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Family Neuradaceae J. G. Agardh in Saudi Arabia

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Morphological characters, seed coat sculpturing (SEM) of seed, leaf, pollen grains and also a key aspects were revisited to revise relationships between dissimilar taxa of the genus Neurada in Saudi Arabia. The present revision shows the occurrence of three distinctive varieties (var. procumbens, var. al-eisawii and var. stellate); the last two varieties considered a new registration in Flora of Saudi Arabia.

Key words: Morphological characters, Neuradaceae, Saudi Arabia.

INTRODUCTION


According to Zohary (1966) two varieties Neurada procumbens L. var. procumbens and var. stellate were recognized. Neurada al-eisawii was described by Barsotti et al. (2000) as a new species from the Southern desert of Jordan. He described the new species by some morphological characters in the fruit in insertion to the plant habit.

In Egypt Neuradaceae is recognized as a monotypic family (Tackholm, 1956, 1974; Boulos, 1995, 1999; El Hadidi and Fayed, 1994-1995). According to a study carried out by Turki (2007), three distinctive varieties were found from Egyptian Neuradaceae.

In Saudi Arabia, N. procumbens is comprised in the family Neuradaceae as a monotypic genus (Migahed, 1974; Mandaville, 1990; Chaudhary, 1999).

Family Neuradaceae

Family Neuradaceae is a densely pubescent, prostrate and annual herb. Leaves alternate stipulate, sinuate to pinnately lobed. Flowers are usually solitary, bisexual, 5-merous, perigynous to epigynous, the receptacle discoid and woody in fruit. Sepals are valvate and petals free,

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and pentameres. It has ten free stamens, and gynaecium of 3-10 carpels immersed in the receptacle. Fruits are discoid, woody, spiny with winged bound formed from the enlargement of sepals in fruit, the seeds develop inside the stiff discoid pericarp, the radicles and the plumes perforate the pericarp and grow down and up correspondingly and the old spiny hypanthium often continue as a collar curved the base of the new plants. Furthermore, Neurada seeds are likely heteromorphous, with both spinose and spineless sides, which involve the vertical scattering of seeds and diasporas, and the exact site in which they lie in the soil (Hegazy et al., 2014).

This family is symbolized by its connate carpels inside the calyx tube.

Neurada are wide-ranging in distribution in Saudi Arabia, it is found in all sandy soil of the Kingdom.

For all the field excursions during the spring of consecutive years 2014-2015, Neurada samples were found which clearly differ from *N. procumbens* in pattern and structures of fruit (Figure 1).

**MATERIALS AND METHODS**

This work was done on fresh plant material collected from the natural habitats in Saudi Arabia (Al-Oassim, Al Kharj, (Njw); Nafud, (NF) and Nuairiya, Dammam and Dahan (E) and kept in College of Science of Herbarium, Imam Abdulrahman Bin Faisal University.

Morphologically, fruits and leaf characters were examined on fresh material. Photographs was taken for SEM on leaf, and seed and pollens grains were examined from fresh resources by escalating them on stubs and covered with a tinny coating of gold using Fei, Inspect S50, Czech Republic SEM at the electron microscopic unit, Institute For Research And Medical Consultation (IRMC). Terms of pollen conferring to El-Ghazaly (1991).

**RESULTS**

*N. procumbens* L. var. *procumbens*

Annual herb 15-40 cm, densely grey-tomentose; stem prostrate; leaves 0.5-3.1 x0.3-1.5 cm, oblong-ovate, sinuate-pinnatifid; sepals 2-2.5 x 1-1.5 mm, ovate-triangular, acute; petals 1 x 1 mm, white, cream or pinkish; fruit 1-2.3 mm diam. With 2-8 mm spines. Figure 1. (1 a, b).

*N. procumbens* var. *al-eisawii* (Barsotti, Borzatti & Garbari) Turki, comb. nova

Syn.: Neurada *al-eisawii* Barsotti, Borzatti & Garbari,
Figure 2. SEM micrographs of leaf hair (a), sculpture of seed (b), pollen grains (c) and type of granules (d) of the studied taxa (1, Neurada procumbens var. procumbens; 2: N. procumbens var. al-eisawii; 3: N. procumbens var. stellate).


Leaves: greenish white; 1.7-2.2 cm long; 1.0-1.9 cm wide; petiole 0.9-1.2 cm; flowers with white petals; fruit with external obvious branched spines (Figure 1, 2a, b).

N. procumbens var. stellata M. & D. Zohary in Zohary & Angelis, de, Palest. J. Bot. Jerusalem, ser. 5,: 249 (1952)

Leaves: greenish white; 1.9-2.4 cm long, 1.0-1.3 cm wide; petiole 1.0 -1.4 cm; flowers with white petals; fruit boundaries intensely 5-lobed; each lobe with 3 spines, (unbranched spine) (Figure 1, a3, b3).

Morphological feature

The following key is suggested for delimiting the taxa studied on the basis of morphological characters of fruits.

Leaf hair: leaf of all studied taxa was covered with densely unicellular branched hair (Figure 2a1, a2 and a3).

Seed coat sculpturing

The seed coat sculpturing (SEM) of the studied taxa was investigated. The spermodern patterns were reticulate with granules (Figure 2b1, b2, b3, d2 and d3).
**Pollen grains**

In polar view, the pollen grain of the revised taxa are tricolpate, triangular, isopolar, exine microreticulate, with asymmetrical carinate profile; lumina subcircular polygonal and Homobrochate (Figure 2 (c1, c2, c3 and d1).

**DISCUSSION**

The morphological features of the taxa *N. procumbens* indicate diversity. In the field, they can be differentiated by stem pattern, plant stature, extent of leaves and fruit type. Borzatti and Garbari (2002) stated no noteworthy changes in the karyotype morphology of *N. procumbens* var. stellata and *N. al-eisawii*. Turki (2007) revealed the presence of three distinct varieties on Egyptian specimens depending on fruit characters and stated that anatomical and pollen types seem to be irrelevant. The specimens collected from Saudi Arabia almost close by in the dimensions of the leaves and pedicels extent from that designated by Turki from Egypt. Seed cote of *N. procumbens* var. *procumbens* and var. *al-eisawii* have the same sculpture and also the same kind and density of granules (solitary granules) while var. *stellate* carries out a densely two types of granules, (single and double granules). Pollen types appear to be irrelevant in typifying the deliberate taxa.

Consequently, fitting to identify *Neurada al-eisawii* as a variety under *N. procumbens* instead of a distinct species is suggested. Therefore, the three deliberate Saudi Arabian taxa may be deliberated as three dissimilar varieties of *N. procumbens*.

This result agrees with the investigation by Turki (2007) and contradicts that by Barsotti et al. (2000) of *Neurada al-eisawii* as a new species.

*N. procumbens* var. *al-eisawii* and var. *stellate* are considered new registration in Flora of Saudi Arabia.

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**CONFLICT OF INTERESTS**

The author has not declared any conflict of interests.

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