hairy. ..... *T. caespitosa*
3. Hypanthium globose, angular, with inconspicuous slightly indurated wings. Plants 0.10–0.30 m tall, not thorny, with short and highly matted branches, shorter than 5 cm. ..... *T. inermis*
- . Hypanthium conspicuously winged, the wings with entire margin slightly wavy, or deep and irregularly dentate, all wings well developed, rarely one of them narrower or replaced by 1–5 slightly indurated teeth. Plants 0.20–1 m tall, mainly thorny, with spreading branches 4
4. Wings of the hypanthium with toothed margin, coriaceous, translucent, with opaque, wide and indurated rays, each ray ending in a sharp tooth at the margin of the wing, these teeth frequently irregular and conspicuous. ..... *T. cristata*
- . Wings of the hypanthium with entire margin, membranous and translucent, or papery and opaque, sometimes slightly wavy. 5
5. Hypanthium papery, opaque, the wings frequently narrower than the fruit. ..... *T. andina*
- . Hypanthium membranous, translucent, the wings wider than the fruit. 6
6. Wings of the hypanthium 2–4 mm wide; hypanthium (4–)5–12 × 5–10(–12) mm. ..... *T. alata* var. *alata*
- . Wings of the hypanthium 0.5–1.6 mm wide; hypanthium 3–7 × 2–6 mm. ..... *T. alata* var. *ameghinoi*

1. ***Tetraglochin acanthocarpa*** (Speg.) Spegazzini (1902: 283). ≡ *Margyricarpus acanthocarpus* Spegazzini (1897: 513). Type:—ARGENTINA. Chubut-Santa Cruz, Golfo de San Jorge, 1896, *C. Spegazzini s.n.* [lectotype designated here: LPS 2385 in LP sheet 008881 [web!], isolectotype JE 0000536 [web!]]. (Fig. 4).

= *Tetraglochin acanthocarpa* (Speg.) Spegazzini var. *typica* (1902: 283), *nom. inval*.

= *Tetraglochin acanthocarpa* (Speg.) Spegazzini var. *macropoda* Spegazzini (1902: 283). Type:—ARGENTINA. Santa Cruz: "S. Julián-R. Deseado, Vere 1899", *C. Spegazzini s.n.* (Lectotype designated here: LPS 11946 in LP [web!]).

Perennial plants 4–20 cm high, cespitose, with lignified branches, erect or decumbent; macroblasts and brachyblasts covered by the sheathing base of the petioles; sheaths glabrous, densely villous at the margin; petioles glabrous. Leaf blades imparipinnate, with 2–6 pairs of leaflets; leaflets 1.5–3 × ca. 0.5–0.9 mm, oblong, the apex acute–apiculate and the base obtuse to cordate, the margin revolute, upper side glabrous, lower side villous, sessile; leaves of the macroblasts with petiole-rachis axis persistent, slightly indurated, 0.5–1.1(–1.5) cm long, whitish, glabrous, straight to somewhat curved, and leaflets easily deciduous; leaves of the brachyblasts with petiole-rachis axis shorter than 0.8 mm, the leaflets smaller than those of the macroblasts, crowded, persistent still at flowering time. Flowers solitary and axillary on the brachyblasts. Sepals ca. 2 mm long, elliptic, acute, glabrous. Stamens 2–3, purplish, easily deciduous. Stigma flabellate. Fruits partially visible in the plant, each one covered by the hypanthium, 4–7 mm long, 2.5–5 mm

lat., indurated, densely pubescent to glabrous on the whole surface, tetragonal, each angle expanded in a narrow wing or without it, with conical thorns, up to 3 mm long, longer than the wings width, the thorns indurated, reddish, pubescent at the base or glabrous.

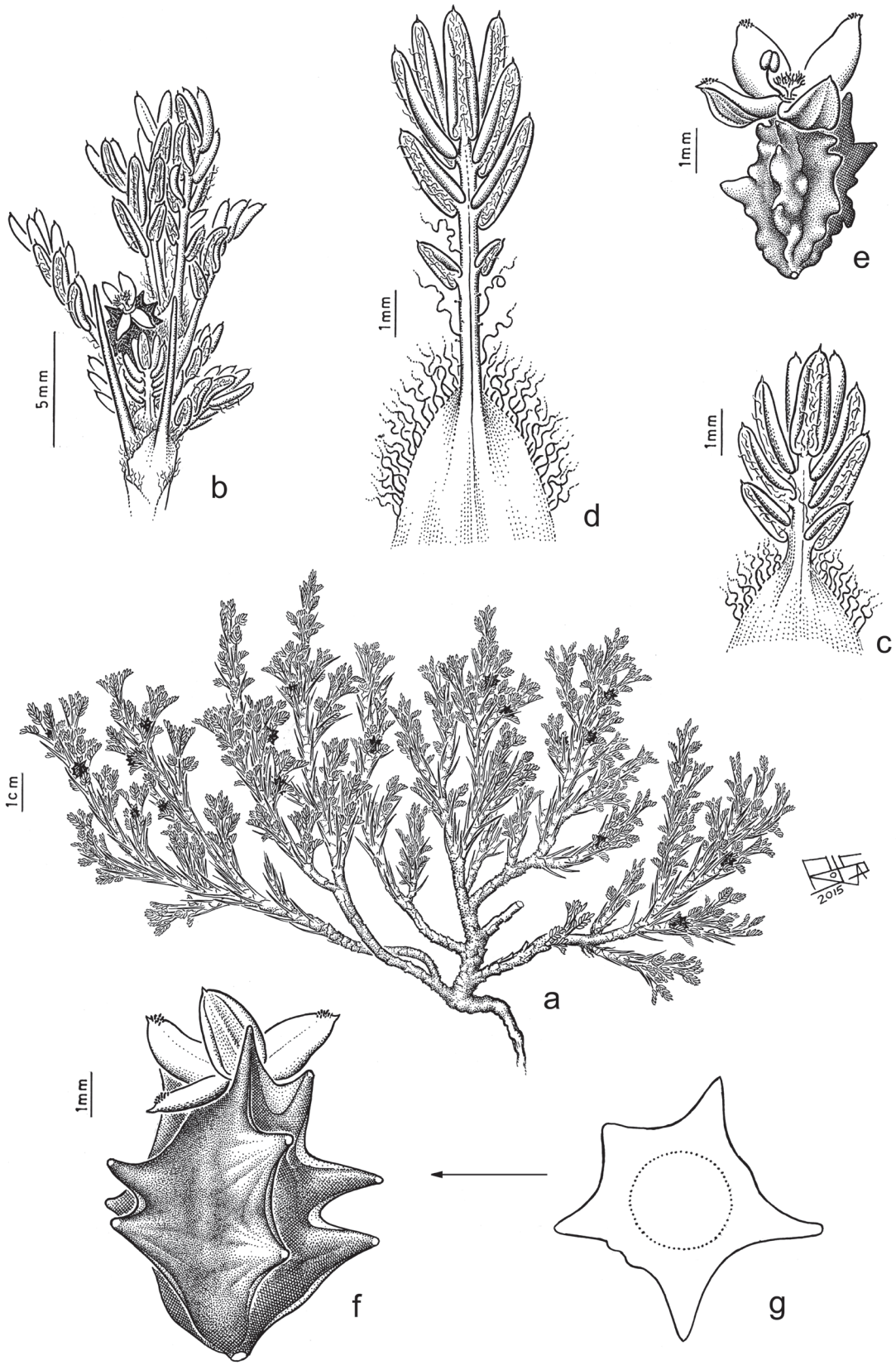

FIGURE 4. *Tetraglochin acanthocarpa*—**a** general aspect of the plant; **b** detail of several leaves of a macroblast and a flower; **c** and **d** details of a leaves of a macroblast, showing the sheating base, the petiole and the compound leaf blade; **e** flower; **f** thorny indurated hypanthium covering the fruit; **g** trasversal section of the hypanthium and fruit. a-g from *Barboza et al. 2393.*

Distribution and habitat:—Southern Chile (Region XII) and Patagonia (Argentina), in the provinces of Neuquén, Chubut and Santa Cruz, at elevations up to 1000 m.

Phenology:—Collected in fruit from November to January.

Taxonomic notes:—The specimen LPS 2385 is considered herein as the lectotype of *Margyricarpus acanthocarpus*, designated as "Typus" by Rothmaler (1939: 436) in his synopsis of the genus. A duplicate of LPS 2385 is kept at the herbarium JE (JE 00000536). Furthermore, a syntype of *Margyricarpus acanthocarpus,* "S. Cruz, 2, 1882", LPS 2386, is kept at the herbarium LP and a duplicate of it is also kept at the herbarium JE under the number 00000537.

Tetraglochin acanthocarpa can be distinguished by having indurated hypanthia provided with conical indurated pricking thorns, up to 3 mm long, and with narrow wings or directly without them. This species shares with *Tetraglochin caespitosa* and *T. inermis* the caespitose habit, with short matted branches and with petiole-rachis axis slightly indurated, frequently up to 1 cm long.

According to Grondona (1984: 85), this species has cleistogamous flowers axillary to the basal leaves.

Representative Specimens:—ARGENTINA. Chubut: Depto. Cushamen, Potrero La Torre, Ea. Leleque, without date, *León 4186* (BAA!); Depto. Languiñeo, por ruta prov. 62, a 9 km de Tecka rumbo a Trelew, 1000 m, 28 January 2010, *Barboza et al. 2393* (CORD!, CTES!, SI!); Ruta Provincial 62, de Tecka a Trelew, 9.5 Km de Tecka, 43º31'81''S, 70º42'07''W, 980 m, 29 November 2015, *Zuloaga et al. 15553* (SI!); 10 km al E de Tecka, 12 December 1981, *Cabrera et al. 33111* (SI!). Neuquén: Depto. Los Lagos, Parque Nacional Nahuel Huapi, La Lipela, 13 December 2000, *Montaldo et al. s.n.* (BAA 25243!). Santa Cruz: Depto. Corpen Aike, Comandante Piedrabuena, 1 December 1945, *O'Donell 3800* (LIL!); Depto. Magallanes, San Julián, 23 November 1945, *O'Donell 3669* (LIL!); "Entre Bote y Valentín, 500 m", without date, *Hicken s.n.* (SI 5115!). CHILE. XII Magallanes y de la Antártica Chilena: Última Esperanza, 4–5 km SE de Estancia Cerro Guido, 150 m, 9 December 1995, *Elvebakk & Robertsen 536* (CONC!).

2. ***Tetraglochin alata*** (Gillies ex Hook. & Arn.) Kuntze (1898: 81). ≡ *Margyricarpus alatus* Gillies ex Hooker & Arnott (1833: 305).

Perennial shrubby plants, up to 1 m high, the branches spreading, lignified, erect; macroblasts and brachyblasts covered by the sheathing base of the petioles; sheaths glabrous, densely villous at the margin; petioles glabrous. Leaf blades imparipinnate, with 1–6 pairs of leaflets; leaflets 2–9 × 0.6–1.4 mm, oblong, the apex apiculate and the base obtuse, the margin revolute, glabrous on both sides, sessile; leaves of the macroblasts with petiole-rachis axis persistent, indurated to slightly hard, thorny, (0.5–)1.5–4 cm long, whitish, glabrous, straight, rarely curved, and leaflets easily deciduous; leaves of the brachyblasts with petiole-rachis axis shorter than 1.5 mm long, the leaflets smaller than those of the macroblasts, crowded, persistent still at flowering time. Flowers solitary and axillary on the brachyblasts. Sepals ca. 1.5 mm long, ovate-elliptic, acute, glabrous. Stamens not seen. Stigma fimbriate. Fruits easily visible in the plant, each one covered by the hypanthium, (3–)5–12 × 2–10(–12) mm, winged, with 4 membranous wings 0.5–4 mm wide, translucent, glabrous, with entire margin slightly wavy, all of them equally developed, rarely one of them reduced, narrower or reduced to 1–5 unequal conical teeth, ca. 1 mm long, slightly indurated, glabrous.

