

Odyssea mucronata, *Sesbania sericea*, and *Sesamum alatum*— new discoveries for the flora of Saudi Arabia

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Abstract: During field studies in sand dune areas and some habitats close to wetland ecosystems of the Tihama region of Jazan Province in south-western Saudi Arabia, specimens of 3 interesting species belonging to the genera *Odyssea* (Poaceae), *Sesbania* (Papilionaceae), and *Sesamum* (Pedaliaceae) were collected; they were identified as *Odyssea mucronata* (Forssk.) Stapf, *Sesbania sericea* (Willd.) Link., and *Sesamum alatum* Thonn. A review of the literature revealed that these tropical African taxa were never before recorded for the flora of Saudi Arabia. *O. mucronata* is represented by a relatively large isolated population. The other 2, *S. sericea* and *S. alatum*—components of a semi wetland ecosystem and sandy areas, respectively—are represented in the Arabian Peninsula by 2 relict populations. Morphology, habitat descriptions, illustrations, and taxonomic commentary of all 3 taxa are presented.

Key words: *Odyssea*, *Sesbania*, *Sesamum*, Tihama region, Jazan Province, Saudi Arabia, Somalia-Masai region

Introduction

For several decades the flora of Saudi Arabia was thought to be poor in terms of plant diversity. This impression was based on various comparative floristic surveys carried out in the region (Blatter, 1919-1936; Vesey-Fitzgerald, 1955; DeMarco & Dinelli, 1974; Migahid, 1988-1990). Nevertheless, towards the end of the previous century a significant amount of information pertaining to the flora of Saudi Arabia was unveiled through extensive field work and subsequent publications (Alfarhan et al., 1997;

Collenette, 1999; Chaudhary, 1999-2001; Al-Turki, 2004). These additional records elevated the species accounts for this country from approximately 1500 species to some 2300 species of higher plants. Field work during the past 5 years, particularly in plant diversity hot spots, has also yielded new discoveries (Al-Turki, 2003; Al-Zahrani & El-Karemy, 2007; Fayad & Zahrani, 2007). These new additions to the flora of Saudi Arabia indicate that the country still has several under-collected areas or areas that have never been visited for plant collection. The quest for

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new additions to the flora of Saudi Arabia and efforts to enrich various herbaria in the Kingdom has not abated. The aim of the present investigation was to explore a botanically rich area in order to enrich various herbaria in the Kingdom and to contribute new additions, if any, to the flora of Saudi Arabia.

Materials and methods

Study area

During a floristic survey carried out between 2007 and 2010 in the Tihama region of the Jazan Province (Figure 1) we came across 3 interesting populations. The 3 collection sites are not far from each other, and all lie within the tropical dry zone of the desert, which

is characterised by high temperature ranges and high humidity (El-Demerdash et al., 1995). The Tihama plain is 500 km long, stretches in a north-south direction, and averages about 40 km in width. The plain is bordered in the west by the Red Sea and in the east by the foothills of the Sarawat Mountains. Unlike the inland regions, this area is made up of alluvial plains, sand dunes, and wadis and is largely arid, with the exception of a few oases. Rainfall is moderate and erratic (>100 mm); however, occasional spates develop during rainy days and often destroy the riparian vegetation. Severe soil erosion was observed in many places in the collection locality except in areas of reasonable vegetation strength where the plant roots firmly bind the silt together. In certain areas

