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A new Variety (*A. foliolosus* var. *viscosus* (Webb & Berthel.) Essokne & Jury, *comb. nov*) from Canary Islands

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A B S T R A C T

Twenty four species have been recognised in this genus. Subspecies rank has been applied to geographical variants of a species which are morphologically distinguishable. In addition, one new variety has been recognised which lacks glandular papillae on the calyx, and grows at a different altilude than the type. The range of descriptions, distributions and the key to the species were drawn up from field collections and herbarim material. All the specimens available to me have been examined, except where specimens were missing some parts (e.g. some sheets lacked flowers). The descriptions and the distributions of most of the taxa were taken directly from the type and herbarium specimens. Therefore, the species *Adenocarpus viscosus* (Leguminosae) is proposed as a new Variety to the Canary Islands. Its morphological, and ecological features are discussed, together with its relationship to, and differences from, the other species of *Adenocarpus foliolosus* (Ait.) DC. Furthermore, earlier Reading University fieldwork in Morocco suggested that the genus presently consists of ca. 25 species (Rafaa Essokne, *et al.*, 2012). However, in this paper *A. foliolosis* var. *viscosus* is recognized as a variety and accordingly described.

1 Introduction

The genus *Adenocarpus* contains approximately 23 species and is centered in the western Mediterranean with a few outlying species in tropical Africa and south-central SE Europe. Many different treatments have been published since the last complete revision over 40 years ago by Gibbs (1967). The most radical new treatment was for Flora iberica (Castroviejo, 1999 a&b), where new species are described and subspecies raised in rank. Although rich in *Adenocarpus* taxa, Ouyahya's account in Flora Pratique du Maroc (Ouyahia *et al*., 2007), has followed that of Med Checklist (Greuter, *et al*., 1998). The new Index Synonymique de la Flore d'Afrique du Nord volume 4 account of *Adenocarpus* enumerates eight species, one with two subspecies, plus a hybrid and maintains a traditional view (Dobignard & Chatelain, 2012).

In order to produce a comprehensive modern revision, morphological and phytochemical studies together with a molecular investigation to create a phylogeny using the independent data sets from: morphology, phytochemistry and the nucleotide sequences of non-coding DNA (ITS) and the chloroplast (trnL-F). The basic variation in the genus has been examined, and the distribution of the variants noted (Essokne, R.S., 2011).

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2 Materials and Methods

Herbarium specimen data of *Adenocarpus* were obtained from the Herbaria of the University of Reading (RNG), Natural History Museum (BM), the Royal Botanic Gardens Kew (K), the Royal Botanic Garden Edinburgh (E), The Linnean Society of London (LINN), the University of Rabat (RAB) and Institute Agronomique et Vétérinaire Hassan II Rabat (IAV). More than 200 herbarium specimen labels were photographed using a digital camera (Sony Ericsson K800i), and the data of the species entered into the Botanical Research And Herbarium Management System (BRAHMS). This system allows searching and export of data and can link to GIS systems.

A small amount of leaves were reserved in Silica gel ready for morphological, phytochemical analysis and DNA extraction. Morphology was studied mainly on herbarium specimen material examined using light microscope. Flowers and leaflets from herbarium specimens were rehydrated in boiling water for about 5 mins with two drops of detergent for the vegetative morphology of leaves, stipules, flowers and the glandular papillae on both the calyx and fruits, samples were obtained from herbarium specimens in RNG, NHM, and E.

Vegetative morphology

The calyx is described by a bilabiate shape in all the tribe Genisteae consisting of two upper lobes and three lower lobes. The upper lobes separate or joined, from an upper lip (Polhill, 1967). However, in *Adenocarpus* the calyx is normally tubular, with two lips, the lower lip longer than the upper lip. The exception is *A. mannii* which has a long lower lip.

Morphological characters of *Adenocarpus* show relationships between all the species even though the geographical distributions of the species are different. All the species are shrubs with many branches, 3-foliolate leaves, glandular papillae on the calyx, *A.foliolosus* var. *viscosus*, and *A. hispanicus* have a calyx with glandular papillae, whereas absent in *A. foliolosus*, and *A. decorticans* (Gibbs, 1967).

