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New records of Asteraceae for the non-native flora of Tunisia and north Africa with some nomenclatural remarks

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Abstract. Sixteen new Asteraceae are added to the non-indigenous flora of Tunisia. Six of them (*Dimorphotheca ecklonis*, *Gaillardia pulchella*, *Gazania linearis* var. *linearis*, *Guizotia abyssinica*, *Rudbeckia triloba* and *Tithonia diversifolia*) are also new for the flora of North Africa. *Chrysanthemum morifolium* is here first reported for the Mediterranean Basin. Seven genera (*Argyranthemum*, *Bidens*, *Dimorphotheca*, *Gaillardia*, *Guizotia*, *Rudbeckia* and *Tithonia*) are recorded for the first time for the vascular flora of Tunisia. Most of these species escaped from gardens and pots and became casual along roadsides and/or disturbed areas after cypselae dispersion (except for *Chrysanthemum morifolium*). Some species, even though appearing to be well established locally and are potentially invasive at a worldwide level, still do not behave so in Tunisia. In addition to the floristic notes, the typification of the names *Dimorphotheca ecklonis*, *Gorteria linearis* and *Mirasolia diversifolia* are discussed.

Keywords. Asteroideae, alien flora, Cichorioideae, Compositae, naturalization, typification.

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Introduction

The northern African flora is very rich and highly diverse due to the presence of Mediterranean, Saharan, and Macaronesian floristic elements (White, 1983). Before human settlement, the landscape was mainly dominated by evergreen deciduous and coniferous forests. The most fertile lowlands have been used for agriculture since Roman times and the plant climax communities are nowadays confined to restricted patches. Agriculture along with the non-controlled importation of seeds and the introduction of ornamental plants have favored over time the installation of many non-native plants (El Mokni pers. obs.; see e.g., El Mokni *et al.*, 2012; El Mokni, 2020a).

The present contribution is aimed at updating and improving the knowledge on the non-native vascular flora of Tunisia and North Africa (see e.g., El Mokni *et al.*, 2019; El Mokni, 2020b; El Mokni & Domina, 2020;

El Mokni & Iamónico, 2020; Iamónico & El Mokni, 2020; El Mokni & Verloove, 2021), specifically on the Asteraceae family (see e.g., El Mokni & Domina, 2017; El Mokni & Véla, 2017; Iamónico & El Mokni, 2017; El Mokni & Iamónico, 2018).

Material and methods

This work is based on field botanical surveys carried out by the first author (REM) in Tunisia over several years and the revision of relevant literature. Collected specimens are deposited at the Herbarium of Monastir University (not listed in Index Herbariorum) and RO.

The taxa are presented in alphabetical order (taxonomic treatment according to Greuter, 2006+) and the global distribution, distribution in Tunisia, and habitats are reported for each one. The assessment of the degree of naturalization is based on various sources

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(see e.g., Richardson *et al.*, 2000; Occhipinti-Ambrogi & Galil, 2004; Pyšek *et al.*, 2004; Richardson & Pyšek, 2006). When other species of the same genus are already known from Tunisia, a dichotomous key is provided. If necessary, taxonomic notes are also given.

Types of the studied names are also reported and the articles cited throughout the text refer to the *Shenzhen Code* (Turland *et al.*, 2018, hereafter ICN). The digital images in the herbaria BM, G, LINN, M, P, SBT, and UPS were consulted (acronyms according to Thiers, 2021 [continuously updated]).

Results and discussion

Ambrosia artemisiifolia L., Sp. Pl. 2: 988. 1753.

Lectotype [designated by Hind *et al.*, 1993: 214]: *Habitat in Virginia, Pennsylvania*, Herb. LINN no. 1114.4 (LINN!, image of the lectotype available at <http://linnean-online.org/11621/>).

Distribution and habitat. *Ambrosia artemisiifolia* (Ambrosiaceae Cass.) is an annual herbaceous plant native to North America and considered as one of the most invasive species in Europe (Lambdon *et al.*, 2008) where it was originally introduced in the 18th century through botanical gardens (Bullock *et al.*, 2012), becoming naturalized from the 1930s onwards (Brandes & Nitzsche, 2006; Chauvel *et al.*, 2006). The spreading process accelerated from the 1960s and since the 1990s it became invasive (Essl *et al.*, 2015). Concerning North Africa, the plant was known so far as naturalized alien in Egypt and as casual in Algeria and Morocco, whereas it is doubtfully present in Lybia (Greuter, 2006+). No records from Tunisia were published until now (see e.g., Dobignard & Chatelain, 2011: 145; APD, 2020; GBIF, 2020). Our finding represents the first record of this species in Tunisia.

Taxonomic notes. *Ambrosia artemisiifolia* is morphologically similar to *A. acanthicarpa* Hook. (not known in the Mediterranean area; Greuter, 2006+; Dobignard & Chatelain, 2011: 145; APD, 2020) but differs in staminate capitula diameter, bur length, and number and length of bur spines (Strother, 2006a). Compared to *A. maritima* L., which is the only *Ambrosia* species occurring along the Tunisian coast (from Bizerta in the NE to Tozeur in the SW), *A. artemisiifolia* differs in cypselae length, shape, and indumentum (2.0–4.0 mm, widely obconic, ± puberulent vs. 3.0–3.5 mm, subglobose to ovoid, glabrous), cypselae spines (4–12, generally blunt, ± vestigial vs. 5–7 horn-like appendages around the middle), and number of florets per capitulum (5–8 vs. 8–20) (see e.g., Pottier Alapetite, 1981; Boulos, 1999; Keil, 2012a).

Key to species of *Ambrosia* occurring in Tunisia

1. Plant green, hirsute, with bulbous-based hairs, not aromatic; leaves pinnatifid to pinnatifid; staminate capitula in ± lax racemose synflorescence 8–14 cm long; florets 5–8 *A. artemisiifolia*

1. Plant grey, villose-canescens, aromatic; leaves 1–2-pinnatisect; staminate capitula in ± dense spicate synflorescences 2–6 cm long; florets 8–20 *A. maritima*

Examined specimen. Tunisia, Tabarka (Houamdia, NW Tunisia), WGS84 36°54'39"N, 8°46'17"E, 20 m a.s.l., 23 April 2012, R. El Mokni *s.n.* (Herb. Univ. Monastir!, RO!).

Argyranthemum frutescens (L.) Sch.Bip. subsp. *frutescens*, Hist. Nat. Iles Canaries 3(2,2): 264. 1844 ≡ *Chrysanthemum frutescens* L., Sp. Pl. 2: 887. 1753.

Lectotype [designated by Humphries, 1976a: 181]: *Herb. Clifford*: 417, *Chrysanthemum* 5 (BM000647217!), image of the lectotype available at <https://data.nhm.ac.uk/object/0333ed44-fcf8-431d-a93c-c458652c7ea5/1603929600000>.

