

Phlomis lychnitis (Lamiaceae), an addition to the flora of Africa from Morocco

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Abstract

PHLOMIS LYCHNITIS (LAMIACEAE), AN ADDITION TO THE FLORA OF AFRICA FROM MOROCCO.— *Phlomis lychnitis* is here recorded for the first time within the African continent. So far, known only from Morocco in the Oriental High Atlas. Description of the species as well as first data about its ecology in Morocco together with geographical distribution and diagnostic features with the morphologically closest taxon sharing yellow-colored flowers are given. Photographic illustrations and an updated key to the *Phlomis* species in Morocco are also provided.

Key words: chorology; Labiatae; Lamiales; new record; Oriental High Atlas.

Resumen

PHLOMIS LYCHNITIS (LAMIACEAE), UNA ADICIÓN A LA FLORA DE ÁFRICA DESDE MARRUECOS.— *Phlomis lychnitis* se registra por primera vez en el continente africano. Hasta el momento, sólo se conoce de Marruecos en el Alto Atlas Oriental. Se proporciona una descripción de la especie, así como los primeros datos sobre su ecología en Marruecos junto con su distribución geográfica y caracteres diagnósticos con la especie morfológicamente más cercana que comparte flores de color amarillo. También se proporcionan fotografías y una clave actualizada de las especies de *Phlomis* en Marruecos.

Palabras clave: Alto Atlas Oriental; corología; Labiatae; Lamiales; nueva cita.

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INTRODUCTION

Many efforts have been made in recent years to study and review the described flowering plants of

Morocco in order to update their geographical distributions and collect botanical photographic records that can serve in studying specifically some emblematic genera such as *Artemisia* L., *Thymus* L., and

others. Extensive prospections undertaken mainly by the first author (AHB) are resulting in the discovery of some new species to science and to Morocco (see e.g. Homrani-Bakali & Peltier, 2020a, b; Homrani-Bakali & Susanna, 2021, 2022). More recently, a prospecting mission undertaken in the Oriental High Atlas led to the discovery of a taxon belonging to the genus *Phlomis* L. that had not previously been reported for African flora, *Ph. lychnitis* L.

Phlomis is one of the largest genera in the subfamily Lamioideae (Lamiaceae), with about 90 accepted species distributed in Asia, southern Europe and northern Africa (Salmaki *et al.*, 2012; Govaerts *et al.*, 2018). Mathiesen *et al.* (2011) indicate that the *Phlomis s. l.* lineage has a Central Asian origin in an area around western China. On the other hand, Hedge (1986) indicates Turkey and Iran as the main centers of diversification in the Mediterranean region. In North Africa, *Phlomis* counts nine taxa (six species and three subspecies), where Morocco is the richest country with seven taxa (five species and two subspecies) (see e.g. Fennane *et al.*, 2007; Dobignard & Chatelain, 2012; APD, 2023).

In this paper, we report for the first time to African continent from Morocco the presence of *Phlomis lychnitis*. A short description and a comparison with the most morphologically closest species sharing yellow-colored flowers in Morocco [*Ph. crinita* subsp. *mauritanica* (Munby) Murb.] are highlighted.

MATERIAL AND METHODS

The work is based on field surveys, analysis of relevant literature and examination of voucher specimens deposited in the Herbarium of the Scientific Institute of Rabat in Morocco (RAB Herbarium). Morphological observations and measurements of the new record and the closest species were carried out based on fresh plant material collected from the wild in Morocco. *Phlomis lychnitis* was collected from Ait Ben Azzo, while *Ph. crinita* subsp. *mauritanica* was collected from Bab Taza and Ighri in the Rif and Anti-Atlas mountains, respectively. Characters were measured using a ruler, a vernier caliper and an Olympus SZX7 Stereo-Microscope.

