Floristic Composition, Chorotypes and Life form of the Family Caryophyllaceae, Libya

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Abstract:

The aim of this research to analyze the floristic composition of the Caryophyllaceae family In Libya utilizing data from the Flora of Libya. The findings indicate that this family comprises 62 plant Sp across 18 Genes. Notably, the genus Silene is the most dominant, featuring 23 Sp, followed by Cerastium with 7 Sp. Other genes include Minuartia and Spergularia, each with 5 Sp, and Dianthus with 4 Sp.

Additionally, the analysis of life forms and chorological spectra reveals a predominance of therophyte life forms, totaling 48 Sp. This is followed by chamaephytes with11 Sp. In terms of chorotypes, Mediterranean-chorotypes lead with 15 Sp followed by Mediterranean/Iranian/Turanian with 14 Sp, and Cosmopolitan regions comprising 5 Sp.

Overall, this study provides valuable insights into. The diversity and distribution of the Caryophyllaceae family within the flora of Libya.

Key words: Caryophyllaceae - Mediterranean – Life form – Chorotype

Introduction

The Caryophyllaceae family, commonly known as the carnation family, consists of flowering plants and is classified within the dicotyledon order Caryophyllales. In the APG III system (APG III, 2009). It is a large family with 81 genes and about 2,625 known Sp, (Christenhusz *et al*, 2016). This cosmopolitan family, primarily comprising herbaceous plants, is most prevalent in temperate climates, though a few Sp can be found in tropical mountain regions. Many Sp are cultivated as ornamental plants, while others are common weeds. The majority of Sp thrive in the Mediterranean and adjacent areas of Europe and Asia. In contrast, the number of genes and Sp in the Southern Hemisphere is relatively limited (Rudolph, 1965). Most members of the Caryophyllaceae family are herbaceous annuals or perennials, typically dying back above ground each year, although a few Sp are shrubs or small trees (Sambamurty, 2005). This large family comprises about 80 genes and

2,000 Sp, distributed across all continents, particularly in the northern temperate regions. In Libya, the family is represented by 18 genes and 62 Sp (Jafri and El-Gadi, 1978).

Libya is located between longitudes 9.58° – 25° east and latitudes 20° – 33° north, and since this area is mostly sandy desert, it lacks vegetation (Al-Werfalli *et al*., 2020), covering an area of 1,760,000 km² (Fig. 1). The country is bordered by the Mediterranean Sea to the north, Egypt to the east, Sudan, Chad, and Niger to the south, and Tunisia and Algeria to the west (Nafea, 2015; Feng *et al*., 2013).

In Libya, the following vital areas have been identified: IT region, MED region, SA region, and the Su region (Qaiser and El-Gadi, 1984). The dominant climatic influences come from the MED Sea and the Sahara Desert. Approximately 95% to 97% of Libya land is desert, making it one of the driest countries in the world. The desert climate is characterized by very hot summers with extreme day-night temperature variations, while winters are mild. Precipitation levels are generally light to negligible (Holdridge, 1974).

(Fig: 1): Map of Libya (https://satellites.pro/Google_plan/Libya_map#google_vignette).

This study offers an overview of the Caryophyllaceae family based on an analysis of the Flora of Libya, focusing on Chorotypes life form patterns, and Sp distribution. According to (Jafri and El-Gadi, 1978). and (Klopper *et al*. 2007) Libya's flora includes 2,088 Sp across 844 genes and 145 family of angiosperms. Within this context, the Caryophyllaceae family comprises 62 Sp distributed among 18 genes, as noted by (Jafri and El-Gadi, 1978).

The dominant genes within this family are:
Silene: 23 Sp
Cerastium: 7 Sp

Minuartia: 5 Sp
Spergularia: 5 Sp
Dianthus: 4 sp
This overview highlights the richness and diversity of the Caryophyllaceae family in Libya's flora.

Life forms is:

Table: 1. Terms of the Life Form.

Therophytes	Th	Annual plants that survive unfavorable seasons as seeds and complete their life cycle during favorable conditions are known as summer annuals or seasonal annuals. These plants germinate, grow, flower, and produce seeds within a single growing season. When conditions become unfavorable (like winter or drought), they die off but leave seeds in the soil, which can remain dormant until the next favorable season.
Chamaephytes	Ch	Buds Near the Ground: (within 25 cm).
Hemicreptophytes	He	Buds at or surface the soil near.

