

Floral Structures - Analysis and Critical Observations

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ABSTRACT

Flower is the most important structure of a plant which is responsible for the sexual reproduction of the plant. Understanding the detailed structure of a flower is essential to study pollination and fertilization activities as well as the reproductive process in a flowering plant. In order to provide a proper understanding about the structure of flower I gave a detailed account of the structure of various parts of a typical flower in this resource.

INTRODUCTION

Flowers are the most attractive parts of a flowering plant. Flowers not only provide attraction to the plant but also carry out some vital important activity in the life of a flowering plants i.e. sexual reproduction. Due to this only, flowers after pollination and fertilization events will transform into fruits which include seeds in them. These seeds help in the propagation of the plant. The branch which deals with the study of flowers is known as 'Anthology'.

Beautiful Bluebell Flowers

A flower is a modified shoot of limited growth where the parts of the shoot are modified into floral leaves. Flowers found on various Angiospermic plants show wide variation in their size, shape, color and in the arrangement of their floral parts. But typically all flowers have the same basic plan of construction.

STRUCTURE OF A TYPICAL FLOWER

In an Angiospermic plant, a flower arises on a plant in the reproductive phase of the plant after the completion of vegetative phase. Usually a flower develops from a floral bud situated in the axillary or terminal position of the plant. Actually these buds are vegetative buds which usually helps in the growth of plant in vegetative phase- Axillary buds help in the development of lateral branches and terminal bud will help in length wise growth of the plant. But these same buds in reproductive phase transform into floral buds to develop themselves into flowers for the sake of sexual reproduction.

Structure of a Typical Flower (Courtesy: from Wikipedia)

Various parts and functions of a Typical Flower

The following are the important parts and their functions in a typical flower. Every part of the flower will serve a special function in it.

1. Bract

Below the base of a flower a scaly leaf like structure present is known as bract. A bract acts like an umbrella and protects the flower in bud condition from severe climatic conditions. A flower with bract is known as bracteate flower and without it is known as ebracteate flower. In Bougainvillea and Poinsettia plants, the flowers are provided with enlarged colorful bracts to attract insects for pollination.

2. Pedicel

A stalk like structure which connects a flower to the stem is known as pedicel. a flower with pedicel is

known as pedicellate flower and the one which is directly attached to the stem without pedicel is known as sessile flower. A stalk of the flower is provided with the vascular tissue consisting of xylem and phloem to transport water and food materials in fluid form to the flower.

3. Thalamus

Thalamus or receptacle is a swollen or flat or dome-shaped or concave structure present at the tip of the pedicel. Thalamus is the structure on which all the floral parts arise or attached.

The floral parts of a flower are arranged on the thalamus in a ring like fashion called whorls. Usually there are four whorls of floral parts present in a typical flower. These whorls from outside of a flower to inside are Calyx (sepals), Corolla (petals), Androecium (stamens) and Gynoecium (carpels). Calyx and Corolla are known as non-essential whorls of a flower as they are directly involved in the process of reduction. Hence they are also known as the accessory organs of the flower. But Androecium and Gynoecium are known as essential whorls of the flower as they are directly involved in the sexual reproduction of the flower.

4. Calyx

Calyx is the outermost and first whorl of the flower. The individual members of calyx are known as sepals and are green in color. Colored sepals are present in Tamarindus. In Mussaenda plant a sepal in a flower is modified into an advertisement flag. In Asteraceae family, calyx in the flower is modified into pappus. In Brinjal (Solanum) sepals become persistent even after the formation of fruit. The important function of calyx in a flower is to hold all the floral parts together and also protect the flower in bud condition. As the sepals are green in color with chlorophyll, so we can expect they have the ability to carry out photosynthesis to some extent.

Usually in a flower five sepals are present but their number varies from one species of plant to the other. In some flowers, the margins of the sepals are fused with each other and such a condition is known as gamosepalous condition. In certain other flowers, the margins of the sepals are free from each other and such a condition is known as polysepalous condition. In certain flowers like Hibiscus (China rose), there is a second series of calyx also present for additional protection of the flower called Epicalyx.

5. Corolla

Corolla is the second whorl of a flower and the individual members of corolla are known as petals. The petals are differently colored with various colors and shades. The various colors of petals is due to various pigments present in the chromoplasts of these petals. The size, shape, color and number of petals present in the flower depends upon the nature of the flower. The important function of corolla in a flower is to attract insects for cross-pollination. For this along with bright color of the petals, the petals also emit scent smells as well as get modified into special shapes to attract insects.