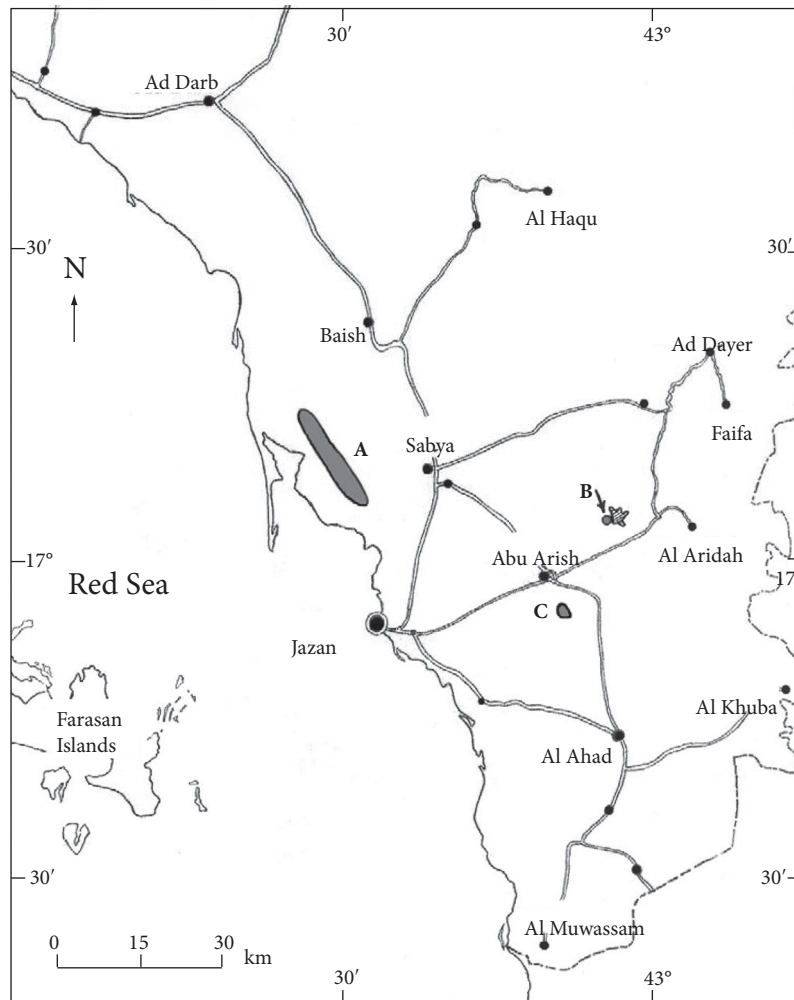


Figure 1. Distribution map of *Odyssea mucronata* (A), *Sesbania sericea* (B), and *Sesamum alatum* (C) in Saudi Arabia.

the silt pans of the wadis extend into broad plains and merge with the sand dune plains of the coastal areas. The vegetation in the wadis near the foothills is luxurious, but becomes sparse as the wadis approach the sea. Vegetation in the wadis of central Tihama is more scattered; however, it appears pronounced in large depressions. Criteria adopted for assessing the threat status of the newly discovered species is based on guidelines published by the International Union for Conservation of Nature (IUCN).

Plant collection

The usual strategy for herbarium sample collection was followed during field studies. On average 400 specimens (100-200 species) were collected from each site. The specimens were deposited in the herbarium (MUZ) of King Abdulaziz City for Science and Technology, Riyadh; duplicate sets were also deposited in the Herbarium (KSU) of the Botany and Microbiology Department at King Saud University and in the Department of Biology, Jazan University, Jazan.

Results

Critical studies (Thulin, 1989; Wood, 1997; Chaudhary, 1999-2001; Collenette, 1999; Ihlenfeld, 2006) of these curious specimens resulted in the discovery of 3 new records for the flora of Saudi Arabia: *Odysea mucronata* (Forssk.) Stapf., *Sesbania sericea* (Willd.) Link., and *Sesamum alatum* Thonn. The following descriptions and distribution details of the species were based on the morphological studies carried out by the authors themselves and from various studies in the literature (Chaudhary, 1989; Wood, 1997).

Morphological descriptions of the specimens studied

Odysea Stapf.

It is a small genus with 2 (Chaudhary, 1989) or possibly 3 (Airy Shaw, 1985) species mainly distributed in tropical and south-western Africa and along the Red Sea coastal regions of the south-western Arabian Peninsula. To date only 1 species, *Odysea mucronata*, is recorded from the Red Sea basin of the Arabian Peninsula. Although this species was known from Yemen since the time of Forsskål

(1775) as *Festuca mucronata* Forssk., this is the first time specimens of this species have been collected from Saudi Arabia.

Odysea mucronata (Forssk.) Stapf. (Figures 2, 3).

Syn.: *Festuca mucronata* Forssk. Fl. Aegypt.-Arab. 22, 1775; *Aeluropus mucronatus* (Forssk.) Asch. Beitr. Fl. Aethiop. 297, 1867.

