

Analysis of numerical taxonomy for *Alyssum* (*Brassicaceae*, sect. *Gamosepalum* Dudley) in Iran

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ABSTRACT- In this research, Taxonomical relationships of *Alyssum* (*Brassicaceae*, sect. *Gamosepalum* Dudley) were studied by use the numerical Taxonomy analysis, for all Iranian species. Accordingly a character table included 32 qualitative and quantitative characters were made for 50 specimens of 10 Iranian species. After standardization of the data, a simplicity matrix was produced. Then a related dendrogeram was drawn by using the Monhatan coefficient and UPGMA method that in which two main clads of *Connata* and *Libera* series were distinguished. Finally the taxonomy of section was accepted and *Libera* series was divided to two *Lepidote* and *Stellate* subseries.

Key words: *Gamosepalum*, *Alyssum*, Numerical taxonomy, Manhatan, UPGMA.

INTRODUCTION

The genus *Alyssum* L. (*Brassicaceae*) consists more than 230 species in the world (AL-Shehbaze and Beilstein, 2006). The genus divided to 5 sections included: *Meniocus*, *Odontarrhena*, *Alyssum*, *Psilonema* and *Gamosepalum* (Dudley, 1964a, b, Ball & Dudley, 1996). The section of *Gamosepalum* had been identified as a genus by Hauskkhnet with 4 species (Dudley, 1964a). Later it identified as a section of *Alyssum* L. (*Brassicaceae*) by Dudley and other species were added to that. Dudley has divided this section to two *Connata* and *Libera* series and is nearly accepted by the botanists (Dudley, 1964 a, b) On the base of present data, The section of *Gamosepalum* has 13 species in the world and 10 of them were thrive in Iran (Koch et al., 2006). Each species carefully was measured in the 32 defined Characters and character table was filled. Then for entering the data on the Excel, quantitative characters were coded and with quantitative characters were put in the new numerical table.

MATERIAL AND METHODS

All Iranian species belong to the sect. *Gamosepalum*, were studied for morphological analysis and numerical taxonomy. For this purpose a character table consists of 32 characters were produced from 50 specimens of 10 presented species in Iran. Each specimen was measured in all characters. The character table was completed then we made coding of qualitative characters. Finally a numerical table was produced. This is the way of coding the characters:

Indumentum of upper part of plant

#1. lepidota(1), stellata(0), lepidota+ stellate (2)

Indumentum of lower part of plant

2. lepidota(1), stellata(0), lepidota+ stellata (2)

#3. many rayed (0), low rayed (1).

Flowering cauline Leaves

#4. upper leaves: oblanceolata or spatulata (0), linear oblanceolata (1), obovata (2), obovata-oblanceolata (3).

#5. lower leaves: spatulata (0), oblanceolata (1), obovata- oblanceolata(3).

Peduncle

#6. In flower state: corymbus (0), another (1).

#7. In fruite state: corymbus (0), another (1).

Sterile cauline leaves

#8. spatulata(0), oblanceolata (1).

Ovule

#9. 2 or more in any locule(0), 1 in any locule (1).

Petal

#10. Apex. Integra (0), retusa(1).

#11. Claw edge.integra(0), undulata (1), denticulata (2).

#12. denth of claw , regular (0), unregular (1), without dent (2).

#13. indumento: stellata (0), lepidota (1), stellata + lepidota (2).

#14.location of indumento: claw(0), claw and limb (1), mediane vessel (2).

#15.number of indumento: low or without (0), high (1).

#16.colure:yellow (0), yellow with purple script (1)

Sepal

#17. cuculata: yes (0), no (1).

#18. hyalina: yes (0), no (1).

#19. shape: not dimorphic (0), very low dimorphic(1), high dimorphic(2).

#20. inner surface indumento; stellata(0), stellata and lepidota (1), stellata and soft hair(2).

#21. inner surface: not hairy(0), hairy (1).

#22. indumento of apex: stellata(0), lepidota(1), stellata and lepidota (2), stellata and soft hair (3).

Short filament

#23. non alata (0), alata without finger appendage(1), alata with finger appendage(2).

