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***Astragalus peregrinus* subsp. *warionis* and *A. guttatus* (Fabaceae): New for the Iberian Peninsula**

By

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With 2 Figures

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Summary

PEÑAS J., BENITO B., LORITE J., MORALES M. C. & MARTÍNEZ-ORTEGA M. M. 2008. *Astragalus peregrinus* subsp. *warionis* and *A. guttatus* (Fabaceae): new for the Iberian Peninsula. – *Phyton* (Horn, Austria) 48(1): 155–167, with 2 figures.

We report the finding of two taxa of *Astragalus* L., *A. peregrinus* VAHL subsp. *warionis* (GAND.) MAIRE (N. Africa, Sicily) and *A. guttatus* BANKS & SOL. (from Israel to C. Asia, Crimea), in the S.E. Iberian Peninsula (Spain), which are new records for the continental flora of S.W. Europe. Information on ecological features and conservation status is provided. Both species inhabit arid Mediterranean ecosystems (with *Stipa tenacissima* or *Lygeum spartum* as predominant species) and are under a severe risk of extinction at the regional level, due to the narrow geographic range of both species and the low number of mature individuals in the scarce known Iberian populations.

Zusammenfassung

PEÑAS J., BENITO B., LORITE J., MORALES M. C. & MARTÍNEZ-ORTEGA M. M. 2008. *Astragalus peregrinus* subsp. *warionis* and *A. guttatus* (Fabaceae) – new for the

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Iberian Peninsula. [*Astragalus peregrinus* subsp. *warionis* und *A. guttatus* (Fabaceae) – neu für die Iberische Halbinsel]. – *Phyton* (Horn, Austria) 48(1): 155–167, mit 2 Abbildungen.

Wir berichten über die Entdeckung von zwei *Astragalus*-Taxa, *A. peregrinus* VAHL subsp. *warionis* (GAND.) MAIRE (N-Afrika, Sizilien) und *A. guttatus* BANKS & SOL. (Israel bis Zentralasien, Krim) auf der SE-Iberischen Halbinsel (Spanien). Es handelt sich um Neufunde für die Flora von Südwest-Kontinental-Europa. Informationen über ökologische Gegebenheiten und den Schutz-Status werden gebracht. Beide Arten bewohnen aride, mediterrane Ökosysteme (*Stipa tenacissima* bzw. *Lygeum spartum*-dominiert) und sind wegen der Kleinräumigkeit der Vorkommen und der geringen Individuenzahlen regional vom Aussterben bedroht.

1. Introduction

Astragalus L. is the most diverse genus of the family Fabaceae, as well as one of the most species-rich genera of vascular plants on Earth, represented by 2,738 taxa accepted by the International Legume Database & Information Service (ILDIS – <http://www.ildis.org/LegumeWeb/>). It has been divided into more than 250 sections (MAASSOUMI 1998). The species of *Astragalus* are distributed mainly in arid and semiarid mountainous regions of the Northern Hemisphere and South America, and the genus is especially diverse in south-western Asia, with ca. 1,000–1,500 species (KARAMIAN & RANJBAR 2005, MAASSOUMI 1998). Generally, the species are adapted to the steppe environments of high mountains in the Irano-Turanian phytogeographic region (PODLECH 1999a).

A total of 59 taxa (species and subspecies) are represented in the Iberian Peninsula, Balearic Islands, and northern Morocco (PODLECH 1999b, ROMO 2002), and 16 of these are endemic to these areas (*A. algarbiensis* BUNGE, *A. nitidiflorus* JIMÉNEZ MUN. & PAU, *A. gines-lopezii* TALAVERA & al., *A. alopecuroides* subsp. *grosii* (PAU) RIVAS GODAY & RIVAS MARTÍNEZ, *A. cavanillesii* PODLECH, *A. tremolsianus* PAU, *A. nevadensis* BOISS. subsp. *nevadensis*, *A. nevadensis* BOISS. subsp. *muticus* (PAU) ZARRE & PODLECH, *A. granatensis* LAM., *A. turolensis* PAU, *A. clusianus* SOLDANO, *A. balearicus* CHATER, *A. hispanicus* COSS. ex BUNGE, *A. reesei* MAIRE, *A. meuselii* ROMO, *A. fontianus* MAIRE, *A. maurus* (HUMBERT & MAIRE) PAU, and many others are exclusively represented in these areas and Algeria (i.e. *A. longidentatus* CHATER, *A. algerianus* E. SHELD., etc.).