Type: Bayt al Faqih; Yemen, 1763/4, *Forsskål* (Museum National d'Histoire Naturelle, P). *s.n.*

Morphological features

Description: About 2 m tall, branched, perennial, rhizomatous grass with stiff, distichous leaves, 2-5 cm long. Leaf-blades coriaceous; leaf base inrolled; ligule represented by a fringe of hairs. Inflorescence dense, 1.5-2 × 1.25-1.75 cm, borne on the central axis, ovoid, formed of several short racemes. Spikelets 5-9 (-10)-flowered, elliptic, laterally compressed silky-villous, shortly pedicelled, each 6-9 mm long; disarticulating above the glumes. Glumes shorter than spikelet, persistent; lower glume acute, lanceolate; 0.7-0.8 mm, scarious; 1-nerved; upper glume oblong; 0.6-0.9-1.2 length of adjacent fertile lemma; scarious; without keels; 1-veined. Fertile lemma ovate, 3-veined, mucronate, membranous, rounded on the back, lateral veins and basal part of the central vein villous; margin scarious. Palea as long as the lemma, 2-veined. Caryopsis ellipsoid, 1.5 × 0.5 mm, brown with free soft pericarp.

Representative specimens: Saudi Arabia: NW of Sabya, Jazan Province, 21.3.2010, *Y. Masrahi* 7544 (MUZ 19078); NW of Sabya, Jazan Province, 13.1.2005, *Y. Masrahi* 27-7 (KSU 21417).

Distribution: Seen along the coastal regions of the Red Sea in Eritrea, the Somali Republic, and the south-western Red Sea coast of the Arabian Peninsula (Thulin, 1989).

Note: *Odysea mucronata* spreads through the sand by rhizomes, forming large colonies (Figure 2). It has some resemblance to *Aeluropus lagopoides* (L.) Trin. ex Thw., a common clump-forming halophyte found both in the coastal and inland 'sabkhas' (salty areas). The latter differs from the former in having 3- to 5-nerved glumes and 9- to 11-nerved lemmas. Another closely related species belonging