Distribution and habitat. *Argyranthemum frutescens* (Anthemideae Cass.), known as Paris daisy, marguerite or marguerite daisy, is a sub-shrub (about 61–91 cm high) known for its very fragrant flowers. It is native to the Canary Islands, Spain (Humphries, 1976a). It is also widely cultivated as an ornamental in private gardens and public parks in many countries. The species is catalogued as a weed by Randall (2003). In Europe, the plant is cultivated in Portugal, France, and Sicily, and it is a casual alien in Italy, Sardinia and Corse (Greuter, 2006+; Galasso *et al.*, 2018). It is also cited as naturalized alien in New Zealand (Webb, 1987) and in southern California (Calflora, 2021). In North Africa, the plant was known so far as cultivated in Lybia and Morocco (Greuter, 2006+; Dobignard & Chatelain, 2011). It is here recorded for the first time in Tunisia, where it grows on palm trees of Bizerta (Figure 1A–B) and in some irrigated public gardens, sidewalks, and disturbed areas near wetlands in the Monastir region.

Taxonomic notes. *Argyranthemum frutescens* is morphologically similar to *A. coronopifolium* (Willd.) Humphries (endemic to the Canary Islands). In comparison with *A. frutescens*, *A. coronopifolium* has more deeply dissected leaves, narrower petioles, smaller capitula, and generally shorter cypselae (Humphries, 1976b).

Examined specimens. Tunisia, Bizerta (Route Bella Plage, NE Tunisia), WGS84 37°16'11.76"N, 9°52'32.43"E, 5 m asl, 23 April 2012, R. El Mokni *s.c.* (Herb. Univ. Monastir!); Monastir (La Medina, CE Tunisia), WGS84 35°46'32.82"N, 10°49'53.32"E, 15 m asl, 8 April 2012, *Errol Vela* & R. El Mokni *s.c.*; Monastir (Route Sousse, CE Tunisia), WGS84 35°46'24.42"N, 10°46'34.66"E, 0–1 m asl, 28 April 2015, R. El Mokni *s.n.* (Herb. Univ. Monastir!); Mahdia, Mahdia city (CE Tunisia), WGS84 35°32'48"N, 11°01'14"E, 15 m asl, 15 December 2019, R. El Mokni *s.n.* (Herb. Univ. Monastir!).



Figure 1. A–B, *Argyranthemum frutescens* subsp. *frutescens* as an epiphytic weed on palm tree in the north-eastern of Tunisia; A, habit and habitat; B, capitula in bloom; C–D, *Calendula officinalis* as casual weed on the centre-eastern coast of Tunisia within a stream water; C, habit and habitat; D, capitulum in bloom; E–G, *Bidens pilosa* on roadsides in the centre-east of Tunisia; E, cypselae; F, habit of the plant during fruiting period, G, cauline leaves. Photos by Ridha El Mokni.

Artemisia absinthium L., Sp. Pl. 2: 848. 1753.

Lectotype [designated by Ling in Jarvis & Turland, 1998: 353]: *Herb. Clifford*: 404, *Artemisia* 7 (BM000647029!), image of the lectotype available at <https://data.nhm.ac.uk/object/e6081d5d-da84-47ae-8a0d-78f594f008f0/1603929600000>).

Distribution and habitat. *Artemisia absinthium* (Anthemideae Cass.) is a perennial herb, growing up to 70(–150) cm tall and developing abundantly branching shoots. It is native to Eurasia and some areas of North Africa. Nowadays, the plant is more widespread and occurs in other continents, mostly due to cultivation

(Maw *et al.*, 1985; Gams, 1987). In Tunisia, this taxon was formerly planted and has become locally common through the lowlands.

Taxonomic notes. *Artemisia absinthium* is morphologically similar to *A. arborescens* L. from which it differs by the unpunctuated leaves (*vs.* more or less punctate), the petiolate with auriculate petiole (*vs.* non-auriculate), and the labrous corolla with glandular cypselae (*vs.* not glandular) (Quézel & Santa, 1963).

Examined specimens. Tunisia, Jendouba (Fernana, NW Tunisia), WGS84 36°39'43"N, 8°41'15"E, 295 m asl, 23 April 2006, R. El Mokni *s.n.* (Herb. Univ. Monastir!); Bizerta (Sejnane, NE Tunisia), WGS84 37°02'09"N, 9°17'36"E, 195 m a.s.l., 8 May 2012, R. El Mokni *s.n.* (Herb. Univ. Monastir!); Zaghuan (El Fahs, NE Tunisia), WGS84 36°16'10"N, 9°36'30"E, 475 m asl, 29 April 2019, R. El Mokni *s.n.* (Herb. Univ. Monastir!).

***Bidens pilosa* L., Sp. Pl. 2: 832. 1753.**

Lectotype [designated by D'Arcy in Woodson & Schery, 1975: 1178]: *Habitat in America*, Herb. LINN no. 975.8 (LINN!, image of the lectotype available at <http://linnean-online.org/9905/>).

Distribution and habitat. *Bidens pilosa* (Coreopsideae (Less.) Lindl.) is an erect annual herb, 20–100(–150) cm tall with quadrangular stems, opposite leaves, the upper ones being trifoliolate or imparipinnate with 2–3 pairs of pinnae and a single terminal leaflet. It is native to tropical America but is now a pantropical weed (Wagner *et al.*, 1999). It is becoming an important weed in crops, pastures, wastelands, gardens, cultivated areas, and along roadsides (Galinato *et al.*, 1999) in southern North America, South America, West and South Africa, East of Suez Canal, Europe, South-East Asia, North and South-East Australia, and some Pacific and Atlantic islands (GBIF, 2020). In North Africa, the species was known so far as naturalized alien in Egypt and Morocco, alien with unknown status in Lybia, and casual alien in Algeria (Greuter, 2006+; APD, 2020). It is here recorded for the first time in Tunisia, where it occurs as a casual weed along sidewalks of railways and roadsides (Figure 1C–E) in Bir Bouregba (Cap-Bon region) and near a nursery of ornamental plants in Monastir region (CE Tunisia).

Taxonomic notes. In the Mediterranean area, *Bidens pilosa* is morphologically quite different from other *Bidens* taxa, mainly based on its leaf segments, indumentum, calycular bracts, and ray florets. The more similar species is *B. frondosa* L. from which it differs by characters of the cypselae. In *B. pilosa* cypselae are black or dark-brown, linear-fusiform (1.0–1.5 cm long, flat, 4-angled, sparsely hairy) with 2–3(–5) erect to divergent, retrorsely barbed awns 1–2 mm. In *B. frondosa* cypselae are blackish to brown, obcompressed, obovate to cuneate with 2 +/--erect, antrorsely or retrorsely barbed awns

2–5 mm), short spatulate calycular bracts, with white ray florets, ray florets at least 2-times longer than disc florets, longer stem, beneath of leaf usually dense pillosulose-tomentose indumentum (see Keil, 2012b).

Examined specimens. Tunisia, Nabeul (Bir Bouregba; Cap-Bon, CE Tunisia), scattered populations with crowded individuals growing by railways station and under walls in roadsides on the left at the arrival to Bir Bouregba from Barakat-Sahel, WGS84 36°25'47"N, 10°34'7"E, 25 m asl, 11 December 2016, R. El Mokni *s.n.* (Herb. Univ. Monastir!); Monastir (Menzel Ennour, CE Tunisia), few flowering individuals growing near a nursery of ornamental plants, WGS84 35°40'43"N, 10°47'04"E, 40 m asl, 21 November 2018, R. El Mokni *s.n.* (Herb. Univ. Monastir!).

