

TXONOMIC STUDIES ON SOME SPECIES OF CARYOPHYLLACEAE IN EGYPT

THESIS SUBMITTED

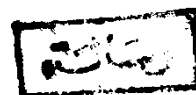
By

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A C K N O W L E D G M E N T

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THIS

THESIS has not been submitted for a degree at
this or any other university .

THE literature cited shows how far I have availed myself of the work of the others .

Signature

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Subjects studied

In addition to this degree the student had attended lectures dealing with branches stated hereafter. She passed successfully the examination as well .

These courses are :

1- PLANT ECOLOGY :

- a)- Climatic factors .
- b)- Edaphic factors .
- c)- Biotic factors .
- d)- Synecology: Study of plant communities in Egypt with special reference to desert vegetation .

2- TAXONOMY OF HIGHER PLANTS :

- a)- History of classification .
- b)- Different systems of classification .
- c)- Taxonomy dealing with all monocotyledonous and dicotyledonous families .

3- FLORA :

Distribution of plant communities in Egypt .

4- PLANT PHYSIOLOGY :

Dealing with plant growth regulators .

5- MICROBIOLOGY :

Dealing with , bacteriophages , general bacteriology and chemical microbiology .

6- CYTOLOGY AND GENETICS .

7- CURRENT RESEARCH .

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PREFACE

The Caryophyllaceae is a cosmopolitan family comprising about 30 genera and 1300 species . It is represented in the Egyptian wild flora by 90 species grouped under 27 genera . The largest of these genera is Silene (26 spp.) , whereas the monotypic genera are Ankyropetalum , Buffonia , Sagina , Holostium , Robbairia , Loefflingia , Gymnocarpus , Sclerocephalus , and Pteranthus . Genera having two species are represented by Tunica , Vaccaria , Arenaria , Stellaria , Spargula , Telephium , Sphaerocoma and Cometes . The genera having three species are Gypsophila , Gerastium , Polycarpon and Polycarpon . Genera having five species are Spargularia , Herniaria and Paronychia . The genera Dianthus and Minuartia have six species each .

Except for the two chamaephytes Gymnocarpus and Sphaerocoma the Egyptian Caryophyllaceous plants are therophytes and hemicryptophytes . The species distribution varies in different phytogeographical regions . Some species are monoregional (e.g. Silene), some are biregional (Gypsophila) and many others occur in more than two regions . The majority of plants belong to the mesophytic community . Some species are members of the uncultivated land community while others are marked structural elements of the mesophytic weed flora of cultivated fields and canal borders and irrigating channels . Still others are characteristics of the saline soils and the mountains .

The general morphological aspects shared by the Caryophyllaceae plants are the simple entire opposite (alternate in Polypodium) leaves , the noded stems , the swollen nodes and the cymose dichasia usually termed the Caryophyllaceous inflorescence . The flowers are generally bisexual , actinomorphic and with biseriate perianth . Sepals free or united , sometimes forming a saccate . Petals usually notched , sometimes with appendages and oftenly differentiated into claws and limbs . Stamens are usually either the same number as petals or twice as many , in 1-2 whorls and the filaments distinct or briefly connate . Petaloid staminodes sometimes present . Ovary superior , usually 1-loculed with basal placentation or basally 3-5 locule with the placenta axile (lower third) or free central (above) . Styles and stigmas 2-5 , rarely one . Fruit capsule or achene . Embryo curved (straight in Dianthus) . Endosperm hard . A gyno- or androgynophore may be present .

Economically , the family is important for the large number of ornamentals available from it . The florists' carnation (Dianthus spp.) , Gypsophila , Silene , Arenaria and many others are among the notable horticultural plants .

