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***Chorispora tenella* (Brassicaceae), alien naturalized in Morocco: comparison with similar-looking species**

Abstract

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Chorispora tenella (Brassicaceae) is reported here as an alien species with an invasive potential in mountain pastoral habitats in Morocco. Illustrations of this and of similar species present in the country are provided, as well as its geographical distribution.

Key words: *Chorispora*, Identification, Chorology, Alien species, North Africa.

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Introduction

Botanical exploration of the Moroccan territory is in continuing development to enhance the knowledge of its flora. Thus, since the publication of the last volume of the “Flore Pratique du Maroc” (Fennane & al. 2014), these efforts resulted in the description of more than 30 new species (Homrani & Chatelain 2023).

Surveys undertaken by a group of botanists, from the National Institute of Agronomic Research – INRA Morocco, the Geneva Conservatory and Botanical Garden – CJBG and Reneco International Wildlife Consultants, led to the identification of an alien *Brassicaceae* species in High-Atlas and Anti-Atlas of Morocco (Oukaimeden, Khouzama). *Chorispora tenella* (Pall.) DC. (≡ *Raphanus tenellus* Pall.) that is reported by the red book of vascular flora of Morocco as a casual alien “Adventice” with ‘Not Applicable’ status, for this reason (Fennane 2021). This species has been sometimes confused with *Strigosella africana* (L.) Botsch. (≡ *Malcolmia africana* (L.) R. Br.) or *Hesperis laciniata* All., both native to Morocco (Dobignard & Chatelain 2010-2013; POWO, 2023). This last is characterized by purple, yellowish petals not maculated, 12–15 mm long, while the petals of *Chorispora tenella* are pale magenta to lavender (White 2013) maculated with purple at their base, 10-13 mm long (Fig.1). *Brassicaceae*, including 212 native species and about 280 taxa in Morocco, is among the top five families in terms of species richness and

endemism in this country (Fennane & al. 2023; Dobignard 2016). *Chorispora tenella* is incomprehensibly not included in the APD, POWO, and Med-Checklist databases until the writing of this paper despite it was cited before by Dobignard (2016:157) as a “new alien species” in Morocco. Given the high number of alien plants that have recently been discovered in Morocco, it appears that the alien flora is still not well known in the country (Homrani & Peltier 2020; Giardi & Homrani 2023; Sukhorukov & al. 2023; Tanji 2023). *Chorispora tenella* is one of these species that has become naturalized in Morocco.

This note is intended to discuss and illustrate the presence of *Chorispora tenella* in Morocco, as well as to provide criteria for distinguishing it from similar species present in the country.

Materials and methods

Floristic field investigations were carried out in the Anti-Atlas and High-Atlas of Morocco, from May 15 to 25, 2022, to collect plants for herbarium enrichment and study some problematic genera. The specimens collected were deposited in the herbaria of Scientific Institute of Rabat (RAB), ECWP and G (codes according to the Index Herbariorum, <https://sweetgum.nybg.org/science/ih/>). The revision of herbarium specimens and an in-depth webographic review revealed an alien plant, *Chorispora tenella*, that is more naturalized than what is supposed and sometimes confused with two other species. The list of examined specimens is presented below. Several sources and references were used to identify this taxon, including the “Flore Pratique du Maroc” (Fennane & al. 2007), “Flore de l’Afrique du Nord” (Maire 1977) “efloramaghreb” (www.efloramaghreb.org), discussion on <https://www.inaturalist.org/> and “Flora Europaea” (Tutin & al. 1964). The comparison of *Chorispora tenella* with similar species provided here is based on our herbarium vouchers and bibliographic sources. An identification key including similar-looking species is presented and discussed. Numerous references and websites were consulted for the nomenclature, mainly the “African Plant Database” (<http://africanplantdatabase.ch>) and “Plants of the World Online” (<https://powo.science.kew.org>). The illustrations were either photographed or drawn from herbarium specimens. The distribution of the taxon in Morocco is given based on the available data.

