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Astragalus tegulensis Bacch. & Brullo (Fabaceae), a new species from Sardinia

Gianluigi Bacchetta & Salvatore Brullo

Abstract

BACCHETTA, G. & S. BRULLO (2010). *Astragalus tegulensis* Bacch. & Brullo (Fabaceae), a new species from Sardinia. *Candollea* 65: 5-14. In English, English and French abstracts.

Astragalus tegulensis Bacch. & Brullo (Fabaceae), a new species belonging to *Astragalus tragacantha* L. group from Capo Teulada (Sulcis, SW Sardinia), is described and illustrated.

Key-words

FABACEAE – *Astragalus* – Sardinia – Taxonomy

Résumé

BACCHETTA, G. & S. BRULLO (2010). *Astragalus tegulensis* Bacch. & Brullo (Fabaceae), une nouvelle espèce de Sardaigne. *Candollea* 65: 5-14. En anglais, résumés anglais et français.

Astragalus tegulensis Bacch. & Brullo (Fabaceae), une nouvelle espèce du groupe *Astragalus tragacantha* L., est décrite et illustrée du Cap Teulada (Sulcis, SW Sardaigne).

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Introduction

During taxonomic investigations on the tragacanthoid species of the genus *Astragalus* L. occurring in the Mediterranean area (BRULLO & GIUSSO, 2001, 2003; BACCHETTA & BRULLO, 2006), a very peculiar population, limited to Capo Teulada in South West Sardinia, was examined. The occurrence of this population in the aforementioned locality was previously recorded by FALQUI (1905) and BALLERO & BOCCHIERI (1984, 1987) who attributed it to *A. massiliensis* (Mill.) Lam., while more recently VALSECCHI (1994), BACCHETTA (2006) and BACCHETTA & al. (2007) attributed it to *A. terracciano* Vals.

Morphological analysis of living material from several individuals has emphasized that the population of Capo Teulada is very different from those present in Northwestern Sardinia and Southern Corsica that belong to the typical *A. terracciano*.

These differences mainly concern the shape and size of the leaves, bracts, bracteoles, floral pieces, legumes and seeds. Thus a new species has been described herein.

Materials and methods

The morphological study was based on data from the literature and herbarium investigations as well as on field surveys. Herbarium specimens of *A. tegulensis* and allied species, preserved in CAG, CAT, FI, G, M, SASSA and SS, were examined for taxonomic comparative purposes (Table 1).

The micro-morphology of the seed outer coat was studied using dried material with the aid of a scanning electron microscope (SEM) Leica Cambridge LEO 420. The preparation of the seeds for SEM observation was done according to the protocol of HUTTUNEN & LAINE (1983).

Results and discussion

Astragalus tegulensis Bacch. & Brullo, *spec. nova* (Fig. 1, 2)

Typus: SARDINIA. **Sulcis:** Cala Piombo (Teulada – CI), 3 m, 38°53'44.69"N 8°38' 37.29"E, SW 215°, incl. 45°, panchina tirreniana, termomedit inf./secco inf., 10.V.2007, G. Bacchetta, S. Cinus, D. Cogoni, G. Fenu & S. Pinna 44/07 (holo-: CAT; iso-: CAG, CAT, FI).

Astragalus terracciano affinis, foliolis ovato-lanceolatis, stipulis erectis apice, 4.5-5 mm longis, 1-nervatis, dense pilosis exteriori superficie, marginis pilis 0.1-0.3 mm longis, bracteolis 1-1.4 mm longis, base calyce insertis, calyce cylindrico-tubuloso, 6.5-8 mm longo, profunde inciso dorso, calycis dentibus triangularibus, inferioribus 0.7-0.8 mm longis, vexillo 11.5-15.5 × 5.5-6 mm, alis 14-15 mm longis, carina 11-11.5 mm longa, anthera

subcirculari, 0.7 mm longa, pistillo 12-12.5 mm longo, ovario sparsim piloso, legumine 10-12 × 3-4 mm, oblongo-ovoideo, rostro recto, 2-2.5 mm longo, semine 2.4-2.5 × 1.5-1.6 mm, testa rugosa differt.