RESULTS AND DISCUSSION

Taxonomic treatment

Phlomis lychnitis L., Sp. Pl.: 585 (1753)

Description: Suffrutescent or sub-shrubby plant up to 60 cm in height, sometimes with stolons. Many stems arched then erect, cottony-whitish, densely hairy, with many basal leaves. Leaves narrow 3–11 × 0.5–1.0 cm, lanceolate, the cauline somewhat wider, oblong, progressively becoming bracts, entire, pubescent above, with stellate hairs, which sometimes have a longer branch, strongly veined-reticulate, white-tomentose below, the young woolly with attenuated petioles, those with opposite leaves welded together, the cauline ones are sessile. Inflorescence formed by 4–8 whorls with 6 flowers each, ± close at the apical part, cupped. Bracts soft straight, setaceous, 1.5–6.0 × 1.5–3.0 cm, sessile, forming a cup between 2 opposite ones, broadly ovate, the lower ones long acuminate, those above ovate and acute, not or barely exceeding the flowers, long hairy on the margin with tangled hairs; bracteoles 12–16 mm long, 2–3 per calyx, linear, with long, feathery hairs. Calyx 14–18 mm long, with 5–8 mm teeth, acute. Corolla 22–27 mm long, deep yellow; glabrous, tube included in calyx; upper lip helmet-shaped, covered on the outside with stellate hairs, ciliate; lower lip with central convex lobe, the lateral ones, triangular; opening between them almost horizontal. Stamens generally recurved within the upper lobe, following its curvature; anthers with soldered theca aligned in the direction of the filament, so they appear to be one, with lateral dehiscence. Recurved style. Nucules 4–6 × 2–4 mm, ovoid, subtrigonal, brown.

Taxonomic remarks: *Phlomis lychnitis* is distinguished from *Ph. crinita* by the shape of the leaves (linear or linear-lanceolate, width <1.1 cm) and the bracts with different shape arranged in the form of a closed cup around the whorl with a large base enveloping the flowers (Figs. 1 and 2, Table 1) (see e.g. Morales, 2010).

Studied material: Morocco, Draâ-Tafilalet: Midelt, Ait Ben Azzou, 1490–1600 m, 32° 39' 49.284" N, 4° 20' 0.12" W, 11.VI.2022, Homrani Bakali (RAB 113642) (Fig. 1).

Distribution and habitat in Morocco: *Phlomis lychnitis* grows on the southern side of the Atlas Mountains, in a drier environment in the Drâa-Tafilalet



Figure 1. Voucher specimen of the Moroccan *Phlomis lychnitis* L. of Ait Ben Azzou in RAB Herbarium.

