

## *Euphorbia hypericifolia* (Euphorbiaceae): a new addition to the vascular flora of Morocco

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### Abstract

*EUPHORBIA HYPERICIFOLIA* (EUPHORBIACEAE): A NEW ADDITION TO THE VASCULAR FLORA OF MOROCCO.— *Euphorbia hypericifolia* L., native to the tropics and subtropics of the New World, has recently been found in disturbed sites in the Moroccan North Atlantic phytogeographic region. It represents a new record for the vascular flora of Morocco. To facilitate its identification, this study provides a brief morphological description of the species, a photographic plate, a distribution map, and notes on ecology and habitats.

Key words: chorology; *Euphorbia hypericifolia*; Euphorbiaceae, Morocco, new record.

### Resumen

*EUPHORBIA HYPERICIFOLIA* (EUPHORBIACEAE): UNA NUEVA ADICIÓN A LA FLORA VASCULAR DE MARRUECOS.— *Euphorbia hypericifolia* L., nativa de los trópicos y subtrópicos del Nuevo Mundo, se ha encontrado recientemente en lugares alterados de la región fitogeográfica del Atlántico Norte de Marruecos. Representa un nuevo registro para la flora vascular de Marruecos. Para facilitar su identificación, este estudio proporciona una breve descripción morfológica de la especie, un conjunto de fotografías, un mapa de distribución y notas sobre ecología y hábitats.

Palabras clave: corología; *Euphorbia hypericifolia*; Euphorbiaceae; Marruecos; nueva cita.

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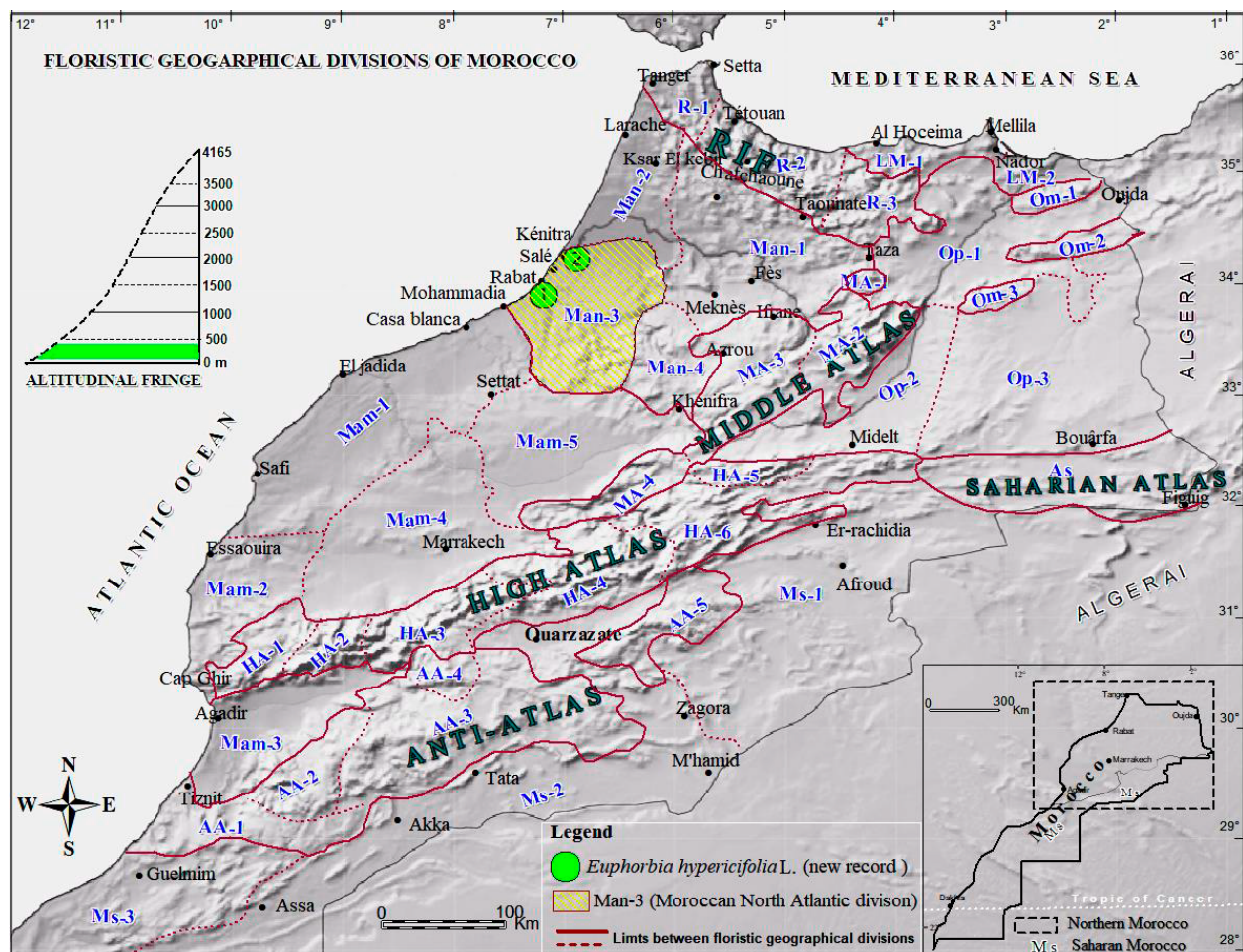
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## INTRODUCTION

