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***Euphorbia hirta* (Euphorbiaceae): a new naturalized xenophyte in the vascular flora of Morocco**

Abstract

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The occurrence of *Euphorbia hirta* (Euphorbiaceae) is reported here for the first time in Morocco. It is a neophyte native to tropical and sub-tropical regions. Discriminating morphological characters, taxonomic note, photographic illustrations, as well as data on habitats and geographic distribution of the taxon in Morocco and worldwide are provided for easy identification.

Key words: Alien flora, new record, N Africa.

Introduction

In the course of our steady efforts to further study the vascular flora of Morocco, interesting specimens of a plant belonging to the genus *Euphorbia* L. caught our attention during an excursion trip in the vicinity of Rabat (the administrative capital of the Kingdom). Due to its morphological characters, this plant could not be identified using the current floristic references for Morocco (Valdés & al. 2002; Fennane & al. 2007), the monography devoted to this genus in Morocco (Vindt 1953, 1960) of the current floristic references for surrounding countries (Quézel & Santa 1963; Pottier-Alapetite 1981; Jafri & El-gadi 1982; Castroviejo & al. 1997). Nevertheless, the Flora of Egypt (Boulos 2000) and the Flora of Mauritania (Barry & Celles 1991) led us to *Euphorbia hirta* L.

The present work takes stock on the discovery of this new species, its morphology, and its geographic distribution and current ecology in Morocco.

Materials and Methods

Fresh samples of *Euphorbia hirta* were collected on the side of the N1 highway nearby the Prince Moulay Abdellah sports complex in Rabat, in September and

December 2020. Appropriate data about the plant and its natural habitat were collected, and digital photographs were taken. The plant was identified using the Flora of West Tropical Africa (Hutchinson & al. 2014) in addition to the floras of Egypt (Boulos 2000) and Mauritania (Barry & Celles 1991). The protologue of the type species (Linnaeus 1753) was checked, and then identification was confirmed by viewing digital images of type specimens kept in the Linnean Collections (LINN) (<http://www.linnean-online.org/>), as well as true specimens examined based on the Jstor (<https://plants.jstor.org>) and Global Biodiversity Information Facility (GBIF) (<http://www.gbif.org/occurrence>) databases, whose images of herbarium specimens are available online and on their websites. Voucher herbarium specimens were prepared and deposited in the National Herbarium (RAB) of the Scientific Institute-Rabat. Herbarium acronym is according to Thiers (2021+).

Results and Discussion

Taxonomy

Euphorbia hirta L., Sp. Pl. 454. 1753.

Lectotype (designated by Wheeler 1939:72): Habitat in India, LINN (Herb. Linn. No. 630.7, image available at <http://linnean-online.org/4601/>).

Among all *Euphorbia* species found in Morocco, *E. hirta* is easily recognizable thanks to the following combination of characters: a stalk that grows dichotomous very near its base (the short main stalk rapidly branches off into secondary stalks); the tomentose and villose pubescence of its stalks, composed of long multicellular spread out yellowish simple tector hairs and of dense \pm curved short whitish hairs; its inflorescences formed of axillary cyathia grouped in thyrsi made of dense small globular cymes 15-18 mm in diameter, borne by a peduncle 10-20 mm long, covered with a pubescence made of short simple appressed whitish tector hairs similar to that of the petiole; thyrsi laid out at the leaf base in an alternate pattern between nodes; old thyrsi dichotomically divided into two or three globulose glomerules (Fig. 1).

The Flora of Morocco (Fennane & al. 2007) considers the genus *Chamaesyce* S. F. Gray distinct from the genus *Euphorbia* L. when classifying the species characterized by opposite stipulate leaves, a \pm dissymmetric limb base, cyathium-type inflorescences and caruncle-less seeds (i.e., *C. canescens* (L.) Prokh., *C. granulata* Forsskål, *C. inaequilatera* Sonder, *C. peplis* L. *C. scordifolia* Jacq.). Yet, the classification of the genus *Euphorbia* L. drastically changed during the last decade following a series of molecular phylogenetic studies that considerably improved our understanding of the relationships among its members (Steinmann & Porter 2002; Bruyns & al. 2006; Zimmermann & al. 2010; Horn & al. 2012; Yang & al. 2012; Dorsey & al. 2013; Peirson & al. 2013; Riina & al. 2013). Consequently, some previously distinct genera are now included in *Euphorbia* L. Thus, a new infra-generic classification was proposed that considers the main four clades of the