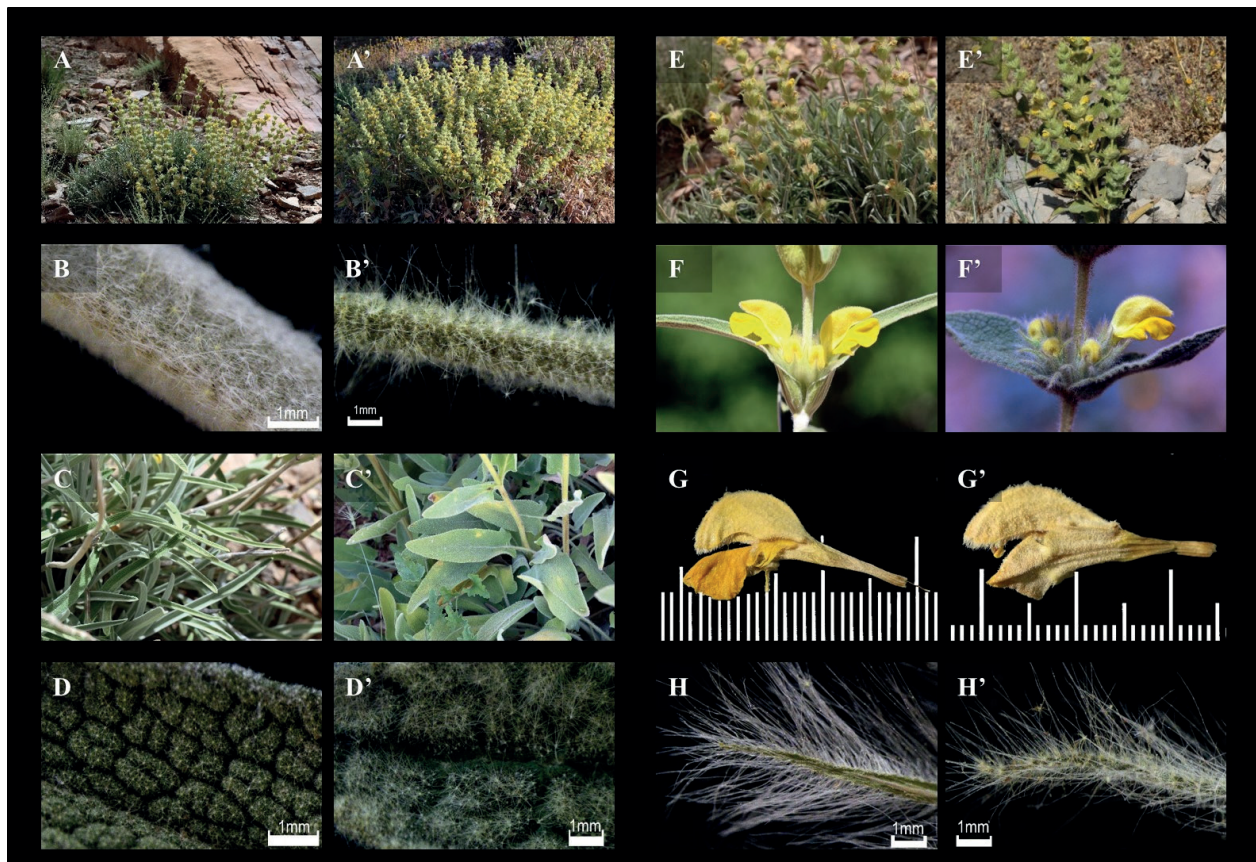


Figure 2. Illustration of some differential characters between *Phlomis lychnitis* L. (left letter without apostrophe) and *Ph. crinita* subsp. *mauritanica* Maire (right letter with apostrophe): (A), plant; (B), stem trichomes; (C), basal leaves; (D), leaf trichomes; (E), form of inflorescence; (F), form of bracts around the whorl; (G), corolla; and (H), bracteole (photograph: A. Homrani Bakali).

Table 1. Morphological comparison between *Phlomis lychnitis* L. and *Ph. crinita* subsp. *mauritanica* Maire.

Character		<i>Ph. lychnitis</i>	<i>Ph. crinita</i> subsp. <i>mauritanica</i>
Stem	trichomes	densely tomentose with stellate hairs, the lower part woolly, hairs adpressed	densely tomentose and glandular with simple and stellate hairs, hairs not adpressed
Basal leaves	form	linear or lanceolate	ovate, ovate-lanceolate or oblong-elliptic
	size	30–110 × 5–10 mm	50–100 × 25–40 mm
Bracts	form	arranged in a closed cup around the whorl	open bracts on whorl
	size	15–60 × 15–30 mm	10–55 × 10–35 mm
Inflorescence	form	generally unbranched	branched
Bracteoles	size	12–16 mm long	11–16 mm long
Calyx	trichomes	glabrous inside	pubescent inside
	size	14–18 mm long	17–21 mm long
Corolla	size	20–27 mm long	25–31 mm long

region, Midelt, in a small area of the mountain of Ait Ben Azzou (Fig. 3). It was found on limestone cliffs at 1490–1600 m a.s.l.

General distribution: France, Portugal, Spain (GBIF, 2022; POWO, 2022) and Morocco (North Africa, present work).

Conservation status: Populations of *Ph. lychnitis* L. are strictly limited to the specific ecological conditions of Ait Ben Azzo Mountain. This population is very limited (less than 5000 km²) and only protected from overgrazing on an abrupt slope. Since the population is of small size and occurs only at

