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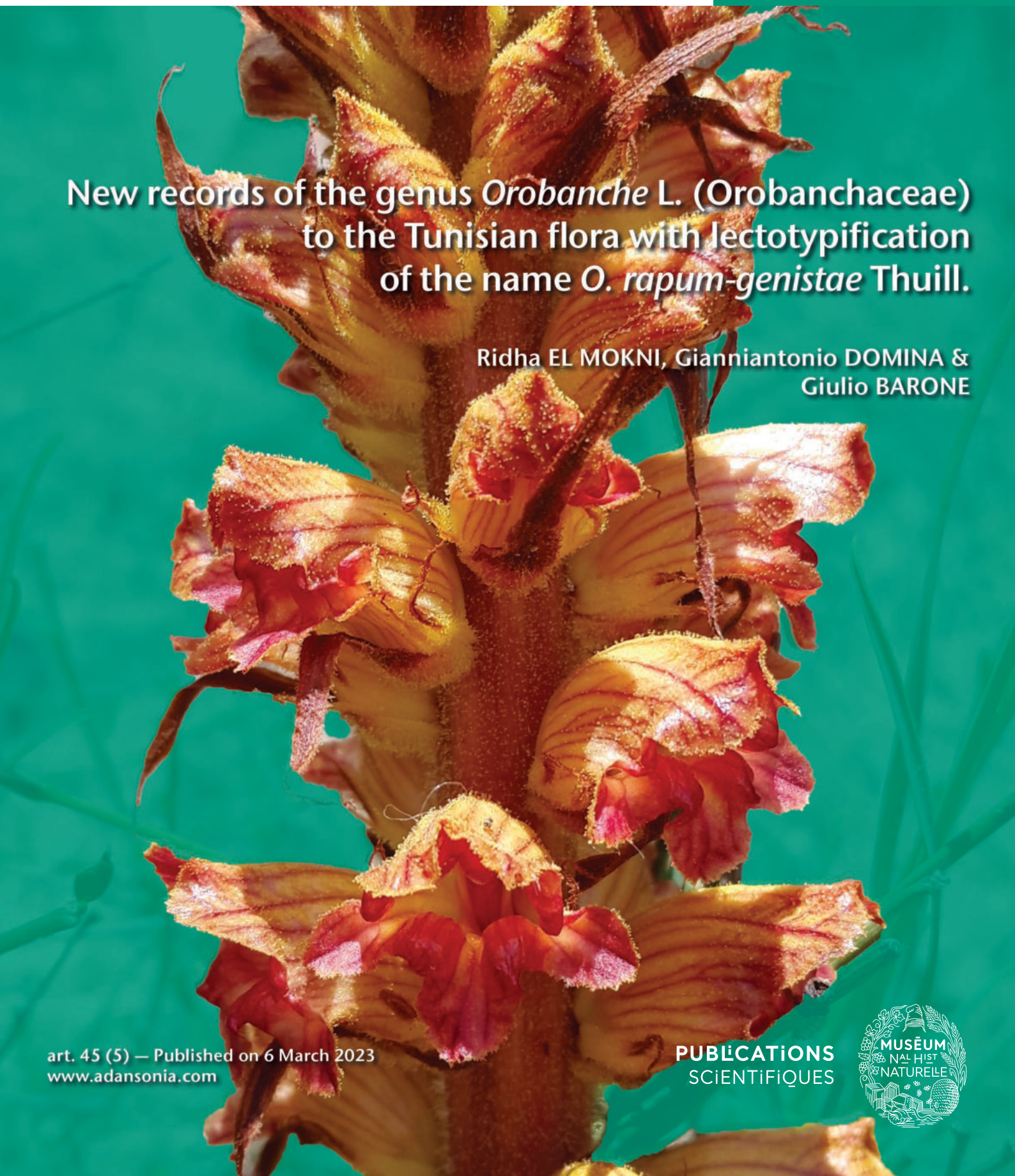

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New records of the genus *Orobanche* L. (Orobanchaceae) to the Tunisian flora with lectotypification of the name *O. rapum-genistae* Thuill.

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ABSTRACT
Based on several field surveys and on the study of original material, we have identified three new species of *Orobanche* L. *s.s.* (Orobanchaceae) new to the flora of Tunisia. *Orobanche alba* Willd., *O. calendulae* Pomel, and *O. gracilis* Sm. are reported as new for the country, and the occurrence of *O. rapum-genistae* Thuill. is confirmed. The lectotypification of *O. rapum-genistae* is here proposed with a specimen housed in Genève (G). The geographical distribution of the four taxa in Tunisia is given, and details of habitats and hosts are provided. Altogether, the genus *Orobanche* in Tunisia now includes 18 species; a dichotomous key is proposed to facilitate the identification of these taxa.