2a. ***Tetraglochin alata*** var. ***alata.*** Type:—ARGENTINA. "El Cerro del Morro, province of San Luis and Uspallata, Andes of Mendoza. *J. Gillies*" *s.n*., year 1826 (Lectotype designated here E 00264274 [web!]). (Fig.5a–f).

= *Tetraglochin stricta* Poeppig (1833: 26) ≡ *Margyricarpus strictus* (Poepp.) J. F. Macbride (1938: 1116). Type:—CHILE. "In Chili austr. Glareos. Ad ripas Rio Laxa, Antuco. Nov. Lect.", *E. F. Poeppig s.n. (254?)* holotype F 0BN 003402 [web! ex B]; isotypes: CORD 00002852 [web!], A 00026673 [web!]).

= *Tetraglochin microphylla* Philippi (1856: 687). Type:—CHILE. "In Andibus prov. Coquimbo prope Hurtado", *C. Gay 1301* (holotype SGO 49713 [web!]).

= *Tetraglochin alata* var. *patagonica* Grondona (1984: 87). Type:—ARGENTINA. Neuquén: Depto. Minas, Lagunas Epulaufquen, pedregales próximos al Arroyo Pincheira, 18 January 1964, *O. Boelcke et al. 11015* (Holotype BAB!; isotypes BAA 4326!, BAA 4327!).

Distribution and habitat:—*Tetraglochin alata* var. *alata* grows along the Andes from San Juan to Chubut in Argentina, and central Chile (IV, V, VI, VII, VIII, RM Regions), between 150 and 3100 m.

Phenology:—Collected in fruit from September to April.

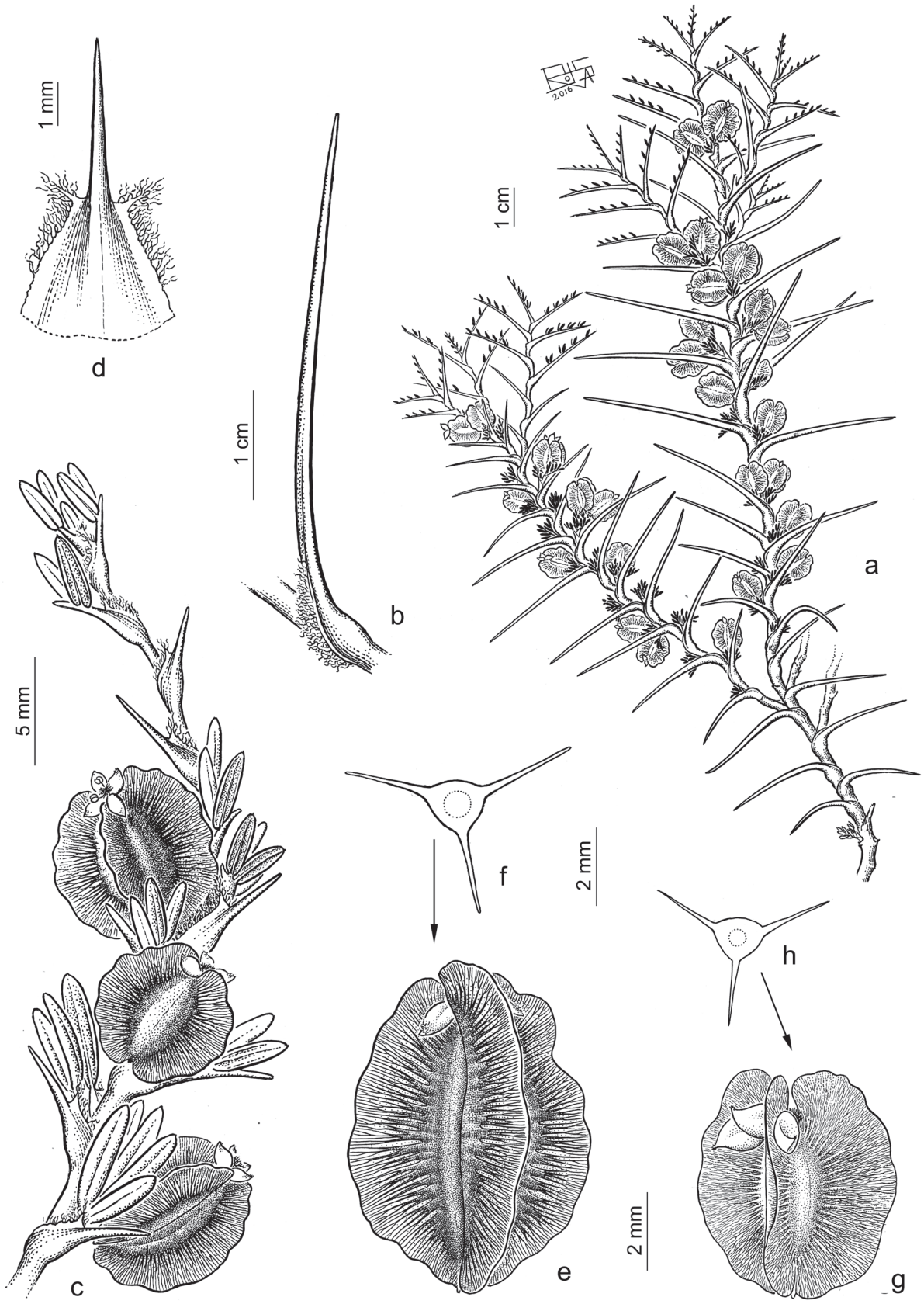

FIGURE 5. *Tetraglochin alata.* var. *alata*—**a** general aspect of a branch; **b** detail of a long thorny petiole-rachis axis of a macroblast without leaflets; **c** general aspect of a macroblast with short thorny petiole-rachis axis; **d** detail of a short thorny petiole-rachis axis; **e** winged hypanthium covering the fruit; **f** trasversal section of the hypanthium and fruit. *Tetraglochin alata* var. *ameghinoi*—**g** winged hypanthium covering the fruit; **h** trasversal section of the hypanthium and fruit. a–b, e–f from *Gentili 162*; c–d from *Morrone 6032*; g–h from *Zuloaga 13961*.

Taxonomic notes:—According to the original description of *Margyricarpus alatus*, Gillies mentioned several specimens on which he based his observations: "El Cerro del Morro, Province of San Luis, and Chili, *Dr. Gillies*. Cordillera of Chili, *Cuming* (*N. 254*). Bella Vista de Aconcagua, *Bridges*, 1832. (*N. 298*). Baths of Collina, *Macrae*". Within the plant collection kept in the herbarium of the Royal Botanic Garden of Edinburgh (E), there are three syntypes of *Margyricarpus alatus*: "El Cerro del Morro, province of San Luis and Uspallata. Andes of Mendoza. *Gillies*" *s.n.,* (E 00264274), "Cordillera of Chili, *Cuming 254*" (E 00254802 [web!], E 00254803 [web!]), and "Bellavista de Aconcagua, *Bridges 298*" (E 00254801 [web!]). The first of these specimens is here designated as lectotype, as it is the most consistent with the protologue of the species. Furthermore, within the collection of the Herbarium of the Royal Botanic Garden (K), there is a specimen which is composed by several fragments of syntypes: "Baths of Collina, *Macrae*" *s.n.* (K 000486019 [web!]), "Near la Punta de las Vacas" (illegible), *Herbarium Hookerianum 1867* (K 000486021 [web!]), and a fragment of the lectotype here designated, kept as K 000486020 [web!].

Rothmaler (1939: 431) cited *Tetraglochin flexuosum* Kuntze ap. Poeppig under the synonymy of *T. alata*, as *nomen nudum*. We could not confirm the identity of this taxon, as we could not find the original publication (also cited by the same author as Coll. Pl. Chil. 2: 128).

Forms with petiole–rachis axis not thorny, but slightly indurated, shorter [5–6.5(–8) mm] or directly absent especially in basal branches, have been treated as *Tetraglochin alata* var. *patagonica* (Grondona 1984: 87). However, the analysis of many specimens of *Tetraglochin alata* showed that the length and induration of the thorny petiole-rachis axis are highly variable, from extremely short or almost absent and slightly hard, to 4 cm and very indurated. Another character cited by Grondona to recognize var. *patagonica* is the leaves with 1–2 pairs of leaflets, which is included within the morphological range of *Tetraglochin alata*. Therefore, var. *patagonica* is here included within the morphological range of *Tetraglochin alata*.

Representative specimens:—ARGENTINA. Chubut: Depto. Cushamen, Ruta Provincial 70, de El Maitén a Epuyén, 42°07'27''S, 71°10'22''W, 690 m, 3 December 2015, *Zuloaga et al. 15661* (SI!); Depto. Escalante, Comodoro Rivadavia, ruta 26, km 9, 157 m, 12 December 2005*, Benjamini 975* (SI!); Depto. Futaleufú, ruta nacional 40, entre Esquel y Tecka, 727 m, 7 January 2011, *Zavala et al. 149* (SI!); Depto. Gastre, Aguada del Pajarito, 6 February 1932, *Castellanos s.n*. (BA 6056, CTES!); Depto. Rawson, Ruta prov. 12, 46°53'41.5'' S, 68°11'7.1'' W, 2 December 2002, *Bonifacino* & *Donato 775* (SI!); Depto. Tehuelches, Gob. Costa, 13 December 1981, *Cabrera et al. 33136* (SI!); Depto. Paso de Indios, Ruta 25, 42 km S, 43°58'13''S, 68°46'27W, 29 November 1976, *Arroyo 87* (SI!). Mendoza: Depto. Las Heras, 2 km from Cruz del Paramillo 24 km from Uspallata, 2940 m, 19 January 1989, *Zech* & *Contogiorgakis 14* (CONC!, LP!); Polvaredas, 32°24'29''S, 69°15'01''W, 2350–2485 m, without date, *Andrada 170* (SI!); Depto. Luján de Cuyo, Valle del río Tupungato, 32°54'39'' S, 69°46'04'' W, 26 December 2006, *Méndez 9860* (CTES!); Depto. Malargüe, camino a Paso Pehuenches, km 50, 10 January 1973, *Cabrera et al. 22824* (LP!); Malargüe, RN 186, desvío a Llancanelo hacia Yacimiento Fortunoso, 2070 m, 35°05'46'' S, 69°25'04'' W, 6 December 2014, *Zuloaga et al. 15266* (SI!); Valle del Salado, 38°08'08''S, 69°21'57''W, 22 December 1985, *Lagiglia 6875* (SI!). Neuquén: Depto. Chos Malal, bajada Chacayco, 1400 m, 23 November 1992, *González 921* (LP!); Depto. Collón Curá, Paso Limay, 750 m, 8 Nov 1967, *Gentili 575* (SI!); ruta 237, km 1,552, ladera de montaña sobre el embalse de Alicurá, 18 December 1999, *Seijo 2083* (CTES!); Depto. Minas, Cajón de los Chenques, 36°28'S, 70°48'W, 25 January 1970, *Boelcke et al. 13864* (SI!); Varvarco, Cabañas La Lomita, 1620 m, 1 December 2014, *Zuloaga et al. 15140* (SI!); Lagunas Epu–Lauquén, Aduana vieja, 36°50'S, 71°04'W, 1300 m, 15 January 1964, *Boelcke et al. 10889* (BAA!, SI!); Depto. Picunches, Arroyo Las Lajitas, 950 m, 12 December 1973, *Gentili 162* (SI!); Depto. Zapala, La Negra, 28 January 1980, *Ezcurra 91* (SI!); Laguna Blanca, 17 December 1965, *Navas 66* (LP!); cerca de Zapala, 7 December 1981, *Cabrera et al. 32845* (SI!). Río Negro: Depto. Valcheta, Cañadón Cortaderas a Laguna Raimunda, 5 January 2003, *Troiani* & *Steibel 15525* (CTES!); Ruta provincial 60, entre Cona Niyeu y Cerro Corona, 41°41'74''S, 67°08'54''W, 1030 m, 26 November 2015, *Zuloaga et al. 15462* (SI!); 9 de julio, Prahuaniyeu, 9 December 2003, *Troiani* & *Steibel 15717* (SI!); desde Conaniyeu hacia la Meseta de Somuncurá, 9 December 2003, *Bártoli & Tortosa 11/03* (BAA!, CTES!). San Juan: Depto. Iglesia, Reserva El Leoncito, Quebrada de las Bandurrias, 16 km al E del destacamento de guardaparques, 2875 m, 19 March 1999, *Biurrun et al. 5723* (CORD, SI!); without department, cerca de Casilla Negra, Yeguas Heladas, 3800 m, 12 January 1976, *Luti 5563a* (SI!). San Luis: Depto. Gral. Pedernera, Arroyo Manzanos, 12 September 1912, *Pastore 33* (SI!).