The aims of this paper are: 1) to report the presence of *A. guttatus* and *A. peregrinus* subsp. *warionis* in S.W. continental Europe and 2) to assess the extinction risk in order to contribute to the conservation of these plants, endangered at regional level.

2. Material and Methods

The study area is located in south-eastern Spain (approx. 3°10'–2°35' W and 37°05'–37°40' N), where the climate is Mediterranean with arid or semiarid character,

annual rainfall <450 mm (frequently torrential) and high evapotranspiration (LÁZARO & al. 2001). Geologically, post-orogenic sedimentary materials predominate, with gypsum-marl or calcareous and siliceous mountain sediments (IGME 1980, 1982). The landscapes are dominated by a mosaic of shrubs and chamaephyte plant communities, xerophytic grasslands with large patches of alpha-grass (*Stipa tenacissima* L.) steppes (espartales in Spanish), and varied communities of ephemeral annual plants; these semiarid ecosystems of S.E. Spain are among the richest of Europe (MOTA & al. 2003).

Flowering and fruiting specimens of *Astragalus* were collected in 2002–2007 from south-eastern Spain (Andalusia), and included in the herbarium GDA (abbreviations of herbaria according to HOLMGREN & al. 1990). The environmental features of each locality were described. Morphological observations were undertaken on living plants and herbarium specimens. We have studied herbarium specimens on loan from the following herbaria: B, BM, C, E, K, L, FI, G, HUJ, M, MA, MPU, P, PAD, W and WU, in order to check the variability of the morphological characters. Additionally, we have reviewed all the herbarium specimens lodged under *Astragalus* in the herbaria J, MGC, HUAL, ALME and GDA and have found two herbarium specimens corresponding to *A. peregrinus* subsp. *warionis* which were collected years ago.

The number of mature and non-mature individuals was directly counted during the springs of the years 2006 and 2007. The areas of occurrence and occupancy were calculated using GPS (± 3 m error) and the GIS program gvSIG 1.1 (<http://www.gvsig.gva.es/>). Throughout the process, qualitative data were recorded, which, together with bibliographic data, enabled deductions related to real or potential threats. The definition of these threats followed the recommendations of the IUCN/SSC 2001, and for the assignment of the endangered status, the categories of the IUCN 2001 were used with the help of the software RAMAS-Red list v2.0 (AKÇAKAYA & FERSON 2001), a useful tool for the management of the uncertainty concept (AKÇAKAYA & al. 2000).

3. Results and Discussion

3.1. *Astragalus peregrinus* VAHL subsp. *warionis* (GAND.) MAIRE (= *A. font-queri* MAIRE & SENNEN)

Belonging to *A.* sect. *Platyglottis* BUNGE, was until now thought to be restricted to North Africa (Morocco, Algeria, Tunisia and Libya) and Linnosa Island (Sicily, Italy). We have collected this plant at the southern base of the Sierra de Los Filabres (Almería, Spain; see specimina visa), which represents the first record for this taxon in continental Europe.

Morphologically, the individuals collected in Spain undoubtedly correspond with those described by PODLECH 1990: 558–562 as characteristic of subspecies *warionis* and not with those of the taxon represented in N.E. Africa, Crete and S.W. Asia, *A. peregrinus* subsp. *peregrinus*.

Description (based on the Spanish material, see Fig. 1): Short living hemicryptophyte; reptant, branched from base, sometimes slightly rosulated; stems up to 30 (70) cm; plant densely hairy, hairs white, 0.5–2(2.5)

mm long, basifix and patent; additional black hairs also basifix and patent in stipules and inflorescence. Leaves 2–7 cm long, imparipinnate, 6–9 pairs of leaflets; stipules 5–7 mm long, greenish, shortly adnate at base to petiole; leaflets 3–9 × 1.5–3.5 mm, elliptic to obovate or narrowly ovate, rarely rotundate, emarginated, with abundant hairs beneath and glabrescent or glabrous above. Inflorescence in pedunculate racemes, with bracts, 2–5 flowers; peduncles 1.5–4 cm long. Calyx 7–9 mm long, tubular-campanulate; teeth ± equal, 2–3 mm long. Corolla violet, pale purple; standard 13–20 mm long, narrow elliptic-rombic, acute, ± mucronated; wings and keel smaller than standard. Androecium diadelphous, 10 stamens. Legume 20–32 mm × 4–8 mm, without pedicel, erect, linear, semi-bilocular, with a keel in the ventral face and a furrow in the dorsal one, with a straight beak 1–2 mm at the apex, not densely hairy. Seeds c. 3 mm, tetragonous. Flowering from February to April.

