



ISSN NO. 2320-5407

Journal homepage: <http://www.journalijar.com>

INTERNATIONAL JOURNAL  
OF ADVANCED RESEARCH

## RESEARCH ARTICLE

## ***Boerhavia erecta* L. (Nyctaginaceae): A new record to the flora of the Arabian Peninsula from Yemen**

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### **Manuscript Info**

#### **Manuscript History:**

Received: 19 September 2015

Final Accepted: 22 October 2015

Published Online: November 2015

#### **Key words:**

*Boerhavia erecta*, Nyctaginaceae,  
New record, Arabian Peninsula,  
Yemen.

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### **Abstract**

The Arabian Peninsula contains a rich and divers flora, which is still incompletely known. In the period on May 2009 – March 2014 have been conducted field studies and collections in the area of three districts are: Toor Al-Baha, Al-Maqatrah and Tuban, which are located in Lahej province, Southwestern Yemen. The result of these studies was recorded in the first time to the flora of the Arabian Peninsula, *Boerhavia erecta* L. (Nyctaginaceae). It was found at altitude between 95-840 m a.s.l., where it grows in roadsides, alluvial plains and borders of fields. *B. erecta* L. can be distinguished from *B. diffusa* L. by its obconical anthocarps which are completely glabrous, truncate at the apex with undulate ribs. Description, habitat, phytochory and figures of the species are given.

## **INTRODUCTION**

The Arabian Peninsula covers some 3.309.478 million km<sup>2</sup>, an area equal approximately 2% of the world's land surface (Fisher *et al.*, 1998). It is more or less rectangular in shape and tilts gently from its highest part along the Red Sea in the west, downwards to the Arabian Gulf in the east. It is a region of divers topography ranging from rugged mountains (reaching over 300 m) through vast sand and rock desert (including some of the hottest and driest on earth) to luxuriantly vegetated, mist-covered mountains and highly productive areas of ancient terraced agriculture (Miller and Cope, 1996). The Arabian Peninsula can be divided into six topography regions:

1. Western coastal plain (the Tihama)
2. Mountains regions of the south and west
3. The mountains of Oman
4. The western Najd
5. The Arabian platform
6. The Socotran archipelago.

The Arabian Peninsula is part of the huge arid zone which extends across N Africa and S Asia from the Sahara to the Sind desert in Indian and Pakistan (Miller and Cope, 1996). According to Fisher *et al.* (1998), Collenette (1999), Ghazanfar (2003), Karim and Fawzi (2007), Norton *et al.* (2009), Al-Khulaidi (2013), Mohamed *et al.* (2014), Al-Hawshabi (2014 and 2015), Al-Hawshabi *et al.* (2015), the flora of the Arabian Peninsula consists of c. 7870 species of vascular plants, the highest number is found in Yemen including Socotra (2843 taxa), followed by (Saudi Arabia 2250 taxa; Oman 1208 taxa; the UAE 600 taxa; Qatar 400 taxa; Kuwait 374 taxa and Bahrain 195 taxa). The number of species of *Boerhavia* represented by three species in the flora of The Arabian Peninsula. In this paper the author collected interesting species belonging to the genus of *Boerhavia*, the specimens collected were compared with the relevant data in literature (Thulin, 1993; Miller and Cope, 1996; Wood, 1997; Chaudhary, 1999; Gilbert, 2000; Ghazanfar, 2003; Karim and Fawzi, 2007; Norton *et al.*, 2009). As a result of all these comparison, the specimen collected was found to be a new record for the Arabian Peninsula flora from Yemen.