***Calendula officinalis* L., Sp. Pl. 2: 921. 1753.**

Lectotype [designated by Alavi, 1983: 195]: *Habitat in Europae arvis*, Herb. LINN no. 1035.4 (LINN!, image of the lectotype available at <http://linnean-online.org/10874/>).

Distribution and habitat. *Calendula officinalis* (Calenduleae Cass.), probably native to Asia and southern Europe, was brought to America by early settlers, and then cultivated in many gardens as a medicinal herb (Yoshikawa *et al.*, 2001; Ukiya *et al.*, 2006). It is an herbaceous perennial plant that reaches 80 cm tall, producing yellow or orange flowers about 4–5(–6) cm in diameter. In Europe, the plant is well naturalized in central Italy, Sicily, Sardinia, and Spain, cited as casual alien in Portugal and Malta (Greuter, 2006+; Galasso *et al.*, 2018). In France, it seems that the species is an occasional alien which persists only for a certain time where it has been cultivated as ornamental plant (Tison & de Foucault, 2014; Tison *et al.*, 2014). The species is also widely naturalized in Europe (north to southern England) and elsewhere in warm temperate regions of the World. In North Africa, the plant was known so far as cultivated in Lybia and naturalized in Morocco (Greuter, 2006+; Dobignard & Chatelain, 2011). *Calendula officinalis* is here recorded for the first time in Tunisia, where it can be considered as casual alien found in some sewages in the centre (Figure 1F–G) and in some irrigated public gardens, sidewalks in the centre and north of the country.

Taxonomic notes. *Calendula officinalis* is morphologically similar to *C. bicolor* Raf., from which it differs in growth habit (perennial in *C. officinalis* *vs.* annual in *C. bicolor*), number of ray florets per capitulum ['double' (ray florets replacing some or all of the disc florets) in *C. officinalis* *vs.* 'simple' in *C. bicolor*], and ray floret length (up to 35 mm long in *C. officinalis* *vs.* up to 20 mm long in *C. bicolor*) (Pottier-Alapetite, 1981).



Figure 2. A, *Chrysanthemum morifolium* as ruderal in the centre-east of Tunisia; B, *Dimorphotheca ecklonis* as casual weed on rips of a wall in the centre-eastern coast of Tunisia; C, *Erigeron karvinskianus* flowering individuals on the ancient walls in the north-western of Tunisia; D–E, *Gaillardia ×grandiflor* within roadsides in the centre-east of Tunisia. Photos by Ridha El Mokni.

Examined specimens. Tunisia, Monastir (roadsides from Khénis to Monastir city, CE Tunisia), WGS84 35° 43'47.84"N, 10°49'10.38"E, 2 m asl, 9 April 2012, R. El Mokni & Errol Vêla s.n. (Herb. Univ. Monastir!); Monastir (Jemmel, CE Tunisia), WGS84 35° 37'28.36"N, 10°45'30.47"E, 32–33 m asl, 17 April 2015, R. El Mokni s.n. (Herb. Univ. Monastir!); Jendouba (Tabarka, NW Tunisia), WGS84 36° 56'03.74"N, 8°47'32.33"E, 15 m asl, 3 May 2014,

R. El Mokni s.n. (Herb. Univ. Monastir!).

Chrysanthemum morifolium (Ramat.) Hemsl., Gard. Chron. Ser. 3, 6: 586 1889 ≡ *Matricaria morifolia* Ramat., J. Hist. Nat. 2: 240. 1792 ≡ *Dendranthema morifolium* (Ramat.) Tzvelev, Fl. URSS 26: 373. 1961.

Type: not designated.

Distribution and habitat. *Chrysanthemum* L. (Anthemideae Cass.) comprises about 40 species mainly distributed in East Asia (Bremer & Humphries, 1993; Oberprieler *et al.*, 2006). According to Kondo *et al.* (2003) polyploidy and hybridization are frequent in the genus making it taxonomically difficult. The genus is of considerable horticultural interest, with some 7.000 autumn-flowering plants named *Ch. morifolium*, an enormous hybrid complex developed in China over many centuries from multiple hybridizations involving several paternal species (including *Ch. indicum* L.) rather than only two or a few wild species, with an extinct species and its subsequent cultivars serving as the maternal parents (Galasso *et al.*, 2020; Ma *et al.*, 2020). It is well known for its commercial cultivars, which are globally important cut flowers and pot plants (Bhattacharya & Teixeira da Silva, 2006).

Chrysanthemum morifolium is a subshrub native to eastern Asia. The wild prototype of this cultivar (Ma *et al.*, 2020) introduced from China and now widely cultivated throughout the world is not yet recognized (Bailey, 1923). Autumn-flowering perennial *Chrysanthemum* plants were successfully introduced to France in 1789, and in 1792 the French botanist Ramatuelle proposed the name *Matricharia morifolia* (\equiv *Ch. morifolium*) for one of these cultivars called “Old Purple” (Gosling, 1970). It is unknown when it was firstly introduced into the New World. It is related to *Ch. zawadskii* Herbich and *Ch. arcticum* L., which are widely cultivated as ornamental plants. Note that numerous cultivars were also created from *Ch. morifolium* (Heywood, 1976) but this species was not recorded neither in Europe nor in North Africa as alien (Greuter, 2006+; APD, 2020; GBIF, 2020).

Chrysanthemum morifolium occurs in Tunisia as casual in some sewages in Bizerta city (Figure 2A), in the margins of some public gardens, sidewalks in Sousse city and its surroundings and with abandoned populations on sidewalks in the centre of El Hamma and Zarzis cities.

Examined specimens. Tunisia, Bizerta (Bizerta city, NE Tunisia), in some sewages and margins of some public gardens, WGS84 37°16'10"N, 9°51'54"E, 5 m asl, 22 December 2016, R. El Mokni *s.c.*; Gabes (El Hamma, SE Tunisia), abandoned population on sidewalks in the centre of the city WGS84 33°53'39"N, 9°48'25"E, 60 m asl, 22 November 2017, R. El Mokni *s.n.* (Herb. Univ. Monastir!); Medenine (Zarzis, SE Tunisia), small population on sidewalks in the centre of the city and touristic zone WGS84 33°30'21"N, 11°06'55"E, 5 m. asl, 17 December 2016, R. El Mokni *s.c.*; Sousse (Sousse city, CE Tunisia), small population on sidewalks in the centre of the city, WGS84 35°50'35"N, 10°37'31"E, 10 m asl, 23 November 2017, R. El Mokni *s.n.* (Herb. Univ. Monastir!).

Dimorphotheca ecklonis DC., Prodr. 6: 71. 1838.

Neotype [designated here by D. Iamónico and R. El Mokni]: South Africa, *s.d.*, *Ecklon 1823* (G-00460837!, see JSTOR, 2020a).