Dwarf shrub forming a dense compact, spiny cushion, 20-40(-60) cm tall. *Stems* woody, very branched, tough, with persistent stipules and rachis in the old part of the branches. *Leaves* imparipinnate 2.5-4 cm long, with rachis cream-whitish juvenile covered by scattered hairs that are protracted into a straight spine, shorter than the upper leaflets. *Leaflets* ovate-lanceolate, green, obtuse to acute at apex, 7-8 paired, 2.5-6 × 1-2.2 mm, covered by appressed medifixed hyaline hairs. *Stipules* ovate, 4.5-5 mm long, joined to the rachis from about half-way, acute to apiculate and erect at the apex, coriaceous, straw-coloured, uninerved, densely hairy on the outer faces and at the margin with hairs 0.1-0.3 mm long. *Raceme* 2-4 flowered, with peduncle 5-15 mm long. *Bract* lanceolate to ovate-lanceolate, hyaline, apiculate, 1.4-1.7 mm long, densely hairy. *Bracteoles* ovate-lanceolate, densely hairy, 1-1.4 mm long, inserted at the calyx base. *Calyx* cylindrical-tubulose, two lipped, deeply incise on the back until the middle part, 6.5-8 mm long, 2.5-3 mm in diameter, densely covered by medifixed hyaline and black hairs, teeth triangular, the lower ones 0.7-0.8 mm long, the upper ones 0.6 mm long. *Corolla* white, tinged with pink-lilac in the keel, 14.5-16.5 mm long; standard platynychioid, spatulate, flat at the margin, retuse at apex, 11.5-15.5 × 5.5-6 mm. *Wings* 12-14 mm long; keel 11-11.5 mm long. *Stamen* tube (fused region of the filaments) 11-13 mm long. *Anther* yellow, sub-circular, 0.7 mm long. *Pistil* 12-12.5 mm long. *Ovary* sparsely hairy. *Style* glabrous and curved. *Stigma* slightly papillose, hemispheric. *Legume* 10-12 × 3-4 mm, hairy, with hairs white and black, 0.3-0.7 mm long, irregularly oblong-ovoid with a long beak straight, 2-2.5 mm long; keel 0.9-1.1 mm wide. *Seeds* reniform, 2.4-2.5 × 1.5-1.6 mm, brown, laterally compressed, with testa densely rugose.

Etymology. – The specific epithet refers to “Tegula”, the ancient name of the town and cape of Teulada.

Seed micromorphology. – In *A. tegulensis* the ornamentation of the testa is well-differentiated from that in *A. terracciano* (Fig. 3). In particular, the seed near the hilum is quite smooth, while the rest of the testa surface is uniformly rugose and cerebriform in shape. In *A. terracciano* the testa is uniformly reticulate.

Distribution, ecology and conservation status. – *Astragalus tegulensis* is an halophyte occurring in SW Sardinia at an altitude of 1-5 m and localized in the Cala Piombo bay of Capo Teulada (Fig. 4). This species is represented by a small population found in the western part of the bay on Paleozoic metamorphites and Tyrrhenian bioclastic calcareous sandstones (panchine). It grows on lithosoils or on developed poorly soils,

Table 1. – Diagnostic morphological characters for *Astragalus tegulensis* Bacch. & Brullo and closely related species (*A. terraccianoii* Vals. and *A. tragacantha* L.).