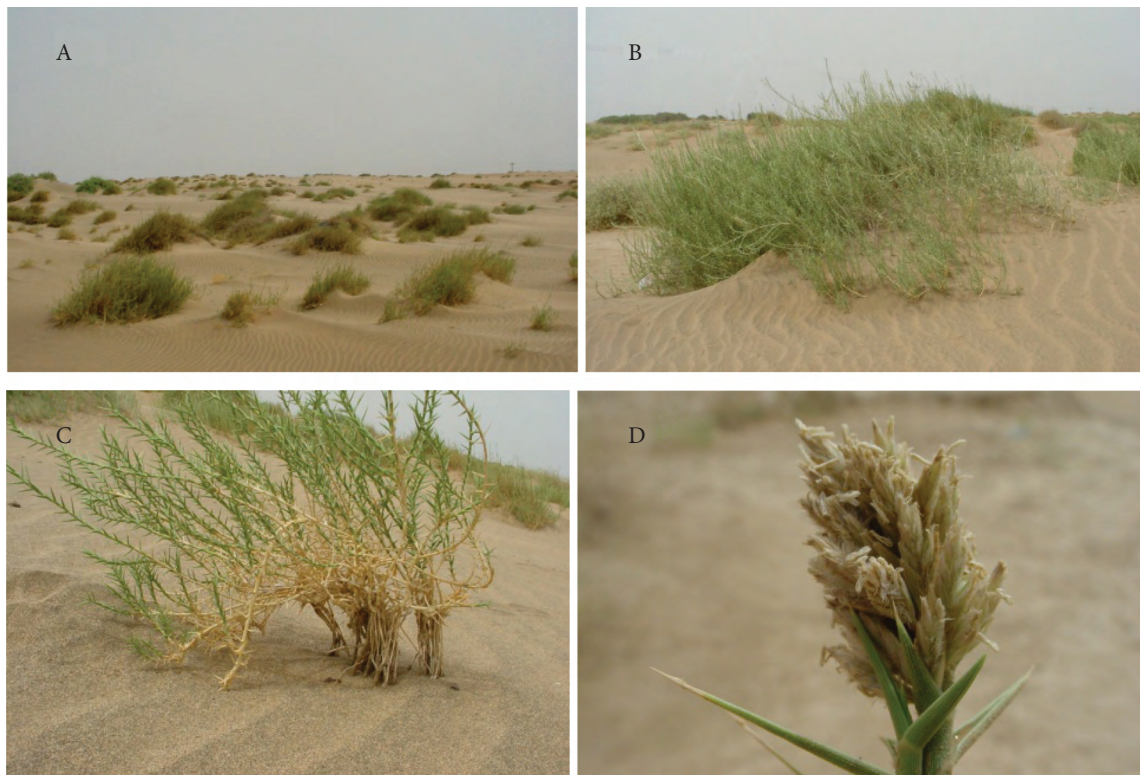


Figure 2. *Odyssea mucronata*. A-habitat, B-habit, C-habit showing the root system, D-inflorescence.

to the genus *Odyssea* is *O. paucinervis* (Nees) Stapf. It is characterised by 15-30 cm tall culms, unequal glumes, and 2.2-3.3 mm long, membranous lemmas. To date it has only been reported from Botswana, Somalia, Tanzania, the United Republic of Zambia, Zimbabwe, and South Africa.

Sesbania Scop.

The genus *Sesbania* of the tribe Robinieae comprises about 55 tropical and subtropical species of herbs, shrubs, or small trees (Mabberley, 1997; Thulin, 1989). Africa is the centre of diversity of this genus, with more than 30 species occurring there. The subsequent distribution of the species has been carried out by humans. Most of the species have nitrogen fixing ability, which enables these plants to grow vigorously on nitrogen deficient soils. Among these, *S. grandiflora* (L.) Poir. and *S. sesban* (L.) Merr. have been used extensively in agroforestry; they are being cultivated in paddy fields in the Indian subcontinent as an intercrop and ground cover (Bisoyi et al., 2010).

***Sesbania sericea* (Willd.) Link (Figures 4, 5).**

Syn.: *Agati sericea* (Willd.) Hitchcock, Missouri Bot. Gard. 4: 75. 1893; *Coronilla sericea* Willd. Enum. Pl. 773. 1809; *Sesbania pubescens* de Candolle, Prodr. 2: 265. 1825.

Type: Sri Lanka: Near Colombo, s.d., *Ferguson s.n.* (Neotype: K).

Description: About 3 m tall, slightly woody pubescent annual or perennial herb. Branches often with minute prickles at the base. Stipules erect, c. 5 mm long, caducous. Leaf rachis up to 20 cm long; leaflets 20-25 pairs, up to 20 × 5 mm, densely pubescent. Racemes 40-50 mm long, silky pilose, rachis, 3-6-flowered; pedicels up to 5 mm long, covered with soft, silky tomentum. Calyx cup-shaped with triangular lobes up to 0.5-1 mm long. Standard petal, broader than long, 6-7 × 8-11 mm, pale cream with a few flecks of violet, apex emarginate, base cordate; appendages narrow, wedge-shaped; wing 5-6 × 3-4 mm; keel 3-3.5 × 4-5 mm, incurved, claw up to 4.5 mm long. Filaments 7-8 mm long. Ovary and style glabrous, c. 2.5 mm long. Legume straight, 150-200 × 2.5-3.5 mm, beaked, 17-30-seeded. Seeds brownish, more or less rectangular.