KEY WORDS
Chorology, broomrapes, nomenclature, North Africa, parasitism, lectotypification, new records.

RÉSUMÉ
Nouveaux signalements du genre Orobanche *L. (Orobanchaceae) dans la flore tunisienne avec lectotypification du nom* O. rapum-genistae *Thuill.*
Sur la base de nombreux inventaires de terrain et de l'étude du matériel original, nous avons identifié trois espèces d'*Orobanche* L. *s.s.* (Orobanchaceae). *Orobanche alba* Willd., *O. calendulae* Pomel et *O. gracilis* Sm. sont nouvelles pour la flore de la Tunisie, et la présence d'*O. rapum-genistae* Thuill. est confirmée. Nous proposons la lectotypification de *O. rapum-genistae* avec un spécimen hébergé à Genève (G). La distribution géographique des quatre taxons en Tunisie est donnée, des détails sur leurs habitats et leurs plantes-hôtes sont également fournis. Au total, le genre *Orobanche* en Tunisie comprend 18 espèces ; une clé dichotomique est proposée pour faciliter l'identification des différents taxons.

MOTS CLÉS
Chorologie, orobanches, nomenclature, Afrique du Nord, parasitisme, lectotypification, signalements nouveaux.

INTRODUCTION

Tunisian holoparasitic plants belong to several families such as the Cuscutaceae Dumort. (*Cuscuta* L.), the Cynomoriaceae Endl. ex Lindl. (*Cynomorium* Micheli), some Orchidaceae Juss. (*Limodorum* Boehmer and *Neottia* Sw.), the Rafflesiaceae Dumort. (*Cytinus* L.) and the Orobanchaceae Vent. with three genera (*Cistanche* Hoffmanns. & Link, *Orobanche* L., and *Phelipanche* Pomel). *Orobanche* has one of its most important centre of diversity in the Mediterranean region (Plaza *et al.* 2004; Pusch & Gunther 2009) and is the largest genus among the Tunisian holoparasitic plants with 14 species reported so far (Pottier-Alapetite 1981; Domina & Raab-Straube 2010; Dobignard & Chatelain 2013; El Mokni *et al.* 2015, 2016).

In this paper the authors provide further results from their intensive field investigations in Tunisia since 2010 which were related, among others, to holoparasitic Orobanchaceae and to the genus *Orobanche* (e.g. Domina 2011; Pavon & Véla 2011; El Mokni *et al.* 2015; El Mokni & Domina 2019, 2020). Repeated field prospections within coastal and inland areas have led to the discovery of interesting populations often of few individuals including some new records for the Tunisian flora.

MATERIAL AND METHODS

Our work is based on extensive field surveys, an analysis of the literature, and the examination of specimens kept in the herbaria B, G, LE, MPU, P, PAL, and PAL-Gr (acronyms according to Thiers 2022). Further specimens are preserved in the personal collection of REM deposited in the herbarium of the Faculty of Pharmacy of Monastir (not yet listed in Index Herbariorum). Identification was done by comparison with original material of the names considered. The nomenclature mostly follows recent sources (Domina & Raab-Straube 2010; APD 2022; POWO 2022-onward). On the basis of the morphological characters observed on Tunisian populations a dichotomous key to the 18 species of *Orobanche s. str.* occurring in the country is here proposed to facilitate the identification of taxa.

RESULTS

Family Orobanchaceae Vent.
Genus *Orobanche* L.

1. ***Orobanche alba*** Stephan ex Willd.

Species Plantarum, ed. 4, 3: 350 (Willdenow 1800).

Lectotype. — Designated by Piwowarczyk *et al.* 2019: 67, (B[B-W11600 -03 0]!).

General distribution. — The native range of this species extends from W Mediterranean to C Himalaya, SE Tibet to China (NW Sichuan) (POWO 2022-onward). In North Africa this species is already reported from Morocco and Algeria (Dobignard & Chatelain 2013; APD 2022), this is its first record from Tunisia.

Distribution in Tunisia. — Along the northern coast of Bizerta, Cap-Blanc (NE Tunisia).

Hosts in Tunisia. — Collected on *Thymbra capitata* (L.) Cav. (Fig. 1).

Habitat. — Calcareous loamy soils within coastal stony slopes.

Flowering period. — Early May to June.

Specimen seen. — **Tunisia**. Bizerta-North (Bizerta), 37°19'57"N, 009°51'43"E, 15 m a.s.l., 9.V.2018, *R. El Mokni s.n.* (Herb. Univ. Monastir).

2. ***Orobanche calendulae*** Pomel

Bulletin de la Société des Sciences physiques, naturelles et climatologiques de l'Algérie 11: 110 (Pomel 1874).

Lectotype. — Designated by Domina *et al.* 2013: 761, MPU[MPU004862]photo!; isolecto-, (P[P00102804]photo!).