CHILE. Región Metropolitana: Santiago, Cordillera Prov., along the Embalse El Yeso, along the Access road 4 km upstream from the dam, 33°35'40''S, 70°10'15''W, 14 January 1993, *Taylor* & *Gereau 10931* (MO, SI!); Cordillera de Santiago, 2200 m, December 1924, *Werdermann 497* (LIL!, SI!); Chacabuco, entre Cajón del estero Colina y cordón Los Españoles, 33°09'S, 70°26'W, 3100 m, 1 March 2001, *Teillier* & *Silva 6181* (CONC!). IV Coquimbo: Illapel, Cuesta Espino, pleno campo, 1600 m, 16 December 1949, *Jiles 1640* (CONC!); Ovalle, Portezuelo Pingo, 2000 m, 15

January 1949, *Jiles 1159* (CONC!). V Valparaiso: Aconcagua, camino internacional de Los Andes a Argentina, Juncal, 2200 m, 16 January 1964, *Marticorena & Matthei 635* (CONC!); Limache, Estero de Chaparro, 6 December 1927, *Garaventa 367* (CONC!). VI O'Higgins: Cachacoal, road from Machali to Coya, near Chacayes bridge, 34°14'01''S, 70°28'45''W, 860 m, 12 November 2006, *Tepe et al. 1995* (CONC!); Rancagua, camino de Coya a Mina Pangal, 1500 m, 16 November 1970, *Marticorena & Weldt 624* (CONC!; LP!); Colchagua, camino de San Fernando a Vegas del Flaco, km 70, 1600 m, 18 January 1964, *Marticorena & Matthei 742* (CONC!). VII Maule: Linares, Fundo El Castillo, 36°14'S, 71°14'W, 975 m, 5 March 1999, *Ruiz & López 928* (CONC!); Linares, Reserva Nacional Bellotos del Melado, 1450 m, 35°51'S, 71°06'W, 21 December 1999, *Arroyo et al. 996346* (CONC!); Talca, Valle del Río Maule, Río Cipreses, Laguna de la Invernada, 1300 m, 18 December 1990, *Leuenberger et al. 4049* (CONC!); Curicó, camino de Curicó a Paso Vergara, 17 km al interior de Los Queñes, 900 m, 9 March 1967, *Marticorena & Matthei 797* (CONC!). VIII Bío Bío: Parque Nacional Laguna de la Laja, ca. 5 km al E de la administración, camino a Los Barros, 1095 m, 29 November 2008, *Morrone et al. 6032* (SI!); 6 km al E de Antuco, 670 m, 16 December 1990, *Leuenberger 4019* (CONC!); Antuco, 650 m, 27 December 1946, *Montero 4670* (CONC!); Antuco, Llano del Río Laja, 11 December 1941, 650 m, *Junge s.n.* (CONC 109944!).

2b. ***Tetraglochin alata*** var. ***ameghinoi*** (Speg.) Cialdella & Pometti *comb. et stat. nov.* ≡ *Margyricarpus ameghinoi* Spegazzini (1897: 512). ≡ *Tetraglochin ameghinoi* (Speg.) Spegazzini (1902: 283).

Type:—ARGENTINA. Chubut-Santa Cruz: "Patagonia australis, in valleculis aridissimis prope Golfo de San Jorge", February 1896, *C. Spegazzini s.n.,* LPS 2383 (holotype LP 008883 [web!]; isotype JE [web!]). (Fig. 5g–h).

This variety mainly differs from var. *alata* in the hypanthium which covers the fruit, being shorter (3–7 mm long vs. (4–)5–12 mm in var. *alata*), with narrower wings (0.5–1.6 mm vs. 2–4 mm in var. *alata*).

Distribution and habitat:—*T. alata* var. *ameghinoi* grows along the Andes from central Chile (IV, RM, VI, VIII Regions) and Argentina, where it is widely distributed, from San Juan to Santa Cruz, from 300 to 3000 m.

Phenology:—Collected in fruit from October to April.

Taxonomic notes:—According to Rothmaler (1939: 432), *Tetraglochin longifolia* Hauman (1918) probably should be included under the synonymy of *T. ameghinoi.* However, the study of a digital image of the holotype of the former (Argentina, Mendoza: "Hautes Cordilleres de Mendoza, Rio Tupungato, 2350 m, L. H., II-1908", *L. Hauman s.n*. (BR 000000526725 [web!])) showed that this specimen lack flowers and fruits and consequently its identification is dubious, being here considered as a dubious name.

Representative Specimens:—ARGENTINA. Chubut: Depto. Escalante, Astra, 22 October 1965, *Kreibohn 279* (SI!); Depto. Languiñeo, ruta 12 entre Gualjaina y Paso del Sapo, pasando el río Gualjaina, 545 m, 31 October 2008, *Biganzoli & Larsen 1909* (SI!); Depto. Futaleufú, 35 km E of Esquel on prov. r. 25, 43°00'59''S, 71°29'40''W, 670 m, 4 December 1984, *Stuessy 6834* (SI!); Depto. Río Senguerr, ruta 22, a 2 km N Río Mayo, 45°39' S, 70°15' W, 7 December 1976, *Arroyo et al. 339* (SI!); ruta nacional 40, entre Facundo y Estancia La Laurita, 41°11'56'' S, 69°59'03'' W, 575 m, 23 November 2013, *Zuloaga et al. 14802* (SI!); ruta nacional 26, de Puerta de la Virgen a Facundo, 45°27'41'' S, 69°42'43'' W, 580 m, 20 November 2012, *Zuloaga et al. 13961* (SI!); ruta nacional 40, entre Estancia La Laurita y Nueva Lubecka, 44°47'24'' S, 70°10'53'' W, 550 m, 23 November 2013, *Zuloaga et al. 14814* (SI!); Depto. Sarmiento, Cañadón de las Manos Pintadas, al SE de Facundo, 22 January 1972, *Eskuche et al. 1290* (CTES!); Depto. Tehuelches, Estancia El Cherque, 15 Jan 1948, *Soriano 3057* (SI!). Mendoza: Depto. Malargüe, Sierra del Nevado, C. Del Agua de la India Muerta, 35°47'S, 68°27'W, 1750 m, 10 December 1973, *Boelcke et al. 15795* (SI!); Reserva Provincial La Payunia, 36°00'48''S 68°48'39''W, 1703 m, 27 November 2002, *Prina et al. 1782* (SI!); Depto. San Rafael, Sierra del Nevado, 35°40'S, 68°23'W, 8 December 1973, *Boelcke et al. 15713* (SI!); El Perdido, 25 de mayo, without date, *Lagiglia 2846* (SI!); Depto. Las Heras, Alto Paramillo, January 1964, *García s.n.* (SI 26113!); RP 52 de Uspallata a Villavicencio, 2,785 m, 32°35'35''S, 69°20'56''W, 9 December 2014, *Zuloaga et al. 15334* (SI!). Neuquén: Depto. Ñorquin, ruta provincial 4, entre Colipilli y El Huecú, 1460 m, 28 November 2010, *Zuloaga et al. 12577* (SI!). Río Negro: Depto. Valcheta, Somuncurá, 30 km N de Laguna Raimunda, 2 November 1975, *Correa et al. 6380* (CTES!). San Juan: Depto. Calingasta, Reserva Natural Estricta El Leoncito, Ciénaga de las Cabeceras, 8 January 1997, *Haene & Izquierdo 1613* (SI!); Depto. Iglesia, Quebrada del Agua Negra, 27 December 2004, *Meglioli 166* (SI!); Quebrada del Agua Negra, 9 December 1979, *Cabrera et al. 31079* (LP!, SI!); Deptos. Calingasta-Iglesia: entre Los Erizos y El Molle, 2700 m, October1980, *Gómez 5972* (SI!); Depto Sarmiento, Quebrada del Río Los Sombreros, 14 November 1982, *Kiesling & Sáenz 4183* (SI!). Santa Cruz: Depto. Lago Buenos Aires, Los Antiguos, 10 km SE, 312 m, 30 November 2009, *Biganzoli et al. 2273* (SI!); Perito Moreno, October 1974, *Suárez 1* (SI!). CHILE. Región Metropolitana: Santiago, Piuquencillos, Valle del Río Colorado, 2000–3500 m, 8–10 December 1942, *Pisano et al.*

1636 (CONC!); Santiago, Cerro Abanico, 2000 m, November 1932, *Grandjot 1034* (CONC!); Santiago, Puente Alto, Valle del Yeso, 33°39'S, 70°04'W, 1900 m, 19 November 1966, *Schlegel 5697* (CONC!). IV Coquimbo: Cerro Tololo-Morado, 30°10'S, 70°48'W, 1800 m, 26 October 1971, *Jiles 6303* (CONC!); Cordillera de Combarbalá, Ramadilla, 31°18'S, 70°50'W, 3000 m, 5 January 1963, *Jiles 4445* (CONC!). VI O'Higgins: Colchagua, San Fernando, Termas del Flaco, 1700 m, 2 January 1959, *Montero 6012* (CONC!). VIII Bío Bío: Parque Nacional Laguna de la Laja, Sierra Velluda and Los Zorros trails, 37°23'39''S, 71°24'54''W, 1110–1250 m, 18 November 2006, *Tepe & Pelser 2137* (CONC!); Parque Nacional Laguna de la Laja, Camping Lagunillas, 37°23'S, 71°25'W, 930 m, 18 Nov 2001, *Mihoc 3127* (CONC!); Reserva Nacional Ñuble, en los alrededores de la avanzada Cuatro Juntas, 37°06'S, 71°14'W, 1500 m, 7 February 2008, *Teneb 582* (CONC!).

3. ***Tetraglochin andina*** Cialdella in Acosta *et al.* (2016: 846). Type:—ARGENTINA. San Juan: Depto. Iglesia, Parque Nacional San Guillermo, El Alero, 29°14'52''S, 69°22'53''W, 3500 m, 28 January 2013, *L. Salomón, J. Acosta* and *M. Suescún 77* (holotype SI!; isotype CTES!). (Fig. 6).

Perennial shrubby plants, up to 1.5 m high, the branches mainly spreading, rarely dense, lignified, erect; macroblasts and brachyblasts covered by the sheathing base of the petioles; sheaths glabrous, densely villous at the margin; petioles glabrous. Leaf blades imparipinnate, with (1)2–3 pairs of leaflets; leaflets 2.5–7(–9) × 0.4–1 mm, oblong, the apex apiculate and the base obtuse, the margin revolute, glabrous on both sides, rarely with few hairs near the margin, sessile; leaves of the macroblasts with petiole-rachis axis persistent, indurated to slightly hard, thorny, (0.5–)1.5–3.5 cm long, whitish, glabrous, straight, rarely slightly curved, and leaflets easily deciduous; leaves of the brachyblasts with petiole–rachis axis shorter than 1.5 mm long, the leaflets smaller than those of the macroblasts, crowded, persistent still at flowering time. Flowers solitary and axillary on the brachyblasts. Sepals ca. 1.2 mm long, ovate-elliptic, acute, glabrous. Stamens not seen. Stigma fimbriate. Fruits easily visible in the plant, each one covered by the hypanthium, 4–9 × 2.5–6 mm, winged, with 3–4 wings 0.5–2 mm wide, frequently narrower than the fruit, papery, hard, glabrous, with entire margin, all of them equally developed, rarely one of them narrower or irregular.

Distribution and habitat:—*Tetraglochin andina* has been collected along the Andes from northern to central Argentina (Jujuy, Salta, Tucumán, Catamarca, La Rioja, San Juan, Mendoza), between 1700 and 4000 m.