Specimina visa: Africa: Algeria: Oran, (illegible word) au pied du Djebel Antar (Sahara), 11-IV-1879?, A. WARION (G00087194). – Algeria: prov. d'Oran, (illegible word) pelouses à Lalla-Maghnia, 4-IV-1869, A. WARION (G00087195). – Algeria: Bedeau, Ch. d'Alleizette (MA66795). – Algeria: Hauts Plateaux oranais, entre Bedeau et Crampel, pelouses sablonneuses, 25-IV-1919, A. FAURE (MSB0124575). – Lybia: Marsa el Bregha, sable après les pluies, crête à Asphodèles, 20 m., 27-I-1969, J. LEONARD (MSB0124585). – Morocco: distr. stepposus orientalis, prope opp. Oudjda, 5 km ad bor.-orient., ca. 550 m, 11-V-1936, G. SAMUELSSON (B10-0268917). – Tunisia: (Arad et Nefzaoua), Kanzeria?, prope Birchenchou?, in arenosis deserto, 1909, C. J. PITARD (G00087190). – Tunisia: (Nefzaoua), Gabès, Tehouama?, in aridis deserti, III-1909 1919?, C. J. PITARD (G00087191). – Tunisia: (Nefzaoua), Gabès, Grâu el Maqui, in aridis deserti, III-1909, C. J. PITARD (G00087192). – Tunisia: (Nefzaoua), Gabès, Raz el Oued, in aridis deserti, III-1909, C. J. PITARD (G00087193).

Europe: Italy: Sicily, Isole Pelagie, Linosa, Punta Calcarella ed ascensione al M. Vulcano da Punta Calcarella, 0–195 m., 15- IV-1992, J. POELT (MSB0124576). – Italy: Sicily, Linosa, SW-Küste, Cala Pozzolanà di Levante am W-Hang des Monte Calcarella, 20- IV-1976, K. P. BUTTLER 20771 & W. ZIELONKOSWKI (MSB0124577). – Spain: Almería, base Sur S^a Los Filabres, pr. Rambla Ancha, 30SWG4208, 780 m, 17-V-2002, J. PEÑAS (GDA52526). – Spain: Almería, Nacimiento, base sur Sierra de los Filabres, 30SWG3308, 770 m, J. PEÑAS (GDA52525). – Spain: Almería, S^a de los Filabres, base, cara sur, pr. a Gérgal, carretera a Olula de Castro, 30SWG4208, 780 m, 16-IV-2007, J. PEÑAS (GDA53244). – Spain, Almería, carretera Ricaberal, desvío a Albolodouy, 30SWG4406, 780 m, 27-III-1989, A. B. ROBLES, J. PEÑAS & C. MORALES, (sub. *A. longidentatus* CHATER) (GDAC36008). – Spain, Almería, T.M. Gérgal, entre cruce de Aulago y Aulago (base Sur S^a Los Filabres), 30SWG3906, 800 m, 29-V-1993, J. PEÑAS, (sub *A. longidentatus* CHATER) (HUAL475).

The new populations grow in ephemeral plant communities with little biomass and coverage, accompanied by *Stipa capensis* THUNB., *S. parviflora* DESF., *Astragalus edulis* DURIEU ex BUNGE, *A. stella* L., *A. sesameus* L., *Eryngium ilicifolium* LAM., etc. These annual communities are placed in patches among the *Stipa tenacissima* L. dominant communities.