	<i>A. tegulensis</i> Bacch. & Brullo	<i>A. terraccianoii</i> Vals.	<i>A. tragacantha</i> L.
Leaves	green, 2.5-4 cm long, with 7-8 pairs of leaflets	grey-green, 3-4(-5) cm long, with 5-10 pairs of leaflets	glaucous, 3.5-6 cm long,) with 5-10(-12 pairs of leaflets
Leaflets	ovate-lanceolate, 2.5-6 mm long and 1-2.2 mm wide, obtuse to acute at the apex	elliptic to obovate, 2-6 mm long and 1-2.5 mm wide, subobtuse at the apex	ovate to obovate, 2-6 mm long and 1-3 mm wide, rounded at the apex
Stipules	ovate, 4.5-5 mm long, 1-nerved, densely hairy in the outer faces and at the margin, hairs 0.1-0.3 mm long	ovate-triangular with curved apex, 4-6(-10) mm long, loosely hairy and ciliate at the margin, hairs 0.3-0.7 mm long	ovate-triangular, 6-8 mm long, hairy at the basis and apex, ciliate at the margin; hairs 0.5-1 mm long
Raceme	2-4 flowered	3-6 flowered	3-8 flowered
Bract	lanceolate to ovate-lanceolate, 1.4-1.7 mm long	ovate to ovate-triangular, 1.5-2.5 mm long	ovate, 3-4 mm long
Bracteoles	ovate-lanceolate, inserted at the calyx base, 1-1.4 mm long	ovate-lanceolate, inserted in the peduncle, 0.7-1 mm long	lanceolate, inserted in the peduncle, 1 mm long
Calyx	cylindric-tubulose, 6.5-8 mm long, 2.5-3 mm in diameter, deeply incise until the middle part	conic-tubulose, (5-)6-7 mm long, 3-3.5 mm in diameter, not incise in the back	campanulate-tubulose, 6-7 mm long, 3-3.5 mm in diameter, not incise in the back
Calyx (teeth)	lower ones 0.7-0.8 mm long, the upper ones 0.6 mm long	lower ones 0.4-0.7 mm long, the upper ones 0.6-0.8(-1) mm long	lower ones 1.5-2.5 mm long, the upper ones 1-2 mm long
Corolla	white tinged with pink-lilac in the keel, 14.5-16.5 mm long	white often tinged with violet and/or lilac, 15-17 mm long	whitish, 17-19 mm long
Standard	platonychoid, spatulate, 11.5-15.5 mm long, 5.5-6 mm wide, retuse at apex	obovate-spatulate, 15-17 mm long, 6.5-7.5 mm wide, incise-retuse at apex	elliptic to obovate, 17-19 mm long, 6-8 mm wide, slightly emarginate at apex
Wings	12-14 mm long	14-15 mm long	16-18 mm long
Keel	11-11.5 mm long	11.5-12 mm long	13-15 mm long
Stamen tube	11-13 mm long	12-13 mm long	13-15 mm long
Anthers	subcircular, 0.7 mm long	subcircular-ovate, 0.8-0.9 mm long	elliptic, 0.5-0.6 mm long
Pistil	12-12.5 mm long, with ovary sparsely hairy	10-11 mm long, with ovary hairy	12.5-14.5 mm long, with ovary hairy
Legume	oblong-ovoid, 10-12 mm long and 3-4 mm wide, with a long beak straight, 2-2.5 mm long	ellipsoid, 8-9 mm long and 4-4.5 mm wide, with beak inclinate, 0.8-1.5 mm long	ellipsoid, 10-13 mm long and 3.5-4 mm wide, with beak straight, 1-2 mm long
Legume (hairs)	0.3-0.7 mm long	0.2-0.6 mm long	0.5-2 mm long
Seed	reniform, 2.4-2.5 mm long and 1.5-1.6 mm wide, with testa uniformly rugose with a cerebriform shape	slightly reniform, 2.5-3 mm long and 1.8-2.2 mm wide, with testa uniformly reticulate	reniform, 2.5-3 mm long and 1.5-1.6 mm wide, with testa reticulate