With more than 2100 accepted species worldwide and a cosmopolitan distribution, *Euphorbia* L. is one of the largest genera in the family Euphorbiaceae and one of the most diversified angiosperm genera of flowering plants (Mabberley, 2008, 2017; POWO, 2023; Riina & Berry, 2023). In North Africa, this genus is represented by 118 accepted taxa, of which 20 are endemic (Dobignard & Chatelain, 2011; APD, 2023). Within Morocco, the genus *Euphorbia* (s. l.) is represented by 56 taxa (46 species and 10 subspecies), of which 10 are endemic (Fennane & Ibn Tattou, 2005; Fennane *et al.*, 2007; Khamar *et al.*, 2021, 2022). Of

all Moroccan taxa, five species are in the subgenus *Chamaesyce* Rafinesque (Yang *et al.*, 2012), and are characterized by opposite stipulate leaves, a  $\pm$  dissymmetric limb base, cyathium-type inflorescences, and caruncle-less seeds (Fennane *et al.*, 2007).

As part of our ongoing fieldwork to revise the floristic list of the Morocco-North Atlantic phytogeographic region (as defined by Fennane & Ibn Tattou, 1998, 2005) (Fig. 1), we came across some unusual specimens of *Euphorbia* L. in the vicinity of the cities of Rabat and Kénitra. At first, we were not able to determine these specimens using the monographs devoted to this genus in Morocco (Vindt, 1953, 1960), the *Practical Flora of Moroc-*



**Figure 1.** Distribution map of *Euphorbia hypericifolia* in Morocco (green color), with the sampling sites: Site 1 (Rabat), Site 2 (Kénitra), Floristic geographical divisions of Morocco modified from Fennane & Ibn Tattou (1998), where HA = High Atlas Mountains, MA = Middle Atlas Mountains, R = Rif mountains, AA = Anti Atlas Mountains, Mam = Middle Atlantic of Morocco, Man = North Atlantic of Morocco, Ms = Saharan Moroccan, LM = Mediterranean Coast, Op = Eastern-lands, Om = Eastern Mountains and As = Saharian Atlas Mountains.

co (Fennane *et al.*, 2007), or the *Northern Flora of Morocco* (Valdés *et al.*, 2002). Subsequently, after careful analysis of their morphological characteristics and consultation of the generic account in the relevant literature (Li *et al.*, 2008; Levin & Gillespie, 2016; Silva *et al.*, 2020), the specimens were identified as *Euphorbia hypericifolia* L., which is a new record for the vascular flora of Morocco. A brief description of the species and photographs are provided along with ecology, geographic distribution map, specimens examined, and habitats for its easy identification.

## MATERIALS AND METHODS

Plant samples of *Euphorbia hypericifolia* were collected from various locations in the cities of Rabat and Kénitra during the fieldwork (Fig. 2), which was conducted between October 2019 and September 2022. The field data collection included data on populations, distribution, geographic coordinates, habitats, and digital photographs. To make and confirm identifications, relevant literature sources including protologues were consulted (Linnaeus, 1753; El Hadidi, 1973; Chen & Wu, 2004; Li *et al.*, 2008; Pahlevani & Riina, 2011; Silva *et al.*, 2014, 2020; Raab-Straube & Raus, 2015; Levin & Gillespie, 2016; Sciandrello *et al.*, 2016; Yang, 2016; BSI, 2023; Sankara Rao & Kumar, 2023). Herbarium specimens were prepared and deposited at the National Herbarium of the Scientific Institute-Rabat (RAB; acronym according to Thiers, 2023 [continuously updated]). The nomenclature of the species found growing with *E. hypericifolia* follows Govaerts (2023) and POWO (2023).