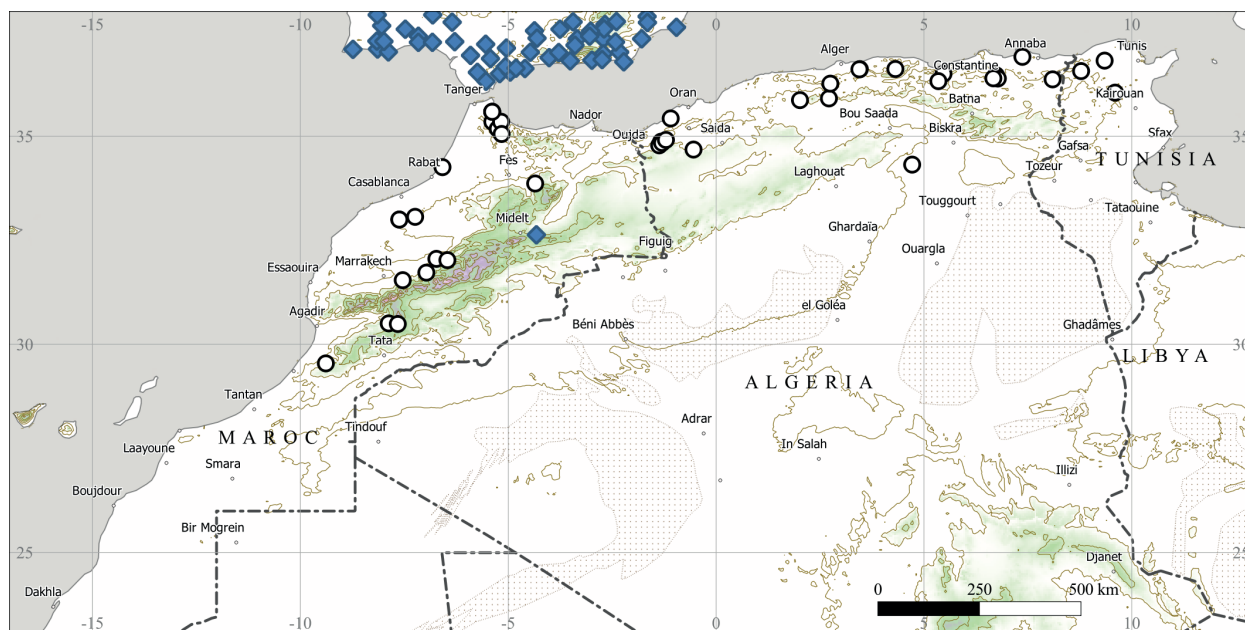


Figure 3. Locality of *Phlomis lychnitis* L. (blue diamond) and herbarium collections of *Ph. crinita* subsp. *mauritanica* Maire in Maghreb (white circle). Dots in Spain and Portugal are taken from GBIF (2022).

unique habitat types only, we provisionally propose a conservation status of “critically endangered” (only one plant that was not on the abrupt slope escaped from the heavy grazing in the zone). More inspection efforts are needed in the oriental High Atlas of Morocco to circumscribe the distribution of the species and better evaluate its status and distribution.

Historical records: There are three samples identified as *Ph. lychnitis* collected by Michel Gandoger in Morocco and deposited in the Geneva Herbarium (Cabo Tres Forcas IV.1908, Midjiga VII.1908, Zeluan IV.1909), but the veracity of the geographic origin of these samples can be questioned. Indeed, many of Gandoger’s samples are probably from false locations, as mentioned by Lainz (1956) and Montserrat (1999). The three Moroccan localities (Midjiga, Zeluan and Cap des Trois-Fourches) mentioned by Gandoger’s were not confirmed by the many botanical inventories carried out in these regions. Subsequently, no Moroccan floras have mentioned the presence of this species (Valdés *et al.*, 2002; Fennane *et al.*, 2007).

CONCLUSIONS

The flora of Morocco still brings new discoveries due to its climatic and topographical diversity, and the

complexity of its territory. Since the publication of the last volume of the *Flore Pratique du Maroc* (Fennane *et al.*, 2014), more than 30 new species have been described (Alonso *et al.*, 2015; Andrés-Sánchez *et al.*, 2015; Brullo *et al.*, 2015, 2017; Chambouleyron *et al.*, 2015; Dobignard, 2015; Talavera *et al.*, 2015; Viganondo *et al.*, 2015; Crespo *et al.*, 2016; Sutorý, 2016; Gonçalves, 2018; Gutiérrez-Larruscain *et al.*, 2018; Khamar *et al.*, 2018; Martínez-Laborde, 2018; Mejías *et al.*, 2018; Hassemer, 2019; Koch & Lemmel, 2019; Chatelain *et al.*, 2020; Martínez Labarga & Ferrer-Gallego, 2020; Vicente *et al.*, 2020; Frankiewicz *et al.*, 2021; Homrani-Bakali & Susanna, 2021, 2022; Romo, 2021; Barone *et al.*, 2022). This highlights the importance of conducting field explorations. The case of *Phlomis lychnitis* is a good example, which allows us to completely re-evaluate the distribution area of this taxon.

Hereafter, an updated diagnostic key is proposed for the species of the genus *Phlomis* in Morocco.