## **MATERIALS AND METHODS**

In this research, the taxa was collected of Southwestern Yemen, Lahej governorate, during the intensive floristic survey between May 2009 to October 2010 in Toor Al-Baha district, on June 2013 in Wadi Mabaq,

Al-Maqatrah district and on March 2014 in Tuban district. The specimen was first compared with similar species from flora of Yemen, and then flora of Kingdom of Saudi Arabia, flora of Oman, flora of the United Arab Emirates, flora of Somalia and flora of Ethiopia, in order to identify it. The references (Thulin, 1993; Gilbert, 2000; Chou *et al.*, 2004; Chen and Wu, 2007) were used for the identification of the taxa. Morphological characteristics and other information like habitat, distribution, Phytochory and color photography as it is shown (Fig. 1). Illustrations are provided to facilitate the identification of the species.

## RESULTS

### TREATMENT

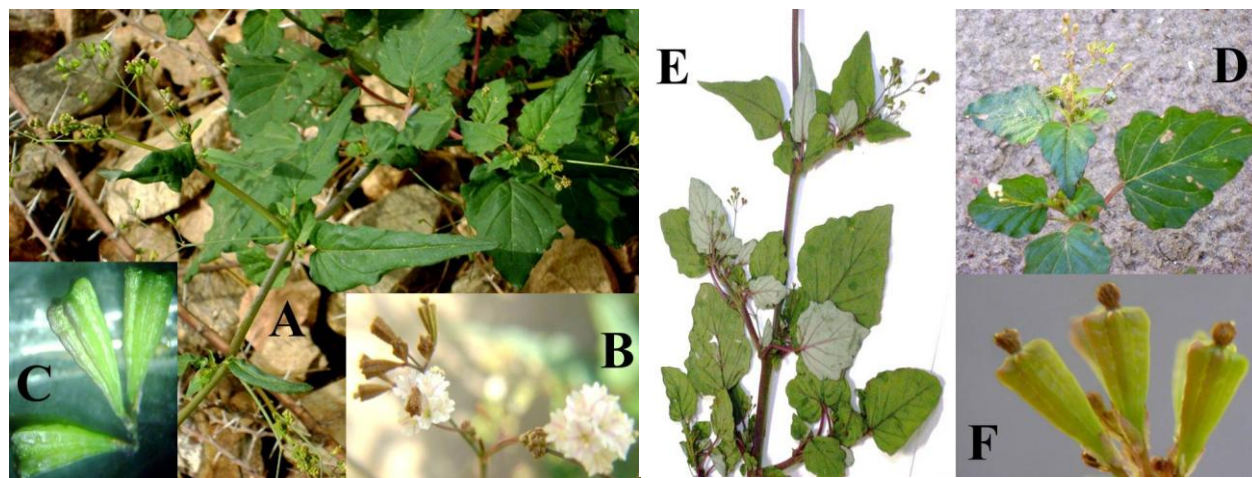
*Boerhavia erecta* L., Sp. Pl. 3. 1753. (Fig. 1)

Annual or short-lived perennial herb, ascending or erect, up to 60 cm tall. Stems terete, green flushed with purple, puberulent, with pilose at nodes and sticky internode bands, becoming glabrous and woody towards the base. Leaves somewhat fleshy, opposite, in unequal pairs; petiole 1-3 cm long; leaf-blade broadly lanceolate to ovate, 2.5-3(-8) × 1.5-2.5 cm, margins sinuate, truncate to rounded at the base, apex subacute rarely obtuse, upper surface green, glandular-dotted or not, lower surface greyish-white and occasionally with sunken red glands. Inflorescence axillary or/and terminal; Flowers in erect, diffuse terminal panicles up to 30 cm tall, the panicle 4-6 branched; all bracts very small; ultimate unit of inflorescence a pedunculate 3-7-flowered umbel, peduncle 2-8 cm long, pedicel up to 3 mm long, with 2-3 lanceolate bracteoles less than 1 mm length. Perianth white. Anthocarps obconical, sharply 5-sided/5-ribbed, with truncate tip, 3.5-4 mm long and 1.5 mm wide, completely glabrous, the ribs undulate. Flowering is throughout the year.

**Habitat:** A common in roadsides, alluvial plains and borders of fields, in Toor Al-Baha district, Al-Maqatrah district and Tuban district (Lahej governorate), Yemen.