Distribution and habitat. *Dimorphotheca* Vaill. ex Moench (Calenduleae Cass.) includes about 20 species native to Zimbabwe, Angola, Namibia, and South Africa. Some *Dimorphotheca* species are naturalized in North America, Europe, and Australia (Strother, 2006b; Nordenstam, 2007; Pruski, 2015; Galasso *et al.*, 2018). It includes the suffrutescent to shrubby species *D. ecklonis*, a popular garden plant native to South Africa but regarded as a weed in Mediterranean-climate regions (Mediterranean basin, North America and Australia). In the Iberian Peninsula, *D. ecklonis* has been reported as naturalized in Galicia, Valencian Community, and Catalonia (González-Martínez, 2015; Aymerich, 2016; Sáez *et al.*, 2016). In continental North Africa, *D. ecklonis* is here firstly reported (Greuter, 2006+; APD, 2020; GBIF, 2020) as casual (Figure 2B) since it was recorded for many years from many sites in Tunisia in disturbed areas escaping from cultivated individuals in the surroundings.

Taxonomic notes. *Dimorphotheca ecklonis* is morphologically very similar to the closely related *D. pluvisialis* (L.) Moench, *D. fruticosa* (L.) DC., *D. sinuata* DC., and *D. jucunda* E. Phillips. Compared to *D. ecklonis* (taxon that shows long ray florets, bright white on the upper side and light blue or violet on the lower side), *D. jucunda* differs in its typical reddish ray florets on both sides. With regard to *D. sinuata* and *D. pluvisialis* (annual herbs with bisexual disk florets), *D. ecklonis* is a subshrubby plant with staminate disk florets. It shows linear-oblong to oblanceolate leaves and smooth ray cypselae up to 8 mm long, whereas *D. fruticosa* displays oblanceolate to obovate leaves and ray cypselae 5–7 mm long (Keil, 2012c).

Typification of the name *Dimorphotheca ecklonis*.

Candolle (1838: 71) validly published the name *D. ecklonis* providing a diagnosis, the provenance (“in Africa Capensis”), and the collector (“legit cl. [clarissimo] Ecklon pl. exs. [planta exsiccata]”); moreover, “v.s.” (= vidi sicco) was reported, so indicating that Candolle had seen at least one specimen. On the basis of Stafleu & Cowan (1976: 254) and HUH Index of botanists (2013a onwards), Ecklon’s collection is preserved in many herbaria. We traced three specimens at G (barcode G-00460837), HAL (barcode HAL-0111581; image available at http://141.48.4.202/djatoka/jacq-viewer/viewer.html?rft_id=hal_0111581&identifiers=hal_0111581), and MO (barcode MO-357907) bearing plants collected by C. F. Ecklon. MO specimen (image available at <http://legacy.tropicos.org/Image/57534>) cannot be sure that it was collected before 1838 and part of the original material (Art. 9.4 of the ICN) since no date of collection is reported. Therefore, we prefer to exclude the specimen at MO for the lectotypification purpose. G specimens bear the following label: “N. 1823 | M. Ecklon 1835”. These two annotations are clearly in different hand writing and only the first one “N. 1823” was written by Ecklon. On the other hand, HAL specimen bears the label “*Dimorphotheca ecklonis* DC. 85” and a recent

and printed label including as date of collection “1829–1832”. All things considered, also these two specimens (G and HAL) cannot be considered as original material with certainty. Since no original material appears to be in extant, we here proposed to neotypify the name *D. ecklonis* using the G specimen which is the more complete among those found, including various capitula and cypselae whose features are diagnostic in the genus *Dimorphotheca* (see e.g., Strother, 2006b; Pruski, 2015), we here designate it as the lectotype of the name *D. ecklonis*.

Examined specimens. Tunisia, Bizerta (Nadhour, NE Tunisia), WGS84 37°19'29"N, 9°51'52"E, 5 m asl, 23 December 2016, *R. El Mokni s.n.* (Herb. Univ. Monastir!); Jendouba, Tabarka-Larméel (NW Tunisia), WGS84 36°57'39"N, 8°44'55"E, 10 m asl, 29 April 2018, *R. El Mokni s.n.* (Herb. Univ. Monastir!); Nabeul, Barakat Sahel (CE Tunisia), WGS84 36°24'15"N, 10°33'36"E, 15 m asl, 10 December 2016, *R. El Mokni s.n.* (Herb. Univ. Monastir!); Mahdia, Mahdia city (CE Tunisia), WGS84 35°30'11"N, 11°04'14"E, 5 m asl, 6 August 2020, *R. El Mokni s.n.* (Herb. Univ. Monastir!); Monastir, Jemmel (CE Tunisia), WGS84 35°37'06"N, 10°45'23"E, 30 m asl, 12 July 2020, *R. El Mokni s.n.* (Herb. Univ. Monastir!).

Erigeron karvinskianus DC., Prodr. [A. P. de Candolle] 5: 285. 1836.

Lectotype [designated by Iamónico, 2018: 799, Fig. 1]: Mexico, Aug 1827, *Karvinski s.n.* (M-0029744!).

Distribution and habitat. The genus *Erigeron* L. (Astereae Cass.) comprises about 400 species which are mostly distributed in the temperate regions worldwide (Nesom, 2006). Nesom (2008) proposed a classification of *Erigeron* recognizing 35 sections. *Erigeron karvinskianus* is native to Mexico, Honduras, El Salvador, and Guatemala. It also occurs as alien in subtropical and temperate regions of all continents (see e.g., Greuter, 2006+; Nesom, 2008; Cullen, 2011; Nesom & Pruski, 2011; Hind, 2012; SANBI, 2012a). Until now, this species was not recorded in Tunisia (Greuter, 2006+; Le Floc'h *et al.*, 2010; SANBI, 2012a; GBIF, 2020). It is here firstly reported from Aïn-Draham in the NW, where it occurs as a casual weed along sidewalks towards hotel ‘Beau Séjour’ (Figure 2C).

Taxonomic notes. *Erigeron karvinskianus* is the type of *Erigeron* sect. *Karvinskia* Nesom, a section including mostly perennial species with branched stems, spatulate to oblanceolate or linear leaves, long-pedunculate and erect capitula with white ray florets (becoming lavender at maturity), cypselae up to 1.9 mm long and 2-nerved, and pappus with 10–27 bristles (see Nesom, 1989, 2008). The species more similar to *E. karvinskianus* is *E. maxonii* S.F.Blake, and it differs in having ray florets 0.1–0.3 mm wide [*vs.* (0.5–)0.8–1.3 mm wide ray florets], 3.3–4.5 mm long disc florets (*vs.* 2.3–3.3 mm long disc florets), and 1.5–1.9 mm long cypselae (*vs.* 1.0–1.4 mm long cypselae) (see Nesom & Pruski, 2011).

Examined specimens. Tunisia, Jendouba (Aïn-Draham, NW Tunisia), WGS84 36°46'39"N, 8°41'24"E, 730 m asl, 31 July 2016, *R. El Mokni s.n.* (Herb. Univ. Monastir!, RO!), *ibidem*, 5 May 2017, *R. El Mokni s.n.* (Herb. Univ. Monastir!), *ibidem*, 3 April 2018, *R. El Mokni s.n.* (Herb. Univ. Monastir!).

Gaillardia pulchella Foug., Hist. Acad. Roy. Sci. Mém. Math. Phys. (Paris 4) 1786: 5, fig. 1. 1788

Lectotype [designated by Turner & Watson, 2007: 17]: France, *grows in Paris from seed gathered in Louisiana*, 1783 (P-JU9464, *non vidi fide* Turner & Watson, 2007).