After entering the data on the excel , a dendrogeram was drawn by use the NTSYS and the results were analyses.

RESULTS AND DISCUSSION

Two main clads of *connate* and *Libera* series were distinguished in dendrogeram (Fig. 1).In the related clad of *Connate* series there were *A. lepidoto-stellatum*, *A. tetrastemon*, *A. thymops*, *A. paphlagonicum*, and in the other,*A.baumgartnerianum*, *A.sulphureom*, *A. harputicum*, *A. niveum*, *A.corningii* and *A.hezarmasjedensis* were distinguished. In numerical taxonomy of *Gamosepalum* based on morphological characters, related species of two *Connate* and *Libera* series put on separate clads and completely separated from one another. *A. lepidoto-stellatum* and *A.paphlagonicum* that have maximum of similarity, put in single subclad and along the sister subclad of *A. tetrastemon* were speparated from *A. tymops*. In morphological studies *A. thymops* has minimum of similarity with other species and it was clear in related dendrogeram. Section of *Gamosepalum* had been defined as a genus by Haussskhnet. Later it was identified as a section of *Alyssum* L. (*Brassicaceae*) and other species were added to it. Since *A. thymops* had been in the genus *Ptilotrichom* (*Brassicaceae*), it is not very far away from the mind that would have clear differences with other species of *Connata* series. The *Libera* series with 6 species, put in a separated clad. Three subclads were distinguished in which, *A. niveum* and *A. hezarmasjedensis* have put in a single clad. Flower segments have maximum of similarity in some characters such as the shape of short stamen wings and petals. They have narrow petal with smooth border and short stamen wing with appendage. *A. Corningii* and *A. sulphureum* put in single subclad and have mixed with *A. harputicum* and *A. baumgartnerianum* in another subclad. On the base of all results, we could explain that *Gamosepalum* have two main series includeing *Libera* and *Connata* that *Libera* series has been divided to two *Lepidote* and *Stellate* subseries.

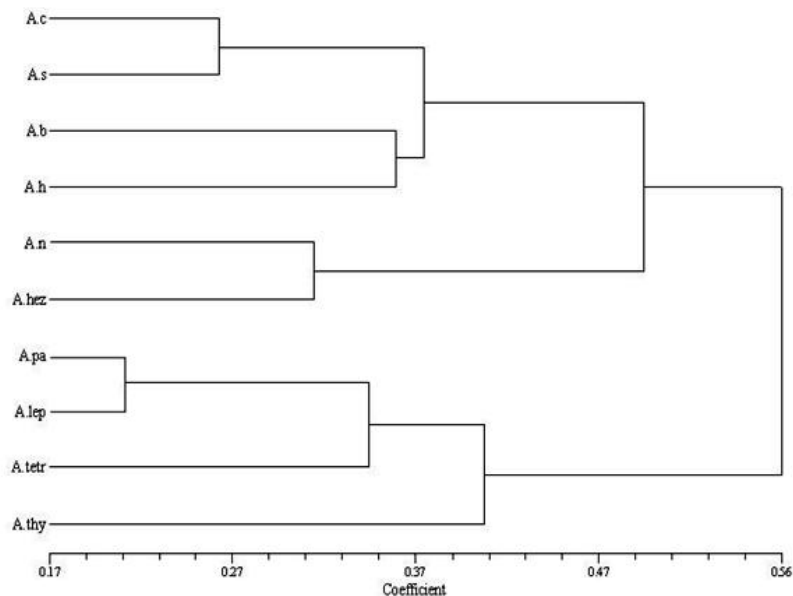


Fig.1. Dendrogram of *Alyssum* L.(Brassicaceae) species belong to sect. *Gamosepalum* in Iran. A. b: *A. baumgartnerianum*, A. h: *A. harputicum*, A. n: *A. niveum*, A. hez: *A. hezarmasjedensis*, A. pa: *A. paphlagonicum*, A. lep: *A. lepidoto-stelatum*, A. tetr: *A. tetrastemon*, A. thy: *A. thymops*.

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