**Phytochory:** Neotropical.

**Specimens examined:** Yemen, Lahej governorate (Toor Al-Baha district, alts. 509 m, 13° 06' 543" N, 44° 21' 059" E, 25. 5. 2009, Othman 0724; 675 m, 13° 11' 818" N, 44° 17' 636" E, 10. 10. 2009, Othman 2059; 783 m, 13° 12' 962" N, 44° 20' 245" E, 12. 10. 2009, Othman 2202; 608 m, 13° 10' 040" N, 44° 19' 247" E, 10. 11. 2009, Othman 2897; 735 m, 13° 12' 348" N, 44° 20' 141" E, 14. 11. 2009, Othman 2915; 829 m, 13° 13' 049" N, 44° 20' 351" E, 16. 11. 2009, Othman 3078; 519 m, 13° 07' 179" N, 44° 21' 009" E, 31. 7. 2010, Othman 4576; 660 m, 13° 11' 157" N, 44° 18' 149" E, 16. 10. 2010, Othman 4731 & 802 m, 13° 12' 673" N, 44° 18' 103" E, 19. 10. 2010, Othman 4770); (Wadi Mabaq, Al-Maqatrah district, alt. 840 m, 13° 10' 93. 2" N, 44° 14' 06.9" E, 12. 6. 2013, Othman 5178) & (Tuban district, alt. 95 m, 12° 59' 86.0" N, 44° 55' 27.9" E, 18. 3. 2015, Othman 5220).



**Fig. 1.** *Boerhavia erecta*, A: Habit, B: Portion of inflorescence inserted (flowers and fruits), C: Anthocarps, D: Axillary and terminal peduncles inserted (flowers and fruits) on terminal branch, E: Branches inserted (leaves and inflorescence), F: Anthocarps.

## DISCUSSION

Nyctaginaceae is represented c. 31 genera and 400 species, almost all of which are widely distributed in all warmer parts of the world with concentration in the new world. Generally the plants are trees, shrubs, climber, or annual or perennial herbs (Bittrich and Kühn, 1993). In Yemen the family is represented by five genera viz.; *Boerhavia*, *Bougainvillea*, *Commicarpus*, *Mirabilis* and *Pisonia* (Miller and Cope, 1996; Wood, 1997; Al-Khulaidi, 2013). *Boerhavia* L. contains c. 20 species, in almost all of which are widely distributed in tropical and subtropical areas of the world (Bittrich and Kühn, 1993). In Yemen three species were previously reported for the genus of *Boerhavia*: *B. diffusa* L., *B. elegans* Choisy and *B. repens* L.

During the intensive floristic survey between May 2009 to October 2010 in Toor Al-Baha district, also on June 2013 in Wadi Mabaq, Al-Maqatrah district and on March 2015 in Tuban district (Lahej governorate), the author found a herbaceous species similar to *B. diffusa* and different from it in having ascending to erect habit, grayish-white lower surface of leaves and glabrous fruit. The specimens of the unknown species were then taken to compare with the species of the genus in the vicinities of Yemen viz. flora of Ethiopia (Gilbert, 2000) and flora of Somalia (Thulin, 1993). The results indicated that the species is *B. erecta* L. which is usually distinguished from other species were previously reported from Yemen by its obconical anthocarps, which are completely glabrous, truncate at the apex, and with undulate ribs. Originally, the species is native to Somalia, Ethiopia, Taiwan, Tropical America, India, Malaysia, Thailand, The Philippines and Mainland China (Thulin, 1993; Gilbert, 2000; Chen and Wu, 2007).