## RESULTS AND DISCUSSION

### Taxonomic Treatment

*Euphorbia hypericifolia* L., Sp. Pl. 1: 454. 1753.

≡ *Chamaesyce hypericifolia* (L.) Millsp. In Publ. Field Columb. Mus., Bot. Ser. 2: 302 (1909)  
 ≡ *Anisophyllum hypericifolium* (L.) Haw. In Syn. Pl. Succ.: 161 (1812).

Lectotype (designated by Fosberg & Mazzeo 1965: 191): Herb. Linn. No 630.4 (LINN) (image available at <http://linnean-online.org/4598/>).

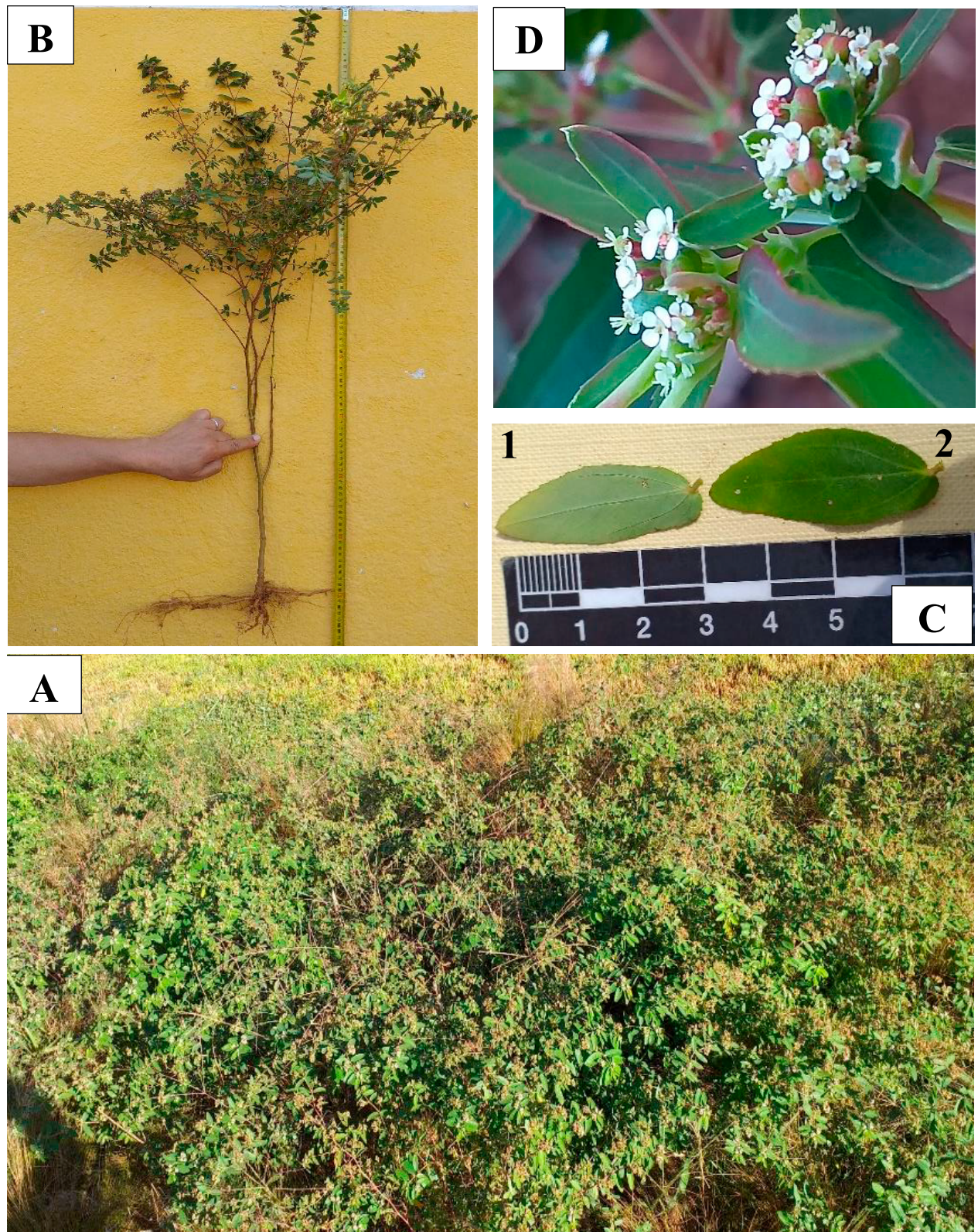
Based on the terminology of El Hadidi (1973), Chen & Wu (2004), Li *et al.* (2008), Pahlevani & Riina (2011), Levin & Gillespie (2016), Sciandrello *et al.* (2016), Mahklouf (2023), and the morphological features observed on the collected specimens, the morphological description of *Euphorbia hypericifolia*, which is distinct from other *Euphorbia* species found in Morocco, is reported in the following section.