The distribution of life forms among Caryophyllaceae Sp reveals a significant prevalence of herbaceous forms, primarily annual and perennial herbs. This absence of woody Sp, such as trees and shrubs, suggests that the harsh environmental conditions, particularly moisture scarcity and drought, limit the growth capabilities of these plants in the area.

According to Raunkiaer's life form classification, as modified by Govaerts, the study indicates that:

- **Therophytes** are the most abundant, comprising 48 Sp (77.4% of the total).
- **Chamaephytes** follow, with 11 Sp (17.8%).
- **Hemicryptophytes** are represented by 2 Sp (3.2%).
- A combination of Therophytes/ Chamaephytes includes 1 Sp (1.6%).

This distribution highlights the adaptation strategies of these Sp in response to the challenging environmental conditions.(Figur:2, 3).

(Table: 2): Sp life forms

Life forms	Sp	total Sp %
Therophytes:	48	77.4
Therophytes – Chamaephytes:	1	1.6
Chamaephytes:	11	17.8
Hemicryptophytes:	2	3.2

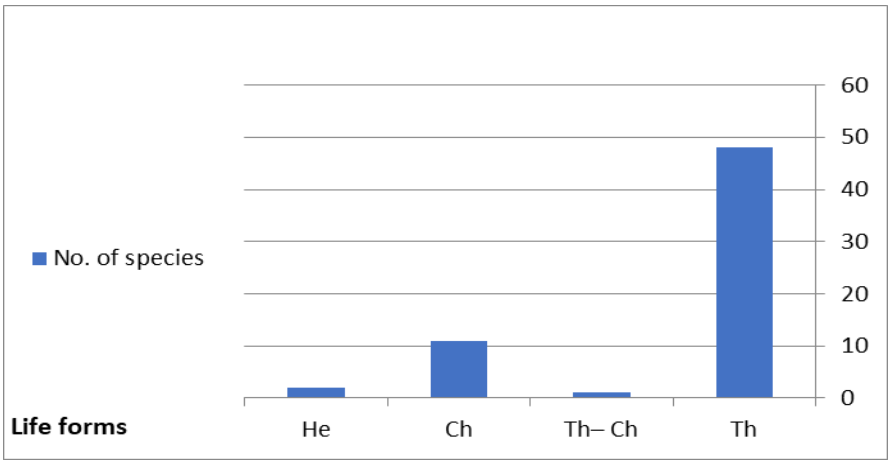


Fig: 2: Shows life forms and Sp in Caryophyllaceae family
Therophytes, Hemicryptophytes, Chamaephytes.

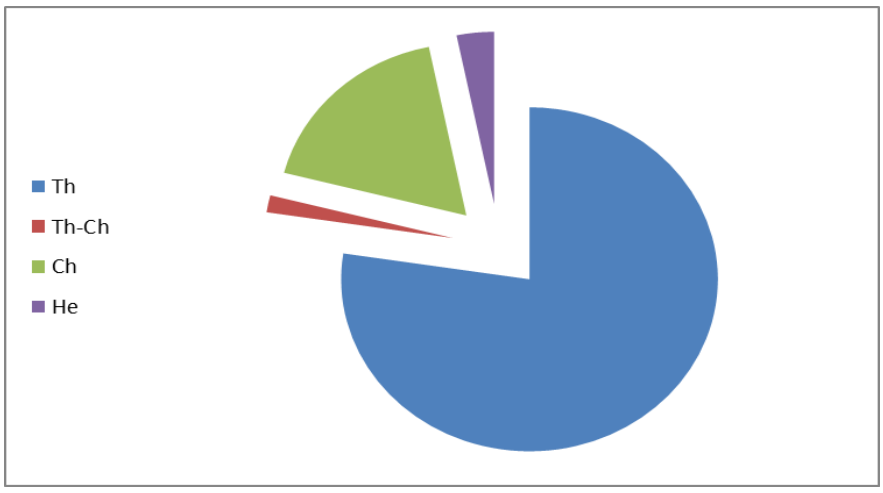


Fig: 3: Percentage of Life forms of Sp in the Caryophyllaceae family
Therophytes, Hemicryptophytes, Chamaephytes.

Chorotype analysis:

Table:3: phytogeographical Terms analysis.