Phenology:—Collected in fruit from January to April.

Taxonomic notes:—This species is morphologically related to *T. alata* by having winged hypanthia and wings with entire margin. It differs from the latter by having a hypanthium with papery wings, hard and not translucent (vs. membranous and translucent wings in *T. alata)*.

Representative Specimens:—ARGENTINA. Catamarca: Depto. Andalgalá, El Globo, 17 February 2010, *Zuloaga et al. 11968* (SI!). Jujuy: Depto. Tumbaya, Ruta nac. 9, Quebrada de Coiruro, 3 km al N de Volcán, 2100–2200 m, 12 January 1985, *Kiesling et al. 5099* (SI!). La Rioja: Depto. Famatina, Sierra de Famatina, 3100 m, 14 January 1947, *J. Hunziker 1873* (SI!); entre Los Corrales y Cueva de Perez, 2700 m, 13 January 1976, *Cabrera et al. 27151* (SI!); subida a La Mejicana, 2900 m, 19 February 2010, *Zuloaga et al. 12046* (SI!); Depto. Gral. Lamadrid, entre Jagué y el Paso Pircas Negras, por la salina del Leoncito, entre los parajes llamados Pampa del Leoncito y Portezuelo del Agua Quemada, 3310 m, 18 April 1999, *Biurrun et al. 5939* (CTES!, SI!). Mendoza: Depto. Malargüe, Valle del Salado, 1750 m, 23 December 1984, *Lagiglia 6881* (SI!); Acceso a Mina Ethel-Peralito, 9 December 1994, *Lagiglia 8757* (SI!); Depto. San Carlos, Reserva Provincial Laguna del Diamante, 34°10'39''S, 69°18'55''W, 2675 m, 8 December 2009, *Prina et al. 3471* (SI!); Depto. Tunuyán, Bella Vista, 4 December 1946, *Covas 18037* (SI!); Depto. Tupungato, a orillas del Arroyo del Novillo Muerto, 1700 m, 13 December 1935, *Ruiz Leal 3568* (LP!). Salta: Depto. Cachi, Cuesta del Obispo, 200 m pasando Piedra del Molino, 3360 m, 16 February 2011, *Zuloaga et al. 12961* (SI!); Depto. La Poma, Ruta nacional 40, de Viaducto La Polvorilla a límite con Jujuy, 4200 m, 17 February 2011, *Zuloaga et al. 13008* (SI!). San Juan: Depto. Angaco, Sierra de Pie de Palo, camino a Mogote de los Corralitos, 2800–3000 m, 20 January 1981, *Kiesling 3121* (SI!), 15 February 1984, *Kiesling 4425* (SI!); Depto. Calingasta, Cerro Castaño, February 1960, *Fabris & Marchionni 2337* (CTES!, LP!); Arroyo Aldeco, 24 January 1971, *Volponi & Zardini 153* (LP!); Reserva Natural Estricta El Leoncito, January 1995, *Apochian et al. 251* (SI!); Depto. Iglesia, Reserva de San Guillermo, Puesto Agua de Godo, 13 January 1983, *Nicora et al. 8474* (SI!); Arroyo de la Quebrada de la Pancha, Ciénaga de las Vicuñitas, 2500 m, 10 April 1989, *Guaglianone et al. 2434* (SI!); Quebrada de Agua Negra, 2900 m, 18 January 1974, *Cabrera et al. 24426* (LP!); Depto. Sarmiento, Ruta nacional 150, Paso de Agua Negra, pasando Arrequintín hacia límite con Chile, 3300 m, 11 February 2011, *Zuloaga et al. 12757* (SI!). Tucumán: Depto. Chicligasta, Estancia Santa Rosa, La Cueva, 16 March 1924, *Venturi 3205* (SI!); without department, cerca de Casilla Negra, camino al Paso Yeguas Heladas, 3800 m, 12 January 1976, *Luti et al. 5563b* (SI!).

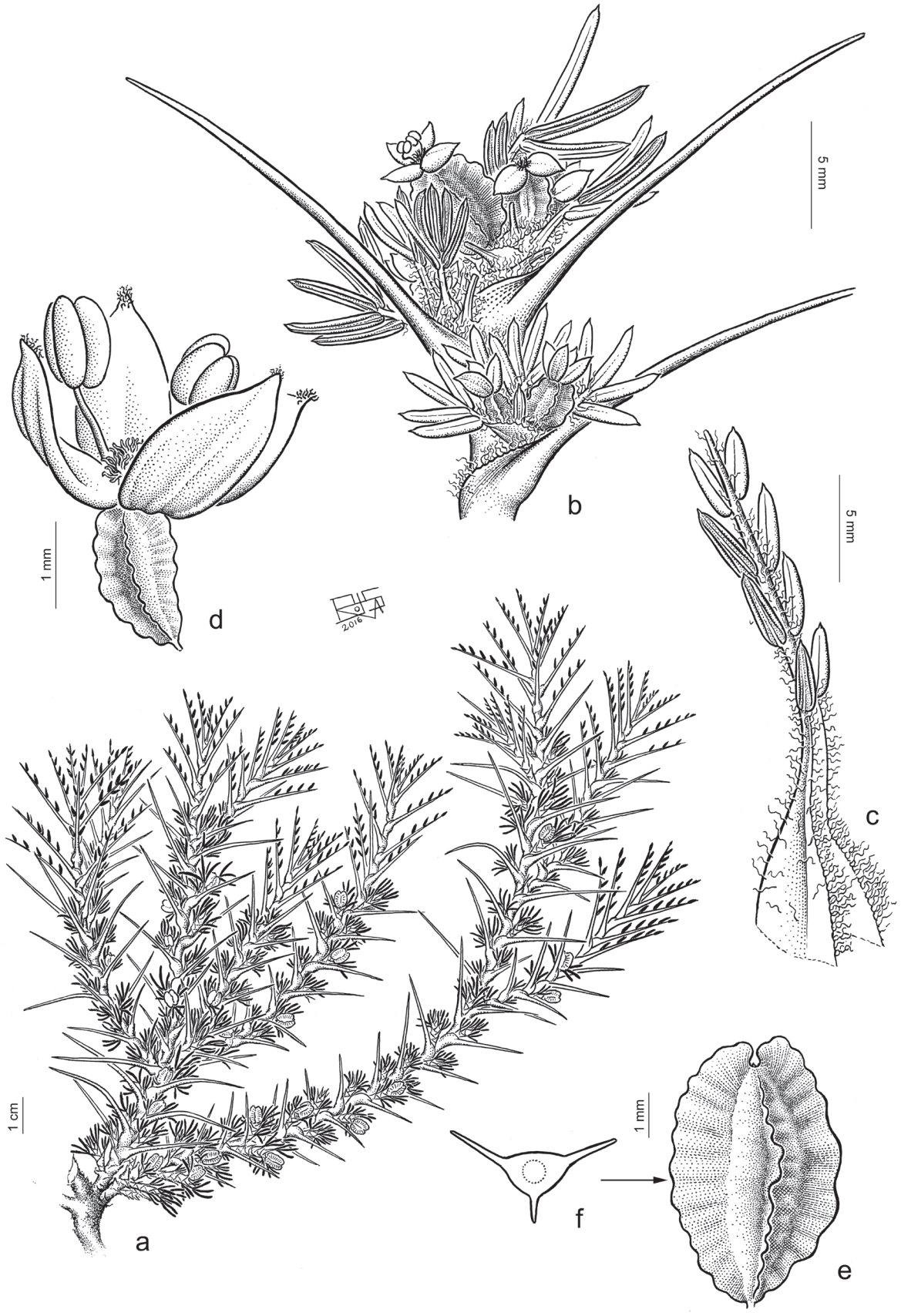

FIGURE 6. *Tetraglochin andina*—**a** general aspect of a branch; **b** detail of a macroblast showing several thorny petiole-rachis axis without leaflets, and groups of axilar brachiblasts with compound leaves and flowers; **c** detail of a leaf of a macroblast, showing the sheating base, the petiole and the compound leaf blade; **d** flower; **e** winged hypanthium covering the fruit; **f** trasversal section of the hypanthium and fruit. a–f from *Zuloaga et al. 12046*.

4. ***Tetraglochin caespitosa*** Philippi (1864: 63). ≡ *Margyricarpus caespitosus* (Phil.) Johnston (1938: 250). Type:—ARGENTINA. "In planitie patagonica, andibus valdivianis adjacente invenit orn. *Cox" s.n*., year 1856 (holotype SGO 49723 [web!]). (Fig. 7).

= *Margyricarpus niederleinii* Spegazzini (1897: 513), *nom nov.* for *Margyricarpus microphylla* Niederlein in Lorentz (1881: 215), *nom. illeg.* Type:—ARGENTINA. Neuquén?: "Nido de Cóndor, Río Nauquén", 17 June 1879, *G. Niederlein s.n.* (holotype CORD 00006001 [web!]).

= *Tetraglochin clarazii* (Ball) Rothmaler (1939: 435) ≡ *Margyricarpus clarazii* Ball (1886: 217). Type:—ARGENTINA. Chubut: without locality, August 1890*, J. Ball 155* (holotype K 000486018 [web!]).

= *Tetraglochin acanthocarpa* (Speg.) Spegazzini var. *lasiocarpa* Spegazzini (1902: 283). Type:—ARGENTINA. Chubut: Depto. Languiñeo, Carrenleufú, "Karren-leufú, Patagoni andia centrali", 1 March 1900, *without collector s.n.* (lectotype designated here LPS 11943 in LP [web!]).

= *Tetraglochin acanthocarpa* (Speg.) Spegazzini var. *dasycarpa* Spegazzini (1902: 283). Type:—ARGENTINA. Santa Cruz: "In altiplanitie aridissima, usque 1000 mts alt. s.m. inter S. Julian et Puerto Deseado, Patagonia australi, vere 1899", *without collector s.n.* (lectotype designated here LPS 11945 in LP [web!]).

= *Tetraglochin acanthocarpa* (Speg.) Spegazzini var. *lejocarpa* Spegazzini (1902: 283). Type:—ARGENTINA. Santa Cruz: "In aridis saxosis secus Rio Deseado, Patag. Australi, vere 1899", *without collector s.n.* (lectotype designated here LPS 11947 in LP [web!]).

Perennial herbs 4–20 cm high, densely caespitose and branched, the branches matted, lignified, robust and thick, erect or decumbent; macroblasts and brachyblasts covered by the sheathing base of the petioles; sheaths glabrous, villous at the margin (hairs 1–2.5 mm long); petioles glabrous. Leaf blades imparipinnate, with 2–5 pairs of leaflets; leaflets 2–3.5 mm × 0.5–1 mm, oblong, the apex apiculate and the base rounded and slightly asymmetric, the margin revolute, both sides densely villous (hairs 1–1.5 mm long), sessile; leaves of the macroblasts with petiole-rachis axis persistent, slightly indurated, 0.5–1.5 cm long, whitish, glabrous, straight, and leaflets easily deciduous; leaves of the brachyblasts with petiole-rachis axis shorter than 1 cm, the leaflets smaller than those of the macroblasts, crowded, persistent still at flowering time. Flowers solitary and axillary on the brachyblasts. Sepals 1.3–1.4 mm long, elliptic, acute, villous at the margin. Stamens 2–3, exserted, purplish, promptly deciduous. Stigma flabellate. Fruits partially visible in the plant, each one covered by the hypanthium, 4–7 × 2.5–7 mm, densely pubescent in all its surface, sometimes slightly pubescent or glabrous, tetragonal, rarely pentagonal, each angle extended in a wing developed or reduced, generally 2(3) wings well developed, thick, somewhat indurated, not translucent, with the margin irregularly toothed, and one wing replaced by 1–2 conical teeth, acute or rounded, not pungent.

Distribution and habitat:—*Tetraglochin caespitosa* is found in western and southern Argentina (Mendoza, Chubut, Neuquén, Río Negro and Santa Cruz), at elevations between 450–2100 m.

Phenology:—Collected in fruit from October to February.