The exception is *A. mannii* which has a long lower lip. Some of the species of the genus have glandular papillae on the calyx: *A. bivonii, A. samniticus, A. foliolosus* var. *viscosus, A. hispanicus, A. lainzii, A. desertorum, A. gibbsianus, A. anisochilus, whereas A. complicatus subsp. commutatus, A. brutius, A. mannii, A. foliolosus var. foliolosus, A. anagyrifolius var. foliolosus, A. decorticans, A. artemisiifolius, A. bacquei, A. cincinnatus and A. boudyi. A. faurei, A. complicatus subsp. Complicatus. The calyx structure reflects the relationships of significant value to distinguish similar or closely related species.*

Similarity between the species

Morphological characters of *Adenocarpus* show relationships between all the species even though the geographical distributions of the species are different. All the species are shrubs with many branches, 3-foliolate leaves, glandular papillae on the calyx, *A.foliolosus* var. *viscosus*, and *A. hispanicus* have a calyx with glandular papillae, whereas absent in *A. foliolosus*, and *A. decorticans* (Gibbs, 1967).

A. foliolosus (Ait.) DC. in Lam & DC., *Fl. Fr., ed.* 3, 5 (*Suppl.*) : 549 (1815).

≡ *Cytisus foliolosus* Aiton, *Hort. Kew* 3: 49 (1789).

Type: Canary Islands 7 & 8. 1779, F. Masson (K !, BM !).

Shrub to 200 cm, erect, densely hairy, branches with villous hairs; leaves trifoliolate; leaflets 3.5—5.5 × 1.0—2.5 mm, oblanceolate; upper surfaces dense with villous hairs, lower surfaces glabrous. Inflorescence lax; bracts 3—4 mm, sublinear; bracteoles 3—4.5 mm, narrowly elliptic; calyx 6.5—8 mm, with dense villous hairs, with or without glandular papillae; lips longer than the tube, upper lip 4.0—5(6.5) mm, lower lip 5.5—6.5(8.5) mm; standard 10—12 mm, broadly ovate, with dense sericeous hairs; wings 8—11 mm; keel 8.5—11.5 mm; legume 24—40 × 4—5 mm, narrowly oblong, with glandular papillae; seeds 3—5.

Distribution: Endemic to the Canary Islands: Tenerife, Gran Canaria, Gomera, La Palma, El Heirro, at 250—2200 m.

Key to varieties

1-Calyx without glandular papillae ….**a. *var. foliolosus***

1-Calyx with glandular papillae…**b . *var. viscosus***

a. var. *foliolosus*

= *A. ombriosus* Ceballos & Ortuno, Ins. Forest. Invest.Exper.,18, no.33: 12 (1947)

Illustration: Bramwell & Bramwell, *Flores Silvestres de las Islas Canarias.* Ed.4: 197 (2001).

Leaflets 3.5—5.5 × 1.0—2.5 mm, oblanceolate; upper surfaces densely hairy, lower surfaces glabrous; calyx densely hairy, without glandular papillae. (Figure 2).

Distribution: Endemic to the Canary Islands: Tenerife, Gran Canaria, Gomera, La Palma, El Heirro.

Notes:

It differs from *A. foliolosus* var. *viscosus* by the absence of glandular papillae on the calyx, although on the legumes they are present (Figure 1). It lives at lower altitudes, usually beneath 1400 m, while *A. foliolosus* var. *viscosus* lives at higher altitudes up to 2200 m.

Specimens examined:

Tenerife, Near Jcod de los Vinas, 1921, Dr. F. Borgesen 139 (K); Pinus canariensis, Erica arborea, wald Bei Aguamansa, 1400 m, 1977, Gill 11.I (K); Las Mercedes, 1921, Borgesen 570 (K); Las Mercedes on dry hill and below wood, 18.6.1913, Sprague & Hutchinson 611 (K); Las Mercedes, ad marginem sylvae in saxosis, 19.5-15-7.1855, Boureau 1304 (E); Guimer, Pico de Badajor, 1857, Ball (E); Las Mercedes, 1.5.1891, Hamilton (E); 5 km after turning to Anaga from Las Cantaras, 28°31′ N 16′18′ W, 700 m, 30.6.1997, Percy 29 (E); road from La Laguna to parquet del Teide, c. 5km above Las Raicas restaurant, on left at beginning on track to Huelgues, between Eucalyptus plantations, 28°26′ N 16°22′30′′ W, 1190 m, 22.6.1997, Percy 4 (E); Near Agua Manza, forestry track, 3 km north of Village, 28°21′ N 12°48′ W, 1400 m, 14.5.1977, Jarvis 693 (RNG); C.821 road, 3 km north of El Portillo, 28°28′ N 12°52′ W, 1900 m, 30.4.1977, Jarvis 503 (RNG); On hill above San Juan da Rambla, 20.2.1929, Maude (RNG); Agua Lgarica, 750 m, 30.5.1969, Bramwell 1716 (RNG); Monte de las mercedes, Mirador, 4 km west of Pico del Ingles, roadside, 28°31′ N 12°35′ W, 800 m, 29.4.1977, Jarvis 462 (RNG); Near Agua Manza, Barranco above Village, Pine foresr, roadside weed, 28°21′ N 12°48′ W, 1100 m, 30.4.1977, Jarvis 478 (RNG); Pine forest above Agua Manza, 1300 m, 14.4.1969, Bramwell 1289 (RNG); Cistus marguis near La Guancha, 400 m, 9.11.1968 Bramwell 363 (RNG); Gran Canaria: Santa-Brigida, in sylvis regionis mediae, 22.4.1855, Bourgeau (K); 13.5.1892, Murray (K); San Jose near Agaiti, 800 m, 8.8.1966, Gosland D40 (K); Near S. Matteo, 30.5.1902, Murray (K); Cruz de Tejeda to Las Legunetas, 1400-1600 m, 19.4.1981, Davis 67370 (E); Above las Mateo, 853 m, 30.5.1972, Kumkel 15014 (E); By road from Cruz de Tejeda to Tejeda Village 27°59′ N 15′36′ W, 1480 m, 5.7.1997, Percy 36 (E) Cruz de Tejeda along the rim of the central crater, up to Los Moriscos, 1500 m, 8.81954, Lems, 2136 (RNG); Moya, enter Los Tilos de Moya et El Palmital, 400 m, 27.4.1982, Retz, 82913 (RNG): Gomera: Dry hillside above Valle Hermoso, 17.5.1899, Murray (K); Above Arafo, on new road to Mirador Ortuno and EL Diabolo, rocky slopes in scrub, 600-700 m, 26.4.1981, Davis 67533 (E); Between La Orotava and Aquamansa, 800 m, 24.4.1981, Davis 67471 (E); Orotava, 900 m, 21.6.?, Bourchard 51 (E); Alto de Garajonay, in exposed places on tops of Mountain, 5000 ft., 28.8.1957, Gillie 2643 (E); Road from Arure to Las Hayas and Parque Nacional, 28°7′30′′N 17°18′30′′ W, 900 m, 13.7.1997, Percy 67 (E); N. coastal road, near Tamagarda and Las Rosas, 28°11′30′′ N 17′13′30′′ W, 600 m, 26.61998, Percy 223 (E); Near Vallehermoso, road to Valle Gran Rey, 4km south of Vallehermoso, roadside, 600 m, 7.3.1973, Aldridge 1065 (RNG); Track to Garajonay, from main track of Vallehermoso to Valle Gran Rey, 1100 m, 8.3.1973, Aldridge 1098 (RNG); Degollada de San Sebasten, between Rio de Villa Agula, 300 m, 6.4.1971, Bramwell, Humphries 3349 (RNG); Roque de Aganda, 1200 m, 27.6.1969, Bramwell 2000 (RNG); Roque de Aganda, in Erica heath, 900 m, 27.6.1969, Bramwell 2000A (RNG); Bco, de Vallehermoso, 4 km south of vallehermoso, 28°9′ N 13°35′ W, 450 m, 7.5.1977, Jarvis 584 (RNG); 1.25 miles south of El cedro, Roque de Aganda, 1100 m, 4.8.1983, Thompson, Baum & Richards 91 (RNG); La Palma: Los Sauces, at Barranco de los Tilos, 700 m, 14.4.1971, Bramwell 3398 (RNG); Road from Breana Alta to Tigalete in the south, 27.3.1973, Angela & Aldridge 1414 (RNG); Pinan de Fue ncalinte, 800 m, 8.6.1969, Bramwell 1857 (RNG).

