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Taxonomical and Anatomical Studies on Genus
***Bromus*L. in Egypt**

By

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6. Summary and conclusion

Bromus L. is one of the largest genera which belong to family *Poaceae*, subfamily *Pooideae*, tribe *Bromeae*, it comprises about 150 species. It is a cosmopolitan genus and widespread in the temperate regions of both hemispheres but mainly in the north one. Its species occupy a wide range of habitats including cultivated fields, canal banks, sandy places, gravelly and stony soils, moist places, deserts, rocky grounds, wadi beds, waste places and roadsides vegetation. *Bromus* is an aggressive weed which strongly competes the other weeds in the same area and occupies wide spaces.

Economically, *Bromus* used as energetic plant due to the oil content in its grains which used as bio-fuel, also it is used as fodder for animals, erosion control grass and in some countries it is cultivated as a crop.

In the present study, some of *Bromus* taxa were collected from different localities including the Mediterranean coastal region from Mersa Matruh – El- Sallum desert road to Rosetta, Nile Valley region from Giza to Beni- Sewif, El- Galala desert (Zaafarana) and South of Sinai, in addition to plant collections kept in CAI and CAIM herbaria.

The morphological examination of the studied specimens leads to the identification of 16 species and 2 subspecies. These taxa were identified according to Täckholm (1974) and Cope (2005) and compared with the plant collections kept in CAI and CAIM herbaria then confirmed by Royal Botanic Gardens "Kew" herbarium staff (personal communication). These taxa are grouped in 5 sections: Sect. *Ceratochloa* (*B. catharticus*), Sect. *Trimuisa* (*B. danthoniae*), Sect. *Bromus* (*B. scoparius*, *B. hordeaceus*, *B. lepidus*, *B. lanceolatus*, *B. japonicus*, *B. pectinatus* and *B. sinaicus*), Sect. *Pnigma* (*B. inermis*) and Sect. *Genea* (*B. diandrus*, *B. rigidus*, *B. tectorum* subsp. *tectorum*, *B. tectorum* subsp. *lucidus*, *B. madritensis*, *B. rubens* and *B. fasciculatus*), Taxonomy of these

species depended on morphological description and supported by anatomical investigation. There are 2 unconfirmed species in Egypt: *B. alopecuroides* (belongs to sect. *Bromus*) and *B. sterilis* (belongs to sect. *Genea*).

Eighty four morphological characters were used for description of the *Bromus* spp., these characters describe both qualitative and quantitative features of the whole plant, culms, leaves, inflorescences, inflorescences axes, spikelets, florets and fruits description (grains "caryopses") according to shape, colour, thickness, margin, shape of the hilum and shape of the embryo, these morphological characters of *Bromus* taxa recorded accurately by using stereomicroscopy, SEM used for caryopses surface description. Cross sections were obtained by cutting in culms at the second internodes near the roots according to Johansen (1940) for LM examination, twenty seven anatomical characters were selected for comparison among the studied taxa including description of the cross sections outline and complete description of the internal tissues including type, lignification, arrangement and number of layers of these tissues. From this study we concluded that:

1. *B. catharticus* and *B. danthoniae* can be recognized easily from the other taxa, coinciding with the fact that the two species represent two separate sections (*Ceratochloa* and *Triniusa* respectively). This conclusion can be extended to involve *B. inermis* which represent section *Pnigma*.
2. *B. scoparius* can be confused with other *Bromus* species due to panicle shape. However, *B. scoparius* can be distinguished by its diagnostic panicle characters.
3. In this work *B. adoensis* was treated as synonym for *B. pectinatus*. On the other hand, *B. sinaicus* was treated as a separate species different from *B. pectinatus*.
4. The morphological description of *B. diandrus* var. *diandrus* and *B. diandrus* var. *rigidus* in the present study revealed diagnostic obvious characters suggesting the treatment of

these two taxa at the specific level, viz, *B. diandrus* and *B. rigidus*.

5. *B. tectorum* was classified into 2 subspecies: *B. tectorum* subsp. *tectorum* and *B. tectorum* subsp. *lucidus*, which are restricted to Sinai.
6. *B. hordeaceus*, *B. lepidus*, *B. lanceolatus*, *B. japonicus*, *B. madritensis*, *B. rubens* and *B. fasciculatus* are treated as separate species; although *B. madritensis* and *B. rubens* are very similar morphologically and can be confused with each other. However, there are diagnostic characters that support their separation as different species.
7. *B. catharticus*, *B. scoparius*, *B. diandrus*, *B. rigidus*, *B. madritensis* and *B. rubens* are common in Egypt, *B. tectorum* subsp. *tectorum* and *B. tectorum* subsp. *lucidus* are restricted in Sinai only, while *B. danthoniae*, *B. hordeaceus*, *B. lepidus*, *B. lanceolatus*, *B. japonicus*, *B. pectinatus*, *B. sinaicus*, *B. inermis* and *B. fasciculatus* were not traced by the author. *B. alopecuros* and *B. sterilis* are unconfirmed in Egypt.

Representatives of each studied 16 species of *Bromus* were used as Operational Taxonomic Units (OTU's). Based on previous studies as well as personal observations, a total of 84 morphological characters including both quantitative and qualitative were recorded. For data homogeneity, a binary matrix was generated for each character state that resulted in 195 records included both quantitative and qualitative. This matrix was subjected to ordination using detrended correspondence analysis (DECORANA) according to Hill and Guach (1980) and the computations were made using community analysis Package (CAP) according to Seaby and Henderson (2007), also 27 anatomical characters with 42 records were amalgamated with those of morphological characters resulted in 111 characters with 237 records and subjected to the ordination. Both sets of data of the morphological characters and the amalgamation between morphological and anatomical characters

gave the same grouping of the studied taxa where *B.catharticus*, *B. danthoniae* and *B. inermis* each comprised a separate section and *B. scoparius*, *B. hordeaceus*, *B. lepidus*, *B. lanceolatus*, *B. japonicus*, *B. pectinatus* and *B. sinaicus* comprised another section and the remaining species were included in the last section.