A GENERAL SYSTEM OF FLORAL DIAGRAMS.

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Diagramatic representations of flowers are of great convenience in assisting one's memory in respect to floral structions, especially when comparative and evolutionary studies are undertaken. Such diagrams have been in use for a long time and are found in most botanical text books and systematic works. However, as usually constructed they are rather vague and of various designs, which makes it difficult to employ them in any exact way. The writer has devised a system by which most of the essential structures of any flower may be represented by a single transverse diagram, which at the same time indicates in a general way the degree of advancement of the flower in the evolutionary series.

There are five general types of flowers which call for definite diagramatic representation, as follows:

1. Hypogynous flower, as in the lily.
2. Perigynous flower with a free hypanthium, as in the rose.
3. Perigynous flower with adnate hypanthium, as in the apple.
4. Epigynous flower without hypanthium, as in the honeysuckle.
5. Epigynous flower with hypanthium, as in the evening primrose.

The various signs used are as follows: carpel, a small circle (Fig. 1 a); vestigial carpel, the same in black (Fig. 1 b); axis of inflorescence, a circle with a dot in the center (Fig. 1 c); stamen, a pair of circles or figure eight without a line through the center if the anther has but two microsporangia or with a line through the center if it has four microsporangia (Fig. 1 d); vestigial stamen, the same in black (Fig. 1 e); united carpels, a large circle with radii to represent the partition walls, (Fig. 1 f); united carpels forming a unilocular ovulary, a similar circle with points on the inside to represent the place of union of two contiguous carpels (Fig. 1 g); sepal, a curved line, thickened in the middle (Fig. 1 h); petal, a curved line thickened in the middle and with a prominent point (Fig. 1 i). A necter pit or spur is represented as shown in Fig. 1 j. Bracts are

represented by curved lines of uniform thickness. The empty glumes and flowering glumes of grasses, on account of their importance, call for special treatment. The empty glumes are represented simply like a pair of bracts, but the lemma receives a narrow point at the middle projecting outward and the palet two such points, one on either side of the middle and some distance apart.

In representing spirals no attempt is made to show the "pitch," or irregularities. Only the average number of spirals with the number of parts in each, is shown, as in figures 2 and 3. Usually only one spiral line is drawn, as in Figure 3, which represents a cone with five spirals, with seven carpels in each spiral. Fig. 2 represents a cone with three spirals, each with nine carpels and all spiral lines represented.

Aside from representing the spiral curves, the diagrams can be made with a pair of compasses and ruler and finished in detail with a pen. Of course, many peculiarities may be added without detracting from the definiteness or clearness of the formal signs.

Figure 4 represents an ordinary hypogynous, actinomorphic, pentacyclic, trimerous flower with united carpels, like a Yucca or lily. If each petal sign were joined at its ends by a straight line to the sepal sign, the diagram would represent a flower like the lily-of-the-valley (Convallaria). In general, connecting lines mean union with or position on an organ.

Figure 5 represents a perigynous, zygomorphic pentacyclic flower with united sepals. The hypanthium is represented by a heavy dotted circle. Sepals, petals and stamens are shown situated upon this by the connecting lines. Nine of the stamen filaments are united, but one is free, showing plainly a diadelphous andrecium. The single free carpel is represented in the center and the slight adhesion of one pair of petals is shown by a dotted connecting line. In general, it is convenient for comparison to place all the diagrams with the odd sepal on top. The relation of the flower to the axis of inflorescence can then be shown by placing the proper sign above or below the diagram.