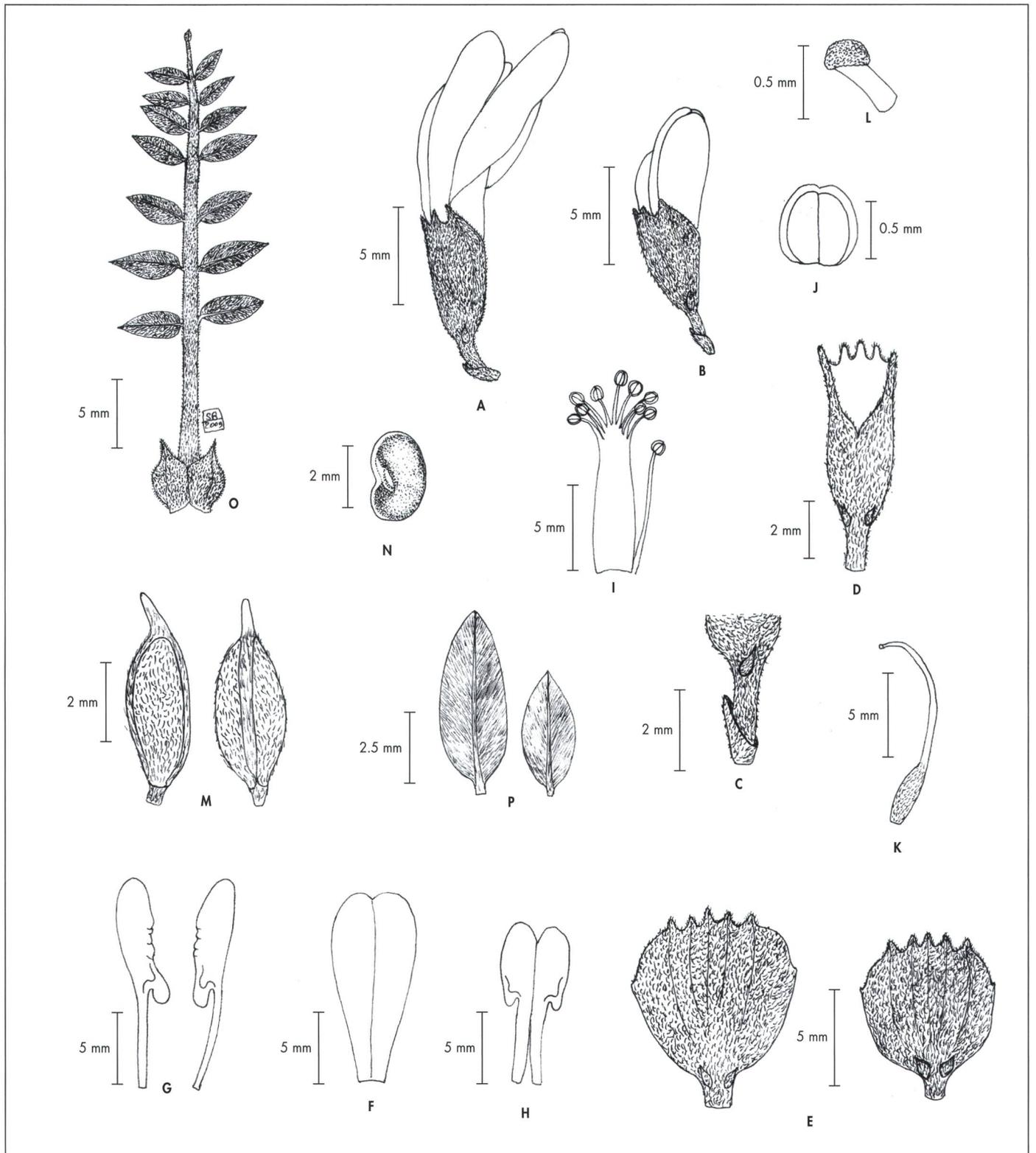


Fig. 1. – *Astragalus tegulensis* Bacch. & Brullo. **A.** Flower; **B.** Flower bud; **C.** Peduncle with bract and bracteole; **D.** Calyx; **E.** Open calices; **F.** Standard; **G.** Wings; **H.** Keel; **I.** Staminal tube; **J.** Anther; **K.** Pistil; **L.** Stigma; **M.** Legumes; **N.** Seed; **O.** Leaf; **P.** Leaflets.

[Bacchetta & al. 44/07, CAT] [Drawn by S. Brullo]