**Botanical description.** Herbs, annual, 15–100 cm high, glabrous, with taproot, stems more or less erect, generally much-branched from upper parts, branches deflexed at apex. Leaves 20–35 × (8)10–15 mm, simple, opposite, distichous, petiole 1–2.5(3) mm, blade elliptical-oblong to oblong-oblancheolate, glabrous, base asymmetric, oblique, apex obtuse or broadly acute, margins serrate or serrulate (or obscurely toothed) toward apex. Stipules triangular or deltate, 1.3–1.5 × 1.4–2 mm. Inflorescences formed of cyathia in dense globose cymes, axillary and terminal, with a peduncle 5–(18)20 mm long; involucre cup-shaped, glabrous, outside; glands 4, orbicular white or light pink, each involucre containing one female flower slightly exserted, surrounded by numerous male flowers subsessile. Ovary green, reddish brown when mature, glabrous, trilobed, with a long pedicel 0.5–1 mm long; styles free 3, each 2-fid (stigma) ± 1/2 length. Fruit a 3-lobed capsule, 1–1.5 × 2 mm, subglobose, smooth, glabrous, with one seed per lobe. Seeds brownish, 0.8–1.1 × 0.5 mm, 4-gonous, faces slightly wrinkled, caruncle absent.

**Phenology.** Based on our field observation, *Euphorbia hypericifolia* may be harvested at any time of year, although it flowers from the beginning of July to September and fruits from the end of September to December.