Studied material

Morocco, Draâ-Tafilalet: Taznakht, Khouzama, 2000–2500 m, coord. WGS84 30.776240, -7.617648. 17 May 2022, Obs. C. Chatelain & F. Mombrial [herb. G, CM1724 G], A Homrani Bakali [herb. INRA-Errachidia, s.n.] and in the same municipality, 2350 m, coord. WGS84 30.75394, -7.67653. 19 May 2022, Obs J.-F. Léger [herb. ECWP, s.n.].

Morocco, Marrakesh-Safi, Oukaïmeden, 2400-2700 m, 31.195767, -7.831288. 11 June 2021: Obs. A. Homrani Bakali [herb. G, RAB1145605].

Results and discussion

Distribution and habitat in Morocco

Chorispora tenella (Pall.) DC. has been observed for the first time in Morocco in the High Atlas, in Oukaïmeden (or Oukaïmedene, in Marrakesh-Safi region), in the surroundings of the Barrage Oukaïmeden and Azib Tiferguine (NB: Azib = sheep enclosure):

- Only one individual located in a small depression, on East side of Oukaimeden dam, on 5 May 2014, by J.C. Thiaudière sub “*Hesperis laciniata*” (com. pers. and Teline: <https://www.teline.fr/fr/photos/brassicaceae/hesperis-laciniata>; coordinates: 31.207742, -7.851092; elevation: 2590 m a.s.l.).
- Azib Tiferguine, 3 km ESE of Oukaimeden, on 9 June 2014, by Dobignard, who published it as a “new species for Morocco” (2016) and also on 11 June 2021, by one of us (AHB; coordinates: 31.19577, -7.83129; elevation: ±2680 m a.s.l.).
- In the manure around the azibs of Oukaimeden area, from May to June 2018, for example in the small valley behind the dam which joins the Assif (torrent) Tiferguine, by Marie Coste sub “*Hesperis laciniata*” (com. pers. and Atlasbota: <https://www.atlasbota.com/wp-content/uploads/2018/06/hesperislaciniata.pdf> – coordinates: 31.21027, -7.84301; elevation: ±2550 m a.s.l.).
- Downstream of the Oukaimeden dam, on 29 May 2022 by Aat Schaftenaar (Observation.org: <https://observation.org/observation/259513528/>; coordinates: 31.2102, -7.8511; elevation: ±2590 m a.s.l.).

We also found the plant on Siroua mountain range in two stations located in Khouzama municipality:

- Near the park Tadrart Amassine, SW of a village called Amassine (Draa-Tafilalet region), on 17 May 2022 (coordinates: 30.776240, -7.617648; elevation: 2500 m a.s.l.) in grazed meadows (Fig. 1 & 2).
- Near the Assif Tadmant, south of the place called Ikouchchal, on 19 May 2022 (coordinates: 30.75394, -7.67653; elevation 2350 m a.s.l.), in a livestock resting place under a small cliff.



Fig. 1. *Chorispora tenella*: A. plants, B. leaves, C. flowers, D. fruits, from Tadrart Amassine-Siroua (17.05.2022, A. Homrani Bakali and F. Mombrial).