Taxonomic notes:—Spegazzini (1902) made the combination *Tetraglochin acanthocarpa* (Speg.) Speg. citing this species for Patagonia in Argentina ["Vulgatus in aridis totius Patagoniae orientalis inter Rio Chubut et Rio S. Cruz, aest. 1894–900 (C.A., J. K., O. M., N. I., F. Basaldua)]". Then, this autor described several varieties of *T. acanthocarpa* without mentioning the locality and the collector for each one. Digital images of three specimens probably identified by Spegazzini as var. *lasiocarpa* were analyzed; the data of these specimens suggest that they could have been considered by Spegazzini to describe the variety: "Karren–leofú, Patagoni andia centrali, 1–III–1900", LPS 11943; "In aridis… (ilegible) prope Puerto Deseado, 1899", LPS 11940; without date, LPS 11944. The first specimen (LPS 11943) is designated herein as the lectotype of the variety, as it is the most representative, showing the caracteres mentioned in the protologue.

Regarding *T. acanthocarpa* var. *dasycarpa*, a digital image of the specimen LPS 11945 in LP was analyzed and, as in the previous variety, it could have been considered by Spegazzini for the description; therefore, it is designated herein as the lectotype of the variety.

Moreover, digital images of two specimens kept as syntypes of *Tetraglochin acanthocarpa* var. *lejocarpa* were analyzed: "In aridissimis submaritimis inter "San Julian" et Puerto Deseado, Patagonia australi, vere 1899", LPS 11949 in LP; "In aridis saxosis secus Rio Deseado, Patag. Australi, vere 1899", LPS 11947 in LP. The morphological characters (hypanthia with wings deeply and irregularly toothed, petiole-rachis axis frequently right) and the collection area of both specimens suggest that this variety must be included in the synonymy of *Tetraglochin caespitosa*, and not under *T. cristata* (see Rothmaler, 1939: 433). The specimen LPS 11947 is designated herein as the lectotype of *T. acanthocarpa* var. *lejocarpa*, as it is the most representative of the variety.

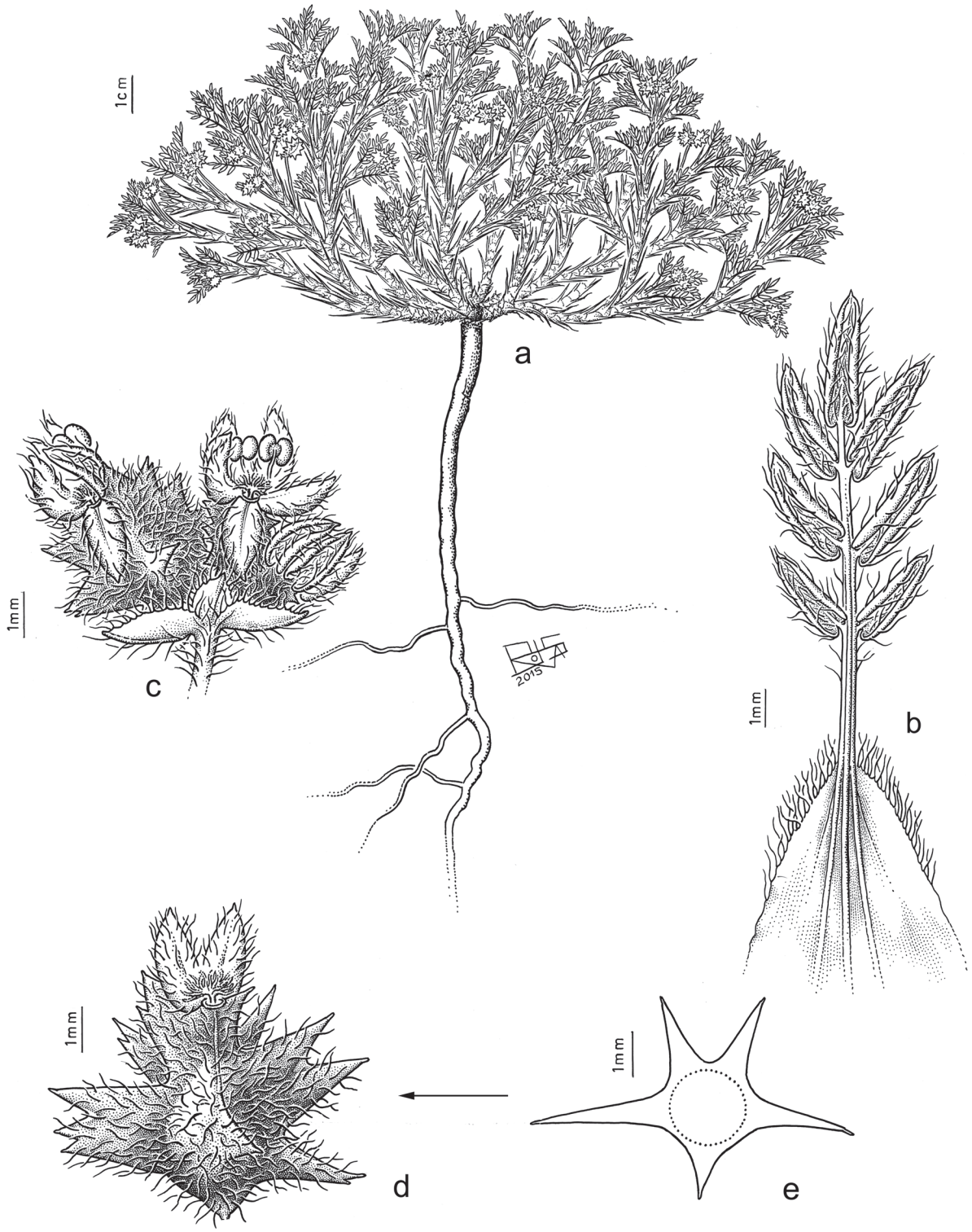

FIGURE 7. *Tetraglochin caespitosa*—**a** general aspect of the plant; **b** detail of a leaf of a macroblast, showing the sheating base, the petiole and the compound leaf blade; **c** two flowers; **d** irregular winged hypanthium covering the fruit; **e** trasversal section of the hypanthium and fruit. a–e from *Zuloaga et al. 14805*.

Tetraglochin caespitosa shares with *T. acanthocarpa* the pubescence surface of the hypanthia in most of the specimens, although in the last species this character is variable; the latter differs by having the hypanthia indurated, with narrow wings or without them and with conical indurated pricking thorns; furthermore, the branches of the plant are more loosely arranged and the upper surface of the leaflets is glabrous.

Representative Specimens:—ARGENTINA. Chubut: Depto. Biedma, Puerto Madryn, 24/25 October 1945, *O'Donell 3242* (LIL!); Depto. Gaiman, Gaiman, 29 October 1945, *O'Donell 3279* (LIL!); Depto. Rawson, Trelew, 18 October 1945, *Soriano 1907* (SI!); Trelew, 28 October 1945, *O'Donell 3294* (LIL!); Depto. Río Senguer, ruta 22, a 2 km N Río Mayo, 45°39'S, 70°15'W, 7 December 1976, *Arroyo et al. 346* (SI!); Paso Río Mayo, 13 December 1979, *León et al. 2531* (BAA!); Ruta nacional 40, entre Facundo y Estancia La Laurita, 575 m, 45°11'56''S, 69°59'03''W, 23 November 2013, *Zuloaga et al. 14805* (SI!); Ruta Nacional 40, paso Río Mayo, 45°40'26''S 70°15'14''W, 450 m, 20 November 2012, *Zuloaga et al. 13964* (SI!); without locality, November 1903, *Illín 186* (SI!); Depto. Telsen, De Telsen a Gan Gan, a 85 km de Gan Gan, 15 December 2002, *Bártoli & Tortosa 57/02-2* (BAA!); Meseta de Somuncurá, Estancia María de las Nieves, 42°28'76''S, 66°20'25''W, 460 m, 27 November 2015, *Zuloaga et al. 15481* (SI!). Mendoza: Depto. Malargüe, Sierras de Chachahuén, bajada del Co. De Ureta, 1660 m, 13 December 2001, *Prina et al. 1475* (SI!); RN 186, desvío a Llancanelo hacia Yacimiento Fortunoso, 2070 m, 35°05'46 S, 69°25'04'' W, 6 December 2014, *Zuloaga et al. 15265* (SI!). Neuquén: Depto. Añelo, Cerro Auca Mahuida, 1700 m, 6 December 1982, *Mallo et al. s.n.* (BAA 18543!); Depto. Confluencia, El Chocón, 5 November 1972, *Zardini & Kiesling 53* (LP!); Cercanías de Villa El Chocón, Embalse Exequiel Ramos Mejía, 13 November 2006, *Martínez 110* (CTES!). Río Negro: Depto. Bariloche, Nahuel Huapi, Estancia Fortín Chacabuco, 3 November 1949, *Boelcke & Hunziker 3574* (BAA!); Depto. Valcheta, Cañadón Cortaderas a Laguna Azul, 27 November 2002, *Troiani & Steibel 15445* (CTES!, SI!); Pomona a Valcheta, 26 November 2001, *Troiani & Steibel 15005* (CTES!). Santa Cruz: Depto. Deseado, Pico Truncado, 2 January 1966, *de Kreibohm 268* (SI!); Ruta nacional 281, hacia Puerto Deseado, 47°08'54'' S, 67°11'56'' W, 180 m, 15 November 2013, *Zuloaga et al. 14653* (SI!); Colonia Las Heras, Cerro Romberg, 22 January 1965, *Ancibor 105* (BAA!); Depto. General Roca, J. J. Gómez, 3 November 1972, *Krapovickas et al. 22438* (CTES!); Lago Buenos Aires, Ruta 45, de Perito Moreno a El Portezuelo, km 18, 460 m, 1 December 2009, *Biganzoli et al. 2290* (SI!).

5. ***Tetraglochin cristata*** (Britton) Rothmaler (1939: 433). ≡ *Margyricarpus cristatus* Britton ex Rusby (1893: 25). Type:—BOLIVIA. La Paz: without locality, year 1890, *M. Bang 170* (holotype NY 43745 [web!], isotypes E 00296011 [web!], GH 00026669 and 00026670 [web!], MICH 1111265 [web!], PH 00017040 [web!]). (Fig. 8).

= *Tetraglochin paucijugata* (I.M. Johnst.) Rothmaler (1939: 436) ≡ *Margyricarpus paucijugatus* I.M. Johnston (1938: 249). Type:—ARGENTINA. Catamarca: Depto. Andalgalá, 10 February 1916, *P. Joergensen 1143* (holotype: GH [web!]; isotypes probably LIL, SI!).

= *Tetraglochin tragacantha* Rothmaler (1939: 434). Type:—PERU. Depto. Puno: Pucará, 3700 m, February 1902, *A. Weberbauer 407* (holotype B; isotype JE [web!]).

Perennial shrubby plants, 20–40(–80) cm high, sometimes with lignified thick branches, erect, densely arranged mainly at the base; macroblasts and brachyblasts covered by the sheathing base of the petioles; sheaths glabrous, densely villous at the margin; petioles glabrous. Leaf blades imparipinnate, with 1–4 pairs of leaflets; leaflets (1–)3–5(–9) mm × 0.4–1 mm, oblong, the apex acute and the base obtuse, the margin revolute, upper side glabrous to slightly villous, lower side densely villous, sessile; leaves of the macroblasts with petiole-rachis axis persistent, indurated, thorny, (0.5–)1.5–3 cm long, rarely slightly thorny, whitish, glabrous, sometimes slightly villous, frequently curved, and leaflets easily deciduous; leaves of the brachyblasts with petiole-rachis shorter than 1 mm, the leaflets smaller than those of the macroblasts, crowded, persistent still at flowering time. Flowers solitary and axillary on the brachyblasts. Sepals ca. 1.5 mm long, ovate-elliptic, acute, yellowish to greenish, glabrous to slightly villous, with glandular short hairs near the apex. Stamens not seen. Stigma with branches flabellate-toothed. Fruits easily visible in the plant, each one covered by the hypanthium, (3–)4–8 mm × (3–)4–8 mm, winged, with 5 wings, one or two of them reduced, rarely all of them equally developed, coriaceous, glabrous, translucent, with opaque, wide, and indurated rays, each ray ending in a sharp tooth at the margin of the wing, these teeth frequently irregular and conspicuous, rarely the wings with entire margin.