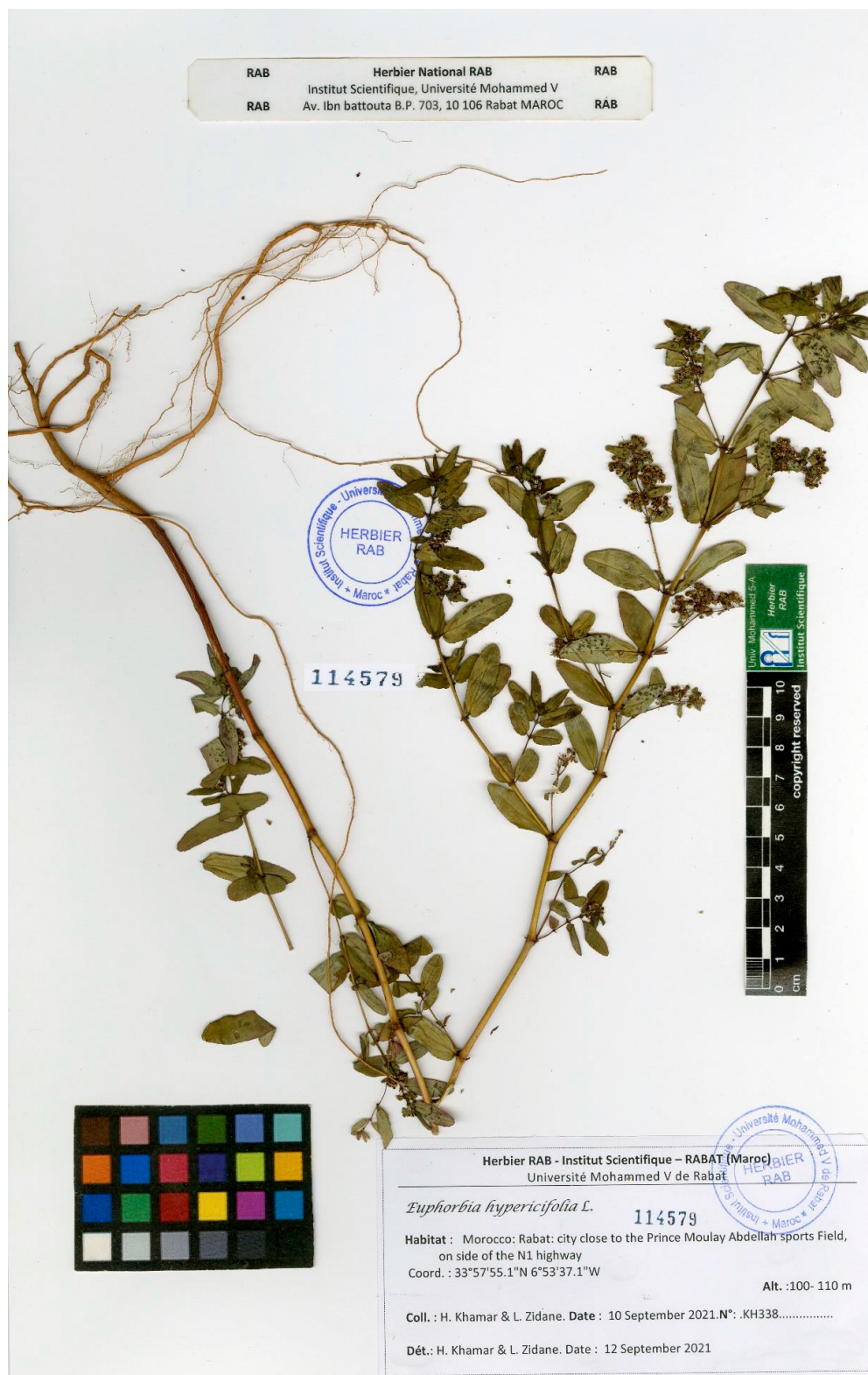
**Chromosome number.** *Euphorbia hypericifolia* is a diploid species with  $2n = 32$  (Wang *et al.*, 1999; Sulaiman *et al.*, 2020).

**Specimens examined.** Morocco. Rabat: vicinity close to the Prince Moulay Abdellah sports Field, on side of the N1 highway, 33° 57' 55.1" N, 6° 53' 37.1" W, 100 m, 10.IX.2021, L. Zidane & H. Khamar (RAB114579, RAB114580, RAB114582,



**Figure 2.** Morphology of *Euphorbia hypericifolia* L.: (A), stand of *E. hypericifolia*; (B), plant habit; (C), leaves (C1), adaxial surface; (C2), abaxial surface); (D), inflorescence.

RAB114583, RAB114584, RAB114585) (Fig. 3); N 6° 34' 11" W, 20–25 m, 24.IX.2021, H. Khamar  
Kénitra: along the national road N1, 34° 15' 38" (RAB114581).



**Figure 3.** Herbarium sheet of *E. hypericifolia* (RAB114579) stored at the National Herbarium of Rabat.

**General distribution.** *Euphorbia hypericifolia* is native to the tropical and subtropical regions of the New World (that is, the southern United States, the Caribbean, and throughout South America) (Steinmann *et al.*, 2016; Atha *et al.*, 2018; POWO, 2023). It has been recorded as a weedy or invasive plant in many areas of the Old World, including the Mediterranean Basin, Western Europe (Belgium), tropical Africa, the Mascarene Islands, and certain parts of Asia (China, India, Iraq, Oman, Pakistan, Taiwan) (Coode *et al.*, 1982; Li *et al.*, 2008; CABI, 2023) (Fig. 4). The geographic distribution of this species in tropical Africa is still uncertain due to frequent confusion with *Euphorbia indica* Lam., a tropical plant that can be found in various regions of Africa and Asia (Emongor, 2008; Sciandrello *et al.*, 2016).