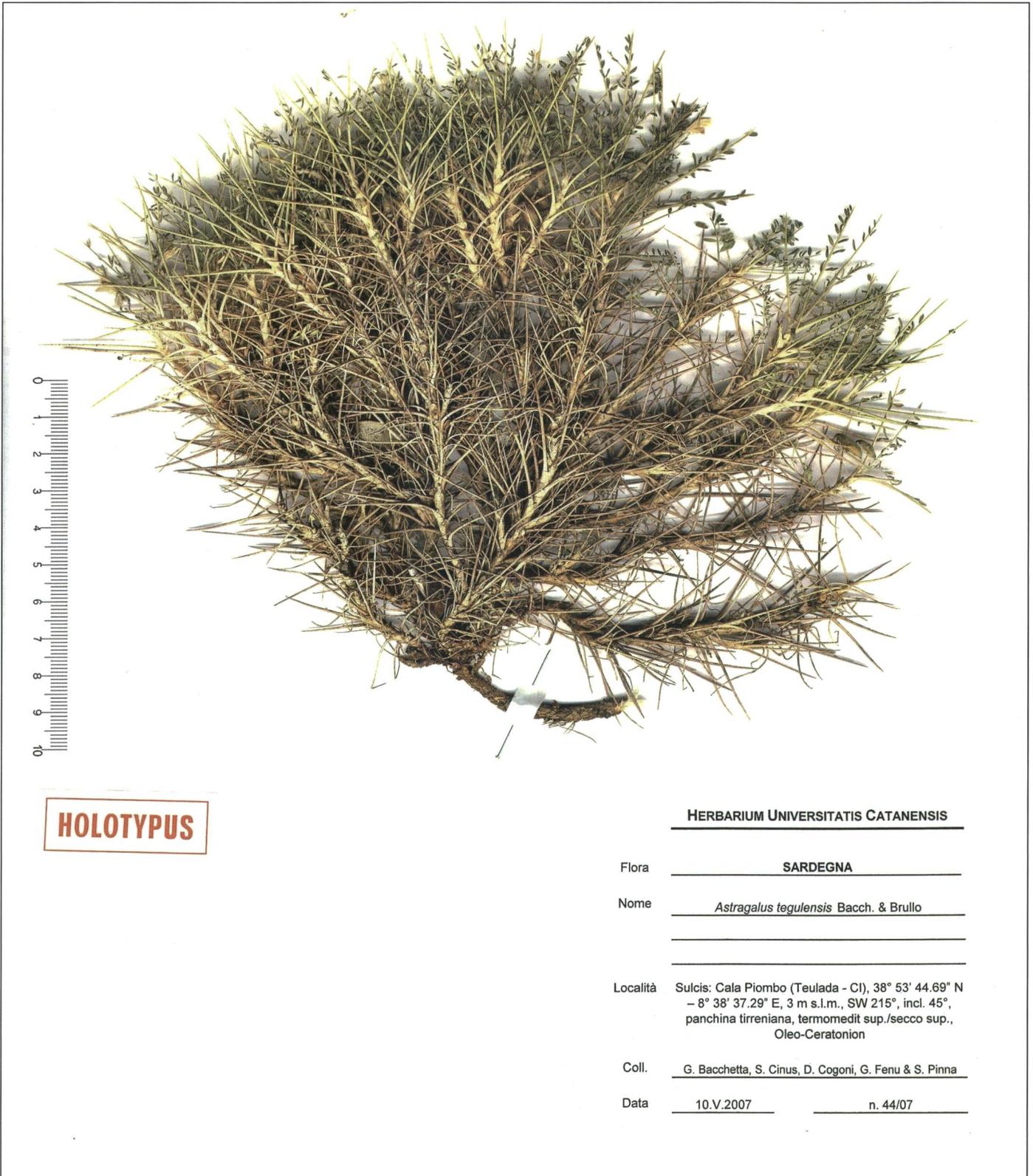


Fig. 2. – Holotypus of *Astragalus tegulensis* Bacch. & Brullo.

[Bacchetta & al. 44/07, CAT] [© Herbarium universitatis catanensis. Reproduced with permission]