Vernacular names:—"kanha", "kanya", "kaylla", "kanguia", "cola de león", "luchu kañlla", "cheke" (Aymara) (according to herbarium specimens labels).

Distribution and habitat:—Central and Southern Perú, Bolivia, northern Chile and northern Argentina (Jujuy, Salta, Tucumán, La Rioja and Catamarca), at elevations between 2000 m and 4950 m.

Phenology:—Collected in fruit from October to May.

Taxonomic notes:—Rothmaler (1939: 433) considered *Tetraglochin acanthocarpa* var. *lejocarpa* ("leiocarpum") as a synonym of *T. cristata*. Digital images of two specimens kept as syntypes of the variety could be analyzed. Both specimens show characters which agree with those of *Tetraglochin caespitosa* (see details under this species).

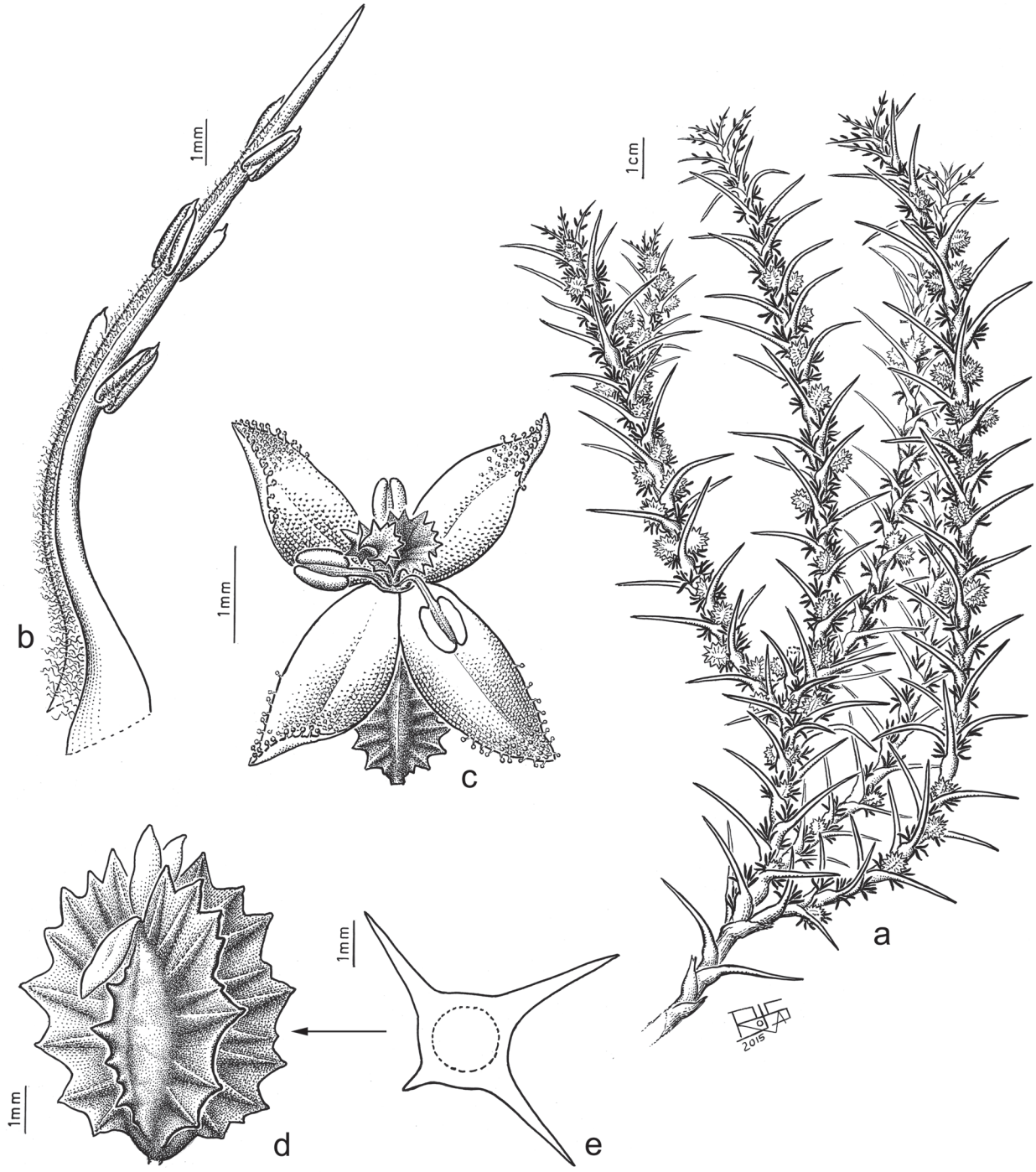

FIGURE 8. *Tetraglochin cristata*—**a** general aspect of a branch; **b** detail of a petiole-rachis axis of a macroblast with leaflets; **c** flower; **d** winged hypanthium covering the fruit, showing the wings with opaque rays and dentate margins; **e** trasversal section of the hypanthium and fruit. a–e from *Zuloaga et al. 13058*.

Rothmaler (1939: 434–435), after describing *Tetraglochin tragacantha*, mentioned that there are intermediate forms between this species and *T. cristata*. The analyzed type material of both species confirmed that there are no clear morphological differences that justify the recognition of *Tetraglochin tragacantha* as distinct from *T. cristata*; therefore, *Tetraglochin tragacantha* is reduced herein to synonymy of *T. cristata*.

The analysis of a digital image belonging to the holotype of *Margyricarpus paucijugatus* (*Joergensen 1143*, GH [photo!]) confirmed that its characters agree with slightly thorny forms of *Tetraglochin cristata*, therefore the former is reduced to synonymy of the latter. A duplicate of *Joergensen 1143* is kept at the Darwinion herbarium (SI). This

specimen shows many branches with thorny petiole-rachis axis 2.5–3 cm long. These measures are within the range of *Tetraglochin cristata* since its petiole-rachis axis varies from 0.5 mm to 3 cm long. Likewise, according to Rothmaler (1939: 437), another duplicate of *Joergensen 1143* is kept in the herbarium of Instituto Lillo (LIL). This duplicate could not be located.

Representative Specimens:—ARGENTINA. Catamarca: Depto. Andalgalá, subida al Cerro Yutuyaco desde Capillitas, 3350 m, 3 March 1952, *Sleumer 2740* (LIL!); Depto. Antofagasta de la Sierra, Estancia Los Colorados, 40 km al E de la ciudad de Antofagasta de la Sierra, 20 February 1974, *Botta et al. 788* (SI!); Depto. Belén, La Angostura, 3600 m, 21 March 1989, *Reca & Ramadori 178* (SI!). Jujuy: Depto. Cochinoca, Abra Pampa, Cerro Huancar, 22°46'01''S, 65°43'01''W, 3530 m, 22 February 2011, *Zuloaga et al. 13205* (SI!); Depto. Cochinoca, inmediaciones del ojo de agua, 22°44'S, 65°54'W, 15 December 1980, *Dell'Arciprete s.n.* (BACP 2200, SI!); Abra de la Cruz, 19 February 1943, *Cabezas 43* (SI!); 1.5 km W of the top of Abra Rechaite, along route 74, 73 km from the town of Abra Pampa, 22°54'12''S, 66°14'16''W, 4050 m, 17 March 1994, *Taylor et al. 11254* (MO, SI!); Cochinoca, cerro de la Candelaria, 23°43'S, 65°54'W, 22 January 1979, *Arenas & Martínez s.n*., (BACF 831, SI!); 1.5 km al sur de Tres Cruces, camino a Mina Aguilar, 3700 m, 26 February 1999, *Saravia Toledo 15161* (CTES!); Depto. Humahuaca, Quebrada de Humahuaca, ruta 9, 19 km al N de Humahuaca, 3380 m, 15 January 1971, *Boelcke et al. s.n.* (BAA 7076!, CTES!); ruta 9, 22 km N de Humahuaca, 19 March 1982, *Schinini & Vanni 22570* (CTES!); Cumbre de "Abra de Cianzo", 3600 m, 26 January 1999, *Saravia Toledo 14777* (CTES!); Ruta Prov. 13, 3 km del desvío de la Ruta Nac. 9 camino a Iturbe, 22°59'S, 65°21'W, 3570 m, 11 February 1998, *Morrone et al. 2425* (CTES!, SI!); Abra del Cóndor, yendo a Iruya, 2–5 km antes del abra, 3700–3950 m, 24 March 1939, *Novara et al. 8779* (SI!); de Humahuaca a Aparzo, 15 km de Humahuaca, 23°12'00''S, 65°13'50''W, 3600 m, 11 February 2007, *Zuloaga et al. 9142* (SI!); Ruta de Abra de Zenta a Santa Ana, 23°12'25''S, 65°03'16''W, 4380 m, 12 January 2012, *Zuloaga et al. 13419* (SI!); RP 13, de Iturbe a Iruya, 22°57'14''S, 65°20'25''W, 3445 m, 12 March 2013, *Zuloaga et al. 14202* (SI!); Mina Esperanza a Mina Aguilar, 23°09'43''S, 65°42'08''W, 4354 m, 13 March 2013, *Zuloaga et al. 14274* (SI!); RP 73 a Santa Ana, Abra de Zenta, 23°10'13''S, 65°02'59''W, 4465 m, 15 March 2013, *Zuloaga et al. 14323* (SI!); Sierra de Zenta, 4500 m, March 1931, *Budin s.n.* (SI 1541!); Mina Aguilar, cerca de Abra Blanca, 4000 m, 11 February 1970, *Ancibor & Mujica 27* (BAA!); entre Humahuaca e Iturbe, Cuesta de Chorrillos, 4000 m, 23°3'S 67°17'W, 23 January 1964, *Giusti et al. 3914* (BAA!); Depto. Dr. Manuel Belgrano, entre León y Nevado de Chañi, Puesto Cerrillos, 3700 m, 8 March 1963, *Fabris et al. 4017* (LP!); Depto. Rinconada, Mina Pirquitas, 4300 m, 1 March 1964, *Schwabe et al. 823* (LP!); Depto. Santa Catalina, Santa Catalina, finca de Urbano Mamaní (3 km aprox. del pueblo), 21°57'S, 66°04'W, 12 February 1980, *Arenas s.n. (*BACF 1752, SI!); Casira, 22°01'S, 65°57'W, 15 February 1980, *Arenas & Dell'Arciprete s.n*. (BACF 1796, SI!); Ruta Nacional 40, pasando Cuesta de Toquero hacia Santa Catalina, 22°06'27''S, 65°47'31''W, 3770 m, 19 February 2011, *Zuloaga et al. 13101* (SI); Cienaguillas, 22°07'S, 65°53'W, 15 February 1980, *Arenas s.n.* (BACF 1767, CTES!); Depto. Tilcara, Quebrada de Huasamayo, 2600–2800 m, 13 February 1980, *Cabrera et al. 31559* (LP!, SI!); Tilcara, arriba de San Gregorio, 3950 m, 27 January 1953, *Sleumer 3572* (SI!); Yala, January 1927, *Pereyra s.n.* (LIL 34949!); Depto. Tumbaya, Abra de Lipán, 4000 m, 24 March 1979, *Cabrera et al. 30533* (SI!); Bajada del Abra de Lipán a Salinas Grandes, 3800 m, 15 February 1980, *Cabrera et al. 31708* (SI!); Quebrada de Tumbaya Grande, 2000 m, 11 March 1982, *Kiesling et al. 3441* (SI!); Abra Portillo, Ruta 52, 3890 m, 17 February 1987, *Nicora et al. 8833* (SI!); Ruta Nacional 51, de Cañada Norquin a Purmamarca, Cuesta de Lipán, 23°41'44''S, 65°43'15''W, 3820 m, 18 February 2011, *Zuloaga et al. 13058* (SI!); Trayecto por camino de herradura entre El Colorado y Casa Colorada, 4–7 km al NE de El Colorado, 20–25 km al N de Ruta Nac. 52, km 46, 3700–3900 m, 6 April 2004, *Tolaba et al. 3497* (SI!); Volcán, Feb 1920, *Castillón 7111* (LIL!); Depto. Valle Grande, Caspalá, 1 March 1940, *Burkart & Troncoso 11699*, *11886* (SI!); 3 March 1940, *Burkart & Troncoso 11848* (SI!); Depto. Yavi, Cerro Negro, 27 February 1940, *Meyer s.n.,* (LIL 33880!), (LIL 33882!, SI!); La Quiaca, 3450 m, 15 February 1940, *Meyer s.n.,* LIL 33879 (LIL!, SI!); alrededores de Yavi, Siete Hermanos N, 3600 m, 30 January 1953, *Sleumer 3713* (LIL!); La Quiaca, 3450 m, 10 February 1960, *Meyer et al. 21192* (LIL!); Cuesta del Toquero, 8 June 1980, *Medán & Tortosa s.n.* (BAA 17207!). La Rioja: Depto. Famatina, camino a la Mina La Mejicana, 28°56'24''S, 67°41'09''W, 1223 m, 11 January 2009, *Donadío et al. 135* (CTES!, SI!); Subida a la Mejicana, 28°55'45''S, 67°40'42''W, 2900 m, 19 February 2010, *Zuloaga et al. 12044* (SI!). Salta: Depto. Cachi, Ruta Provincial 33, de Payogasta a Escoipe, Parque Nacional Los Cardones, 25°13'54''S, 65°56'05''W, 3160 m, 16 February 2011, *Zuloaga et al. 12947* (SI!); Cafayate, Cerro del Cajón, La Laguna, without date, *Rodríguez 1334* (LP!, SI!); Depto. Chicoana, Cuesta del Obispo, ruta prov. 33, km 63–65, entre el acceso a Valle Encantado y Piedra del Molino, 3500 m, 20 February 2004, *Tolaba & Alarcón 3462* (SI!); Depto. La Caldera, Potrero del Castillo, arriba de la Escuela, 2500 m, 13 March 1952, *Sleumer 2827* (LIL!); Depto. La Poma, Incahuasi, 27 January 1944, *Cabrera 8220* (LP!); Ruta Nacional 40, de Viaducto La Polvorilla a límite con Jujuy, 24°10'52''S, 66°24'46''W, 4200 m, 17 February 2011, *Zuloaga et al. 13010* (SI); Depto. Los Andes,