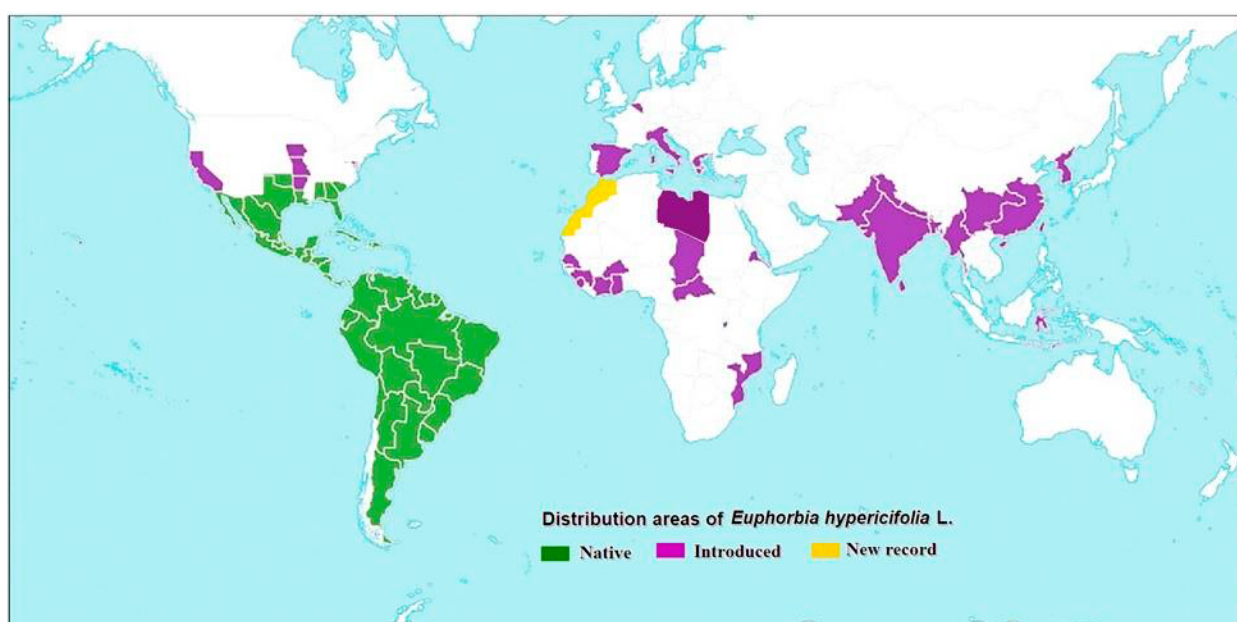
*Euphorbia hypericifolia* has been reported as an introduced or rarely naturalized xenophyte in some Mediterranean countries, and its sporadic range is gradually expanding in this part of the world (Sciandrello *et al.*, 2016). Thus, it has been recorded from Egypt (El Hadidi, 1973; Greuter *et al.*, 1986), from Israel/Palestine (Greuter *et al.*, 1986), from Crete (Gregor & Meierott, 2013), from Greece (Raab-Straube & Raus, 2015), from Italy (Sciandrello *et al.*, 2016), from the Maltese Islands (Mifsud, 2018) and, in the western part of the Mediterranean Ba-

sin, it has been recorded from the Canary Islands (Otto & Verloove, 2016), from peninsular Spain (Verloove, 2005, 2015) and recently from Libya (Mahklouf, 2023).

Throughout its global distribution, *E. hypericifolia* has demonstrated its ability to occur in diverse habitats. It is commonly observed at elevations ranging from sea level to 600 m a. s. l., in humus-rich soils, wastelands, stony riverbanks, along roadsides, along the margins of ponds and marshes, and close to cultivated areas (Chen & Wu, 2004; Sciandrello *et al.*, 2016; Mifsud, 2018). This plant is occasionally cultivated and commercially traded as an ornamental species (CABI, 2023).

**Distribution and ecology in Morocco.** So far, this species is known from the Moroccan North Atlantic phytogeographical region (Man-3 on the map in Fig. 1). In this geographical area, *E. hypericifolia* grows around Rabat and in some places in Kénitra. The bioclimate of this phytogeographical zone is between subhumid and semi-arid Mediterranean. Winters are temperate, the average annual rainfall is around 400 mm, and the average annual minimum and maximum temperatures are 12°C and 24°C, respectively. The relative humidity ranges from 81% in January to 70% in June (Climate-Data, 2023).