Figure 1. *Adenocarpus foliolosus* DC (https://plants.jstor.org/stable/10.5555/al.ap.specimen.k000227082)

B. var. *viscosus* (Webb & Berthel.) Essokne & Jury, comb. nov.

≡ *A. viscosus* Webb & Berthel., Hist. Nat. Iles. Canaries (Phytogr.) 2: 32 (1842).

= *A. anagyrus* Spreng, Syst. Veg. ed. 16, 3: 226 (1826) .

= *A. frankenioides* Choisy, in DC., Prodr 2: 158 (1825).

Illustration: Bramwell & Bramwell, Flores Silvestres de las Islas Canarias, ed.4: 197 (2001).

Leaflets 2.5—6.5 × 1.2—1.8 mm, narrowly elliptic; both surfaces densely hairy; calyx 6.5—8.0 mm, with dense villous hairs, with glandular papillae. (Figure 2).

Distribution: Endemic to the Canary Islands: Tenerife, La Palma.

Specimens examined: Tenerife: Caldera, cliffs above Tenerife, 13.6.1913, Sprague & Hutchinson 467 (K); Cañades, 2000 m, 11.5.1933, Asplund 1233 (K); Caňades, 2000 m, 25.2.1935, Chaytor 5-7 (K); Pico del Teyde, ad radices coni superioris, 7.6.1855, Bourgeau 1313 (K); Codizo del Pies, 1400 ft., 9.6.1890, Muray (K); Above Vilaflor, abundant shrub in pine forest and higher up in superasylvatic zone, 6000 ft., 13.7.1957, Gillie 2754 (E); Tenerif, 9.5.1891, Hamilton (E); Tenerife, 2000 m, 22.5.?, Burchard 124 (E); LaPalma: Pico del Cedro, 4.6.1913, Sprague & Hutchinson 286 (K); In regione alpine, Bourgeau 117 (E); Palma, 1800 m, 21.VI.? Burchard 13 (E); Road from Santa Cruz to Las Calderas, 28°43′ N 17°47′ W, 1500 m, 15.7.1997, Percy 74 (E); La Caldera rim, 28°45′ N 17°51′ W, 2200 m, 20.5.1998, Percy 209 (E); El paso, Pine woodlands around Ermita del Pino, and crest of El Paso towards Los

Roques, 800-1500 m, 22.5.1966, Lems 7735 (RNG); Cambres de Los Tilos, 1500 m, 7.6.1969, Bramwell 1841 (RNG); North Coast road from Ti jarafe to Garafe, pine woodlans on slops with loamy soil, 1000-1200 m, 23.5.1966, Lems 7724 (RNG); Near Fuencaliente, 5 km from Fuencaliente on El Charco road, 28°29′ N 14°11′ W, 500 m, 22.4.1977, Jarvis, Gibby, Humphries 440 (RNG)

Figure 2. *Adenocarpus viscosus* Webb & Berthel (https://plants.jstor.org/stable/10.5555/al.ap.specimen.k000227094)

3 Results and Discussion

According to Gibbs (1967), the genus originated either in North Africa with the ancestors of *A. mannii* moving to Tropical Africa and *A. complicatus* to Southern Europe, or the genus originated in Tropical Africa and extended to Northern Africa and Southern Europe. According to the molecular and chemical data the first explanation is much more likely. However, the combined results from the morphology, phytochemistry and phylogeny shows that there are 24 species, *A. complicatus* with three subspecies and two species each with two varieties. I have described a new species from the Middle Atlas of Morocco, *A. ronaldii*, based on *Jury & Shkwa 20890* as this does not belong to the *complicatus* complex which I believe is restricted to Europe. However, I believe that *A. bracteatus* is a part of the *A. complicatus* complex, as outlined above, and so I have reduced this to a third subspecies of *A. complicates* (Rafaa Essokne, *et al*., 2018).