San Antonio de los Cobres, 4000 m, 22 February 1945, *Cabrera 8858* (LP!); Depto. Santa Victoria, Ruta Provincial 7, de Abra de Lizoite a Santa Victoria, 22°13'15''S, 65°13'15''W, 4410 m, 20 February 2011, *Zuloaga et al. 13142* (SI!). Tucumán: Depto. Chicligasta, Estancia Santa Rosa, La Cueva, 3800 m, 16 March 1924, *Venturi 3213* (SI!); Tafí del Valle, Infiernillo a Tafí del Valle, 1 February 1947, *Schulz 6662* (CTES!, SI!); Lara, 3200 m, 16 February 1912, *Rodríguez 334* (SI!); Faldeo W Laguna Lobos, Huaca-Huasi, Cumbres Calchaquíes, 4350 m, 18 February 1990, *Ayarde 359* (LIL!); Río Blanco, December 1914, *Castillón s.n.* (LIL 53767!). BOLIVIA. Cochabamba: Chapare, 14.8 km S of Colomi (junction of the road to Candelaria), on the road to Cochabamba, 3500 m, 17°24'S, 65°52'W, 23 October 1985, *Solomon 14511* (LPB!); Quillacollo, 60 km de Cochabamba, en dirección a Cami Cantón Sipe Sipe, 390 m, 15 December 1988, *Liberman 2320* (LPB!, SI!); Arani, 24.5 km E–SE of San Benito (junction) and 11.7 km E of Arani, 17°34'S, 65°43'W, 3180 m, 3 January 1999, *Hibbs 150* (MARY [photo!]); 28 km E of San Benito along old Cochabamba-La Paz road, 17°29'S, 65°39'W, 3500 m, 3 January 1999, *Hibbs 148* (MARY [photo!]). La Paz: Trail from Cota Cota to Muela del Diablo, 16°32'S, 68°03'W, 3500–3800 m, 13 April 1982, *Solomon 7458* (SI!); illegible locality, 3800 m, 3 December 1932, *Buchtien 124* (CONC!); Murillo, Ovejuyo, Laguna Apaña (Huni), 4950 m, 9 February 1986, *Moraes 755* (LPB!); Ingavi, Comunidad Titicani-Tacaca, 3890 m, 13 March 1989, *Villavicencio 5* (LPB!); Murillo, 2 km S of main La Paz-Oruro road on road into Valle de Achocalla, 16°34'S, 68°11'W, 3950 m, March 1980, *Solomon 5284* (LPB!). Oruro: L. Cabrera, alrededor de Salinas de Garci Mendoza, ca. 3600 m, 28 February 1986, *Beck 11758* (SI!); Cercado, De Juchuy Pata, desvío a Oruro, ca. 8 km hacia Cochabamba, 3850 m, 22 April 1989, *Beck et al. 18006* (SI!); Sajama, de Curahuara de Carangas 9 km hacia Turco, 18 March 1992, *Beck 21036* (LPB!); Sebastián Pagador, 6 km de Huari hacia Condo, pasando el río, 19°3'S, 66°46'W, 3700 m, 13 December 2000, *Michel et al. 2812* (LPB!, SI!). Potosí: Salida de Potosí hacia San Diego, 3400 m, February 1979, *Ceballos et al. 282* (SI!); Sud Chichas, Abra Blanca, al E–NE en línea recta de la ciudad de Tupiza aprox. 4.47 km, 21°25'26''S, 65°40'36''W, 3503 m, 3 March 2012, *Zenteno-R & Moya 11754* (LPB!, SI!); Sud Chichas, Churquipampa, al S–SE en línea recta de la ciudad de Tupiza aprox. 4.65 km, 21°28'15''S, 65°41'13''W, 3272 m, 2 March 2012, *Zenteno-R & Moya 11724* (LPB!, SI!); Sud Lípez, San Pablo de Lípez, 16 km hacia Quetena, 21°35'S, 66°45'W, 4100 m, 27 April 2000, *Beck 27496* (LPB!, SI!); Nor Lípez, 100 km hacia Alota pasando 6 km del desvío a San Cristóbal, 21°15'S, 67°15'W, 3720 m, 29 April 2000, *Beck 27517* (LPB!, SI!); Quijarro, camino de Potosí a Khucho Ingenio, 3700 m, 16 December 1987, *Schulte 76* (LPB!). Tarija: Cuesta de Sama, 2800 m, 24 January 1978, *Coro 713/78* (LIL!); ca. 5 km from Potosí towards Betanzos, 3800–3900 m, 3 December 1993, *Wood 7673* (LPB!); Méndez, Iscayachi, 3200 m, 30 November 1985, *Ehrich 49* (LPB!). CHILE. XV Arica y Parinacota: Cordillera Volcán Tacora, Ancara, 4300 m, AprIL 1926, *Werdermann 1122* (SI!); Arica, camino Zapahuira a Putre, km 12, 3300 m , 4 May 1972, *Ricardi et al. 143* (CONC!, CTES!); Arica, Socoroma, 18°16'S, 69°36'W, 3150 m, 24 March 1988, *Belmonte 88048* (CONC!). PERÚ. Arequipa: Cailloma, Chivay-Tuti, unos pocos km de Chivay, 3650 m, 13 January 1999, *Beck 26364* (LPB!, SI!). Cusco: without locality, February 1922, *Herrera s.n.* (SI 10432!). Junín: Entre Oropa y Tarma, 27 June 1982, *Zardini 1471* (LP!); Puna de Tarma, 17 December 1952, *Cabrera 10960* (LP!).

6. ***Tetraglochin inermis*** (I. M. Johnst.) Rothmaler (1939: 436). ≡ *Margyricarpus inermis* I. M. Johnston (1938: 250). Type:—ARGENTINA. Catamarca: Depto. Santa María, Sierra Aconquija, 4600 m, 24 February 1925, *S. Venturi 6633* (holotype US [web!]; isotype GH 00026671 [web!]). (Fig. 9).

Perennial plants, 10–30 cm high, densely caespitose, with many matted branches, lignified, erect or decumbent; macroblasts and brachyblasts covered by the sheating base of the petioles, those sheaths glabrous, with their margin densely villous. Leaf blades imparipinnate, reduced to 2–3(–5) leaflets, 1–4 × 0.4–1 mm, the apical leaflet slightly larger, oblong, the apex acute or apiculate and the base rounded, the margin revolute, upper side glabrous, lower side sparsely villous or glabrous, sessile; leaves of the macroblasts with petiole-rachis axis persistent, slightly indurated, up to 0.8 cm long, whitish, glabrous, frequently straight; leaves of the brachyblasts with petiole–rachis axis shorter than 0.5 mm, the leaflets persistent at flowering time. Flowers solitary and axillary on the brachyblasts. Sepals 1–1.8 mm long, elliptic, acute, glabrous. Stamens 2–3, purplish, promptly deciduous. Stigma flabelliform. Fruits partially visible in the plant, each one covered by the hypanthium, 2.5–5.5 × 2–4.5 mm, globose, slightly angular, papery, with 5 inconspicuous wings, their margin slightly indurated and mostly entire, exceptionally with very inconspicuous teeth, glabrous, generally all the wings equally developed, rarely one of them reduced.

Distribution and habitat:—Southern Bolivia (Tarija) and Northern Argentina, in the provinces of Jujuy, Salta, Tucumán and Catamarca, at elevations between 3000–4800 m.

Phenology:—Collected in fruit from October to March.

