

A PHENETIC STUDY OF THE GENUS *LINUM* L. (LINACEAE) IN IRAN

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Morphological data from *Linum* species were analyzed to evaluate taxonomic grouping of the genus *Linum* in Iran. The study was based on fresh materials from field as well as herbarium specimens. Thirty six characters were used. Grouping of the species was carried out by using single linkage clusters, were recognized in phenogram. The four clusters are more or less equivalent to the sections are known from the genus.

Key words. *Linum*, phenetic study, morphology, cluster analysis.

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مطالعه فنتیکی جنس کتان *Linum* L. در ایران

فریبا شریف نیا و مصطفی اسدی

اطلاعات ریخت‌شناسی گونه‌های کتان مورد بررسی قرار گرفت تا گروه‌بندی تاکسونومیک این جنس در ایران روشن شود. مطالعات براساس نمونه‌های تازه و نمونه‌های هرباریومی انجام شد. تعداد ۳۶ صفت ریخت‌شناسی مورد مطالعه قرار گرفت. گروه بندی گونه‌ها با استفاده از نرم‌افزارهای کامپیوتری انجام شد. براساس فنوگرام بدست آمده ۴ شاخه اصلی تشخیص داده شد که با ۴ بخش (section) شناخته شده جنس مطابقت می نماید.

Introduction

One of the authors revised the genus *Linum* L. in Iran biosystematically as a Ph. D. thesis (Sharifnia 2000). Both authors did the *Linaceae* Flora of Iran. In this paper a part of studies including phenetic studies are presented to evaluate taxonomic grouping of the genus *Linum* in Iran.

Materials and methods

Thirty six quantitative and qualitative morphological characters were studied (Table 1). The study was based on fresh specimens and herbarium specimens of Research Institute of Forests and Rangelands (TARI) and IRAN.

Grouping of the species was carried out by using single linkage clustering method based on the correlation matrix obtained from the Operational Taxonomic Units (OTUs), i. e. *L. catharticum* L., *L. strictum* L., *L. corymbulosum* Reichenb., *L. tenuifolium* L., *L. austriacum* L., *L. glaucum* Boiss. & Noe., *L. peyronii* Post., *L. bienne* Miller, *L. usitatissimum* L., *L. nervosum* Walst & Kit., *L. bungei* Boiss., *L. densiflorum* P. H. Davis., *L. nodiflorum* L., *L. mucronatum* Bertol., *L. album* Ky. ex Boiss., *L. persicum* Ky. ex Boiss. Groupings of all species were accomplished by using ordination method based on Principal Component Analysis (PCA) (Sheidai & Alishah 1998). Statistical analysis was performed using NTSYS-pc. (Rolf 1988).

Results and discussion

Cluster analysis of morphological data of *Linum* species is presented in fig.1. Four clusters can be recognized at 1.2 linkage distance. The first cluster embraces *Syllinum* section which consists of *L. persicum*, *L. album*, *L. mucronatum*, and *L. nodiflorum*.

The second cluster embraces section *Linum* of which two species, *L. bungei* and *L. nervosum* are so close and as a matter of fact based on seed protein data and palynological studies, *L. bungei* is

known as a variety of *L. nervosum* (Sharifnia 2000, Sharifnia & Assadi 2000). *L. usitatissimum* and *L. bienne*, two other species of the sect. *Linum*, are also close together, finally, similarites of three remaining species, *L. peyronii*, *L. glaucum* and *L. austriacum* are close together. *L. densiflorum* (sect. *Dasylinum*) of the second cluster is distinct from other species of *Linum* section.

The third cluster is comprised of species *Linastrum* section (i. e. *L. tenuifolium*, *L. strictum* and *L. corymbulosum*). *L. tenuifolium* is showing more similarity to species of *Linastrum* section than *Linum* section. The fourth cluster is comprised of *L. catharticum* (sect. *Cathartolinum*) that is distinct but is nearly close to species of sect. *Linastrum*.

Ordination of the species on the first two principal components axes is presented in fig. 2.

The morphological characters having high correlations (>0.8) with the principal component are: variation in leaf morphology, number of sepal nerves, sepal width, capsule length, capsule diameter, length and width of seed, stem shape (being costate or smooth) and presence/absence of hair. The mentioned characters proved to be the most variable morphological characters among the species studied.

References

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Table. 1. List of characters and related numerical codes used in morphological studies.

No.	Characters	Numerical code	No.	Characters	Numerical code
1	Growth period	0=annual, 1= perennial	19	Petal length	Mm
2	Plant height	Cm	20	Sepal length to petal length ratio	In no.
3	Leaf arrangment	0= opposite, 1= alternate	21	Petal color	0= white, 1=other
4	Leaf variation	0=absence, 1=presence	22	Stigma shape	0=non-thread form, 1=thread from
5	Leaf shape	0=non-linear- lanceolate, 1=linear- lanceolate	23	Stigma length	Mm
6	Leaf apex	0=non-acute, 1=acute	24	Anther length	Mm
7	Leaf margin	0=smooth, 1=rough	25	Capsule shape	0=almost spherical, 1= spherical
8	Leaf length	Mm	26	Capsule length	Mm
9	Leaf width	Mm	27	Capsule diameter	Mm
10	Inflorescence length	Cm	28	Sepal length to capsule length ratio	In no.
11	Number of flowers	In no.	29	Seed length	Mm
12	Styles	0=homostyle, 1= heterostyle	30	Seed width	Mm
13	Sepal shape	0=non-linear, 1= linear	31	Petiole length	Mm
14	Sepal apex	0=non- acute, 1= acute	32	Stem shape	0=non-lineare, 1= lineare
15	Sepal margin	0=non-glandular, 1= glandular	33	Indumentum of the stem	0=glabrous, 1= pubescent
16	No. of sepal veins	In no.	34	Position of sepals	0=free, 1= joint at the base
17	Sepal length	Mm	35	Stipular glands of the leaves	0=absence, 1= presence
18	Sepal width	Mm	36	Plant color	0= green, 1= dark green