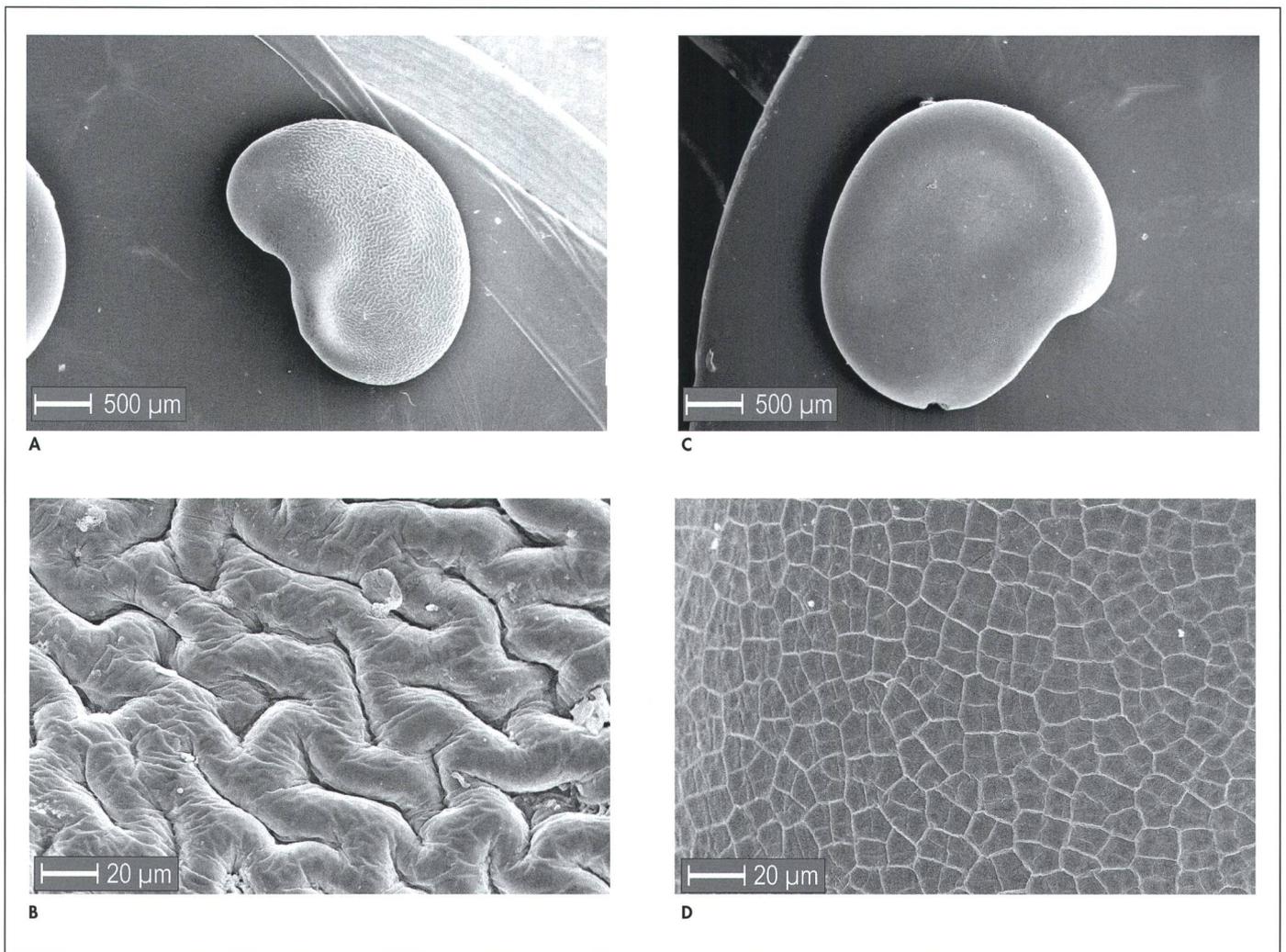


Fig. 3. – Micromorphology of testa. A, B. *Astragalus tegulensis* Bacch. & Brullo; C, D. *Astragalus terraccianoii* Vals.

from a pedogenetic point of view. *Astragalus tegulensis* is distributed in the Mediterranean xeric-oceanic bioclimate, in the lower thermomediterranean belt and is a lower dry ombrotype. Phytosociologically it is a member of a coastal chasmophytic and chasmo-comophytic communities of cliffs and lithosols that are splashed by marine salt spray, belonging to the *Crithmo-Limonietaea* Br.-Bl. 1952. In this vegetation type halophytes such as *Anthemis maritima* L., *Crithmum maritimum* L., *Dactylis glomerata* subsp. *hackelii* (Asch. & Graebn.) Cif. & Giacom., *Daucus gingidium* L., *Limonium tigulianum* Arrigoni & Diana, *Lobularia maritima* (L.) Desv. subsp. *maritima*, *Lotus cytisoides* subsp. *conradiae* Gamisans, *Scabiosa atropurpurea* subsp. *maritima* (L.) Arcang. and *Spergularia media* (L.) C. Presl are frequent.

At present the only known population of this new species is unfortunately threatened by the military activity (rifle drilling, tank movements and mock battles). Thus, *A. tegulensis* may be considered, based on the regional red lists of the IUCN, as an endangered species (EN). In particular, based on the IUCN criteria (2001, 2006), the following specific category is proposed: EN B1ab(ii,iii, v) + 2ab(ii,iii,v).

Taxonomical notes. – *Astragalus tegulensis* belongs clearly to sect. *Melanocercis* Bunge of subgen. *Cercidothrix* Bunge (CHATER, 1968; CHAMBERLAIN & MATTHEWS, 1969) based on its spiny suffruticous habit, mediafixed black and hyaline hairs, imparipinnate leaves with a spine-like rachis, stipules adnate to the petiole, flowers joined in racemes, tubular calyx,