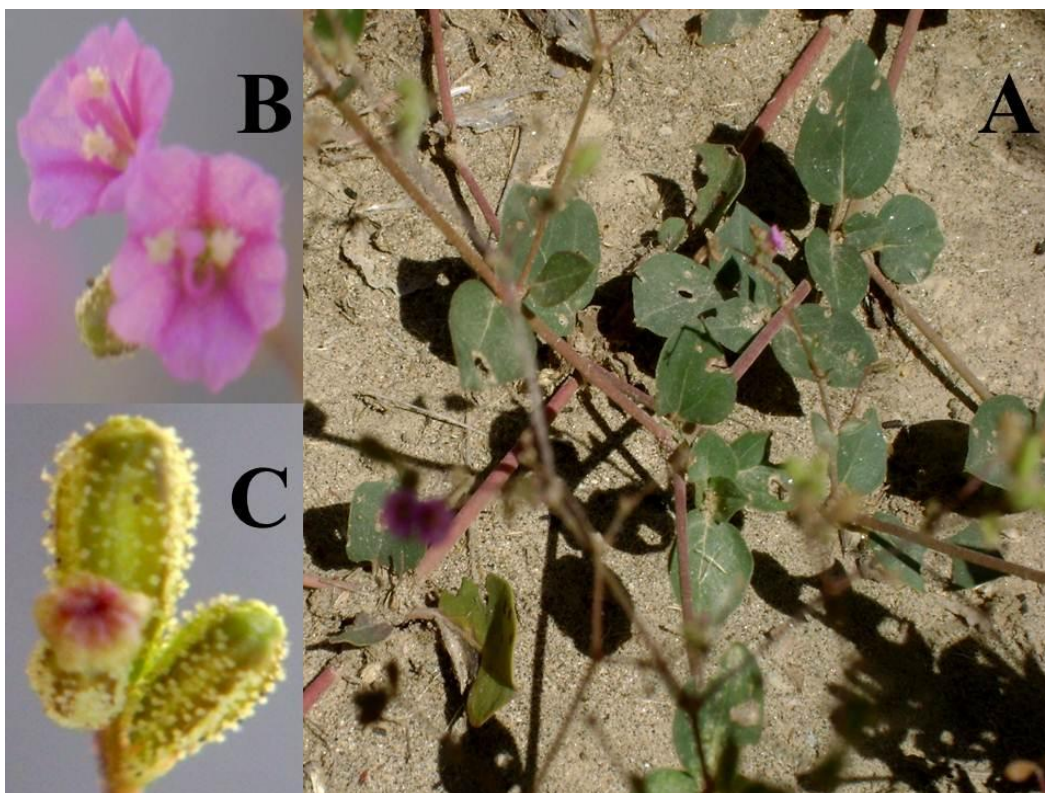
*Boerhavia erecta* is here reported for the first time in Arabian Peninsula (Miller and Cope, 1996; Wood, 1997; Chaudhary, 1999; Ghazanfar, 2003; Karim and Fawzi, 2007; Norton *et al.*, 2009). With this new record the total number recorded of *Boerhavia* in Yemen has reached four species.

The most closely related species to *Boerhavia erecta* (Fig. 1.) in Arabian Peninsula is *B. diffusa* (Fig. 2). The most important diagnostic characters for both species are shown in Table 1.

**Table 1.** Comparison between two species of *Boerhavia*

Characteristics	<i>B. erecta</i>	<i>B. diffusa</i>
<b>Habit</b>	Erect to ascending herb.	Prostrate to ascending herb.
<b>Leaves</b>	Broadly lanceolate to ovate, truncate to rounded at the base, subacute rarely obtuse at the apex, upper surface green, glandular-dotted or not, lower surface grayish-white, sparsely pubescent.	Broadly ovate to subcircular, subcordate to broadly cuneate at the base, acute to rounded at the apex, upper surface dark green, lower surface pale, glabrous except for margins and veins beneath.
<b>Perianth</b>	White	Purplish-red
<b>Anthocarps</b>	Obconical, sharply 5-ribbed, truncate tip, and with undulate ribs, completely glabrous.	Ellipsoid to obovate, densely glandular or puberulous, usually covered in numerous yellowish glands, rounded or tapering at apex.





**Fig. 2.** *Boerhavia diffusa*, A: Habit, B: flowers, C: Anthocarps.

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