The Parsimony tree shows slightly different clades than the Bayesian clades. In the Parsimony tree (Figure 3. A), the first clade A consist of two sub-clades: sub-clade A1 contains the High Atlas endemic taxa *A. anagyrifolius* var. *anagyrifolius*, and *A. anagyrifolius* var. *leiocarpa*, *A. cincinnatus* and A. *bacquei* from the (Middle Atlas Morocco) with low value of 54% BS and 100 PP, as a sister group to *A. decorticans* (from both Spain and Morocco), *A. desertorum*, *A. hispanicus* and *A. argyrophyllus* (Spain). The most interesting aspect being their relationships as endemic species to the same geographic area, also this support has a similar topology to the ITS tree. The only difference between the topologies of the ITS and *trn*L-*trn*F trees concerns the position of *A. faurei* is sister to clade B (the *complicatus* and the endemics taxa from Canary Islands group) with a bootstrap support of 76% (MP analysis) and 1.0 (BI analysis), and the position of the Moroccan endemic *A. artemisiifolius* is unresolved as shown in the parsimony tree cluster with *A. telonensis* (also Moroccan), whereas in the Bayesian Inference tree it is adjacent to the endemics from the High Atlas with a value of 1.00 PP.

Clade B**,** (Figure 3. B) shows that *A. decorticans* from Spain is nested with the Moroccan *A. decorticans* and the Spanish *A. desertorum* subclade with value of 66% BS. *Adenocarpus decorticans* is adjacent to *A. desertorum* (Spanish) with the low value of 66% BS. This subclade is sister to the *A. hispanicus*, *A. argyrophyllus*, (all Spanish taxa) subclade with value of 69% BS.

Clade B of the parsimony tree (Figure 3. A) consists of two sub-clades, the first sub-clade contains the Middle Atlas taxa *A. ronaldii* (Moroccan), *A. telonensis* adjacent to *A. boudyi* (Moroccan) *A. complicatus* subsp. *bracteatus* and *A. aureus* (Spanish) with a support value of 66% (MP analysis)and 1.0 (BI analysis), this sub-clade is sister to *A. faurei* (Algerian) which cluster with the endemic *A. foliolosus* var. *foliolosus* from Canary Islands, and adjacent to *A. decorticans* (Algerian) and *A. complicatus* subsp. *commutatus*. The second sub-clade

shows slightly different topology between the two trees analysis, and consists of *A. complicatus* subsp. *bracteatus*, *A. anisochilus* (Portugal), *A. lainzii* and *A. gibbsianus* (both from Spain), *A. complicatus* subsp. *commutatus*, *A. bivonii* and *A. brutius* (both from Italy) with low value of 59 % BS. There is a slightly different topology of the species position in the two trees Figure 3. A and 3. B. (**Essokne, R.S.,** 2011).

The endemic taxa from the Canary Islands, *A. foliolosus* var. *foliolosus*, and *A. foliolosus* var. *viscosus* have identical sequences and very strong support value of 100 % BS and 1.0 PP in the *trn*L-*trn*F tree, and are very closely related taxa to the European *complicatus* complex by the ITS analysis. Those two Canary Islands' taxa are morphologically distinct, the leaf shape is obovate, and the calyx without glandular papillae in *A. foliolosus* var. *foliolosus*, whereas in *A. foliolosus* var. *viscosus* the leaves are narrowly elliptic and the calyx has glandular papillae. Lems (1954) in his *Botanical notes on the Canary Islands* distinguished a number of varieties and hybrids between these two species which happened as they live within short distance of one another. They grow abundantly in the famed Retama-Codeso and the Canary Pine (*Pinus canariensis*) forest in Tenerife. Our data show that these two taxa have identical sequences, results also suggested by Kàss & Wink (1997), Percy & Cronk (2002) and Cubas (2002, 2010). I propose, therefore, to reduce *A. viscosus* to a variety of *A. foliolosus*