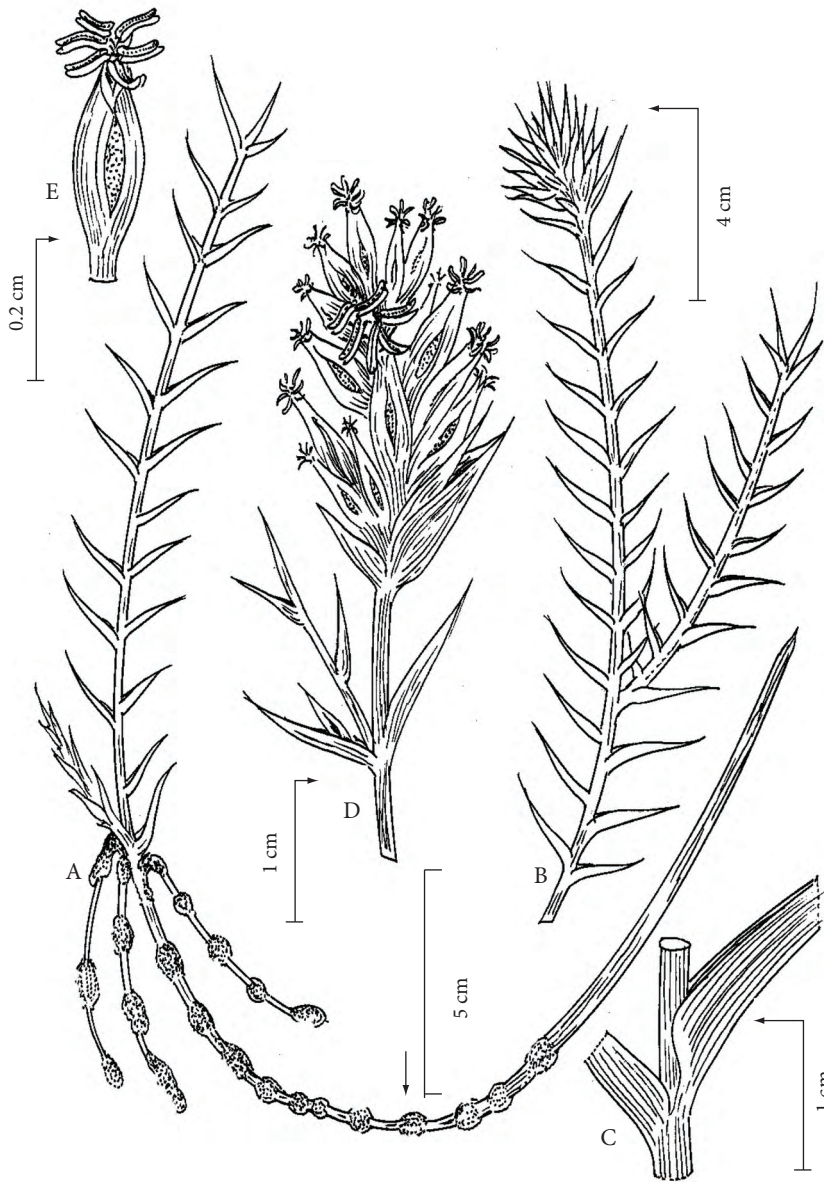


Figure 3. *Odyssea mucronata*. A-habit, B-part of a vegetative branch, C-leaf axile, D-inflorescence, E-flower.

Representative specimens: Saudi Arabia: Malaki Dam, near Abu-Arish, 9.5.2010, *Y. Masrahi* 7911 (MUZ 18456, KSU 20546).

Note: To date 4 species of the genus *Sesbania*, including the newly recorded *S. sericea*, are recorded from Saudi Arabia. Among these, *S. grandiflora* (L.) Poir.—seen near the road sides—is often cultivated as an ornamental plant. It is characterised by large, 5-10 cm long red (or white) flowers. The other 2

species [*S. sesban* (L.) Merr. and *S. leptocarpa* DC.] are wild, and often seen in disturbed ground. The former is a small tree or a tall shrub, sometimes seen near agricultural areas as a windbreak. The latter is more similar to the newly recorded *S. sericea* and can be separated from it by the presence of glabrous leaflets. *S. sericea*, commonly called silky sesban, is reported from Senegal to the Somali Republic (S.), Congo, and Angola; the West Indies and northern South America (perhaps not native); Saudi Arabia