Term	Key
Mediterranean.	MED
Sahara-Arbain.	SA
Irano-Toranian.	IT
European-Sibirian.	ES
Sudanain.	Sud
Cosmopolitan.	Cos
Tropical.	Trop

Your text provides a detailed overview of the geographical distribution of Sp within the Caryophyllaceae family, particularly in relation to the Mediterranean region. Here's a refined version for clarity and readability:

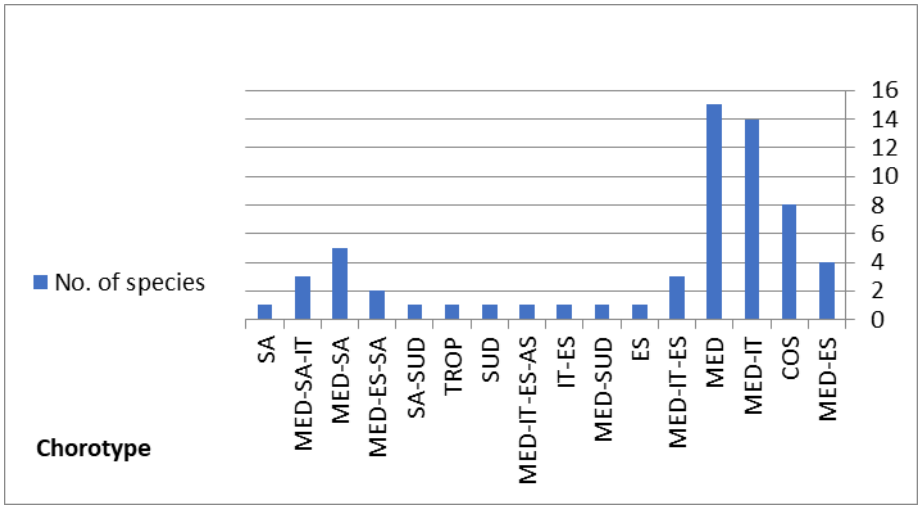
Geographical Distribution of Caryophyllaceae Sp

The analysis of the geographical distribution of Caryophyllaceae Sp reveals the following:

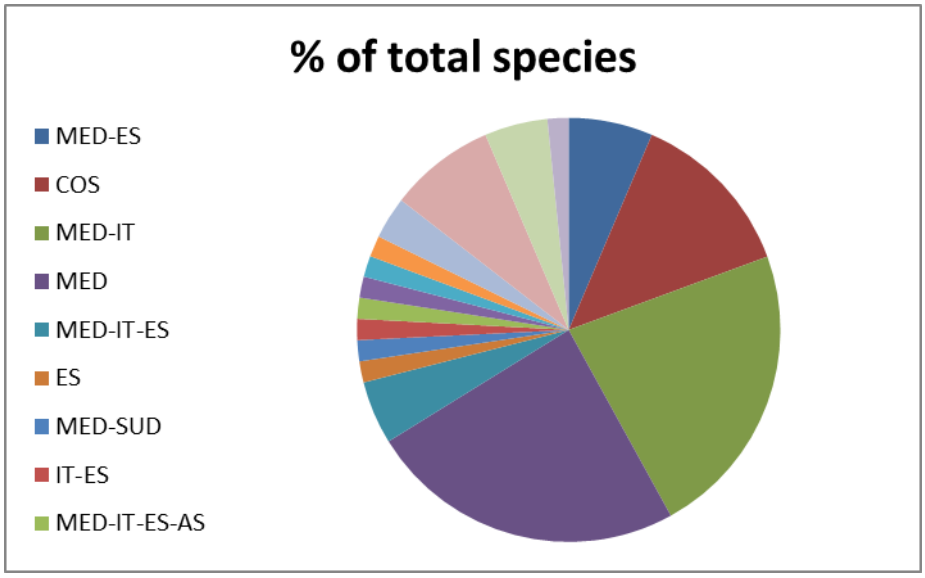
Table 4. Shows the Number of Sp, According to their Chorotypes.