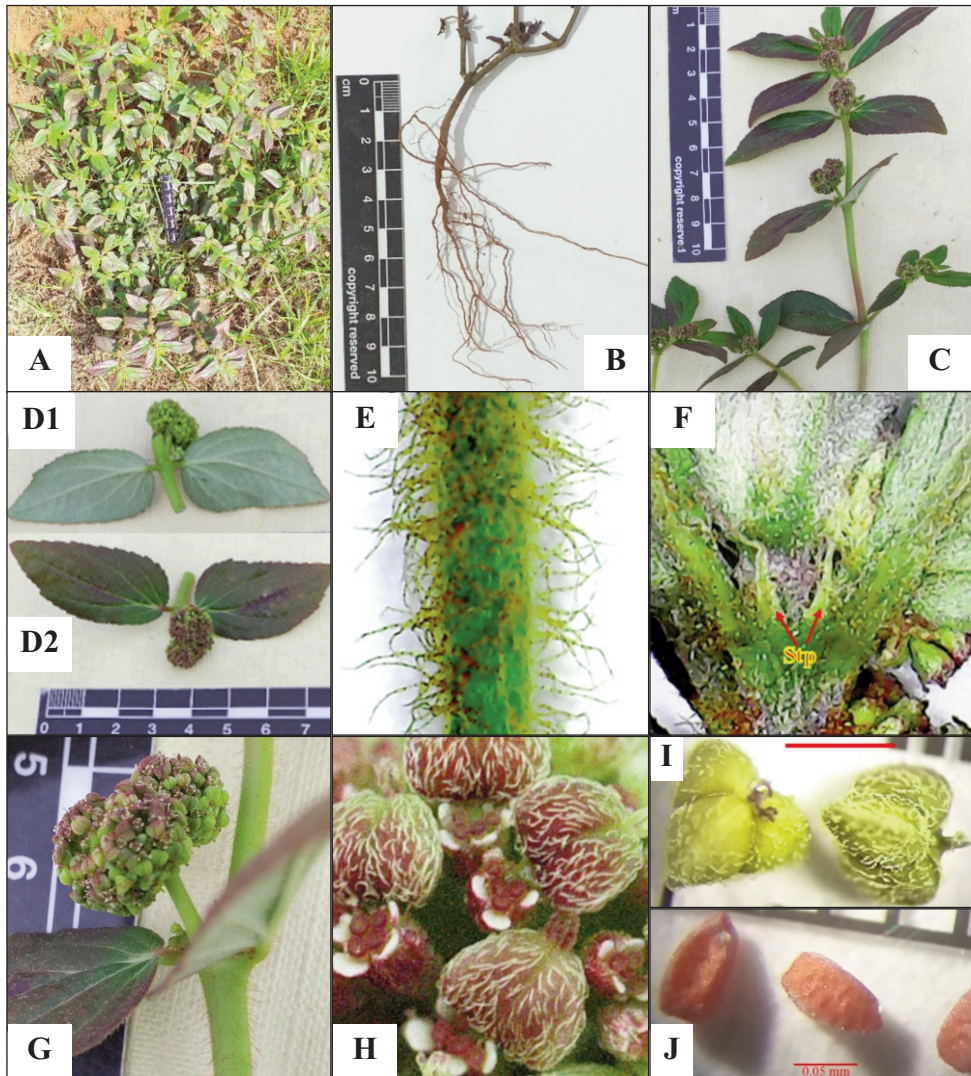


Fig. 1. *Euphorbia hirta*: **A**) Habit; **B**) Root; **C**) Flowering stalk; **D**) Leaves (**D1**, abaxial surface, **D2**, adaxial surface); **E**) tector hair on the stem; **F**) Stipules (Stp); **G**) Inflorescence showing old cymes dichotomously divided into three globose glomerules of Cyathia; **H**) Cyathia with whitish petaloid deltoid glands; **I**) Capsule, top view (left) and lateral view (right); **J**) Seeds.

genus as monophyletic subgenera (subg. *Athymalus* Necker (Peirson & al. 2013), subg. *Chamaesyce* Raf. (Yang & al. 2012), subg. *Esula* Persoon (Riina & al. 2013), and subg. *Euphorbia* (Dorsey & al. 2013). These subgenera are divided into sections (Horn & al. 2012; Peirson & al. 2013).

Thus, by adding 5 species belonging to the subgenus *Chamaesyce sensu* Yang & al. (2012) in addition to the new species described in the present article, the number of taxa in the genus *Euphorbia* in Morocco increases from 51 (41 species and 10 subspecies) (Fennane & Ibn Tattou 2005; Fennane & al. 2007; Dobignard & Chatelain 2011) up to 57 taxa (47 species and 10 subspecies), including 9 endemic ones.