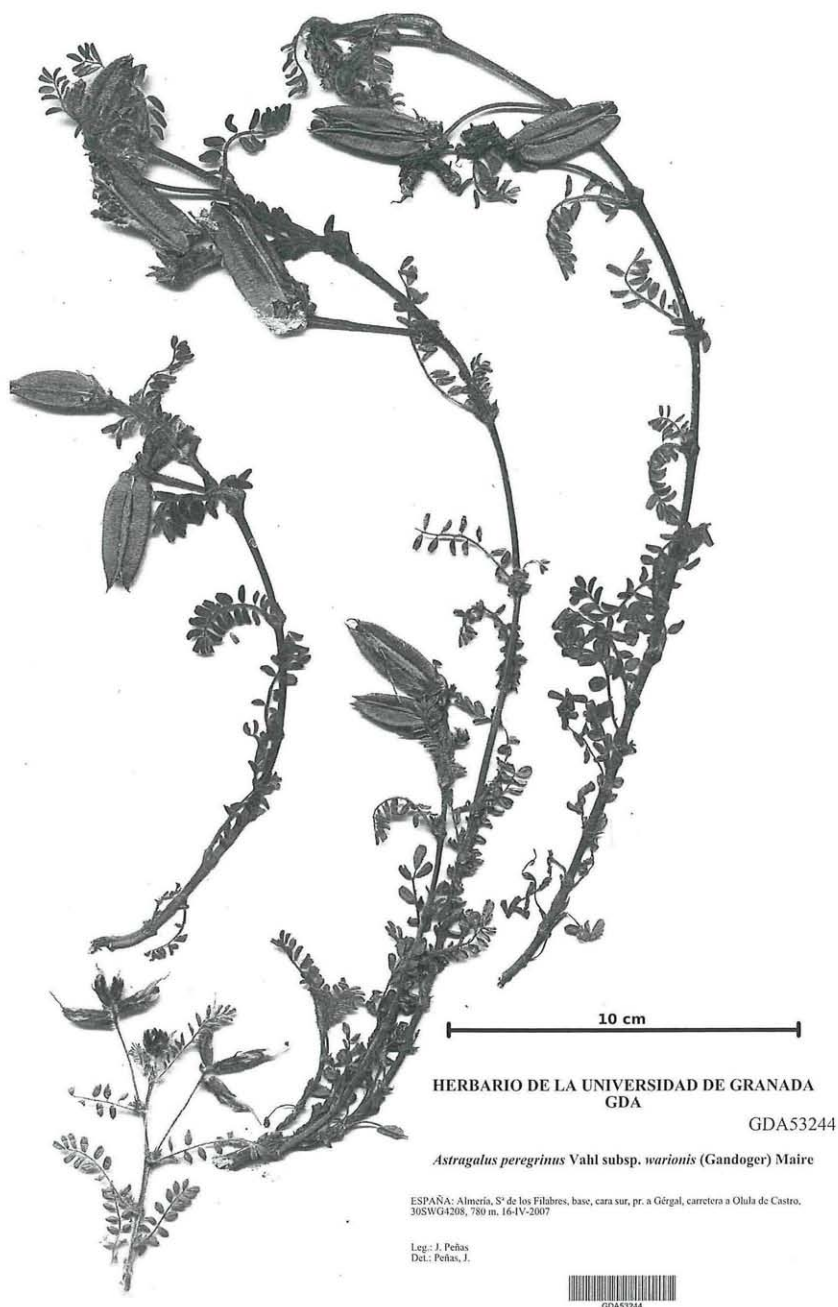


Fig. 1. *Astragalus peregrinus* subsp. *warionis* herbarium sheet from S.E. Spain (GDA53244).

The arid, slightly sandy soils are developed from metamorphic rocks (mica-schist). The general bioclimate of the area is Pluviseasonal and Oceanic Mediterranean (*sensu* RIVAS-MARTÍNEZ & LOIDI 1999), with annual average precipitation of 439 mm and average annual air temperature of 15° C (slope 9°, aspect 260°).

The only metapopulation of *A. peregrinus* subsp. *warionis* found in Spain is composed of 5 sub-populations with few individuals (i.e., 30 mature and 19 non-mature individuals are currently known), growing densely aggregated. The area of occupancy is 25 m² and the extent of occurrence is 4.8 km². The plant usually grows close to country roads and livestock pathways ("vías pecuarias").