Chorotype	Sp	total Sp%
MED-ES	4	6.4
COS	8	12.9
MED-IT	14	22.5
MED	15	24.1
MED-IT-ES	3	4.8
ES	1	1.6
MED-SUD	1	1.6
IT-ES	1	1.6
MED-IT-ES-AS	1	1.6
SUD	1	1.6
TROP	1	1.6
SA-SUD	1	1.6
MED-ES-SA	2	3.2
MED-SA	5	8.06
MED-SA-IT	3	4.8
SA	1	1.6

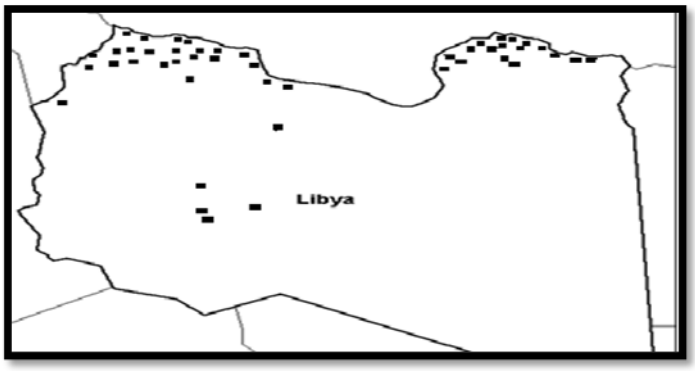
For a comprehensive understanding of the Sp, distribution of Caryophyllaceae members based on coordinates refer to the Libya flora, as illustrated in Figure: 6.



(Fig: 4): Sp showing number of Sp in each Chorotype.



(Fig: 5): Percentage of Chorotype of Sp in Caryophyllaceae family.



(**Fig: 6)**: Distribution of Sp of Caryophyllaceae, depending on coordinates

Discussion

Your text provides a concise overview of the flora of Libya, particularly focusing on the Caryophyllaceae family and its distribution across different climatic regions. Here's a refined version with improved clarity and structure:

The flora of Libya is significantly influenced by the Mediterranean climate, as well as the IT region and the Sahara Desert (Feng et al., 2013). Our findings reveal that a substantial portion (24.1%) of the Sp in the Caryophyllaceae family is endemic to the Mediterranean region. This is followed by Sp that are shared between the Mediterranean and IT regions, then those that are Cosmopolitan, and finally, those from the SA region.

The life form Spectra of the Sp, in the study area indicate, a dominance of Therophytes (77.4%), with Chamaephytes making up 17.8%. Therophytes are well-adapted to arid

conditions and limited rainfall (Asaadi, 2009). This suggests that both annual and perennial life forms, are the preferred survival strategies, in Libya's temperate deserts.

Analysis of the Sp distribution map clearly indicates that the majority of Caryophyllaceae Sp are concentrated within the Mediterranean region. While the Caryophyllaceae family is cosmopolitan, in its distribution, it is predominantly found in areas with a MED climate.

This version maintains your key points while enhancing readability and flow.

References

1. **Adel D. El Werfalyi, Sami H. Rabei, Abdel Hamid A. Khedr Salem A. Hassan (2020):** Floristic Composition, Chorotypes and Life form of the Masalata Natural Reserve, Libya. Journal of Medicinal Plants Studies 2020; 8(6): 131- 141.
2. **Angiosperm Phylogeny Group (2009):** "An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III". *Botanical Journal of the Linnean Society*. 161 (2): 105–121.
3. **Christenhusz, M. J. M. & Byng, J. W. (2016):** "The number of known plants Sp in the world and its annual increase". Phytotaxa. Magnolia Press. 261 (3): 201–217.
4. **Rudolph, E. D. (1965):** "Antarctic lichens and vascular plants: their significance". BioScience. 15 (4): 285–287.
5. **Sambamurty, A. V. S. (2005):** "Caryophyllaceae (pink family)". Taxonomy of Angiosperms. I. K. International. pp. 270–279.
6. **Nafea, E. M. A., (2015):** Floristic Composition of the Plant Cover at Surt Region in Libya. CATRINA 12 (1): 63 – 71.
7. **Feng Y, Lei JQ, Xu XW. (2013)** : Composition and Characteristics of Libyan Flora. BiolSci Belgrade. 65(2):651- 7.
8. **Qaiser. M., and El- Gadi, A., (1984):** A Critical Analysis of the Flora of Libya. The Libyan Journal of Science (An Interantional Journal): Vol. 13: 31- 40.
9. **Holdridge, L.R. (1974):** Determination of world plant formations from simple climatic data. Science.105, 367 - 368.
10. **Jafri, S.M.H. and El-Gadi, A. (1978):** Caryophyllaceae. Flora of Libya, Al Faateh University, Faculty of Science, Department of Botany, Tripoli, Libya, vol. 59: 1 – 122.
11. **Klopper, R.R., Gautier, L., Chatelain, C., Smith, G.F. and Spichiger, R. (2007):** Floristics of the angiosperm flora of sub-Sahara African: an analysis of the Africa Plant Checklist and Database.
12. **Raunkiaer, C. (1934):** The Life Forms of Plants and Statistical Plant Geography. Clarendon Press, Oxford.
13. **Govaerts, R. , Frodin, DG. & Radcliffe-Smith, A. (2000):** World Check list and Bibliography of Euphorbiaceae (with Pandanaceae). Volume 1. The Royal Botanic Gardens, Kew.
14. **Asaadi, A.M. (2009):** Floristic study of Firuzeh watershed (North Khorasan province). Research journal of biological science.