General distribution. — This species is native to the Iberian Peninsula (S Portugal to SW Spain) and North Africa from the Canary Islands and Madeira to Morocco and Algeria (Domina & Raab-Straube 2010; Domina *et al.* 2013; Dobignard & Chatelain 2013; APD 2022; POWO 2022-onward). In Tunisia it is here reported for the first time.

Distribution in Tunisia. — Along the northern coast of Tabarka, Melloula-Larmèel (NW Tunisia).

Hosts in Tunisia. — Collected on *Calendula suffruticosa* Vahl.

Habitat. — Grassy slopes with clayey soils, on sunny places.

Flowering period. — April to May.

Specimina visa. — **Tunisia**. Tabarka (Jendouba), 36°57'35"N, 008°45'04"E, 20 m a.s.l., 5.VI.2021, *R. El Mokni s.n.* (Herb. Univ. Monastir).

3. ***Orobanche gracilis*** Smith

Transactions of the Linnean Society of London 4: 172 (Smith 1798).

Lectotype. — Designated by Foley 2001: 231, Herb. Smith 1087.11 (no. 1 LINN photo!).

General distribution. — The range of this species extends almost continuously throughout the Mediterranean area in southern Europe from the Iberian Peninsula in the west to the Black Sea coast in the east, including Anatolia and the Caucasus Mountains. In the North it reaches France, Switzerland, Germany, Austria, and South West Slovakia (Kreutz 1995; Zázvorka 1997; Pusch *et al.* 2001; Sánchez Pedraja *et al.* 2005; Domina & Arrigoni 2007; Domina & Raab-Straube 2010). In North Africa, it occurs in Morocco and Algeria (Domina & Raab-Straube 2010; Dobignard & Chatelain 2013), it is here the first record for the Tunisian flora.

Distribution in Tunisia. — Pine forests of Le Kef, area of 'Dir' (NW Tunisia).

Hosts in Tunisia. — On *Cytisus laniger* DC. (Fig. 2) and *Genista cinerea* (Vill.) DC. (Fig. 3). The individuals growing on *Genista cinerea* have the characters used to distinguish *O. gracilis* var. *deludens* (Beck) A. Pujadas (synonym *O. austrohispanica* M. J. Y. Foley) the corolla keeled along dorsal line, reddish veined, pale coloured corollas lacking the shiny red interior typical of *O. gracilis s.s.* and almost glabrous filaments (Román *et al.* 2007). As already noted for

Fig. 1. — *Orobanche alba* Willd. in north-eastern Tunisia: **A**, habit of a flowering plant in its natural habitat parasiting on *Thymbra capitata* (L.) Cav.; **B**, **C**, details of inflorescence and closed flowers. Photographs: R. El Mokni, 9.V.2018.

Fig. 2. — *Orobanche gracilis* Sm. in north-western Tunisia: **A**, habit of a flowering plant in its natural habitat parasiting on *Cytisus laniger* DC.; **B**, details of scales, inflorescence and opened flowers. Photographs: R. El Mokni, 30.IV.2019.

Fig. 3. — *Orobanche gracilis* Sm. in north-western Tunisia: **A**, habit of a flowering plant in its natural habitat, parasiting on *Genista cinerea* (Vill.) DC.; **B**, details of scales, inflorescence and opened flowers. Photographs: R. El Mokni, 30.IV.2019.

FIG. 4. — *Orobanche rapum-genistae* Thuill. The specimen G[G00396694] here designated as the lectotype of the name. Credits: Conservatoire et Jardin botaniques de la ville de Genève.

Identification key of *Orobanche* L. species

1. Corolla with reddish or brown glandular hairs ..... *Orobanche alba* Willd.
— Corolla without dark glandular hairs 2

2. Corolla inflated under the stamen insertion, narrowed distally 3
— Corolla of the same diameter throughout, or slightly widened distally 5

3. Corolla yellow with purple veins; calyx teeth linear; stigma yellow or white ..... *O. hederae* Duby
— Corolla lavender; calyx teeth triangular; stigma pale violet 4

4. Plant 10-30 cm tall, inflorescence dense, corolla 15-18 mm long, anthers glabrous ..... *O. cernua* L.
— Plant 35 or more cm tall, inflorescence lax, corolla 19-22 mm long, anthers hairy ..... *O. cumana* Wallr.

5. Calyx teeth linear, twice as long as the tube 6
— Calyx teeth triangular, long at most, a little more than the tube 9

6. Corolla distally dark red ..... *O. foetida* Poir.
— Corolla whitish or yellowish with violet veins 7

7. Corolla lips curved outwards ..... *O. crenata* Forssk.
— Corolla lips straight 8

8. Corolla lobes with entire margin ..... *O. artemisiae-campestris* Gaudin
— Corolla lobes crenulate ..... *O. calendulae* Pomel

9. Corolla > 20 mm long 10
— Corolla < 20 mm long 12

10. Dorsal line of the corolla regularly curved ..... *O. rapum-genistae* Thuill.
— Dorsal line of the corolla strongly curved near the base, almost straight distally 11

11. Middle lobe of the lower corolla lip larger than the lateral lobes ..... *O. variegata* Wallr.
— Middle lobe of the lower corolla lip smaller than or subequal to the lateral lobes ..... *O. gracilis* Sm.