PART I

HISTORICAL INTRODUCTION

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CONTENTS :

- A- SYSTEMATY
- B- ANATOMY
- C- FLORAL MORPHOLOGY
- D- AIM OF THE PRESENT STUDY

HISTORICAL INTRODUCTION

1) SYSTEMATY

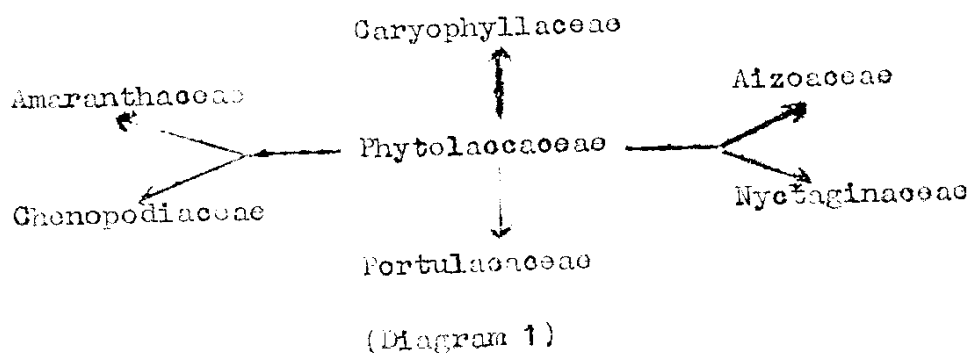
The order name was Alsinaceae applied by Wahlenberg(1824), then displaced by the conserved name Caryophyllaceae, applied by Reichenbach(1828).

The Caryophyllaceae have long been treated differently in various classificatory systems. Bentham and Hooker(1862-1883) gave the name Caryophylleae and placed them under the Polypetalae Thalamiflorae. In Halliers' classification(1912), the Caryophyllaceae were allied with the Plumbaginaceae; both, and others, under the Caryophyllinae. Bessey(1915) included them in the Caryophyllales of the subclass Strobiloideae of the class Oppositifoliae. Rendle(1925) classified them under the Monochlamydeae Centrospermae. Engler and Prantl(1936) also placed them under the same order, Centrospermae, of the Archichlamydeae. Pax(1927) divided them into the two subfamilies Alsinoidae with free sepals and Silenoideae in which the flowers are gamosepalous; the former subfamily was further split into groups according to the fruit type. Bentham and Hooker(1862-1883) separated some of these groups as independent family Illecebraceae (Monochlamydeae Curvembryae), retaining the rest(Caryophylleae) in Polypetalae Caryophyllinae as mentioned above. Willis(1960) stated that the relationships of these families show that this is an unnatural separation of closely allied groups.

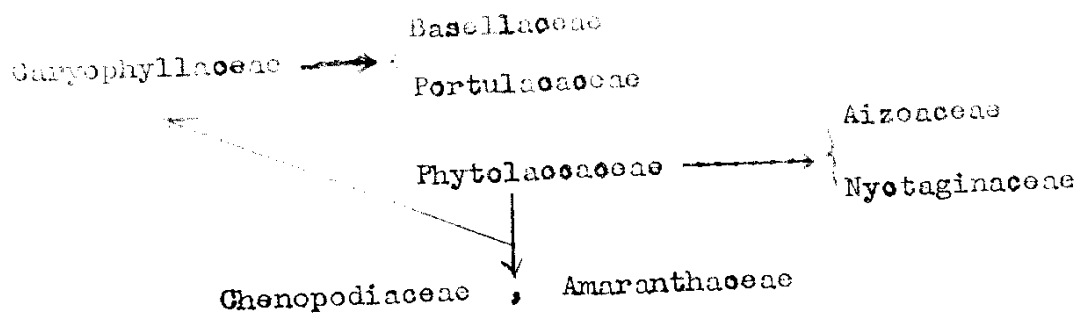
Botanists have presented many views to account for the evolution of the Caryophyllaceae. Eichler(1875) considered the family