Updated dichotomous key for Moroccan species of *Phlomis* (cf. Fennane *et al.*, 2007; Morales, 2010):

1. Corolla purplish, pinkish or white; basal bracts lanceolate-linear, not cusped..... 2
- Corolla yellow, yellowish-brown; basal bracts ovate-rhombic, cusped..... 5

2. All leaves petiolate..... 3
 -. Cauline leaves petiolate, upper ones sessile or subsessile..... 4
 3. Bracteoles linear-lanceolate, 1.8–3.5 mm wide; calyx *ca.* 2 cm long; corolla pale pink; herbaceous plant, sometimes lignified at base
 ***Ph. bovei* subsp. *maroccana*** Maire
 -. Bracteoles linear-lanceolate to oblong, 2–3 mm wide; calyx 1.1–1.3 cm long; corolla purple or pink, rarely white; shrub up to 200 cm
 ***Ph. purpurea*** L.
 4. Herbaceous plant; basal leaves attenuated; bracteoles subequal or longer than calyces; calyx with spinescent teeth ***Ph. herba-venti*** L.
 -. Suffrutescent or herbaceous plant; basal leaves with wedge-shaped base; bracteoles shorter than calyces; calyx with no or barely mucronate teeth...
 ***Ph. antiatlantica*** J.P. Peltier
 5. Basal leaves linear or linear-lanceolate, up to 12 mm width; bracts often arranged in a closed cup around the whorl, inflorescence generally unbranched ***Ph. lychnitis*** L.
 -. Basal leaves ovate, ovate-lanceolate or oblong-elliptic, more than 30 mm wide; open bracts on whorl, inflorescence generally branched.....
 ***Ph. crinita* subsp. *mauritanica*** Murb.

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REFERENCES

- Alonso, M. A., Crespo, M. B., Juan, A. & Sáez, L. 2015. *Helianthemum* (sect. *Helianthemum*) *raskebdanae* (Cistaceae), a new species from northeastern Morocco. *Phytotaxa* 207(3): 253–264. <https://doi.org/10.11646/phytotaxa.207.3.3>
- Andrés-Sánchez, S., Gutiérrez-Larruscain, D., Rico, M. & Martínez-Ortega, M. 2015. Overlooked singularity and tiny plants: the *Filago desertorum* clade (Gnaphalieae, Asteraceae). *Botanical Journal of the Linnean Society* 179: 742–754. <https://doi.org/10.1111/boj.12318>
- APD [African Plant Database] 2023. *Phlomis L. in North Africa*. Retrieved January, 2023, from <https://africanplantdatabase.ch/en/search/phlomis/fna/1/fsa/0/fta/0/bdm/0/page/1>
- Barone, G., Domina, G., Bartolucci, F., Galasso, G. & Peruzzi, L. 2022. A nomenclatural and taxonomic revision of the *Senecio squalidus* group (Asteraceae). *Plants* 11: 2597. <https://doi.org/10.3390/plants11192597>
- Brullo, S., Brullo, C., Cambria, S., Cristaudo, A. & Giusso del Galdo, G. 2017. *Bituminaria antiatlantica* (Psoraleae, Fabaceae), a new species from Morocco. *PhytoKeys* 85: 109–142. <https://doi.org/10.3897/phytokeys.85.12288>
- Brullo, S., Pavone, P. & Salmeri, C. 2015. Biosystematic researches on *Allium cupani* group (Amaryllidaceae) in the Mediterranean area. *Flora Mediterranea* 25(Special Issue): 209–244. <https://doi.org/10.7320/FIMedit25SI.209>