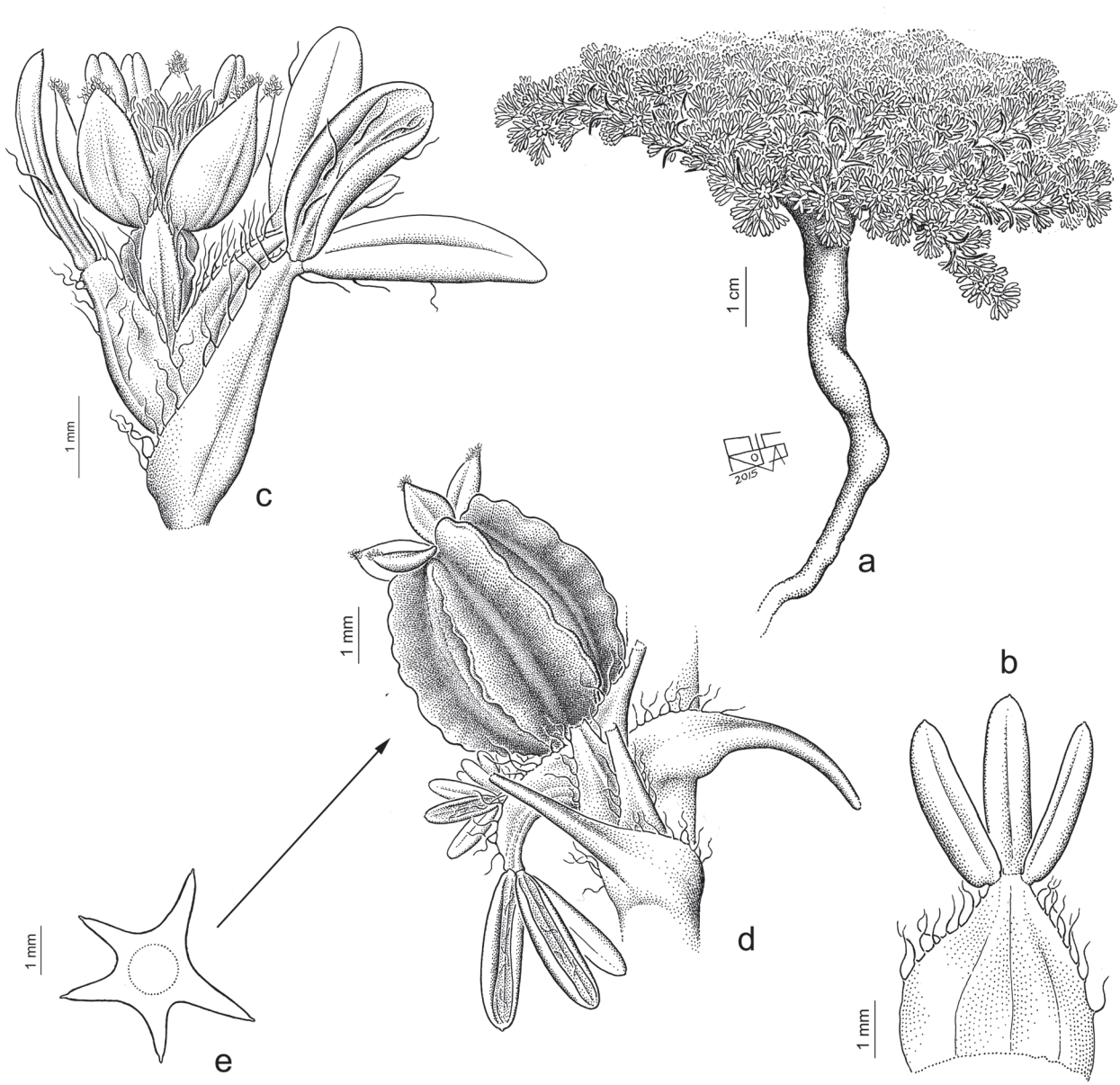

FIGURE 9. *Tetraglochin inermis*—**a** general aspect of the plant; **b** detail of a leaf of a macroblast, showing the sheating base and the leaflets (petiole-rachis axis absent); **c** detail of a flower and leaves; **d** globose hypanthium with narrow wings, covering the fruit; **e** trasversal section of the hypanthium and fruit. a–e from *Zuloaga et al. 13169*.

Taxonomic notes:—*Tetraglochin inermis* is easily distinguished by its caespitose habit, with many short and matted branches, without thorns. Macroblasts and brachyblasts show leaflets with petiole–rachis axis extremely short, almost only represented by its sheating base. The leaf blade is composed by few leaflets. These leaflets are very crowded in the brachyblasts and partially covered by the sheaths of the macroblasts.

The hypanthium in this species is somewhat inflated when mature, and shows narrow, entire and papery wings, sometimes with opaque and indurated rays which resemble those observed in *Tetraglochin cristata*. However, the latter species differs by having hypanthium with well developed and toothed wings, apart from being a thorny species due to indurated petiole–rachis axis of the leaves.

Tetraglochin inermis shares with unarmed forms of *T. alata* the lack of thorns and the leaves with few leaflets, but they can be distinguished by the characters of the hypanthium: papery, with inconspicuous wings in *T. inermis* vs. membranous with conspicuous wings in *T. alata*.

Representative Specimens:—ARGENTINA. Jujuy: Depto. Valle Grande, Caspalá, cumbres, 4800 m, 3 March 1940, *Burkart & Troncoso 11836* (SI!); Ciénaga Grande, entre Abra Colorada y Caspalá, 11 March 1967, *Fabris &*

Crisci 6893 (LP!); Cerro de Caspalá, 3000 m, 23 March 1929, *Venturi 8614* (SI!); Depto. Yavi, Abra de Cajas, 4400 m, 18 January 1966, *Cabrera et al. 17566* (LP!). Salta: Depto. Cafayate, Cerro del Cajón, 18 February 1914, *Rodríguez 1332* (SI!); Depto. Santa Victoria, Ruta provincial 145, de El Condor a Nazareno, Abra del Cóndor, 22°23'51''S, 65°17'02''W, 4500 m, 16 February 2009, *Zuloaga et al. 10797* (SI!); Ruta provincial 145, entre Quebrada Colorada y Abra Fundición, 22°26'20'' S, 65°10'34''W, 4700 m, 21 February 2011, *Zuloaga et al. 13169* (SI!). Tucumán: Depto. Tafí del Valle, Cumbres Calchaquíes, Cerro Bayo, alrededores del refugio, 26°43'S, 65°42'W, 4200 m, 12 March 1984, *Gómez Sosa & Múlgura 151* (SI!); Cumbres Calchaquíes, Quebrada Isabel, 4300 m, 9 March 1952, *Sparre 9683* (LIL!); Cumbres Calchaquíes, N. de los Callejones, 4200 m, 14 February 1952, *Sparre 9573* (LIL!); Las lagunas del negrito, 4300 m, 6 October 1926, *without collector 4387* (LIL!). BOLIVIA. Tarija: José María Aviléz, Abra Pulario, camino río Honda hacia Pulari-Villazón, 21°56' S, 65°06' W, 4100 m, 7 March 1998, *Beck et al. 23742* (LPB!, SI!); Avilez, Cuenca de Tajsara, 3860–3920 m, 6 Februray 1986, *Campero Meyer 6* (LPB!).

Excluded species

Tetraglochin buxifolia C. Presl (1849: 200).

Rothmaler (1939: 431) included *Tetraglochin buxifolia* C. Presl in the synonymy of *T. alata*. A digital image of the type material of *T. buxifolia* ("Habitat in Cordillera de Chile", *Cuming s.n.,* holotype PRC 455028 [web!]) was analyzed. This specimen has two branches without flowers, and one fruit, winged, the wings membranous, with reticulate veins. Although the characters of the fruit are similar to those found in *T. alata*, the digital image shows that this specimen has sessile obovate leaves, apparently simple, and axilar straight thorns with the apex bifurcate. These latter characters, also mentioned in the original description of *T. buxifolia,* arenot present in the genus *Tetraglochin*. Consequently, *Tetraglochin buxifolia* is herein excluded from the genus. This digital image was compared with herbarium material of *Bougainvillea spinosa* (Cav.) Heimerl (Nyctaginaceae), i.e., *Kiesling 6481* (SI) and *Taylor 11206* (SI), and the similarities suggest that this image could correspond to this species.

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Appendix 1. Examined material of *Tetraglochin* used for morphometric analyses. Each specimen is cited by the last name of the first collector when there is more than one collector. Species/group number is indicated between parentheses.

1. ***Tetraglochin acanthocarpa*** (Speg.) Speg.
2. ***Tetraglochin alata*** (Gillies ex Hook. & Arn.) Kuntze
3. ***Tetraglochin*** aff***. alata***
4. ***Tetraglochin ameghinoi*** (Speg.) Speg.
5. ***Tetraglochin andina*** Ciald.
6. ***Tetraglochin caespitosa*** Phil.
7. ***Tetraglochin cristata*** (Britton) Rothm.
8. ***Tetraglochin inermis*** (I. M. Johnst.) Rothm.

Álvarez, A. s.n., CONC 127364 (3); *Andrada, L. 170* (3); *Apochian, C. 251* (5); *Arancio, G. 94181* (4); *Arroyo, M. K. 994697* (3), *995277* (3), *99634* (2); *Arroyo, S. C. 87* (3), *339* (4), *346* (6); *Baeza, M. 3236* (4); *Barboza. G. 2393* (1); *Bártoli, A. 11/ 03* (3); *Baxter, P. s.n.*, CONC 176843 (3); *Beck, S. 8995* (7), *11758* (7), *21036* (7), *23742* (8), *26364* (7); *Behn, F. s.n*., CONC 23061 (3); *Behn, K. s.n.* CONC 24341 (3); *Belmonte, E. 88048* (7); *Biganzoli, F. 2273* (4), *2290* (6); *Biurrum, F. 5723* (3), *5939* (5); *Boelcke, O. 10889* (2), *13864* (3), *15713* (4), *15795* (4); *Bonifacino, M. 775* (3); *Botta, S. 788* (7); *Buchtien, O. 124* (7); *Burkart, A*. 11836 (8), 11699 (7), 11848 (7), 11886 (7); *Cabezas, V. 43* (7); *Cabrera. A. L. 17566* (8), *32845* (2), *33111* (1), *33136* (3); *Campero Meyer 6* (8); *Ceballos, A. 282* (7); *Correa, M. N. 6380* (4); *Dell'Arciprete, A. s.n.,* BACP 2200 (7); *Donadío, S. 135* (7); *Ehrich, R. 49* (7); *Ezcurra, C. 91* (2); *Fabris, H. A. 856* (4), *6893* (8); *Garaventa, A.367* (2), *5680* (3); *Gentili, M. 162* (2), *575* (3), *s.n.*, SI 201072 (2); *Gleisner, G. s.n*., CONC 34193 (2); *Gómez 5972* (4); *Gómez Sosa, E. 151* (8); *González, E. 921* (3); *Grandjot, C. 1034* (4); *Guaglianone 2434* (5); *Haene, E. 1613* (4); *Herrera, F. s.n*., SI 10432 (7); *Hicken, C. M. s.n.,* SI 5115 (1); *Hunziker, J. 1873* (5); *Jiles, C. 1537* (3), *1640* (3), *2443* (3), *3283* (3), *3324* (3), *3711* (4), *4445* (4), *5575* (3), *6303* (4); *Junge, C. s.n*., CONC 109944 (3); *Kiesling, R. 3121* (5), *5099* (5); *Krapovickas, A. 22438* (6); *Kreibohn 279* (4); *Lagiglia, H. A. 6875* (2), *6881* (5), *8757* (5); *Leuenberger, B. E. 4019* (2), *4049* (3); *Luti 5563 a* (3), *5563 b* (5); *Marticorena, A. 635* (3), *652* (3), *742* (2); *Martin, T. s.n.,* SI 201007 (4); *Martínez, L. C. A. 110* (6); *Meglioli 166* (4); *Méndez, E. 9860* (3); *Mihoc, M. 6871* (3); *Montero, G. 4670* (2), *6104* (3), *7401* (3); *Moraes, M. 755* (7); *Morales, J. s.n*., CONC 127370 (3); *Morrone, O. 2425* (7), *6032* (2); *Muñoz, P. 20597* (3), s.n. CONC 127371 (3); *Nicora, E. 8474* (5); *Novara, L. 8779* (7); *Pastore 33* (2); *Pisano, E. 1636* (4); *Prina, A. O. 1475* (6), *1782* (4), *3471* (5); *Reca, A. R. 178* (7); *Ricardi, M. 143* (7); *Rodríguez, D.1332* (8); *Ruiz, E. 928* (3); *Ruiz Leal, A. 3568* (5); *Salomón, L. 77* (5); *Schulte, M. 76* (7); *Schulz, A. G. 6662* (7); *Schwabe, H. 175* (3); *Seijo, G. 2083* (2); *Skottsberg, C.11054* (3); *Sleumer, H. O. 3572* (7); *Solomon, J. C. 7458* (7), *14511* (7); *Soriano, A. 3057* (4); *Spegazzini, C. 15617* (4), 15619 (4); *Stuessy, T. F. 6834* (4); *Suárez, C. 1* (4); *Teillier. S. 6181* (2); *Tepe, E.J. 1995* (2), *2137* (4); *Tolaba, J. A. 3462* (7), *3497* (7); *Troiani, H. 15005* (6), *15445* (6), *15717* (3); *Venturi, S. 3205* (5), *8614* (8); *Villavicencio, X. 5* (7); *Weldt, E. 705* (3); *Werdermann 497* (3); *Wood, J. R. I. 7673* (7); *Zardini, E. M. 53* (6); *Zavala, L.149* (3); *Zech, J. C. 14* (3); *Zöllner, O. 10044* (4); *Zuloaga, F. 9142* (7), *10797* (8), *11968* (5), *12046* (5), *12577* (4), *12757* (5), *12961* (5)*13058* (7), 13169 (8), *13961* (4), *13964* (6), *14202* (7), *14274* (7), *14323* (7), *14653* (6), *14805* (6), *15059* (3), *15140* (3), *15265* (6), *15266* (3), *15334* (4), *15462* (3), *15481*(6), *15553*(1), *15661*(3).