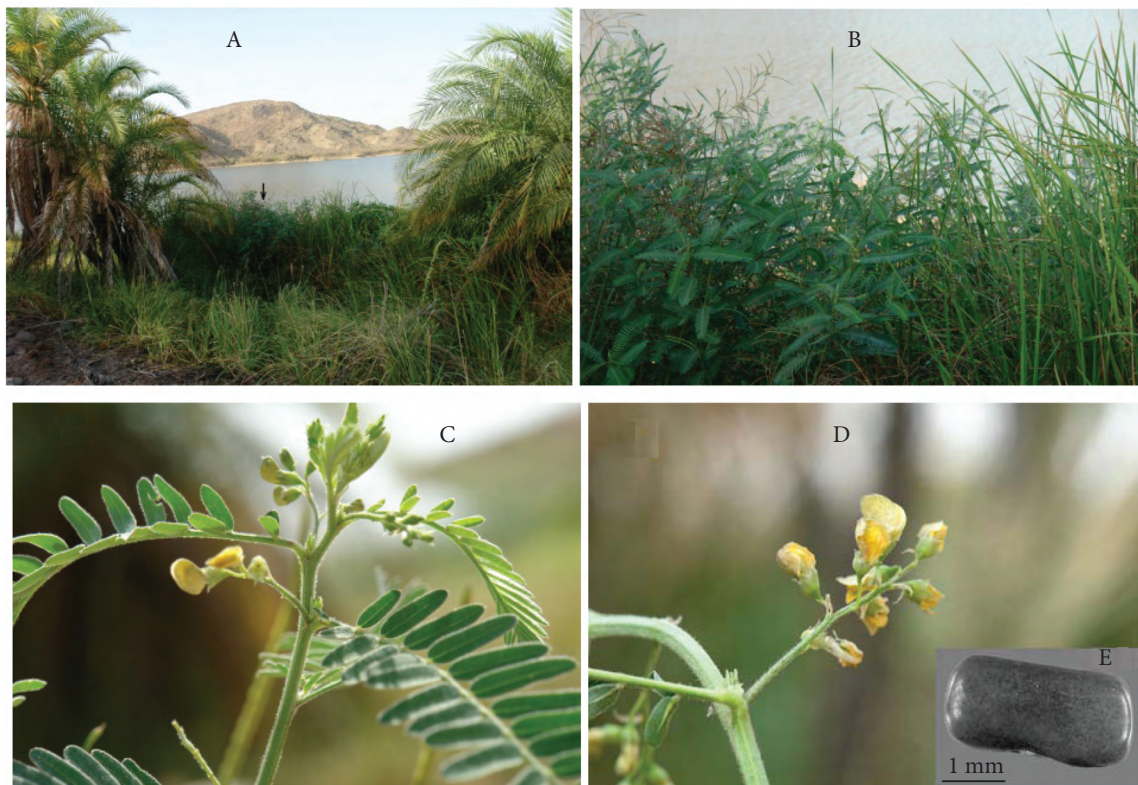


Figure 4. *Sesbania sericea*. A-habitat, B-habit, C-flowering branch, D-inflorescence, E-seed.

and Ceylon (introduced) (Gillet, 1963; Thulin, 1989). In Saudi Arabia this species is represented by a small population (not more than 20 individual plants) observed very close to a wetland ecosystem. *S. sericea* is found among *Phoenix caespitosa* Chiov., *Desmostachya bipinnata* (L.) Stapf., *Typha domingensis* (Pers.) Poir. ex Steud., and *Scoparia dulcis* at an altitude of about 30 m a.s.l. Since similar habitats are common in the south-western region, the occurrence of this species in other areas cannot be ruled out.

Sesamum L.

A small genus with 20 species distributed in the arid parts of sub-Saharan Africa and India. Among these, the most popular plant—*S. indicum* L. (= *S. orientale* L.)—is widely cultivated in tropical Africa, India, Sri Lanka, Madagascar, tropical Australia, the south-western Arabian Peninsula, and Malaysia. To date only 2 species, including the newly reported species, are known from Saudi Arabia. *S. alatum* Thonn. is distinguished from *S. indicum* by its

palmate (3- to 5-foliolate) basal leaves and winged seeds.

Sesamum alatum Thonn. (Figures 6-7).

Syn.: *Sesamum sabulosum* A. Chev. Fl. Afr. Centr., Enum. Pl. Recolt. 1: 229 (1913); *Volkameria alata* (Thonn.) Kuntze, Revis. Gen. Pl. 3: 247 (1898).

Type: Gold Coast, Thonning (Holo. C).