12. Corolla geniculate above the base ..... *O. amethystea* Thuill.
— Corolla with dorsal line regularly curved 13

13. Corolla narrow (width / length = 0.2), distally red; stem bracts linear 14
— Corolla wider (width / length ≥ 0.25), distally whitish with violet veins; stem bracts triangular 15

14. Corolla lips straight, throat rounded ..... *O. sanguinea* C. Presl
— Corolla lips curved outwards, throat flattened ..... *O. densiflora* Bertol.

15. Spike dense, with ± contiguous flowers ..... *O. litorea* Guss.
— Spike lax, with clearly spaced flowers 16

16. Corolla woolly on the upper lip; style pubescent ..... *O. pubescens* d'Urv.
— Corolla glabrous or hairy; style subglabrous 17

17. Flowers erecto-patent; filaments densely hairy at the base ..... *O. canescens* C. Presl
— Flowers patent; filaments scarcely hairy at the base ..... *O. minor* Sm.

Orobanche crenata Forrsk. (Domina 2018) this kind of variability of the parasite could be influenced by the different hosts.

Habitat. — On roadsides and edges within pine forests, on clayey soils of sunny places.

Flowering period. — April to May.

Specimen seen. — **Tunisia**. *Orobanche gracilis* var. *gracilis*, Le Kef North, 36°10'14"N, 008°43'55"E, 625 m a.s.l., on *Cytisus laniger*, 30.IV.2019, *G. Domina & R. El Mokni s.n.* (PAL, Herb. Univ. Monastir). — *O. gracilis* var. *deludens*, Le Kef North, 36°10'14"N, 008°43'55"E, 625 m a.s.l., on *Genista cinerea*, 30.IV.2019, *R. El Mokni s.n.* (Herb. Univ. Monastir).

4. ***Orobanche rapum-genistae*** Thuill.

La Flore des environs de Paris, ed. 2.: 317 (Thuillier 1799).

Lectotype. — **France**. "Environs de Paris", s.d., *J. L. Thuillier s.n.* (lecto-, designated here, G[G00396694]photo!) (Fig. 4).

Note

Beck-Mannagetta (1930) reports: "vidi spec. orig. in Herb. Petrop." The study of the herbarium samples preserved in LE resulted in only one specimen from Paris [LE01148356]

photo! coming from the herbarium of Ledebour which has no direct connection with Thuillier and therefore cannot be considered original material. A specimen was found in P[P04384660]photo! with a label bearing the name of the species and the indication "Herb. Thuillier" but without place of collection and date. Another specimen has been found in G[G00396694]photo! that the imprinted label authenticates as coming from the Thuillier herbarium. It was so labeled when included in the Delessert collection). This label demonstrates that it is one of the originals used for the Flora of Thuillier. On fact Thuillier's collections were purchased in 1827 by the banker Benjamin Delessert and transferred to Geneva (Lasègue 1845). In addition, the specimen in G is more abundant, better preserved and more complete. Therefore, we chose the specimen G[G00396694] as the lectotype of *O. rapum-genistae* Thuill. It includes two complete individuals and the basal portion of another one. The lectotype designated here matches the protologue and corresponds to the current application of the name.

General distribution. — This species occurs from North West Europe to West and Central Mediterranean area including North Africa (POWO 2022-onward). Its presence in Tunisia has not been reported by Pottier-Alapétite (1981) and it is considered doubtful in Le Floc'h *et al.* (2010) and in APD (2022). We here confirm its occurrence.

Distribution in Tunisia. — Aîn Draham (Jendouba), area of 'Coll des Ruines' (NW Tunisia).

Hosts in Tunisia. — Observed on *Cytisus villosus* Pourr.

Habitat. — Within oak forests, on acidic soil of stony slopes.

Flowering period. — May to early August.

Specimen seen. — **Tunisia**. Aîn Draham (Jendouba), 36°47'01"N, 08°41'06"E, 775 m a.s.l., 4.VIII.2018, *R. El Mokni s.n.* (Herb. Univ. Monastir).

DISCUSSION

These new records suggest that targeted exploration could lead to the discovery of additional populations and of further taxa previously confused with others. Detailed distribution data will bring useful knowledge to the biology and to the conservation of many taxa which have the southern limit of their distribution in North Africa. The check of original materials of the names has highlighted the lack of the type of *O. rapum-genistae* Thuill., an unknown gap which has been filled here.

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