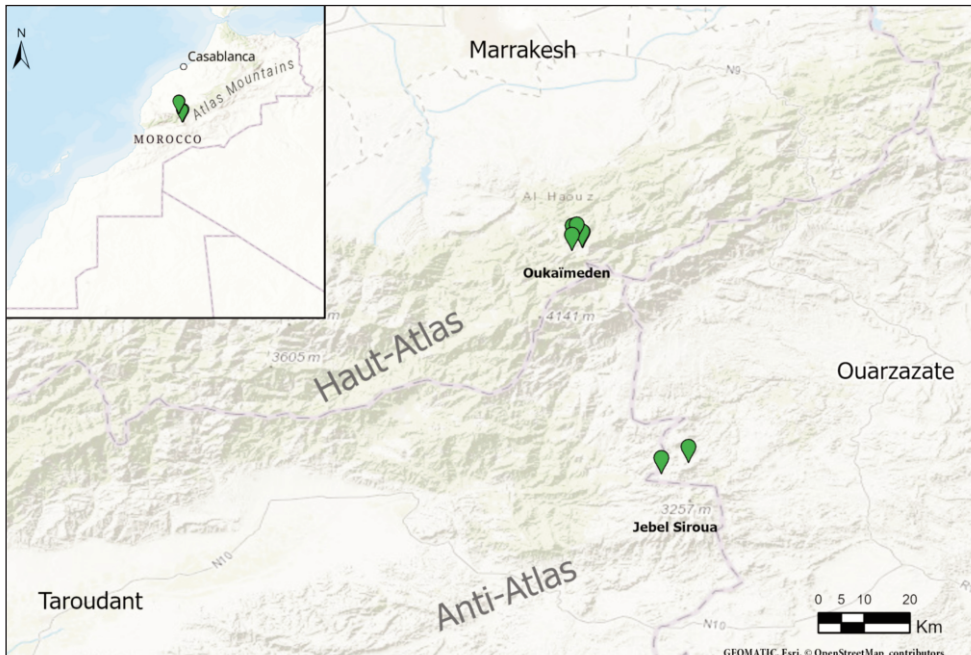


Fig. 2. Distribution map of *Chorispora tenella* in Morocco.

It is difficult to know how *Chorispora tenella* arrived in Morocco and at such high elevations. Dobignard (2016) assumes that this species, which has gone unnoticed until recently, is of “very old introduction”, given the natural environments where it has been spotted. Nevertheless, it is astonishing that no botanist has observed this species until recently in the upper Oukaimeden valley, a site that has historically been extensively prospected. M. Coste (com. pers.) has been visiting the location for decades, but she has never observed this species before recent years, then it became increasingly abundant in the manure around the azibs.

We are therefore led to propose that *Chorispora tenella* was introduced in Morocco recently, either by tourists (both locations above are visited by many tourists) or, more probably from our standpoint, through the importation of cereals to feed livestock or to be sowed around azibs to produce forage. However, we do not know if the plant has been transported from one site to another (from High Atlas to Anti-Atlas), if that is the case.

In all its Moroccan sites, *C. tenella* behaves as a ruderal, nitrophilous species, which thrives in areas over-fertilized by livestock or near manure heaps, at high elevation. A ruderal and nitrophilous ecology is fairly common among alien plant species, which take advantage of habitats disturbed by man, but the high elevation of the locations *C. tenella* colonizes in Morocco is remarkable. According to the information gathered here, and in particular its Oukaimeden population, which has spread over an area around 3 km long in just around 10 years, this is definitely an invasive species in Morocco, according to Richardson & al. (2000).

General distribution

Chorisporea tenella is a plant of temperate Asia including the Irano-Turanian region” and introduced in many countries including Morocco (cf. POWO 2023).

Similar-looking species

In Morocco, *Chorisporea tenella* can be confused with *Hesperis laciniata* and *Strigosella africana*. The three species are phylogenetically related genera (Beilstein & al. 2006; Mandáková & al. 2017). Hereafter, a figure (Fig. 3) and a key to differentiate *Chorisporea tenella* from *Hesperis laciniata* and *Strigosella africana*.