Examined specimens (new record)

MOROCCO: Rabat nearby the Prince Moulay Abdellah sports complex, on side of the N1 highway (33°57'55.1"N 6°53'37.1"W), in Sept. 2020. *H. Khamar* 375 & *L. Zidane*. (RAB111693, RAB111694, RAB111695, RAB111696).

Discovery site and ecology in Morocco

In the present state of our knowledge, the distribution area of *Euphorbia hirta* in Morocco is limited to the Morocco-north Atlantic phytogeographic region (Man-3 in the present study). We only observed it in the region of Rabat on the side of highway N1. It grows about 100 m of altitude, on clayey-sandy, more or less humid soil.

About thirty mature *E. hirta* plants or so were observed on the discovery site, along with *Mercurialis annua* L., *Euphorbia peplus* L., *E. lathyris* L., *E. paniculata* Desf., *E. terracina* L., *Verbascum sinuatum* L., *Lupinus atlanticus* Dladst., *Lotus arenarius* Brot., *Ononis laxiflora* Desf., *Erigeron canadensis* L., *Plantago major* L., *Emex spinosa* L., *Parietaria mauritanica* Durieu, and *Urtica urens* L.

According to Waterhouse (1994), one *E. hirta* plant can produce up to 3,000 seeds. Seeds are dispersed thanks to an explosive mechanism of the capsule, as described by Bolaji & al. (2020). However, this dispersal mechanism only sends seeds a few meters away around the mother plant (Hufhuis & Hay 2017). The seeds do not display any morphological feature (hooks, gluey substances, wings, etc.) that would allow them to get hooked to animals (exozoochory) or be wind-borne. Studies on the potential of animals (e.g., migratory birds) to disperse this species by endozoochory (they would transport the seeds in their intestinal tract) (Bolaji & al. 2020) are lacking. The proximity of a main highway and of the highly frequented sports complex would be at the origin of the incidental introduction of this species in Morocco. This mode of dispersal has been greatly implied in the intentional introduction and the naturalization of species belonging to the same genus in certain European countries (i.e., *E. davidii* Subils in Switzerland (Hoffer-Massard 2011) and Bulgaria (Vladimirov & Petrova 2009); *E. serpens* Kunth in Bulgaria (Petrova, 2018), *E. glyptosperma* Engelm and *E. serpens* Kunth in Romania (Sîrbu and Suşnia (TONE) 2018), *E. prostrata* Aiton in Hungary (Bátori & al. 2012) and *E. hypericifolia* L in Malta (Mifsud 2018)).

Geographic distribution around the world and habitat

Euphorbia hirta is a ruderal, messicolous plant; it is found from the seaside level up to more than 1500 m of altitude (Steinmann & Felger 1997; Santana & al. 2015, 2016; Levin & Gillespie 2016). It is fond of humid places bared by erosion,

but it can adapt to clayey or more or less rich soils (CABI 2021). It is found in highly diverse environments like the rims of conurbations, roadsides and trail sides, uncultivated lands, or wastelands (Li & al. 2008; Halford & Harris 2012; Silva & al. 2014). It is tolerant to high temperatures and drought within its distribution area (Santana & al. 2015; CABI 2021). According to the literature, *E. hirta* is native to central tropical America (Li & al. 2008; Huang & al. 2012; Levin & Gillespie 2016; CABI 2021). It is currently among the common *Euphorbia* species of tropical and sub-tropical regions around the world (Klopper & al. 2006; Li & al. 2008; Yang & Berry 2011; Hutchinson & al. 2014; Govaerts 2019; POWO 2019; CABI 2021; etc.).

Conclusion

Euphorbia hirta was collected in the vicinity of Rabat (Morocco). Its presence in Morocco is reported for the first time in the present study. This discovery further enriches the vascular flora of Morocco and brings the number of taxa of the genus *Euphorbia* up to 57 (47 species and 10 subspecies).

With this study, our record of *E. hirta* as naturalized alien highlights how important field investigations are; it also shows that many phytogeographic sectors of Morocco still remain under-prospected.

On the other hand, as long as *E. hirta* is widely used as a medicinal plant in several regions of its range (e.g. Agra & al. 2008; Huang & al. 2012; Santana & al. 2015) and for the richness in secondary metabolites (e.g. Hore & al. 2006; Ogunlesi & al. 2009, Al-Snafi 2017; etc.), it will constitute an important addition for the country's medicinal flora and also has opened the path for further investigations in pharmacology and phytochemical screening in order to discover newer and potential bioactive compounds.

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