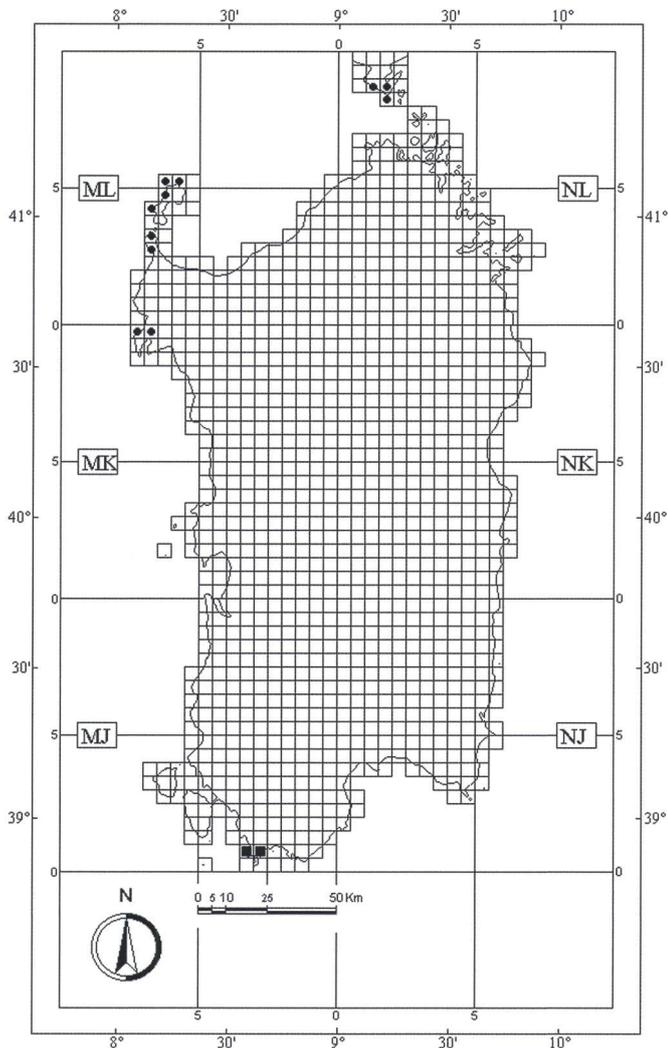


Fig. 4. – Geographical distribution in Sardinia of *Astragalus tegulensis* Bacch. & Brullo (■) and *A. terraccianoii* Vals. (●).

and legume exceeding calyx. In this section, described by BUNGE (1868, 1869), *A. tragacantha* L. and its allied species (*A. balearicus* Charter, *A. terraccianoii* and *A. thermensis* Vals.) should be included.

In particular, *A. tegulensis* shows a close relationship to *A. terraccianoii* based on the habit, leaves, corolla size and stamen tube, but it differs in numerous other features that are listed in Table 1. The differences concern mainly the colour, shape and size of leaflets; the size and insertion of the bracteoles; upper lip sinus of the calyx; shape and size of the standard, wings and keel; shape, size and beak of the legume; shape, size and testa of the seed (Fig. 5).

From taxonomical and ecological point of view, *A. tegulensis* and *A. terraccianoii* are closely related to *A. tragacantha*, species distributed along the coast of Provence (France), Catalonia (Spain) and Algarve (Portugal), as emphasized by VALSECCHI (1994) and PODLECH (2008). In fact, *A. tragacantha* can be considered as a species complex represented by taxa with scattered and but circumscribed distribution in the western Mediterranean area, where they grow in rocky or sandy places. At present, they are represented by relict populations dating back to the Tertiary, linked to habitats characterized by a humid sea wind (Fig. 6). In these particular ecological conditions species having pulvinate and thorny habit are favoured (PIGNATTI & al., 1980). The communities growing in these places are very specialized, showing a tolerance to sea spray. Phytosociologically, they are usually included in the *Chritmo-Limonieta* or sometimes in the class of *Ammophyletea* Westh., Dijk & Passchier 1946.

According to BACCHETTA & BRULLO (2006), in Sardinia there are other species belonging to sect. *Melanocercis*, such as *A. genargentus* Moris and *A. gennarii* Bacch. & Brullo, but they fall into the *A. sirinicus* Ten. group. Both species are orophytes, found on the top of Gennargentu massif (granitic substrates) and Mt. Albo (limestone), respectively. Noteworthy morphological differences distinguish these species from *A. tegulensis*, even if it shares some similarities with *A. gennarii*. In particular, the latter species differs in its larger size (up to 80 cm tall), leaflets 6-11 pairs, oblong, stipules widely triangular, 5-6 mm long, longer bracts (1.5-3 mm), calyx not incised in the back, longer calyx teeth (1-1.5 mm), bigger standard (14-18 × 7-8 mm), longer keel (12-15 mm), bigger seeds (2.6-2.9 mm × 1.6-1.7 mm) with a reticulate testa.

Basing on morphological, chorological and ecological data, *A. tegulensis* can be considered a vicariant of *A. terraccianoii* arose from the old geographical isolation of the Sulcis-Iglesiente plate (CHERCHI & MONTADERT, 1982). It is important to emphasize that the SW Sardinia is very rich in rare and endemic taxa, exclusive to this biogeographic sector, many of which are paleoendemics (BACCHETTA & PONTECORVO, 2005; BACCHETTA, 2006; BACCHETTA & al., 2007).

Additional material examined. – **SARDINIA:** Spiaggia di Cala di Piombo, Capo Spartivento, 24.IV.1897, *U. Martelli s.n.* (M); Punta della Torre, C. Teulada, 08.XI.1981, *M. Ballero & E. Bocchieri s.n.* (CAG); Punto Cogodulos, C. Teulada, 08.XI.1981, *M. Ballero & E. Bocchieri s.n.* (CAG); Cala Piombo (Teulada – CI), 2.5 m, 38°53'42.20"N 8°38'43.77"E, SW 215°, incl. 10, panchina tirreniana, termomedit sup./secco sup., Crithmo-Limonieta, 16.VI.2006, *G. Bacchetta, G. Fenu, P. Cuccus & G. Mandis 138/06* (CAG).