Morphological features

Description: Erect annual herb, 50-100 (-150) cm tall. Leaves generally heteromorphic, opposite, sometimes alternate; lower leaves, petiolate, 2.5-7.5 cm long, palmate, 3- to 5-foliolate or very deeply divided with narrow, linear-lanceolate lobes; margin entire or undulate, central lobe usually longer than others, base cuneate; upper leaves simple, glabrous, margin entire, 3.5-6 cm long, glabrous except for the mucilage glands, which are denser below. Flowers about 3.5 cm in diameter. Calyx deciduous, lobes linear-lanceolate, acuminate, c. 3.5 mm long, pubescent outside. Corolla pink or



Figure 5. *Sesbania sericea*. A and B-part of a fruiting branch; C-leaf, showing the dorsal and ventral view; D-flower; E-pod.

purple, sometimes with red spots within, up to 3.5 cm long, obliquely campanulate and constricted at the base, limb sublunate with 4 extrafloral nectaries, thinly pubescent and glandular outside. Four fertile stamens, inserted. Ovary slightly 4-angled, 5×1 mm, densely ascending-appressed pubescent, 2-carpellate with several ovules. Style slender, attenuate at apex. Fruit an obconical, beaked capsule, 2-4 cm long, beaks 5-13 mm long, 2-loculed, each locule separated by false septum, glandular and thinly pubescent,

becoming glabrous at maturity, 4-sulcate. Seeds winged at both ends, 2-3 mm long, foveolate; wings both at base and apex, suborbicular, 2-3 mm long.

Representative specimens: Saudi Arabia: 5 km S of Abu-Arish ($17^{\circ}18'152''\text{N}$, $42^{\circ}50'297''\text{E}$), near Jizan, 24.9.2010. Y. Masrahi 7950 (MUZ).

Note: Widespread from tropical Africa to Namibia, South Africa, and the Arabian Peninsula (Ghazanfar, 2007). In Saudi Arabia it grows in sandy



Figure 6. a. Habit of *Sesamum alatum*.
b. Close-up view of the flower of *Sesamum alatum*.

soils along roadsides and around villages at 132 m a.s.l. Dominant plants associating with *S. alatum* include: *Tamarix nilotica* (Ehrenb.) Bunge, *Abutilon bidentatum* A.Rich., *Senna alexandrina* Mill., *Acacia ehrenbergiana* Hayne, etc.

Discussion and conclusion

The new additions to the flora of Saudi Arabia have brought the total number of genera under subtribe Eleusininae (Poaceae) to 16 and the number of species under *Sesbania* (Leguminosae-Papilionoideae) and *Sesamum* (Pedaliaceae) in Saudi Arabia to 4 and 2, respectively. The centre of origin

of *Odyssea* is believed to be in east Africa. In Saudi Arabia *Odyssea mucronata* is known only from the Red Sea basin of the Tihama plain of the Jazan Governorate at an altitude between 20 and 30 m a.s.l. It grows on sand dunes codominated by *Panicum turgidum*, *Dipterygium glaucum*, and *Salvadora persica*. Ecologically, *O. mucronata* is often the major primary producer in sandy soil and is an important component in food chains in arid environments. Since this part of Tihama is very dry, the density and vigour of plant growth are mainly controlled by the availability of water. Field observations indicated that most of the areas within the open plains appear to be barren, with the exception of widely spaced clump-forming grass colonies. Although the population of *O. mucronata* is healthy and dense within its limited area of occupancy, the frequency and abundance of this species decreases inland, and it is not found in areas above 100 m a.s.l. The sandy areas are a transition zone between 2 ecologically diverse habitats. West of the *O. mucronata* population, the coastal alluvial zone is dominated by the mangrove species, *Avicennia marina*, and a few halophytes such as *Zygophyllum simplex* and *Z. coccineum* (*Z. boulosii* auct. Hadidi); the east, is a broad wadi dominated by *Acacia ehrenbergiana*, *A. tortilis*, and *Leptadenia pyrotechnica* (El-Demerdash et al., 1994).

Conservation value

To date, all 3 species have been collected from their respective localities only. However, the population of *O. mucronata* is strikingly large, containing approximately 1000 individual plants. Though Chaudhary (1989) and Cope (2007) speculated on the presence of this species in the Tihama region in Saudi Arabia, the population of this species is apparently overlooked by most plant collectors. The newly discovered population of *O. mucronata* in Saudi Arabia represents the easternmost point of the species distribution range. Since *O. mucronata* is one of the important populations of the Tihama region and the habitat in which the population occurs is subjected to several anthropogenic activities, this species requires immediate conservation attention before it is too late. The south-western region of Saudi Arabia is considered to be the centre of plant diversity in Saudi Arabia; however, most of the area is extremely threatened by habitat transformation