- Chambouleyron, M., Bidat, M. & Léger, J. F. 2015. *Sarcocapnos crassifolia* subsp. *simplicifolia* (Papaveraceae, Fumarioideae), a new narrow-endemic taxon from northeastern Morocco. *Annales Botanici Fennici* 52: 205–210. <https://doi.org/10.5735/085.052.0312>
- Chatelain, C., Andrieu, F. & Dobignard, A. 2020. Une espèce nouvelle de Fabaceae du Sahara occidental (Maroc): *Lotus zemmouriensis*. *Candollea* 75(2): 189–192. <https://doi.org/10.15553/c2020v752a3>
- Crespo, M. B., Alonso, M. A., Vicent, A. & Villar, J. L. 2016. A new North African subspecies in the *Helianthemum origanifolium* aggregate (*H.* subg. *Plectolobum*, Cistaceae). *Phytotaxa* 252(4): 263–272. <https://doi.org/10.11646/phytotaxa.252.4.2>
- Dobignard, A. 2015. À propos de 3 taxons critiques pour la flore du Maroc observés lors de la 49^e Session extraordinaire de la Société botanique du Centre-Ouest dans le Grand Atlas marocain. *Evaxiana* 2: 253–266.
- Dobignard, A. & Chatelain, C. 2012. *Index synonymique de la flore d'Afrique du Nord 4. Dicotyledoneae: Fabaceae à Nymphaeaceae*. Conservatoire et Jardin Botaniques de la Ville de Genève, Genève.
- Fennane, M., Ibn Tattou, M. & El Oualidi, J. (Eds.) 2014. *Flore Pratique du Maroc* 3 (Série Botanique, 40). Travaux de l'Institut Scientifique, Université Mohammed V, Rabat.
- Fennane, M., Ibn Tattou, M., Ouyahya, A. & El Oualidi, J. (Eds.) 2007. *Flore Pratique du Maroc* 2 (Série Botanique, 38). Travaux de l'Institut Scientifique, Université Mohammed V, Rabat.
- Frankiewicz, K. E., Banasiak, I., Oskolski, A., Reduron, J., Reyes-Betancort, J. A., Alsarraf, M., Trzeciak, P. & Spalik K. 2021. Long-distance dispersal events rather than growth habit and life-history traits affect diversification rate in tribe Apieae (Apiaceae). *Botanical Journal of the Linnean Society* 198: 1–25. <https://doi.org/10.1093/botlinnean/boab032>
- GBIF [Global Biodiversity Information Facility] 2022. *Phlomis lychnitis* L. Retrieved June 27, 2022, from <https://www.gbif.org/fr/species/3887383>
- Gonçalves, A. C. R. S. 2018. *Taxonomic revision of the genus Calendula L. in the Iberian Peninsula and Morocco*. PhD Thesis, Universidade de Aveiro, Aveiro.
- Govaerts, R., Paton, A., Harvey, Y., Navarro, T. & García Peña, M. R. 2018. *World Checklist of Lamiaceae*. Royal Botanic Gardens, Kew. Retrieved December, 2022, from <http://apps.kew.org/wcsp/>
- Gutiérrez-Larruscain, D., Santos-Vicente, M., Anderberg, A. A., Rico, E. & Martínez-Ortega, M. M. 2018. Phylogeny of the *Inula* group (Asteraceae: Inuleae): Evidence from nuclear and plastid genomes and a recircumscription of *Pentanema*. *Taxon* 67(1): 149–164. <https://doi.org/10.12705/671.9>
- Hassemer, G. 2019. Mediterranean mysteries: notes on *Plantago* sect. *Lancifolia* (Plantaginaceae). *Phytotaxa* 423(3): 111–128. <https://doi.org/10.11646/phytotaxa.423.3.1>
- Hedge, I. C. 1986. Labiatae of South-West Asia: diversity, distribution and endemism. *Proceedings of the Royal Society of Edinburgh, Section B: Biological Sciences* 89: 23–35. <https://doi.org/10.1017/S0269727000008873>