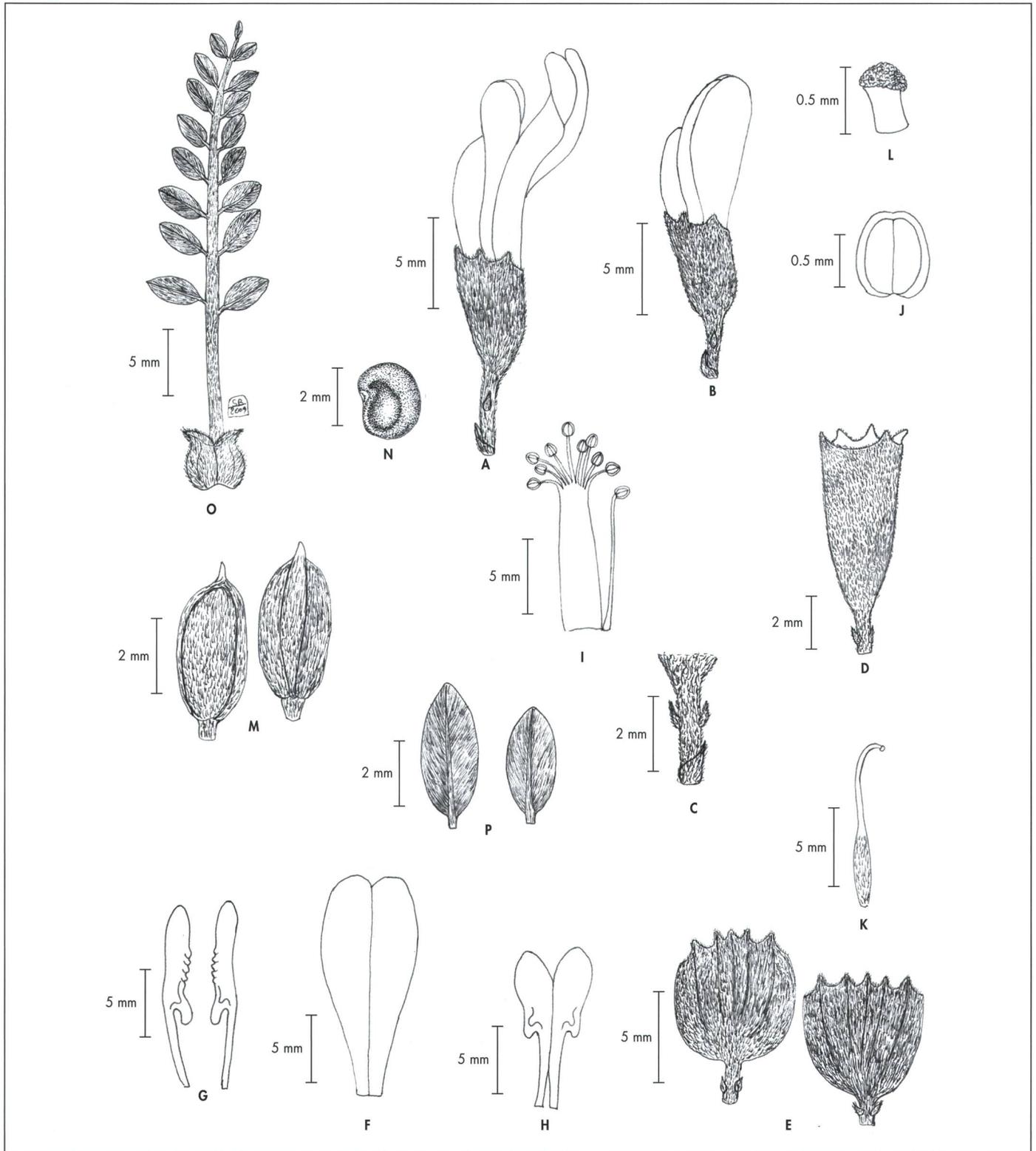


Fig. 5. – *Astragalus terraccianoii* Vals. **A.** Flower; **B.** Flower bud; **C.** Peduncle with bract and bracteole; **D.** Calyx; **E.** Open calices; **F.** Standard; **G.** Wings; **H.** Keel; **I.** Staminal tube; **J.** Anther; **K.** Pistil; **L.** Stigma; **M.** Legumes; **N.** Seed; **O.** Leaf; **P.** Leaflets.

[Brullo & al. s.n., CAT] [Drawn by S. Brullo]



Fig. 6. – A. Cala Piombo bay; B. Habit of *Astragalus tegulensis* Bacch. & Brullo in the spring time; C. Habit of *A. tegulensis* in the summer; D. Flowers of *A. tegulensis*.
[Photos: G. Bacchetta]

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