and originated from the Phytolaccaceae by evolution of the stamens short to petals and of the outer carpal short to stamens. This view was accepted in principle by Wettstein(1935) and Rendle (1925). The second view was held by Vernham(1911) who considered that the family has evolved from ranalian ancestors. Meanwhile, it is the source of origin for the Primulaceae, Amaranthaceae and Chenopodiaceae. This second view was also accepted in principle by Bessey(1915); Hutchinson(1934) and by many others. In Hutchinson's view(1934), the Caryophyllales are the more primitive arising from Ranales through Saxifragaceae. Chenopodiales as well as Polygonales are derived from them. Pax and Hoffmann(1934) stated that Chenopodiaceae with the closely associated Amaranthaceae, not Phytolaccaceae, should be considered as representing the origin of the group (Centrospermae) in general. Dickson(1936) suggested that the family may have been derived from the Geraniaceae, but Thompson (1942) did not support this view.

Summing up the different views held by various Botanists to account for the phylogenetic status of the Caryophyllaceae, Rendle (1952) gave the following two diagrams:



...this concept, the Caryophyllaceae represents ...
...Phytolaccaceae.



(Diagram 2)

This concept opposes that of Wernham(1911) in that the reduced Amaranthaceae and Chenopodiaceae are the origin of the Caryophyllaceae.

3) ANATOMY

That anatomical studies are serving taxonomy, evolution has been fully realized in recent years and many papers assert to the value of anatomical methods in analyzing hybridization. In this connection, such an approach has proved, in many cases, to be a good clue for the solution of some puzzling relationships in some taxa of the Caryophyllaceae.

Stomatal types, other than caryophyllaceous, are not absent. Solovchev(1903) stated that deviations from this type are recorded and an approximation to the cruciferous type does occur. Hootenife and Chalk(1950) reported that the caryophyllaceous type is also rare in certain species of Arenaria, Cerastium

The structure of the trichomes varies in different members. They are either epidermal papillae (in app. with elongated epidermal cells), uni- and multicellular clothing hairs or glandular hairs. Correns (1909) stated that the hair structure is believed to be of specific diagnostic value in Cerastium.

The cork, when present, arises either in the pericycle (Deullot, 1889) or in the outermost part of the cortex (Metcalf and Chalk, 1950). Solereder (1908) reported on a subepidermal phellogen in Paronychia while Esau (1953) stated that, in the family, it arises near the vascular region or directly within the phloem.

The stem cortex is usually of no distinctive differentiation. However, it sometimes contains assimilatory tissue. Betts (1916) stated that the outer zone is suberized in Colobanthus. In Scleranthus biflorus, the cortex is formed of thick-walled cells, giving a dark brown colour when treated with chlorozinciodide (Poweraker, 1916).

The pericycle is formed from a solerenchymatous ring of varying width in different species. Sabnis (1921) stated that this ring of fibres is accompanied by groups of stone cells in Polyparpaea corymbosa. Esau (1953) included the Caryophyllaceae among the families which have complete cylinders of pericycle close to the vascular tissues.

The vascular bundles are usually distinct but tending to become united in large arcs in some species (Metcalf and Chalk, 1950). Esau (1953) stated that the primary bundles in the herbaceous forms of this family are not clearly distinct, since they are interrupted by parenchyma cells only at the gaps.

The leaf mesophyll is either centric or dorsiventral. Metcalf and Chalk (1950) stated that in the first case the vascular strands are generally surrounded by water storage cells. Halm (1913) stated that in dorsiventral leaves of Saponaria officinalis, the palisade tissue occurs towards the adaxial surface. Simmler (1910) reported that the same tissue in the genus Saponaria sometimes occurs towards both surfaces, or, alternately the whole of the mesophyll is composed of rounded cells, those towards the center of the leaf being slightly larger.

In the Caryophyllaceae, calcium oxalate is commonly secreted in the form of large cluster-crystals, although solitary crystals and crystal-sand occur rarely (Metcalf and Chalk, 1950). Tanniniferous substances may be present as well.

C) FLORAL MORPHOLOGY

The anatomical approach via the study of the floral morphology began as early as 1871 when Van Tieghem published his classic paper in the field. Subsequent workers adopted the same approach