During the last four years we have monitored these five sub-populations of *A. peregrinus* subsp. *warionis*. The entire number of individuals, their medium size and the proportion of reproductive plants has increased over time. The coordinates where the plant is present have been used together with topographic, climatic and soil reflectance (Landsat EMT+) data in order to generate a model of potential distribution using MaxEnt (PHILLIPS & al. 2006). The potential area for *A. peregrinus* subsp. *warionis* is wider than that occupied nowadays by the plant, indicating that it could be a neophyte species, because it does not cause local diversity loss. An alternative explanation to this fact is that the taxon exhibits a relict distribution. With the available data and according to the IUCN 2001 criteria, it should be included provisionally in the Critically Endangered (CR) at the regional level, under the following items (criteria B1ab(ii,iii,v)c(ii,iv) + 2ab(ii,iii,v)c(ii,iv); D, see IUCN 2001 for a further explanation about threat criteria): extent of occurrence estimated to be less than 100 km² and area of occupancy less than 10 km²; severely fragmented, with inferred continuous decline in terms of: area of occupation, habitat quality, number of locations, number of mature individuals, and population size estimated in less than 50 mature individuals (30 ind.). The main threats detected for the species were on the one hand the changes in the habitat (human induced): shifting agriculture (past, present and future), livestock grazing (past and present), changes in the management regime (future), human settlement (present), pollution (global warming and land pollution; future). On the other hand, natural causes include drought (present and future), wild or human-mediated fire (potential), competitors (present and future), predators (present and future), limited dispersal (present), poor recruitment/reproduction/regeneration (present), high juvenile mortality (present), inbreeding (present), low densities (present), population fluctuations (present) and restricted range (present).

3.2. *Astragalus guttatus* BANKS & SOLANDER (= *A. striatellus* M. BIEB.)

This species is distributed in C. and S.W. Asia (Turkey, Syria, Lebanon, Israel, Jordan, Iraq, Iran, Russia (Daghestan), Georgia, Azerbaijan, Kazakhstan, Turkmenien and Uzbekistan) and E. Europe (Ukraine-Krim), and has been located in the Guadix basin ("Hoya de Guadix", Granada, Spain; see specimina visa). Ours represents the first record in S. W. Europe and a further example of a phytographical disjunction between the Irano-Turanian region and the arid lands of the S.E. of the Iberian Peninsula, similar to other examples of mesogean flora (QUEZÉL 1985), such as *Astragalus oxyglottis* M. BIEB., *Krascheninnikovia ceratoides* (L.) GUELLENST. and *Enneapogon persicus* BOISS.

Astragalus guttatus belongs to *A. sect. Heterodontus* BUNGE (PODLECH 1994: 127–129).

Description (based on the Spanish material, see Fig. 2): Therophyte; stems up to 10(15) cm; branched from base or not branched; glabrous or with sparse black hairs and a few white hairs, basifix, 0.5–1 mm long, usually more densely hairy at inflorescence and buds. Stems slightly angulate, glabrous or with some scarce hairs. Leaves 1.5–4 cm long, imparipinnate, 4–6 pairs of leaflets; stipules 3–4 mm long, white-hyaline, free, shortly adnate at base to petiole; leaflets 3–7 × 1–4 mm, narrow elliptic to cuneiform, emarginated, glabrous or with a few hairs on the nerves or margins. Inflorescence in racemes, 1–2 flowers, bracteate, with a terminal edge 1–10 mm, acrescent; peduncles 1–4.5 cm long. Calyx 3–4 mm long, campanulate, densely hairy, mostly with black hairs; teeth unequal, the lower three ± subequal c. 2.5 mm long and the upper ones c. 1.5 mm long. Corolla white; standard 8–10 mm, longer than wings and keel; wings smaller than the keel. Androecium diadelphous, 10 stamens. Legume 12–22 × 3–5 mm, hanging, with a 2 mm pedicel, slightly falcate, semi-bilocular, triangular in transversal section, with a single keel in the ventral face plus two additional ones in the dorsal face, glabrous. Seeds 2.5–3 × 2–2.5 mm, smooth. Flowering from April to May.