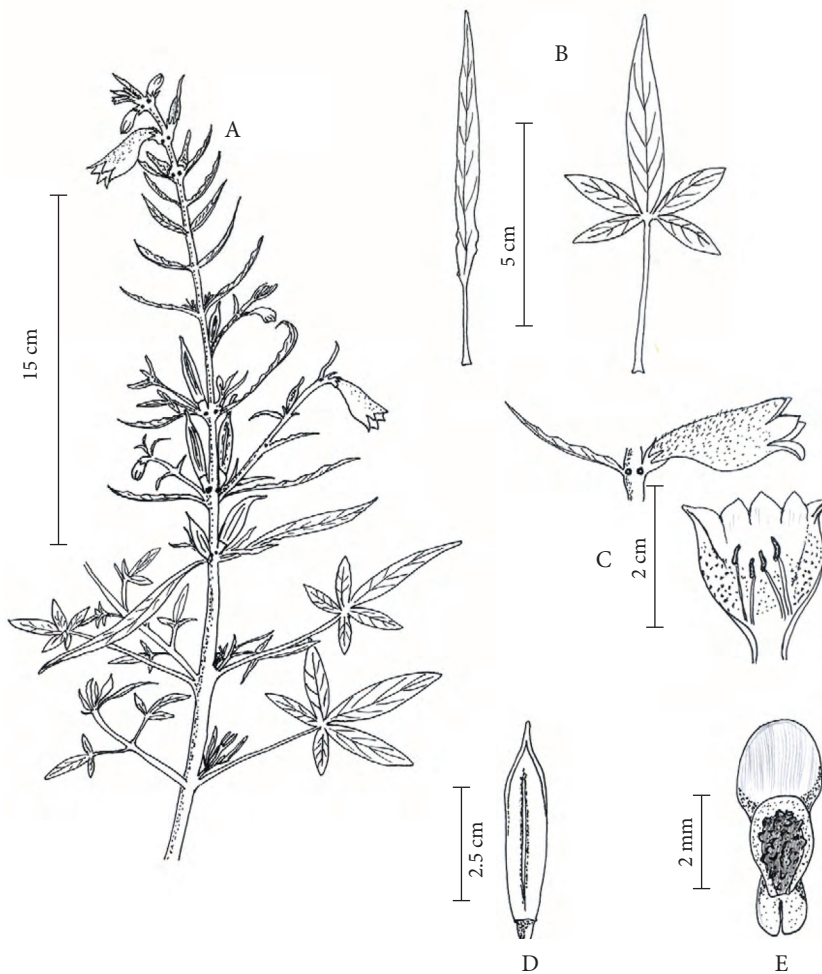


Figure 7. *Sesamum alatum*. A-habit, B-upper and lower leaves, C-detail of a flower, D-fruit, E-detail of a seed.

in the form of invasive species, flash floods, and subsistence agricultural practices in which vegetation rich areas and plains are cleared for crop cultivation (Ghazanfar, 2008). Despite this anthropogenic impact, the regions around Tihama still harbour some of the threatened plant species, including endemics such as *Ceropegia tihamana* Chaudhary and Lavranos, *C. bulbosa* Roxb., and *Indigofera brachyphylla* Al-Turki. *Sesbania sericea* and *Sesamum alatum* in the Arabian Peninsula (represented by not more than 10-20 individual plants) are considered to be rare, although we expect that further populations will be discovered from similar habitats. *Odysea mucronata* is not included in the global International Union for Conservation of Nature (IUCN) Red List of Threatened Plants. The extent of distribution of this

species in Yemen and in the horn of Africa is highly restricted. In Saudi Arabia its population mosaically occupies a small area (ca. 500 m²). The habitats in Tihama face several natural and anthropogenic pressures, such as drought and flash floods, which cause significant population size fluctuation and habitat fragmentation and destruction. Applying the IUCN (2003) Red List Categories and Criteria at the regional level, the current status of *O. mucronata* in Saudi Arabia (based on a 5-year assessment) is estimated as vulnerable (VU D1 D2); *Sesbania sericea* is critically endangered (CR B1). These projections take into account the expectation of continuing population decline and the fact that each of these species occupies a single location with a small area of occupancy.

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