- Homrani-Bakali, A. & Peltier, J. P. 2020a. *Gypsophila struthium* L. nouvelle espèce pour la flore du Maroc. *Bulletin de l'Institut Scientifique, Rabat (Section Sciences de la Vie)* 42: 59–62.
- Homrani-Bakali, A. & Peltier, J. P. 2020b. *Senna alexandrina* Mill. xénophyte tropical signalé pour la première fois au Maroc. *Al Yasmimina* 13: 1–7.
- Homrani-Bakali, A. & Susanna, A. 2021. *Centaurea peltieri* (Asteraceae), a new endemic species from the Oriental High Atlas of Morocco. *Phytotaxa* 523(2): 192–198. <https://doi.org/10.11646/phytotaxa.523.2.6>
- Homrani-Bakali, A. & Susanna, A. 2022. *Centaurea achilleifolia* (Asteraceae), a new endemic species from the Oriental Middle Atlas of Morocco. *Phytotaxa* 542(1): 083–089. <https://doi.org/10.11646/phytotaxa.542.1.7>
- Khamar, H., Civeyrel, I., Pelissier, C., Badr, D., El Oualidi, J. & Touhami-Ouazzani, A. 2017. *Verbascum ifranensis* (Scrophulariaceae), a new endemic species from Morocco. *Phytotaxa* 295(2): 132–140. <https://doi.org/10.11646/phytotaxa.295.2.2>
- Koch, M. A. & Lemmel, C. 2019. *Zahora*, a new monotypic genus from tribe Brassiceae (Brassicaceae) endemic to the Moroccan Sahara. *PhytoKeys* 135: 119–131. <https://doi.org/10.3897/phytokeys.135.46946>
- Lainz, M. 1956. Un enigma de Gandoger a la luz de su herencia. *Anuário da Sociedade Broteriana* 2: 41–43.
- Martínez Labarga, J. M. & Ferrer-Gallego, P. 2020. Taxonomic and nomenclatural notes on African *Linum squarrosum sensu lato* (Linaceae). *Phytotaxa* 439(2): 27–135. <https://doi.org/10.11646/phytotaxa.439.2.3>
- Martínez-Laborde J. B. 2018. Taxa related to *Diploaxis virgata* (Brassicaceae) in northwest Africa. *Phytotaxa* 371(3): 205–216. <https://doi.org/10.11646/phytotaxa.371.3.4>
- Mathiesen, C., Scheen, A. C. & Lindqvist, C. 2011. Phylogeny and biogeography of the lamioid genus *Phlomis* (Lamiaceae). *Kew Bulletin* 66(1): 83–99. <https://doi.org/10.1007/s12225-011-9257-0>
- Mejías, J. A., Chambouleyron M., Kim, S-H., Infante M. D., Kim, S.-C. & Léger J.-F. 2018. Phylogenetic and morphological analysis of a new cliff-dwelling species reveals a remnant ancestral diversity and evolutionary parallelism in *Sonchus* (Asteraceae). *Plant Systematics and Evolution* 304: 1023–1040. <https://doi.org/10.1007/s00606-018-1523-2>
- Montserrat, J. M. 1999. Plantas falsas de Marruecos. *Lagascalia* 21(1): 246–248.
- Morales, R. 2010. *Phlomis* L. In: Morales R., Quintanar, A., Cabezas, F., Pujadas, A. J. & Cirujano, S. (Eds.), *Flora iberica* 12. Real Jardín Botánico, CSIC, Madrid: 206–214.
- POWO [Plants of the World Online] 2022. *Phlomis lychnitis* L. Retrieved 11 December, 2022, from <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:453955-1>
- Romo, A. 2021. Apomictic species of *Alchemilla* from the High Atlas Mountains: revision of the genus *Alchemilla* (Rosaceae) in Morocco. *Plant and Fungal Systematics* 66(2): 114–121. <https://doi.org/10.35535/pfsyst-2021-0010>
- Salmaki, Y., Zarre, S., Ryding, O., Lindqvist, C., Scheunert, A., Bräuchler, C. & Heubl, G. 2012. Phylogeny of the tribe *Phlomideae* (Lamioideae: Lamiaceae) with special focus on *Eremostachys* and *Phlomoides*: New insights from nuclear and chloroplast sequences. *Taxon* 61(1):161–179. <https://doi.org/10.1002/tax.611012>
- Sutorý, K. 2016. New names in the *Cynoglossum montanum* group (Boraginaceae) in the Mediterranean area. *Edinburgh Journal of Botany* 73(3): 265–275. <https://doi.org/10.1017/S0960428616000123>
- Talavera, S., Ortiz, M. A., Jiménez, F. J., Tremetsberger, K. & Talavera, M. 2015. Los géneros *Hypochaeris* L. y *Achyrophorus* Vaill. (Compositae, Chichorieae): nuevos taxones y combinaciones. *Acta Botanica Malacitana* 40: 332–343. <https://doi.org/10.24310/abm.v40i0.2558>
- Valdés, B., Rejdali, M., Achhal El Kadmiri, A; Jury, S. L. & Montserrat, J. M. (Eds.) 2002. *Catalogue des plantes vasculaires du nord du Maroc, incluant des clés d'identification* 2. CSIC, Madrid.
- Vicente, A., Alonso, M. A. & Crespo, M. B. 2020. Born in the Mediterranean: Comprehensive taxonomic revision of *Biscutella* ser. *Biscutella* (Brassicaceae) based on morphological and phylogenetic data. *Annals of the Missouri Botanical Garden* 105(2): 195–231. <https://doi.org/10.3417/2020554>
- Vigalondo, B., Fernández-Mazuecos, M. Vargas, P. & Sáez, L. 2015. Unmasking cryptic species: morphometric and phylogenetic analyses of the Ibero-North African *Linaria incarnata* complex. *Botanical Journal of the Linnean Society* 177(3): 395–417. <https://doi.org/10.1111/boj.12251>