Specimina visa: Asia: Armenia: Erevan, Vochchabert, 28-V-2001, P. GAMBARJAN & al. (WU). – Azerbaijan: Transcaucasia, respublica Nachitshevan, distr. Shach-buz, prope pag. Koroboba, 23-V-1934, A. GROSSHEIM & C. GURVITSH (WU). – Azerbaijan: Mianeh to Zanjan, Kaflan Kuh, electricity station road opposite old Turkish bridge, amongst hillside cornfields, 29-V-1971, J. LAMOND & M. IRAN-SHAHR (E00266263). – Azerbaijan: Baku, Mts Caucaso, Bec? (illegible collector name) (FI). – Azerbaijan: in deserticis ad stationem ferroviae Adzhikabul, 29-IV-1915, A. MAJOROV (K). – Azerbaijan: in collibus ad p. Budzhagh prope Geok-Tapa, 2-V-1915, G. WORONOW (K). – Azerbaijan: steppa Shirvan, m. Kolmas, st. v. ferr. Adzhilkahne, 24-IV-1931, M. SACHOKIA (K). – Azerbaijan: Baku, T. PICHLER (K). – Iraq: Arbil, 2-IV-1931, 1250 ft., E. R. GUEST 1453 (K). – Georgia: Tiflis, PRESCOTT (K). – Iran: Gifan, 1200 m, 19-V-1939, D. E. GAUBA (B10-0268905). – Iran: inter Rescht et Teheran, in



FLORA DE ANDALUCÍA ORIENTAL

Identificación confirmada

Rev. Julio Peñas de Giles Fecha FEB. 2007

HERBARIO DE LA UNIVERSIDAD DE GRANADA
GDA

GDA53245

Astragalus guttatus Banks & Solander

ESPAÑA: Granada, Hoya de Guadix, pr. Alicún de Ortega, 30SVG8864, 800 m, 17-V-2007, margas
yesíferas

Leg.: B. Benito & L. Gutiérrez
Det.: Peñas, J. & Martínez Ortega, M.M.



GDA53245

Fig. 2. *Astragalus guttatus* herbarium sheet from S.E. Spain (GDA53245).