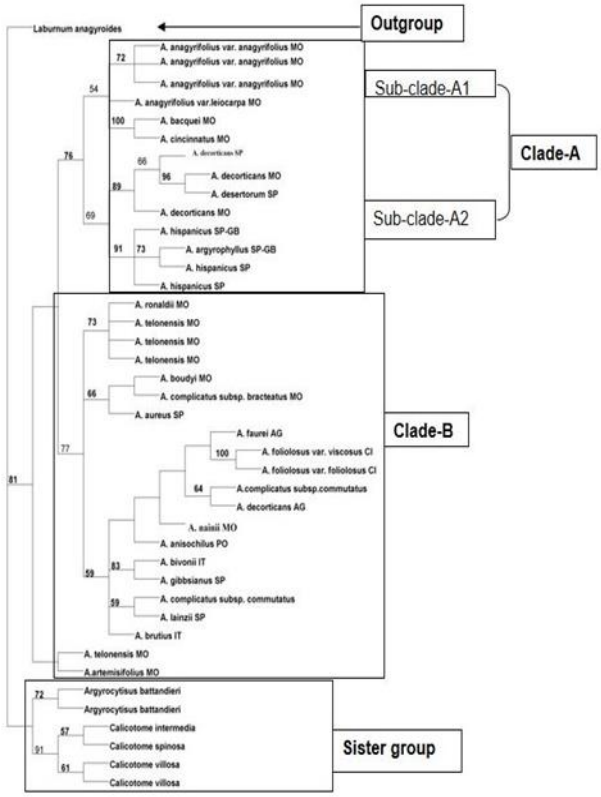

Figure 3.A. One of the 3748 most parsimonious trees based on the trnL trnF data sets obtained from maximum parsimony (MP) analysis of 42 Adenocarpus accessions. Numbers above branches are bootstrap support percentage values for clades receiving more than 50% bootstrap support (Essokne, R.S., 2011).

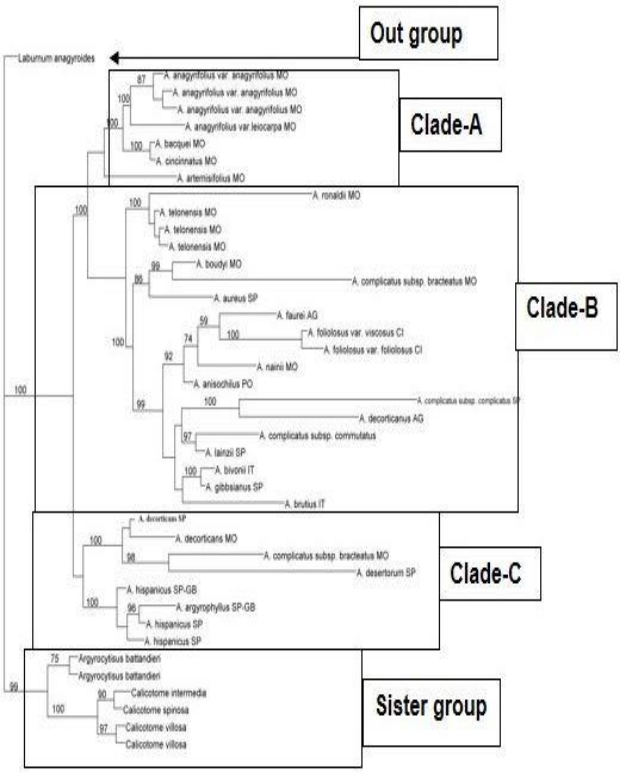

Figure 3.B. Majority-rule consensus tree of the Bayesian inference based on the *trn*L *trn*F data set of 42 *Adenocarpus*. Posterior probability values of the nodes are indicated above the branches. (Essokne, R.S., 2011).

Figure 4: Calyx with glandular papillae as in *A. viscosus*

Calyx without glandular papillae as in *A. foliolosus*

4 Conclusion

On the basis of the herbarium specimens, phytochemical analysis and the phylogeny of this taxon, Therefore, this taxon must be considered as a variety of *A. foliolosis*. According to our observations (Rafaa Essokne, *et al*., 2012), and in accordance with the previous revisions (Gibbs, 1967), *A. viscosus* (Figure 4) can be distinguished from *A. foliolosus* by the presence of glandular papillae on the calyx. Therefore, I have sunk *A. viscosus* as a variety of *A. foliolosus* as although I can recognize them by the rather small distinction of the presence of glandular papillae on the calyx in the former species, they are not distinguishable by the molecular studies. Moreover, Google Earth map has been used to present the distribution of the *Adenocarpus* species in the Canary Islands (Figure 5)