Distribution and habitat. The genus *Gaillardia* Foug. (Helenieae Lindl.) includes 15–17 species occurring in North America, Mexico, and South America (mostly Argentina). Among these species, *G. aristata* Pursh and *G. pulchella* are horticultural species. *Gaillardia pulchella* is native to coastal areas of Texas, U.S.A. (USDA-NRCS, 2020). It has been widely cultivated as ornamental and can be found cultivated and naturalized in Europe, South Africa, Central America, and on several islands of the Caribbean and the Pacific Ocean (GBIF, 2020; USDA-ARS, 2020). The plant grows on sandy or calcareous soils, often in grasslands, open disturbed areas, or cultivated places. It was also reported from coastal areas (dunes), human-made habitats (e.g., roadsides, gardens, and arable lands), river banks, and grassy places (Webb *et al.*, 1988; Wagner *et al.*, 1999; Strother, 2006c; Flora of Taiwan Editorial Committee, 2014). In North Africa, the plant is so far known only in the Canary Islands (Greuter, 2006+), therefore, it is here recorded for the first time as an alien species in continental North Africa.

Taxonomic notes. *Gaillardia pulchella* is morphologically very similar to *G. aristata* Pursh. Its annual habit and the variously colored ray florets (red or purple, sometimes with yellow tips, or multicolored) are reliable characters for separating it from *G. aristata*, which is a perennial species with wholly yellow or basally purple ray floret (Keil, 2012d).

Examined specimens. Tunisia, Monastir (Khénis, CE Tunisia), disturbed areas in roadsides on the right from the bridge of Khénis towards Monastir city, WGS84 35°43'43"N, 10°49'08"E, 5 m asl, 3 October 2014, *R. El Mokni s.n.* (Herb. Univ. Monastir!).

Gaillardia ×grandiflora Van Houtte, Fl. des Serres 12: 1, pl. 1183. 1857.

Type: not designated (ind. loc. Belgique, Selessines [cultivated plant]).

Distribution and habitat. *Gaillardia ×grandiflora* is a hybrid native to North America (from the Central Great Plains to western United States), commonly used as ornamental plant and occasionally escaping

(Bělohávková, 2004). It was recorded as invasive in Belgium (Verloove, 2002, 2006, 2020a), Czech Republic (Daníhelka *et al.*, 2012), and Italy (Galasso *et al.*, 2018). In North Africa, the plant is so far known only in Morocco (Greuter, 2006+; Sukhorukov *et al.*, 2017; APD, 2020; GBIF, 2020). So, our observation represents the second record for North Africa.

Taxonomic notes. *Gaillardia* ×*grandiflor* is a tetraploid hybrid resulting from a cross between the perennial *G. aristata* and the annual *G. pulchella*. The taxon arguably inherited its perennial habit from the former and its long flowering period and rapid growth rate from the latter (MBG, 2020). Many cultivars can be treated from seed, among which *G. ×grandiflor* ‘Punch Bowl’ (with bicolored ray florets; Figure 2D) and *G. ×grandiflor* ‘Mesa Yellow’ (with yellow ray and disc florets; Figure 2E)

Key to species of *Gaillardia* found in Tunisia.

1. Plant simple, perennial; disc florets with corolla 6.5–8.0 mm long; setae c. 1.5 times as long as cypselae *G. ×grandiflor*
- 1'. Plant branched, annual; disc florets with corolla tube 4–5 mm long and lobes 2.5–3.5 mm long; setae as long as cypselae *G. pulchella*

Examined specimens. Tunisia, Monastir (Monastir city, CE Tunisia), in roadsides under some planted trees of *Ficus microcarpa* L.f. in Monastir city, WGS84 35°45'58"N, 10°49'52"E, 15 m asl, 9 January 2018, R. El Mokni *s.n.* (Herb. Univ. Monastir!), *ibidem*, 27 February 2018, R. El Mokni *s.n.* (Herb. Univ. Monastir!), *ibidem*, 4 December 2018, R. El Mokni *s.n.* (Herb. Univ. Monastir!), *ibidem*, 16 October 2020, R. El Mokni *s.n.* (Herb. Univ. Monastir!).

Gazania linearis (Thunb.) Druce, Rep. Bot. Soc. Exch. Club Brit. Isles 4(Suppl. 2): 624. 1917 ° *Gorteria linearis* Thunb., Prodr. Pl. Cap. 2: 162. 1800.

Lectotype [designated “as holotype” by Ghafoor, 2015: 170, here corrected by D. Iamónico and R. El Mokni according to the Art. 9.10 of ICN]: South Africa, Cape Province, *e Cap. b. spei*, Thunberg *s.n.* (UPS-THUNB20513B! [digital image] Figure 3).

Distribution and habitat. *Gazania* Gaertn. is a genus well known for its horticultural uses, with several species and hybrids widely cultivated in gardens (see e.g., Magee *et al.*, 2011). The genus belongs to the tribe Arctotideae Cass., subtribe Gorteriinae Benth. & Hook f., based on the connate and acute phyllaries, the ray florets 4-lobed, and the sclerified margins of the disc floret lobes (Karis, 2007). It comprises 18–20 species endemic to southern Africa (with the exception of the widespread *G. krebsiana* Less., extending to tropical East Africa) (Roessler, 1959; Magee *et al.*, 2011). *Gazania linearis* (native to South Africa and Lesotho) has been cultivated as an

ornamental plant since the 19th century, becoming an invasive plant in several regions of the World (Hassler, 2019). In Europe, it is recorded in Italy (Galasso *et al.*, 2018, 2019) and Spain (Laguna & Ferrer, 2013), whereas in North Africa, it was not yet reported. As a consequence, the Tunisian population is the first one for North Africa (APD, 2020; GBIF, 2020) as an alien in roadsides on sandy and loamy soils.

Taxonomic notes. *Gazania linearis* is characterized by its tufted leaves (at the base of the stem) mostly being linear to narrowly lanceolate (*vs.* leaves simple, linear-lanceolate to pinnatisect in *G. krebsiana*), dead leaves persistent, peduncles usually > 20 cm long [*vs.* peduncles usually < 15 cm long in *G. rigens* (L.) Gaertn.], outer phyllaries 1.5–2 mm width, with silky margin, long and rigid cilia (*vs.* triangular-lanceolate), leaves whole to 1–3(–5) leaflets in *G. rigens* (*vs.* up to 7–9 leaflets in *G. ×splendens* Hend. & A.A.Hend.), inner phyllaries narrowly triangular (*vs.* finely acuminate in *G. krebsiana*), ray florets usually yellow with basal macula black or bicolor (*vs.* ray florets intense orange to yellow without macula or with brown or bicolor macula in *G. krebsiana*) (Laguna & Ferrer, 2013).

Typification of the name *Gorteria linearis*. Thunberg (1800: 162) validly described the species *G. linearis* by the following short diagnosis (“*linearis*. G. [*Gorteria*] herbacea foliis linearibus glabris basi ciliato-serratis, scapo erecto unifloro”); no detailed provenance was given.