jugo Charsan 13-1800 m, 13-V-1902, J. & A. BORNMÜLLER (B10-0268906). – Iran: bei Sultanabad, 14-VI-1904, Th. STRAUSS (B10-0268907). – Iran: Steppe zw. Kaswin und (illegible word), 1400 m, 1-V-1938, D. E. GAUBA (B10-0268908). – Iran: Lake Rezaieyeh, SW side, fields and waste land near small salty lake, 1300-1400 m., 36° 56' N-45° 52' E, 21-V-1963, M. JACOBS 6644 (E00266266; K). – Iran: 6 Km S Mianeh, jachère et pâturage pierreux, exp. N, 1000 m., 19-V-1960, H. PABOT 3319 (G00087165). – Iran: 11 Km NW Malayer, pâturage très dégradé, schistes, 1850 m., 7-VI-1959, H. PABOT 1364 (G00087166). – Iran: Persepolis to Yazd, 20' NE of Persepolis, road side between road and cornfield, 5800 ft., 1-IV-1962, P. FURSE (K). – Iran: Tabriz, garden weed, 12-VI-1928, B. GILLIAT-SMITH 2271 (K). – Iran: 20 miles E of Miyaneh (Tabriz-Tehran), 5500 ft., crest of mud hills, little other vegetation, deep earth, 14-V-1963, Bowles Scholarship Bot. Exp. 1576 (K). – Iran: near Malayer Hamadan-Arak road, 6000 ft., cultivated land, 20-V-1963, Bowles Scholarship Bot. Exp. 1508 (K). – Iran: Khorasan: 38 km. from Kalat-e-Naderi, to Mashhad, 1170 m., 28-IV-1986, ASSADI & MAASSOUMI (MSB002776). – Iran: Ostan e Khorasan, Nokhodak, IV-1956, A. PARSA (K). – Iraq: 10-15 Km E of Arbil (to Darband), 20-IV-1958, 470 m., A. SHAHWANI (K). – Iraq: Ain Ghazal (Mosul province), fields, 1200 ft., 28-IV-1933, GUEST 4058 (K). – Iraq: C Iraq, Nimrud, on the plain, calcareous loam, 260 m, 20-IV-1955, H. HELBAEK 889. (K). – Iraq: (no exact locality, "Expedition to the Euphrates"), (no date), CHESNEY 165 (E00266265; M0140053; K). – Iraq: NW Iraq, 39 km N of Mossul (W of El Bavira), field, compact steppe soil, ca. 400 m, 26-IV-1933, A. ZEIG & M. ZOHARY (HUJ). – Iraq: hillsides S of Mosul, 250 m., IV-1969, O. ANDERS 2610 (MSB002775). – Iraq: in agro Ectabanensi, 1882, Th. PICHLER. (WU; K). – Israel: N Negev, 33 km on the Beersheva Arad road, edge of field, III-1965, M. ZOHARY (HUJ). – Israel: N Negev, 1, 5 km W of Malhata, loess soil, 3-IV-1991, A. DANIN (HUJ). – Jordan: district of Amman, NE end of Dead Sea, between Tell el-Rama and Tell Iktanu, 1 km WNW of Tell Iktanu, cultivations, barley fields, 160 m, 13-III-1992, J. WALTER (MSB002779). – Jordan: Transjordan, Ziza to Um-el-'Amud, 15-IV-1929, A. EIG & M. ZOHARY (HUJ; M0140054; MSB002778). – Jordan: W of Zizeh, 720 m, 25-IV-1911, F. S. MEYERS & J. E. DINSMORE. (B10-0268904; L; K; G00087167). – Jordan: midway between Amman and Madaba, 5-V-1974, L. BOULOS & W. JALLAD (B10-0268910; C; MA 66843; G 00087200). – Jordan: Shobek, 21-IV-1945, P. H. DAVIS 8799 (E00266264; K). – Syria: Damascus, Doumar, 15-IV-1891, E. PEYRON (G00087176). – Syria: Damascus, II-1951, L. PABOT (G00087174). – Syria: Km 110 au S de Homs et Km 91 vers Qaldoun, 21-IV-1954, P. MOUTERDE 11014 and 11015 (G00087173). – Syria: Jabal Gasyoun?, 11-IV-1964, P. MOUTERDE 9233 (G00087170). – Syria: Haret Horik, (adventice), 11-IV-1948, P. MOUTERDE 10981 (G00087169). – Syria: Balbek, 28-VI-1881, E. PEYRON 1277 (G00087168). – Syria: about Damascus, 14-V-1931, M. ZOHARY (HUJ). – Syria: Antilibanon, Ouadi Barada, Djebel el Kebli, 900 m, 6-V-1933, G. SAMUELSSON (K; C). – Syria: in vicin. urbis Aleppo, Jebrine, in agris stepposis, ca. 375 m, 22-IV-1933, G. SAMUELSSON (K). – Syria: C Syria, inter urbem Aleppo et flumen Euphrat, Deir Hafir, in agro stepposo, ca. 375 m, 22-IV-1933, G. SAMUELSSON (K). – Syria: inter urbem Aleppo et flumen Euphrat, in glareosis calcareis valliculi, ca. 325 m, 22-IV-1933, G. SAMUELSSON. (K). – Syria: N of Palmyra, IV-1943, P. H. DAVIS (K). – Syria: SE of Quarryatein, IV-1943, P. H. DAVIS (K). – Syria: NE of Nebk, 9-IV-1943, P. H. DAVIS. (K). – Syria: Umgebung von Damaskus: Acker südlich Seid Naya, 18-IV-1965, DOPPELBAUR 257 (M0140056). – Syria: prov. Halab, 0,5 km from fork in road from Aleppo to Hansa and Buada, depression in field, in crop, 210 m., 35° 49' N- 3719' E, 20-III-1986,

MAXTER, EHRMAN & KHATTAB 2136 (M, MSB). – Syria: Haleb, Aleppo, in humosis et agris inter vicos Dschebrin et Tijara, substrato calcareo, 380 m., 23-III-1910, HANDEL-MAZZETTI (Tageb. No. 52) (WU). – Turkey: Elazığ: Elazığ- Hazar-Göl, on plain 9 Km from Elazığ, cornfield weed, 850 m, 5-VI-1957, J. PONERT (E00266262). – Uzbekistan, prov. Syr-Darja, distr. Taschkent, in collibus rubris argillosis gypsaceis circa stationem viae ferreae Sary Agatsch, 15-IV-1924, KOROVIN & VVEDENSKY (C).