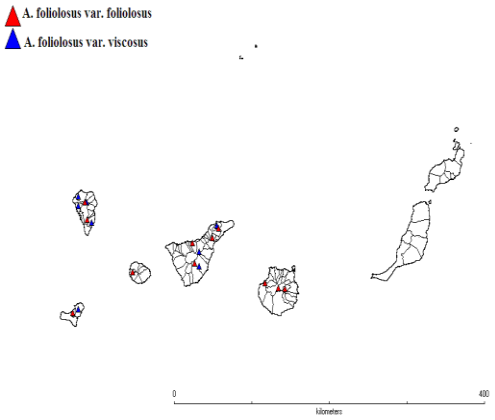

Figure 5. Map showing distribution of the *A. foliolosus* var. *foliolosus* and *A. foliolosus* var. *viscosus* varieties in the Canary Islands

Conflict of Interest: The authors declare that there are no conflicts of interest.

References

Castroviejo, S., (1999a). Apuntes sobre algunos *Adenocarpus* (Leguminosae) Ibericos. Anales Jardín Botánico de Madrid 57, 37–46.

Castroviejo, S., (1999b). *Adenocarpus* DC. In S. Castroviejo *et al*. (eds) *Flora iberica*, 7(**1**): 189—205. Madrid: CSIC.

Cubas, P., Pardo, C. & Tahiri, H. (2002). Molecular approach to the phylogeny and systematics of *Cytisus* (Leguminosae) and related genera based on nucleotide sequences of nrDNA (ITS region) and cpDNA (*trn*L-*trn*F intergenic spacer). *Plant Systematics and Evolution* 233: 223—242.

Cubas, P., Pardo, C., Tahiri, H. & Castroviejo, S. (2010). Phylogeny and evolutionary diversification of *Adenocarpus* DC. (Leguminosae). *Taxon* 59: 720—732.

Dobignard, A., Chatelain, C., (2012). Index synonymique de la flore de l'Afrique de Nord, 4. Genève: Ville de Genève, Editions des Conservatoire et Jardins botaniques.

Essokne, R.S., 2011. A Taxonomic Treatment of the Genus *Adenocarpus* (Leguminosae). PhD Thesis, University of Reading.

Gibbs, P.E., (1967). A Revision of the Genus Adenocarpus. In: Boletim Sociedade. Broteriana Série, vol. 2, pp. 67–121.

Greuter, W., Burdet, H. & Long, G. (1989). Med-Checklist, 4. Dicotyledones (Lauraceae – Rhamnaceae) : Genève: Conservatoire et Jardin Botanique de la Ville de Genève.

Käss, E. & Wink, M. (1997). Phylogenetic relationships in the Papilionoideae (family Leguminosae) based on nucleotide sequences of cpDNA (rbcL) and ncDNA (ITS 1 and ITS2). *Molecular Phylogenetics and Evolution* 8: 65—88.

Lems , K., (1954). Botanical Notes on the Canary Islands II. The Evolution of Plant Forms in the Islands: Aeonium. Ecology, Vol 41.1: 1— 17

Ouyahia A., Fennane, M., Ibn Tattou, M., & El oualidi, J., (2007). Flore pratique du Maroc, manuel de détermination des plantes vasculaires – volume 2 : Angiospermae (Leguminosae - Lentibulariaceae). Travaux de l'Institut Scientifique, Série Botanique, n°38, Rabat (MA) : 636 p.

Percy, D. M. & Cronk, C. B. (2002). Different fates of island brooms: contrasting evolution in *Adenocarpus*, *Genista*, and *Teline* (Genisteae, Fabaceae) in the Canary Islands and Madeira. *American Journal of Botany* 89: 854—864.

Polhill, R. M. (1976). Genisteae (Adans.) Benth. and related tribes. *Botanical Systematics* 1: 143—380.

Rafaa S. Essokne, Mohamed H. Makhlouf, Stephen L. Jury. (2018). *Adenocarpus ronaldii* Essokne & Jury. sp. nov. (Leguminosae). A New Species From Morocco**.** *American Journal of Life Science Researches* 6(1): 1—5

Rafaa S. Essokne, Renée J. Grayer, Elaine Porter , Geoffrey C. Kite, Monique S.J. Simmonds, Stephen L. Jury (2012). Flavonoids as chemosystematic markers for the genus *Adenocarpus*. Biochemical Systematics and Ecology, 42: 49–58

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