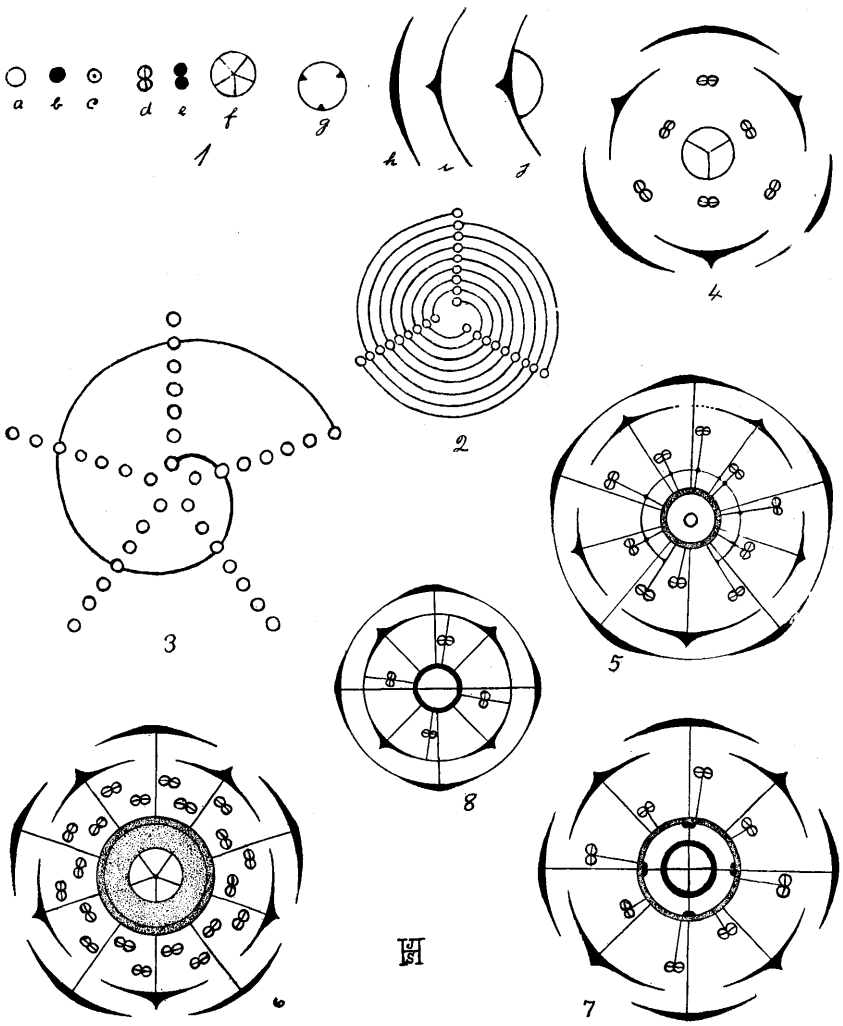
Figure 6 represents the diagram of an apple, in which the perigynous hypanthium is grown together with the ovulary. This is represented by filling in the space between the two with dots. The sepals and petals are on the hypanthium and are

therefore connected with it by lines. The stamens are also on the hypanthium and properly should also be connected with it by lines, but as they are sometimes very numerous, these lines may be omitted for convenience; since the position of the stamens between the perianth and the hypanthium necessarily implies that they are situated on the latter organ. The best rule to follow in this respect perhaps is that where the stamen are few in number and the lines can be drawn conveniently the connections should be made, but where they are very numerous, the connecting lines may be omitted, provided that they are shown with the parts of the perianth. The same procedure would be followed in epigynous types, either with or without hypanthium.

The epigynous type of flower with an epigynous hypanthium is represented in Figure 7. The representation of this type is the same in general as in the perigynous flower, but the hypanthium is connected with the ovulary wall by lines showing its superior position. The ovulary wall is shown with a heavy line in all epigynous types. This is merely to make the diagram more striking when compared with the hypogynous type and is not absolutely necessary since the epigyny is definitely shown by the connecting lines. Diagram seven represents Fuchsia, the four black oval spots inside of the hypanthium indicating four glands.

The epigynous flower without hypanthium is shown by figure 8, which represents Houstonia ciliolata. The calyx is composed of united sepals and the corolla of united petals. The stamens are distinct, but their filaments are united with the corolla. This is indicated by the line connecting the anther signs with the corolla sign. The lines connecting the anthers with the ovulary represent the epigyny of the stamens and the same is shown for the calyx and corolla. Extreme reductions and specialization like the pappus of the dandelion may be represented by a circle of dots.

In many cases it is possible to represent other structural details in connection with the usual floral organs, but nothing should be added that will obscure the real representation of the important and fundamental morphology of the flower. If properly and consistently constructed, such a series of flower diagrams will be found a great aid in any study of comparative morphology or evolutionary series.



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EXPLANATION OF PLATE XXVII.

Fig. 1. The conventional signs used to represent the ordinary flower parts.
a. Carpel.
b. Vestigial carpel.
c. Axis of inflorescence.
d. Stamen.
e. Vestigial stamen.
f. United carpels, plurilocular ovulary.
g. Unilocular ovulary with three carpels.
h. Sepal.
i. Petal.
j. Petal with nectar cup.

Fig. 2. Diagram of carpellate cone of Tsuga canadensis, with three spirals.

Fig. 3. Diagram of carpellate cone of Sequoia washingtoniana, with five spirals, only one traced out.

Fig. 4. Diagram of hypogynous flower of Yucca filamentosa.

Fig. 5. Diagram of perigynous flower of Lathyrus odoratus.

Fig. 6. Diagram of perigynous flower of Malus malus, with adnate hypanthium.

Fig. 7. Diagram of epigynous flower of Fuchsia, with epigynous hypanthium.

Fig. 8. Diagram of epigynous flower of Houstonia ciliotata.

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