Ghafoor (2015: 170) reported, under *Gazania linearis*: “*Gorteria linearis* Thunb., Skr. Naturhist.-Selsk. 4: 2 (1798). T [= Type]: Cape Province, S. Africa, Thunberg *s.n.*; holo: UPS”. Since Ghafoor (2015) did not indicate the phrase “*hic designatus*” or an equivalent, then, the pretended typification was not effective according to the Art. 7.11 of ICN. Thunberg’s Herbarium is mainly deposited at UPS (see Stafleu & Cowan 1986: 306 and HUH Index of botanists (2013b onwards) where we traced the specimen cited by Ghafoor (2015), i.e. UPS-THUNB20513B. UPS-THUNB20513B is here designated as the lectotype of the name *Gazania linearis* (no holotype was indicated by Thunberg, 1800: 162).

Examined specimens. Tunisia, Monastir (Monastir city, CE Tunisia), many flowering individuals growing with ruderal plants on sandy soils, WGS84 35° 45'56"N, 10°48'24"E, 10 m asl, 1 March 2018, R. El Mokni *s.n.* (Herb. Univ. Monastir!); Sousse (El Borjin, CE Tunisia), many flowering individuals growing with coastal and ruderal plants WGS84 35°38'49"N, 10° 35'09"E, 75 m asl, 23 April 2020, R. El Mokni *s.n.* (Herb. Univ. Monastir!).

Guizotia abyssinica (L.f.) Cass. ≡ *Polymnia abyssinica* L.f., Suppl. Pl.: 383(–384). 1782.

Lectotype [designated by Baagøe, 1974: 20]: Herb. LINN no. 1033.5 (LINN!, image of the lectotype available at <http://linnean-online.org/10869/>).



Figure 3. Lectotype of *Gorteria linearis* (designated here). Origin: South Africa, Cape Province, e *Cap. b. spei* (Thunberg's handwriting), Thunberg s.n. (UPS-THUNB20513B, 2020).

Distribution and habitat. The genus *Guizotia* Cass. (Heliantheae Cass.) consists of six species, five of them are native to the Ethiopian highlands in tropical Africa (Baagøe, 1974; Bekele *et al.*, 2007). *Guizotia abyssinica* is a species native to East Africa that occurs in Ethiopia

and adjacent countries (Rzedowski & Rzedowski, 2001), whereas it is considered as an alien plant in the other continents: America (Strother, 2006d), Asia (Weiss, 1983; Getinet & Sharma, 1996), Australia (Atlas of living Australia, 2020), and Europe (Greuter, 2006+).

In continental North Africa, *G. abyssinica* was hitherto not known (Greuter, 2006+; APD, 2020; GBIF, 2020), so our finding represents the first report. In Tunisia, the species is found mainly as ruderal near areas drained by polluted water (Figure 4A).

Taxonomic notes. *Guizotia abyssinica* and *G. scabra* (Vis.) Chiov. subsp. *schimperi* (Schultz-Bip.) J. Baagøe (basionym: *G. schimperi* Sch.-Bip.) are morphologically very similar (Getinet & Sharma, 1996). *Guizotia abyssinica* is glabrous to hairy and never glandular, has receptacular paleae 5-veined with sessile glands, and cypselae 3–6 mm long, whereas *G. scabra* subsp. *schimperi* is always hairy and often glandular, has receptacular paleae 3-veined with hairy glands, and cypselae 2.0–2.5 mm long (see Verloove, 2020b).

Examined specimens. Tunisia, Ben-Arous (Mornag, NE Tunisia), few flowering plants growing on the margins of some vineyards, WGS84 36°41'26"N, 10°18'39"E, 60 m asl, 13 November 2017, *R. El Mokni s.n.* (Herb. Univ. Monastir!); Bizerta, Bizerta city (NE Tunisia), many flowering individuals growing with ruderal plants on the border of stream of polluted water, WGS84 37°17'05"N, 9°52'21"E, 5 m asl, 20 December 2015, *R. El Mokni s.n.* (Herb. Univ. Monastir!; RO!); Monastir, Té Boulba (CE Tunisia), many flowering individuals growing with coastal and ruderal plants, WGS84 35°39'23"N, 10°57'31"E, 5 m asl, 19 March 2017, *R. El Mokni s.n.* (Herb. Univ. Monastir!).

Helianthus annuus L., Sp. Pl. 2: 904. 1753.

Lectotype [designated by Green & Hitchcock, 1929: 183]: *Habitat in Perù, Mexico*, Herb. LINN no. 1024.1 (LINN!, image of the lectotype available at <http://linnean-online.org/10544/>).

Distribution and habitat. The genus *Helianthus* L. (Heliantheae Cass.) comprises 52 species, native to North America. *Helianthus annuus* (sunflower) was domesticated in North America at least 4000 years ago (Harter *et al.*, 2004). It grows in disturbed areas (widespread along roadsides and railroads), pastures, meadows, plains, and foothills. It is alien in central Argentina (Poverene *et al.*, 2008) and Australia (Seiler *et al.*, 2008), where it is found in crop fields and uncultivated places (Poverene & Cantamutto, 2014) where it is highly competitive with other species owing to its quick development (Geier *et al.*, 1996). It is reported to be the most common and most problematic weed in sorghum crops in northern Tamaulipas, Mexico (Rosales-Robles *et al.*, 2005). It was introduced in Europe as an ornamental plant at the end of the fifteenth century (Putt, 1997). Currently, *H. annuus* is used in Europe both as ornamental plant and as crop for production of seed oil. Alien populations grow in the continent in cultivated lands (and adjacent areas) as well as along roads. In North Africa, *H. annuus* is so far known in the Canary Islands (casual alien) and Morocco (naturalized), whereas in Lybia is reported as “in

large-scale cultivation” (Greuter, 2006+). In Tunisia, the species was found in disturbed areas (sidewalks) of Bizerta city (Figure 4B), along banks of the Béja region, and in croplands at Nefza.

Taxonomic notes. According to Schilling (2006), *Helianthus annuus* is similar to *H. argophyllus* Torr. & A.Gray from which differs by the stem (hispid *vs.* tomentose) and the margins of the leaves (serrate *vs.* entire).

Examined specimens. Tunisia, Béja (Béja city, NW Tunisia), escaped ‘wild’ multiheaded *H. annuus* with many flowering individuals growing on both banks of the Béja stream WGS84 36°44'48"N, 9°12'24"E, 160 m asl, 14 June 2020, *R. El Mokni s.n.* (Herb. Univ. Monastir!); on right of the road towards Nefza, just after the bridge, WGS84 36°45'57"N, 9°11'48"E, 185 m asl, 14 June 2020, *R. El Mokni s.n.* (Herb. Univ. Monastir!); Bizerta (Bizerta city, NE Tunisia), escaped cultivated *H. annuus* with many flowering individuals growing with disturbed areas towards Corniche road, WGS84 37°17'38"N, 9°52'13"E, 2 m asl, 2 January 2016, *R. El Mokni s.c.*; Monastir, (Bekalta, CE Tunisia), about seven flowering individuals growing on the margin of an olive grove, WGS84 35°36'46"N, 10°59'30"E, 1 m asl, 23 October 2020, *R. El Mokni s.c.*

Rudbeckia triloba L., Sp. Pl. 2: 907. 1753.

Lectotype [designated by Reveal & Jarvis, 2009: 981]: *Habitat in Virginia*, Herb. LINN no. 74 (SBT!, image of the lectotype available at info.bergianska.se/bilder/bergius/00/rudbtri1.jpg).