Appendix:

List of Sp, Chorotype and Life forms based on Abdul Ghafoor (1978)

Scientific name	Chorotype	Life form
Agrostemma githago L.	MED – ES	Th
Arenaria serpyllifolia L.	COS	Th
Cerastium dichotomum L.	MED – IT	Th
Cerastium glomeratum Thuill.	COS	Th
Cerastium illyricum Ard.	MED – IT	Th
Cerastium ligusticum Viv.	MED	Th
Cerastium pumilum Curtis	MED – IT – ES	Th
Cerastium semidecandrum L.	MED – IT – ES	Th
Cerastium siculum Guss.	MED	Th
Dianthus caryophyllus L.	COS	Ch
Dianthus chinensis L.	ES	Th
Dianthus crinitus Sm.	MED – IT	Ch
Dianthus serrulatus Desf.	MED – SUD	Ch
Gypsophila elegans Bieb.	IT – ES	Ch
Gypsophila pilosa Hudson	MED – IT	Th
Loeflingia hispanica L.	MED – IT – ES – SA	Th
Minuartia campestris L.	MED	Th
Minuartia geniculata (Poiret) Thell.	MED	Ch
Minuartia hybrida (Vill.) Schiskin	MED – IT	Th
Minuartia mediterranen (Ledeb.) K. Maty	MED	Th
Minuartia montana L.	MED – IT	Th
Petrorhagia cyrenaica (Durand & Barratte) Ball & Heywood	MED	Th
Petrorhagia illyrica (Poir.) Maire	MED	Th - Ch
Petrorhagia velutina (Gauss.)Ball & Heywood	MED	Th
Polycarpaea repens (Forsk.) Asch. & Schweinf.	SUD	He
Polycarpon prostratum (Forsk.) Aschers & Schweinf.	TROP	Th
Petrorhagia velutina (L.) L.	MED	Th
Robbairea delileana Milne-Redhead	SA – SUD	Th
Sagina apetala Ard.	MED – ES	Th
Sagina maritima G. Don	MED	Th
Silene apetala Willd.	MED – IT	Th
Silene articulata Viv.	MED	Th
Silene behen L.	MED – IT	Th
Silene biappendiculata Ehrenb. ex Rohrb.	MED	Th
Silene cerastioides L.	MED	Th
Silene colorata Poiret	MED – ES – SA	Th
Silene conoidea L.	MED – IT	Th
Silene cyrenaica Maire & Weiller	MED	Th
Silene fruticosa L.	MED – IT	Ch
Silene fuscata Link.	MED – IT	Th
Silene gallica L.	COS	Th
Silene italica (L.) Pers.	MED – IT – SA	Ch
Silene longipetala Vent.	MED – IT	Ch
Silene marmarica Beg. & Vacc.	MED	Ch

Silene muscipula L.	MED – ES	Th
Silene nocturna L.	MED – SA	Th
Silene rubella L.	MED – ES	Th
Silene sedoides Poiret	MED – IT	Th
Silene succulenta Forsk.	MED – SA	He
Silene tridentata Desf.	MED – SA	Th
Silene villosa Forsk.	MED – SA – IT	Th
Silene viviani Steud.	MED – SA	Th
Silene vulgaris (Moench) Garcke	COS	Ch
Spergula fallax (Lowe) Krause	SA	Th
Spergularia bocconii (Scheele) Asch. & Graebn.	MED – IT	Th
Spergularia diandra (Guss.) Heldr. &. Sart.	MED – IT – SA	Th
Spergularia marina (L.) Griseb.	ES - Med – IT	Th
Spergularia media (L.) C. Presl	MED – SA – ES	Ch
Spergularia rubra (L.) J. &. C. Presl.	COS	Th
Stellaria media (L.) Cyrill.	COS	Th
Telephium sphaerospermum Boiss.	MED – SA	Th
Vaccaria pyramidata Medik.	COS	Th