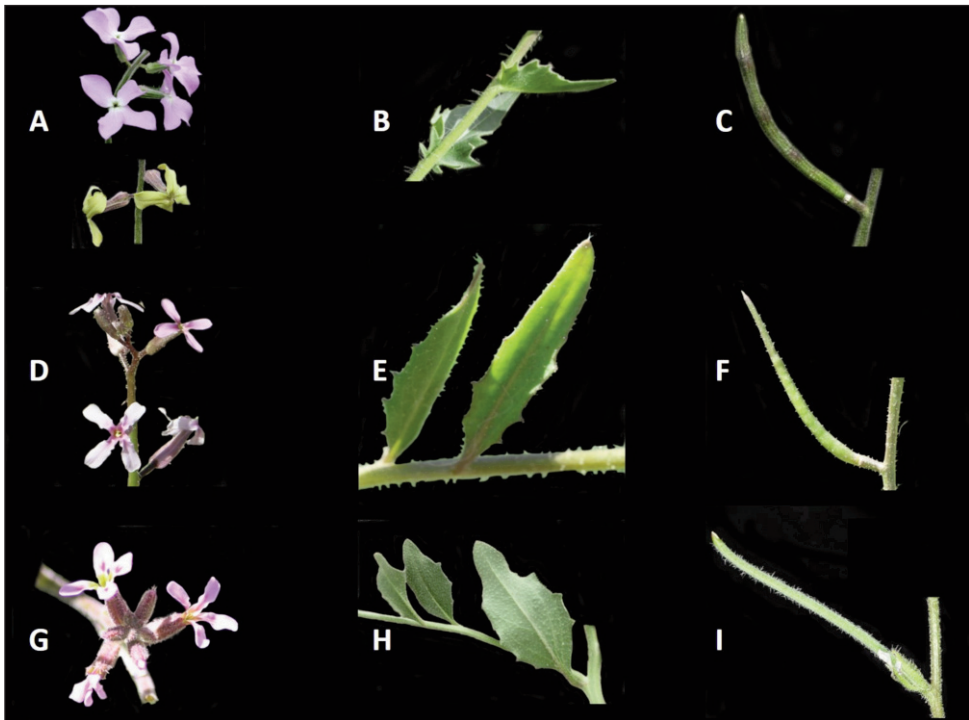


Fig. 3. Flower, cauline leaves and siliques of *Hesperis laciniata* (A, B, C), *Chorisporea tenella* (D, E, F) and *Strigosella africana* (H, I, J) (Photos of *Hesperis laciniata* are modified from pictures taken from flora-on.pt and atlasflore04.org).

- 1. Simple or stellate trichomes; Cauline leaves petiolate; Flowers lilac, violet, or pinkish, rarely whitish, maculated or not with purple, sepals <5 mm, the laterals ones not saccate; Siliques, 4–7 cm long, quadrangular, not torulose, often straight, rarely curved
1. *Strigosella africana*

2. Sparsely glandular sometimes with simple multiseriate trichomes; Leaves with decurrent limb, upper cauline leaves from short petiolate to sessile; Flowers pale magenta to lavender maculated with dark purple at their base, sepals 6–8 mm long, the inner ones saccate at base; Siliques 2–4 cm long, often curved upwards, slightly torulose, long-beaked, breaking into corky units**2. *Chorispora tenella***
3. Simple or branched, uniseriate rough hairs; Cauline leaves sessile; Flowers yellowish or purple not maculated, sepals >8 mm, the laterals ones saccate at base; Siliques 4–14 cm long, torulose, glandular, not breaking into corky units**3. *Hesperis laciniata***

Conclusion

Thanks to these records, *Chorispora tenella* can now be considered as naturalized in Morocco, after having been mentioned as an adventive by Fennane (2021). In Africa, this species was previously known only from Algeria, where it was mentioned probably for the first time by Ducellier & Maire (1923), at Oran, as a weed, but it did not persist there (Maire 1977). Then, it was identified in Oukaimeden in 2014 by Dobignard (2016) as new for Morocco. Further field investigations especially in the Moroccan mountains would be useful to gain a better understanding of its distribution and invasiveness.