Usually five petals are present in a flower but their number varies from one species of flower to the other. In some flowers, the margins of the flowers are fused with each other and such a condition is known as gamopetalous condition. Due to this condition the corolla will be bell shaped or tube shaped. In certain other flowers, the margins of the petals are free from each other and such a condition described as polypetalous condition.

6. Androecium

Androecium is the male reproductive part of a flower. It is the third whorl of a flower and the individual members of androecium are known as stamens. Each stamen is comprised of a long

filament, a fertile anther and a connective. Filament and connective are non-fertile whereas anther is a fertile part. Anther is a two lobed structure which include four pollen chambers or pollen sacs inside. Pollen grains are produced inside the pollen sacs of the anther. Pollen grains are powdery dust like particles liberated from anther when the pollen sacs rupture. Each pollen grain on its surface is covered by rough wavy outer coat called exine for its protection and a smooth delicate inner lining called intine from which the pollen tube develops.

In different flowers, the stamens of androecium are arranged in different ways. The different types of stamens according to their arrangement as follows:

(i) Monadelphous

In this type of arrangement of stamens, the filaments of the stamens are united into a single bundle leaving the anthers free and such a condition is known as Monadelphous condition. Ex: China rose, Cotton.

(ii) Diadelphous

In this type of arrangement of stamens, the filaments of stamens are arranged in two bundles. Ex: Pea, Bean (nine stamens in one bundle and one stamen separately)

(iii) Polyadelphous

In this type of stamens, the filaments are arranged in several groups. ex: Bombax, Citrus.

(iv) Syngenesious

In this type of stamens, the anthers of the stamens are fused but filaments are free. Ex: Sunflower, Gourd.

(v) Epipetalous

In some flowers, the stamens are attached to the petals all along their length and such a condition is known as epipetalous condition. Ex: Petunia, Datura.

(vi) Didynamous

In some flowers a total four stamens are present of which two stamens are with long filaments and the other two stamens are with short filaments. This type of condition in those flowers is described to be didynamous condition. Ex: Ocimum, Leucas.

(vii) Tetradynamous

In certain flowers a total of six stamens are present of which four stamens are with long filaments and two stamens are with short filaments. Ex: Mustard, radish.

(viii) Synandrous

In some flowers of certain plants if both filaments as well as anthers also fuse together and such a condition is known as synandrous condition. Ex: Benincasa (Ash gourd), Colocasia (taro).

(ix) Gynandrous

In some flowers, the stamens by filaments or wholly united to carpels is known as gynandrous condition. Ex: Orchids, Calotropis.

(x) Epiphyllous

If the stamens of a flower are attached to perianth members is known as epiphyllous condition. Ex: Tube rose, Lilly.

7. Gynoecium or Pistil

Gynoecium is the innermost whorl and female part of a flower. The individual members of gynoecium are known as carpels. Basing on the number, presence of free carpels or fusion of carpels, gynoecium is of the following kinds.

(i) Monocarpous

If only one carpel is present in the pistil is known as monocarpous. Ex: Crotalaria, Pea.

(ii) Apocarpous

All the carpels present in a pistil are free from each other and such a condition is known as Apocarpous condition. Ex: Rose, Salvia.

(iii) Syncarpous

All the carpels of a pistil are fused with each other and such a condition is known as syncarpous condition. ex: China rose, Sunflower.

Structure of a Carpel

A carpel is made of three parts- ovary, style and stigma. Ovary is the swollen basal part of the carpel. Ovary is divided into one or more chambers called locules. Each locule contain one or more round or egg shaped ovules in them. Each ovule encloses an embryo sac in it. An ovule after its maturation develops into a seed. Ovules are attached to a soft cushion like tissue in the ovary called placenta. The arrangement of ovules on the placenta of the ovary is known as placentation.

Style is an elongated tube like structure which connects stigma to ovary. When pollen grain germinates on stigma a tube like structure called pollen tube arises from pollen grain which travels through the stylar canal and reaches the embryo sac. This pollen tube carries two male gametes to carry out fertilization in the embryo sac of ovule.

Stigma is the swollen, sticky tip part of the style which receives pollen grains during pollination process. This is the part where pollen grains also germinate. The stigma get variously modified like bilobed or globose or brush like or feathery in order to catch the pollen grains efficiently in different types of flowers.

Types of placentation in flowers

Basing on the arrangement of placenta with in the ovary, the placentation can be divisible into the following kinds.