Distribution and habitat. The genus *Rudbeckia* L. (Heliantheae Cass.) contains 23 species native to North America and Mexico (Urbatsch & Cox, 2006). Many species are cultivated as ornamentals outside their native distribution range. Six of these species have been introduced in Europe but only *R. hirta* L. and *R. laciniata* L. are considered to be widely naturalized in Europe (Greuter, 2006+). *Rudbeckia triloba* is native to the eastern North America (Britton & Brown, 1970), and it is considered as casual alien in few European countries (Greuter, 2006+) where it occupies human-made habitats, meadows, and uncultivated lands. Concerning North Africa, the species has been not yet recorded (see Greuter, 2006+; APD, 2020; GBIF, 2020). So, our observation is the first one for the whole north african area. We found it as casual alien in disturbed habitats.

Taxonomic notes. *Rudbeckia triloba* is morphologically close to *R. hirta*. based on stem (branched and up to 150 cm long in *R. triloba vs.* simple and up to 100 cm long in *R. hirta*), lower leaves (3-lobed *vs.* simple), capitula (many with a minute crown pappi *vs.* 1–3 without pappi) (see e.g., Maslo & Šarić, 2018: 9).



Figure 4. A, *Guizotia abyssinica* as a casual alien in the centre-east of Tunisia; B, *Helianthus annuus* as casual weed within disturbed areas in the north-east of Tunisia; C–E, *Tagetes erecta* in different ruderal habitats in the centre-east of Tunisia. Photos by Ridha El Mokni.

Examined specimen. Tunisia, Jendouba (Fernana, NW Tunisia), within an abandoned house, WGS84 36° 39'03"N, 8°41'50"E, 265 m asl, 3 October 2006, R. El Mokni *s.n.* (Herb. El Mokni! Fac. Sc. Bizerta).

Tagetes erecta L., Sp. Pl. 2: 887. 1753.

Lectotype [designated by Hind in Jarvis *et al.*, 1993: 92]: *Habitat in Mexico*, Herb. LINN no. 1009.1 (LINN!,

image of the lectotype available at <http://linnean-online.org/10422/>).

Distribution and habitat. *Tagetes* L. (Tageteae Takht.) is an American genus with a continuous distribution from southwestern U.S.A. to central Chile and northern Patagonia in Argentina (see e.g., Neher, 1966; Everett, 1982; Gutiérrez & Stampacchio, 2015; Schiavinato *et*

al., 2017). The greatest diversity of the genus is found in south-central Mexico. This genus comprises annual or perennial, strongly aromatic herbs or shrubs, with opposite or alternate leaves, usually pinnately dissected laminas, phyllaries fused in one series, and pappus of few scales or awns (Schiavinato & Bartoli, 2018). Many *Tagetes* species were introduced out of their native range as ornamental plants, or e.g. for medicinal uses (Singh *et al.*, 2003). In particular, three annual

species (*T. erecta* L., *T. lunulate* Ort. and *T. tenuifolia* Kunth) are commonly cultivated throughout the world as ornamental plants (Vasudevan *et al.*, 1997). *Tagetes erecta* is currently known as alien from many European countries (see e.g., Greuter, 2006+; Galasso *et al.*, 2018; GBIF, 2020) whereas in North Africa it is recorded in Morocco only (SANBI, 2012b). In Tunisia, *T. erecta* can be considered as casual alien growing along sidewalks and in disturbed areas (Figure 4C–E).

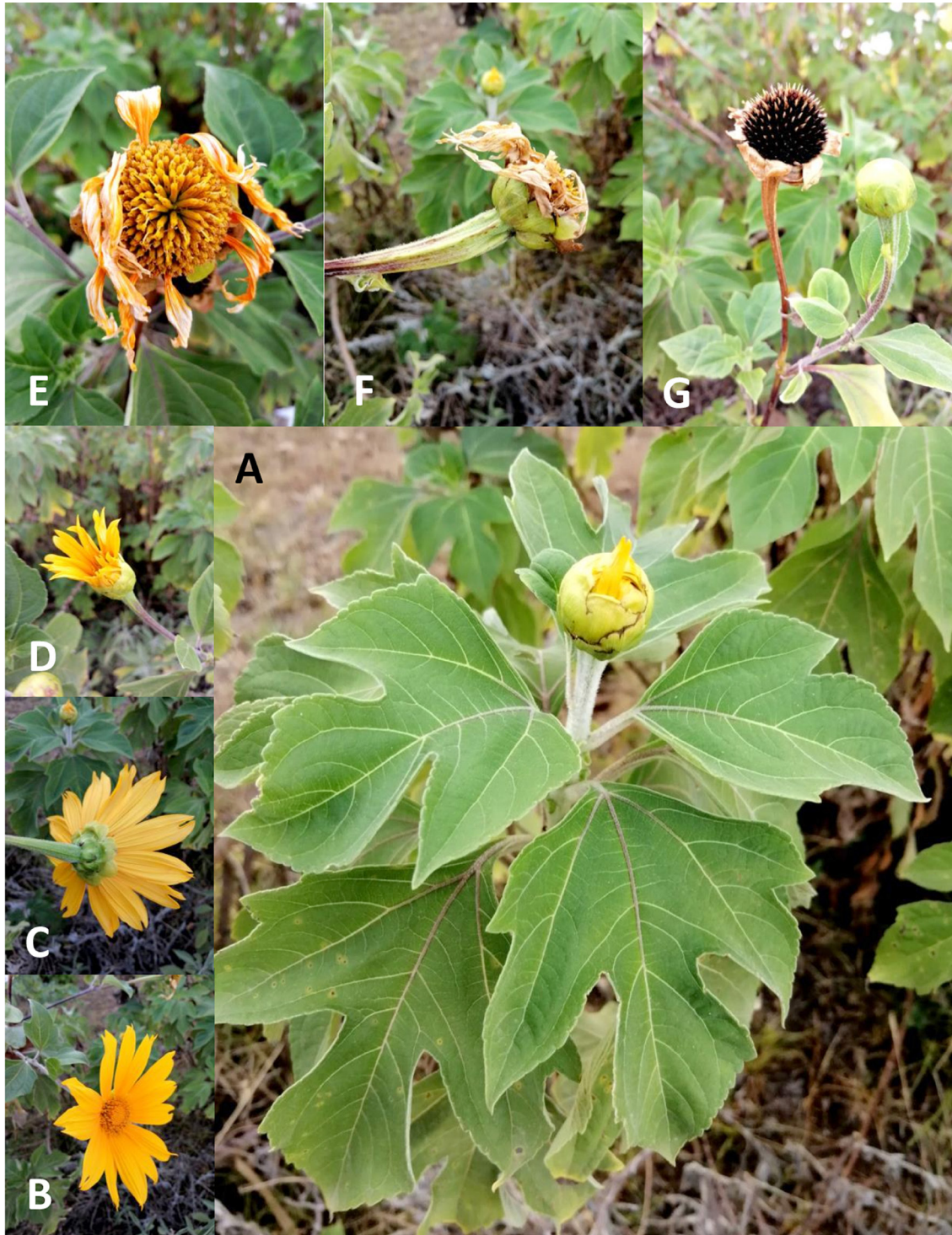


Figure 5. *Tithonia diversifolia* as a casual alien in the margins of cultivated parcels in the north-western of Tunisia; A, habit with typical leaves; B–C, capitulum in bloom; front and back view; D, capitulum in the beginning of blooming; E–F, capitulum in fruiting period; front and lateral view; G, capitulum with mature cypselae. Photos by Ridha El Mokni.