Europe: Spain: Granada, Villanueva de las Torres, Loma de la Muleta, 30SVG8850, 795 m, 24-V-2007, B. BENITO (GDA53247). – Spain: Granada, Hoya de Guadix, pr. Alicún de Ortega, 30SVG8864, 800 m, 17-V-2007, B. BENITO & L. GUTIÉRREZ (GDA53245). – Spain: Jaén, Quesada, Cuevas de San Pedro, 30SVG8863, 762 m, 24-V-2007, B. BENITO (GDA53246). – Ukraine: Tauria (Krym), distr. Sudak, Montes Tauricae (extremitas orientalis), jugum Enyschar orientem versus a pago Planerskoe, ad pedes declivium, 21-V-1987, T. SMIRNOVA & V. SCHATKO (FI; B10-0268909; MSB002773; MA531692; G00087198). – Ukraine: Crimea: sea of Azov, village Kurortnoe (Russkaja Mama), steppe, 2-V-2000, A. SYTIN & L. RYAZANOVA (SB002777).

The new populations grow in ephemeral plant communities with very little biomass and coverage, together with *Astragalus oxyglottis* M. BIEB., *A. scorpioides* POURR. ex WILLD., *A. sesameus* L., *Plantago ovata* FORSKAL, *Hedysarum* sp., *Filago* sp., etc.. These annual plant species grow among *Ononis tridentata* L. subsp. *angustifolia* (LANGE) DEVESA & G. LÓPEZ and *Lygeum spartum* L. communities.

The soils are arid, with clay mixed with carbonate of lime, overlying sedimentary marls rich in gypsum (belonging to post-orogenic deposits). The general bioclimate of the area is Pluviseasonal and Oceanic Mediterranean (sensu RIVAS-MARTÍNEZ & LOIDI 1999), with annual average precipitation of 439 mm and average annual air temperature of 15° C (slope 11°, aspect 210°).

To date, only two populations (with 1 and 2 patches respectively) of *A. guttatus* have been found in the Iberian Peninsula, and a total of 710 mature individuals have been directly counted (200 and 510 individuals respectively). The area of occupancy is 24 m² and the extent of occurrence is 4.2 km². With the available data and according to the IUCN 2001 criteria, *A. guttatus* should be evaluated as Critically Endangered (CR) at regional level, under the following items (criteria B1ab(ii, iv,v)c(ii,iii,iv)+2a-b(ii,iv,v)c(ii,iii,iv), see IUCN 2001 for a further explanation about threat criteria): extent of occurrence estimated to be less than 100 km² and area of occupancy less than 10 km²; severely fragmented, with inferred continuous decline and extreme fluctuations in terms of: area of occupation, and number of mature individuals.

The main threats detected for the species were on the one hand changes in the habitat (human induced): shifting agriculture (present and future), livestock grazing (past and present), changes in the management regime (future). On the other hand, natural causes include drought (present and future), storms/flooding (present and future), wild or human-mediated

fire (potential), competitors (present and future), predators (present and future), limited dispersal (present), poor recruitment/reproduction/regeneration (present), inbreeding (present), population fluctuations (present), and restricted range (present).

3.3. Conservation Implications

Records of new species for the Iberian flora indicate that there are significant gaps in the knowledge of its impressive biodiversity. The flora and vegetation of arid and semiarid Mediterranean ecosystems of south-eastern Spain display an exceptional concentration of species and high indices of endemism (SAINZ & MORENO 2002; CABELLO & al. 2003), constituting "micro-hotspots" of biodiversity within the extensive Mediterranean hot-spot (MÉDAIL & QUÉZEL 1997). Southern Spain has been highlighted as a priority area for the conservation of plant diversity on a global scale (DAVIS & al. 1994); however, the arid and semiarid ecosystems have traditionally been undervalued in relation to active conservation.

Astragalus guttatus and *A. peregrinus* subsp. *warionis* are Critically Endangered (CR), because of their narrow geographic range and low number of mature individuals in the scarce known populations (we still have no data regarding fluctuations of population sizes). The main factor of threat observed is grazing and trampling by the livestock that periodically visit the populations. The potential risk will be the erosion and disturbance of the habitat, and the reduction of the number of mature individuals. New species should be carefully monitored (MARGULES & al. 2002); there is a clear need to gather further information on the fluctuations in population sizes, as well as on fragmentation or depletion of populations, fluctuations in extension of occurrence, and other environmental and biological factors that could affect and place the new species in risk of extinction.

The criteria for the threatened categories are to be applied to a taxon whatever the level of conservation action affecting it (IUCN 2001). The *Astragalus* species studied may require conservation action and management planning, and should be included in the Spanish and Andalusian Red Lists of vascular plants (i.e., BAÑARES & al. 2004, CABEZUDO & al. 2005).

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