In the Rabat region, *E. hypericifolia* grows along the N1 highway near the Prince Moulay Ab-



**Figure 4.** General distribution areas of *Euphorbia hypericifolia* (modified from POWO, 2023).

dellah Sports Center, where a population of about 250 individuals has been confirmed growing on clayey-sandy, more or less humid soil at an altitude of about 100 m; at this site, the following plants were found in association with it: *Mercurialis annua* L., *Euphorbia peplus* L., *E. lathyris* L., *E. paniculata* Desf., *E. terracina* L., *E. hirta* L., *E. maculata* L., *Verbascum sinuatum* L., *Lupinus atlanticus* Gladst., *Lotus arenarius* Brot., *Ononis laxiflora* Desf., *Erigeron canadensis* L., *Plantago major* L., *Oxalis pes-caprae* L., *Emex spinosa* L., *Parietaria mauritanica* Durieu, *Urtica urens* L., *Physalis philadelphica* Lam., *Salpichroa origanifolia* (Lam.) Baillon, *Phyllanthus tenellus* Roxb., *Cyperus rotundus* L., *Bidens pilosa* L., *Erigeron sumatrensis* Retz., *Erigeron bonariensis* L., *Ambrosia artemisiifolia* L., *Pennisetum alopecuroides* Steud., and low grasses.

However, in the Kénitra localities, mature plants of our new record were found in two humid places at altitudes ranging from sea level to about 20 m a. s. l., on limestone and sandstone substrates, in association with the following species: *Ononis diffusa* Ten., *Astragalus baeticus* L., *Erigeron sumatrensis* Retz., *Silybum marianum* (L.) Gaertn., *Ricinus communis* L., *Urtica urens* L., *Verbesina encelioides* (Cav.) Benth. & Hook. f. ex A. Gray, and *Euphorbia helioscopia* L.

The precise introduction pathway of *E. hypericifolia* to Morocco is unknown. However, previous findings have substantiated the existence of this species in various places beyond its indigenous habitats, likely attributable to human activities (Chen & Wu, 2004; Sciandrello *et al.*, 2016). In the local context, the ruderal sites from which this species was collected have been used as parking and turning areas for long-distance trucks and various modes of transportation. The absence of morphological features such as hooks, sticky substances, or wings in the seeds of *E. hypericifolia* limits its ability to disperse over long distances. Consequently, it is widely believed that the unintentional introduction and subsequent naturalization of this species can be attributed to global trade (Mifsud, 2018). Similarly, this mode of dispersal has been attributed to other species within the same genus in certain countries, such as *E. hirta* L. in Morocco (Khamar *et al.*, 2021),

*E. hypericifolia* L. in Malta (Mifsud, 2018), *E. glyptosperma* Engelm. and *E. serpens* Kunth in Bulgaria (Petrova, 2018) and Romania (Sîrbu & Șuşnia, 2018), *E. davidii* Subils in Switzerland (Hoffer-Massard, 2011) and Bulgaria (Vladimirov & Petrova, 2009), and *E. prostrata* Aiton in Hungary (Bátori *et al.*, 2012).

The monitoring conducted over the past three years in Morocco has revealed that *E. hypericifolia* has a low level of invasiveness and demonstrates a propensity for easy spread within its local habitat. However, it lacks the capability to expand beyond its current distribution range. The findings presented align with the observations reported by Mifsud (2018) regarding the occurrence of this species on the Maltese Islands.

## CONCLUSION

This study presents the first documented occurrence of *Euphorbia hypericifolia* in Morocco. Based on our current knowledge, the geographical range of this species in Morocco is limited to the phytogeographic zone known as the Moroccan-North Atlantic. No morphological confusion was observed between this species and other species of the same genus found in the country. Further field studies are needed to clarify the possible distribution of this particular species in various locations in Morocco, particularly in outdoor nurseries, roadside embellishment soils, near cultivated fields, and within ruderal habitats. This will enable us to assess the level of naturalization and evaluate the potential ecological and economic impacts it may cause. In addition, it will deepen our understanding of our flora and propose management plans capable of conserving it efficiently.

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## AUTHORSHIP CONTRIBUTION STATEMENT

**Hamid Khamar:** Conceptualization, Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing. **Soukayna Boudik:** Investigation, Visualization. **Ouafae Benkhnigue:** Investigation, Visualization. **Lahcen Zidane:** Conceptualization, Investigation, Methodology, Writing – review & editing.

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