Taxonomic notes. *Tagetes erecta* differs from the similar *T. minuta* L. in the size [10–120 cm vs. 30–100(–180+) cm.]. Moreover, *T. erecta* shows solitary capitula with peduncles 30–100(–150) mm and 6–8 ray florets whereas *T. minuta* displays numerous (20–80) small capitula, usually in flat-topped cymes or in corymbiform clusters with peduncles 1–5 mm and 2–3 ray florets (see e.g., Mesfin, 2004; CABI, 2021).

Examined specimens. Tunisia, Monastir (Monastir city, CE Tunisia), on disturbed areas, WGS84 35°45'58"N, 10°48'26"E, 30 m asl, 22 January 2018, R. El Mokni s.n. (Herb. Univ. Monastir!); Mahdia, Mahdia city (CE Tunisia), on roadsides under walls not far planted individuals of the same species in huge ornamental pots, WGS84 35°30'09"N, 11°04'09"E, 5 m asl, 6 August 2020, R. El Mokni s.n. (Herb. Univ. Monastir!)

Tithonia diversifolia (Hemsl.) A.Gray, Proc. Amer. Acad. Arts 19. 5. 1883 ≡ *Mirasolia diversifolia* Hemsl., Biol. Cent.-Amer., Bot. 2: 168. 1881.

Lectotype [designated by Blake, 1921: 434 (first step), La Duke, 1982: 498 (second-step): third-step lectotypification (Art. 9.17) here designated by D. Iamónico and R. El Mokni]: Mexico, Veracruz, Valley of Orizaba, 12 May 1866, *Bourgeau 2319* (K000487726!, image available at <http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000487726>); isolectotypes BR-0000005522910 (<http://www.botanicalcollections.be/specimen/BR0000005522910>), FI-006466! (<http://parlatore.msn.unifi.it/types/search.ph>), K-000487727!, GH00010519! (<https://s3.amazonaws.com/huhwebimages/4D59846ADCF7484/type/full/10519.jpg>), MSC-0092398! (see JSTOR, 2020b), N (*non vidi fid* Blake, 1921: 434), P00107479! (<http://mediaphoto.mnhn.fr/media/14440181223241UII2muZrJWOBmlc>), and US-00128796! (<http://n2t.net/ark:/65665/m31f2a9a3c-493f-430b-ae6d-0ae6e55bf118>).

Distribution and habitat. The origin of *Tithonia diversifolia* (Heliantheae Cass.) is currently debated. It is considered to be native to Mexico and America (including British Columbia (Canada), USA, Belize, Costa Rica, Guatemala, Honduras, Jamaica, Nicaragua and Panama; see e.g., Roja-Sandoval *et al.*, 2018; Tagne *et al.*, 2018). On the other hand the species is clearly introduced as ornamental and/or green manure in Africa, Asia, Oceania, West Indies, and Australia, where it is naturalized growing as a weed in roadsides, wastelands, crop fields, and homesteads (see e.g., Blake, 1921; Jex-Blake, 1957; GRIIS, 2018; ISSG, 2018; USDA-ARS, 2020). *Tithonia diversifolia* is able to form dense populations that impact negatively the cultivated lands. In fact, this species produces a large amount of small seeds, which can be dispersed by wind, water, and animals. Seeds may also be spread in dumped garden waste and through contaminated agricultural produce (Orwa *et al.*, 2009). In addition, *T. diversifolia* produces allelochemicals which affect the nutrient uptake and growth of young native plants (Oyerinde *et al.*, 2009). In North Africa, *T. diversifolia* has been still not recorded

(see e.g., Greuter, 2006+; GBIF, 2019; APD, 2020) and the population found in Tunisia represents therefore the first observation. It is here considered as casual alien occupying disturbed areas (Figure 5).

Taxonomic notes. *Tithonia diversifolia* is similar to *T. rotundifolia* (Mill.) S.F.Blake and to *Helianthus tuberosus* L. *Tithonia diversifolia* has mostly alternate leaves with 3–7 acuminate lobes (Figure 5A) with yellow ray florets (4–7 cm long) (Figure 5B–D) and bright yellow disc florets (ligulae) (Figure 5E–F). In contrast, *T. rotundifolia* has leaves with entire or with rounded lobes, and orange or reddish ray florets (2.0–3.5 cm long). *Helianthus tuberosus* has lower cauline leaves opposite or in whorls of three, whereas the upper cauline leaves are alternate, simple, ovate to ovate-lanceolate. Capitula of *H. tuberosus* has golden-yellow ray florets (see e.g., CABI, 2020)

Typification of the name *Mirasolia diversifolia*. *Mirasolia diversifolia* was validly published by Hemsley (1881: 168), who provided a short diagnosis and a detailed description. He also reported the provenance and cited some collections which are syntypes according to the Art. 9.6 of the ICN: [“SOUTH MEXICO, abundant in the valley of Orizaba, also in the valley of Cordova (*Bourgeau*, 2319, 1562); GUATEMALA, Dueñas (*Fraser, Salvin*). Hb. Kew”].

Blake (1921: 434) reported: “TYPE LOCALITY: Valley of Orizaba, Veracruz. The species was based by Hemsley on *Bourgeau* 2319, from Valley of Orizaba; *Bourgeau* 1562, from Valley of Cordova; and plants collected by *Fraser* and *Salvin* at Dueñas, Guatemala. The first one is here selected as type”. So, Blake designated the collection no. 2319 by E. Bourgeau as the type (lecto-) of the name. However, Bourgeau’s collection consists of several specimens kept at different herbaria as he stated “SPECIMEN EXAMINED”, Blake (l.c.) stated: “VERACRUZ: ... Valley of Orizaba, May 12, 1866, *Bourgeau* 2319 (type collection: G, K, N)”. So, he did not distinguish among the listed syntypes (G, K, and N specimens).

About 60 year later, La Duke (1982: 498) listed *Mirasolia diversifolia* reporting “TYPE: MEXICO, Veracruz, Valley of Orizaba, 12 May 1866, *E. Bourgeau 2319* (LECTOTYPE, K!, [photo, os!]; ISOLECTOTYPES, BR!, FI!, GH!, S!, US!).”. So, La Duke (1982) restricted the type to K (second-step typification). However, we traced two specimens at K [barcodes K-000487726 (image at <http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000487726>) and K-000487727 (image at <http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000487727>) collected by E. Bourgeau on May 12, 1866 in Valley of Orizaba. We here designate K-000487726 as the (third-step) lectotype of the name *M. diversifolia*.

Examined specimens. Tunisia, Tabarka (Houamdia, NW Tunisia), WGS84 36°55'17"N, 8°47'18"E, 45 m asl, 21 June 2020, R. El Mokni s.n. (Herb. Univ. Monastir!), *ibidem*, WGS84 36°45'51"N, 8°46'57"E, 40 m asl, 21 June 2020, R. El Mokni s.n. (Herb. Univ. Monastir!).

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