(i) Marginal placentation

Placenta bearing ovules found along the junction where two margins of a carpel fuse. Ovary is usually of one chambered in this type of placentation. Ex: Bean, Mimosa.

(ii) Axile placentation

Ovary may be many chambered and ovules are developed from the central axis of the carpels. Ex: Lemon, Tomato.

(iii) Parietal placentation

Ovary is one chambered and ovules develop from the inner wall of the ovary. Ex: Carica, Mustard.

(iv) Basal placentation

Ovary is one chambered and the ovules develop from the base of the ovary. Ex: Sunflower, Marigold.

(v) Central placentation

Ovary is one chambered and the placenta bearing ovules develop from the central axis of the ovary. Ex: Dianthus, Saponaria.

(vi) Superficial placentation

Ovary is many chambered and the placenta bearing ovules develop all along the surface of the partition walls. Ex: Nymphaea (water lily), Ottelia.

Types of flowers basing on the relative position of ovary with respect to other floral parts

Basing on the nature of thalamus i.e. swollen concave or cup shaped or flat shaped thalamus, the arrangement floral parts and the position of vary in the flower vary from flower to flower. Basing on the position of the ovary in respect to other floral parts on the thalamus, flowers are classified into three types.

1. Hypogynous flowers

In this type of flowers, ovary occupies the highest position on the thalamus and the other floral parts arise below from it. In this type of flowers the ovary position is described to be superior in comparison with other floral parts. Ex: Mustard, Brinjal.

2. Perigynous flowers

In this type of flowers, the thalamus is cup shaped and partially covers around the ovary. From the rim of the thalamus all the other floral parts arise thus making the ovary half superior and half inferior. Flowers with such a condition is said to be perigynous flowers. Ex: Rose, Peach.

3. Epigynous flowers

In this type of flowers, the thalamus completely covers over the ovary and all the other floral parts arise above the ovary. In this type of flower, the ovary position is described to be inferior in comparison with other floral parts. Ex: Cucurbita, Gourd.

Some more information related to flowers

- If a flower include both male and female sex organs in the same flower such a flower is known as bisexual flower. Ex: China rose
- If a flower is having either male or female reproductive parts only in it such a flower is known as unisexual flower. Ex: Gourd.
- If a flower has only stamens, such a flower is known as staminate flower and if it has only pistil then it is known as pistillate flower.
- If a flower lack both male and female sex organs in it and such a flower is known as neuter flower. Ex: Ray florets of Sunflower.
- If male and female flowers of a plant present on the same plant, such a plant is known as

monoecious plant. Ex: Maize, Cucumber.

- If male and female flowers are present on different plants, such a plant is known as diecious plant. Ex: Palm, Papaya.
- If a flower bear all the four floral whorls in it, such a flower is known as a complete flower. Ex: Datura, Petunia.
- If any one of the whorl is missing from the flower, such a flower is known as incomplete flower. Ex: Gourd, Papaya.
- In some flowers, sepals and petals are not distinguishable, such members are known as Perianth.
- An aggregation of so many flowers on a common axis is known as Inflorescence.
- Largest flower in plant kingdom is *Rafflesia arnoldi* and the smallest flower is *Wolffia*.
- In some cross pollinated flowers, nectar secreting cells are present in the form of a gland at the base of the flower. These cells in the nectar gland secrete nectar to attract insects for cross-pollination. In some flowers like *Canna indica*, beautiful markings or design also present on the petals to guide insects towards nectar secreting region of the flower.

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REFERENCES

1. Sattler R. 1973. Organogenesis of flowers: a photographic text-atlas. University of Toronto Press. ISBN 0-8020-1864-5
2. Tiny haploid female plant which includes the egg.
3. Crepet W.L. (2000). "Progress in understanding angiosperm history, success, and relationships: Darwin's abominably "perplexing phenomenon"". *Proceedings of the National Academy of Sciences* 97 (24): 12939–41. doi:10.1073/pnas.97.24.12939. PMC 34068. PMID 11087846.
4. Wilson Nichols Stewart & Gar W. Rothwell ? 1993Paleobotany and the evolution of plants. 2nd ed, Cambridge Univ. Press.
5. Nam, J.; Depamphilis, CW; Ma, H; Nei, M (2003). "Antiquity and evolution of the MADS-Box gene family controlling flower development in plants". *Mol. Biol. Evol.* 20 (9): 1435–1447. doi:10.1093/molbev/msg152. PMID 12777513.