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References

- Al-Shehbaz, I. A., German, D. A., Mummenhoff, K. & Moazzeni, H. 2014: Systematics, tribal placements and synopses of the *Malcomia* s.l. segregates (*Brassicaceae*). – Harvard Univ. Herb. **19(1)**: 53-71.
- African Plant Database 2023: African Plant Database (version 3.4.0). – <https://www.ville-ge.ch/mus-info/bd/cjb/africa> [accessed 15 November 2023]
- Beilstein, M. A., Al-Shehbaz, I. A. & Kellogg, E. A. 2006: *Brassicaceae* phylogeny and trichome evolution. – Amer. J. Bot. **93**: 607-619. <https://doi.org/10.3732/ajb.93.4.607>
- Dobignard, A. 2016: - Iter maroccanum 2014. Compte rendu de la 49e session extraordinaire de la Société Botanique du Centre-Ouest dans le Grand Atlas marocain. – Evaxiana **2**: 107-252.
- Ducellier, L. & Maire, R. 1923: Végétaux adventices observés dans l’Afrique du Nord. – Bull. Soc. Hist. Nat. Afr. N. **14(8)**: 304-325.
- Fennane, M. 2021: Livre rouge de la flore vasculaire du Maroc. – Trav. Inst. Sci. (Rabat), Sér. Bot., Num. Spécial. **1-12**: 1-750.
- , Ibn Tattou, M. & El Oualidi, J. (eds) 2014: Flore Pratique du Maroc, **3** (Série Botanique, 40). – Trav. Inst. Sci., Université Mohammed V, Rabat: 1-793.

- , —, —, Taleb, M. S., Benkhniq, O., Khamar, H. & Moujahdi, C. 2023: Floristic research in Morocco: achievements and future trends. – *Fl. Medit.* **33**: 5-16. <https://doi.org/10.7320/FIMedit33.005>
- , —, M., Ouyahya, A. & El Oualidi, J. (eds) 2007: Flore Pratique du Maroc, **2** (Série Botanique, 38). – Trav. Inst. Sci., Université Mohammed V, Rabat.
- Giardi, L. & Homrani, B. H. 2023: *Maireana brevifolia* (*Chenopodiaceae*), an Australian xenophyte established recently in southeastern Morocco. – *Collect. Bot.* **42**: e009. <https://doi.org/10.3989/collectbot.2023.v42.009>
- Homrani, B. A. & Chatelain, C. 2023: *Phlomis lychnitis* (*Lamiaceae*), an addition to the flora of Africa from Morocco. – *Collect. Bot.* **42**: e004. <https://doi.org/10.3989/collectbot.2023.v42.004>
- & Peltier, J. P. 2020: *Senna alexandrina* Mill. xénophyte tropical signalé pour la première fois au Maroc. – *Al Yasmina* **13**: 1-7.
- Mandáková, T., Hloušková, P., German, D. A. & Lysak, M. A. 2017: Monophyletic origin and evolution of the largest Crucifer genomes. – *Pl. Physiol.* **174**: 2062-2071. <https://doi.org/10.1104/pp.17.00457>
- Maire, R. 1977. Flore de l'Afrique du Nord (Maroc, Algérie, Tunisie, Tripolitaine, Cyrénaïque et Sahara), **14**. – Paris.
- POWO [Plants of the World Online] 2023: *Chorispora tenella* (Pall.) DC. <https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:281254-1> [Accessed 7/9/2023]
- Richardson, D. M., Pysek, P., Rejmanek, M., Barbour G. M., Dane-Panetta F. & West, C. J. 2000. Naturalization and invasion of alien plants: Concepts and definition. – *Divers. Distrib.* **6**: 93-107. <http://dx.doi.org/10.1046/j.1472-4642.2000.00083.x>
- Sukhorukov, A. P., Léger, J.-F. & Chambouleyron, M. 2023: Two new species alien to the flora of Morocco: *Amaranthus spinosus* (*Amaranthaceae*) and *Cardamine occulta* (*Brassicaceae*). – *Fl. Medit.* **33**: 31-38. <https://doi.org/10.7320/FIMedit33.031>
- Tanji, A. 2023: Two new annual weeds in Morocco: *Amaranthus palmeri* and *Chenopodium ficifolium* subsp. *ficifolium* (*Amaranthaceae*). – *Fl. Medit.* **33**: 91-99. <https://doi.org/10.7320/FIMedit33.031>
- Tutin, T. G., Heywood, V. H., Burges, N. A., Valentine, D. H., Walter, S. M. & Webb, D. A. (eds) 1964: *Flora Europaea*, **1**. – Cambridge.
- White, M. R. (ed.). 2013: *Invasive Plants and Weeds of the National Forests and Grasslands in the Southwestern Region*. MR-R3-16-6. – Albuquerque.

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