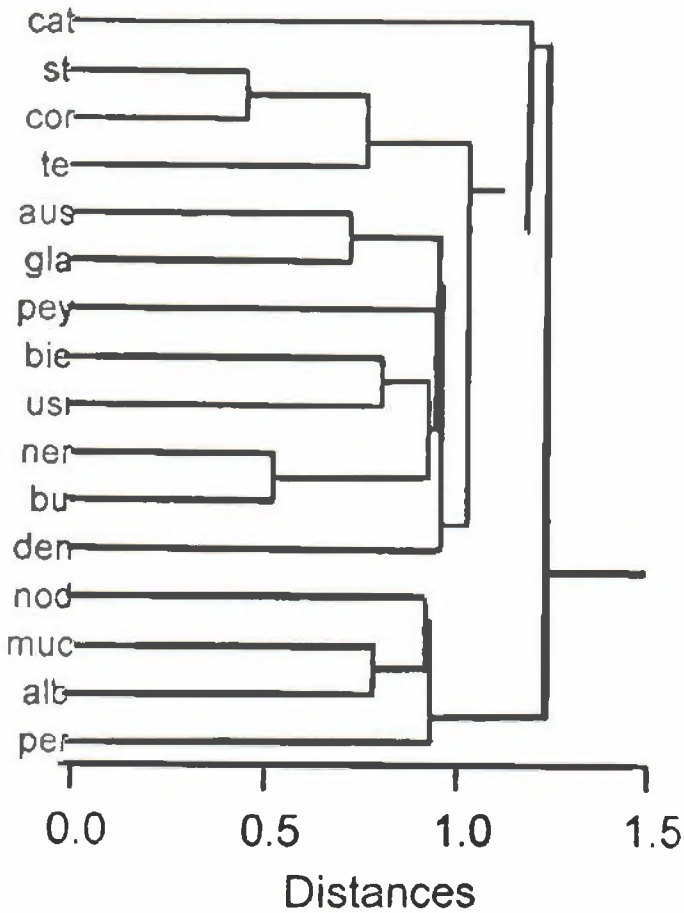


Fig. 1. Phenogram based on morphological data of *Linum* species. -abbreviations, cat= *L. catharticum*; st= *L. strictum*; cor= *L. corymbulosum*; te= *L. tenuifolium*; aus= *L. austriacum*; gla= *L. glaucum*; pey= *L. peyronii*; bie= *L. bienne*; usi= *L. usitatissimum*; ner= *L. nervosum*; bu= *L. bungei*; den= *L. densiflorum*; nod= *L. nodiflorum*; muc= *L. mucronoatum*; alb= *L. album*; per= *L. persicum*.

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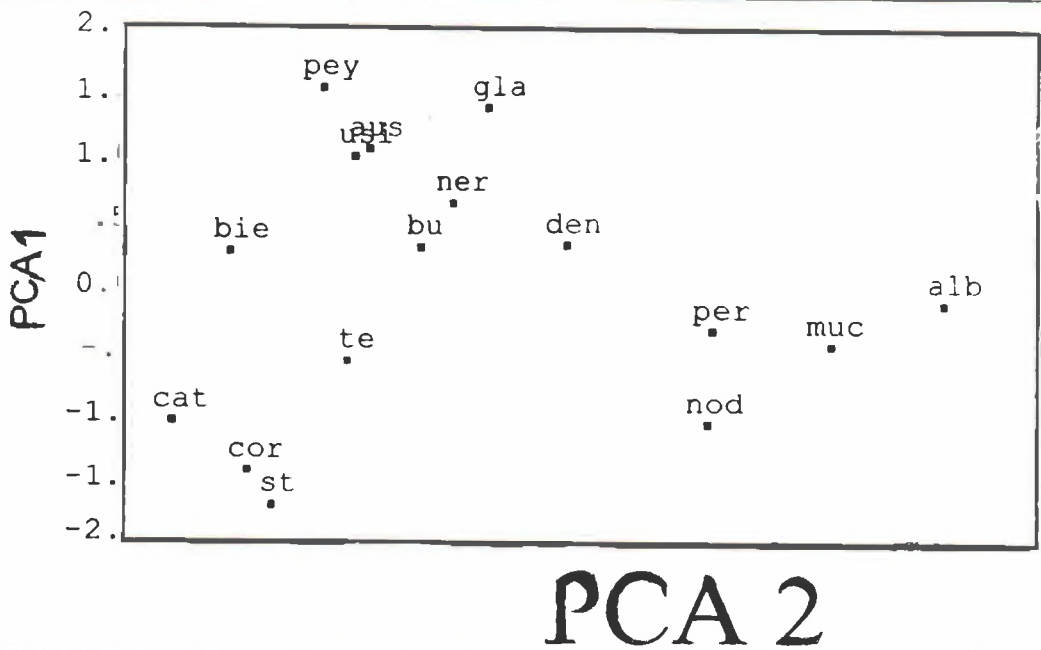


Fig. 2. Ordination of *Linum* species based on morphological data, abbreviations as in fig. 1.