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THE FLORAL ANATOMY OF *YUCCA GLORIOSA* L. (AGAVACEAE) WITH A NOTE ON TAXONOMIC POSITION OF THE GENUS

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The floral anatomy of *Yucca gloriosa* L. is presented. The outer floral whorls are shortly adnate to the base of ovary. This is inferred as a trend towards the development of an inferior ovary. The tricarpellary syncarpous gynoecium is unilocular in the basal part and trilocular upwards. The placentation in the basal part though appears parietal, it is transitional leading to the axile type in the upper part of the ovary. The carpels are basically 5-traced. The association of the placental bundles with the septal nectaries is reiterated. The extension of the residual placental bundles in the style is phylogenetically insignificant. The outer and inner perianth segments are 5-traced and 3-traced respectively. The stamens are 1-traced organs. Placement of the genus *Yucca* under the Agavaceae is justified on various grounds.

Keywords : Floral anatomy; Taxonomy; *Yucca gloriosa*.

Introduction

Systematic position of the genus *Yucca* has been much debated in the various contemporary systems of plant[1-12]. In the earlier communications, the floral anatomy of some agavoids was described[13-18]. This paper presents results of floral anatomical study of *Yucca gloriosa* L. with a view to shed more light on its taxonomy.

Material and Methods

The fixed flowering material of *Yucca gloriosa* L. was dehydrated, infiltrated and embedded by customary methods. The serial transactions (10-15 microns in thickness) were stained with crystal violet using erythrosine as counter - stain. Sketches were drawn from camera lucida.

Observations

A central group of about 12-15 prominent vascular bundles surrounded by numerous unequl-sized, often tiny, bundles extended in the pedicel (Fig.1). Upwards, the central group of bundles shift outwards and anastomose with the surrounding ones. From these branching bundles, six strands shift outward and extend as the LS bundles (Figs.2-3). A little upwards, the compound MS-OS-D strands in the postero-lateral and anterior positions and the MP-IS strands on the alternating radii, and the LS-LP bundles emerge out (Fig.4). Many bundles simultaneously shift inwards and these are the placental bundles (Fig.3-5).

The fusion of principal bundles of the floral whorls to develop compound cords is for a short length. It is also not of the same degree, particularly in the case of the MS-OS-D bundles. While one bundle splits into the MS, OS and D strands, another divides into the MS and OS-D bundles with the latter splitting quickly into the constituent strands (Fig.4). MP-IS bundles separate out into the component strands a little upwards (Fig.5). The laterals of the sepals and the petals divide repeatedly in their upward course (Figs.4-5.).

The perianth members and the stamens are adnate to the base of the ovary for a very short distance (Fig.6). They separate from the latter in quick succession. At the level of insertion, the outer perianth segments receive 20-25 bundles, whereas the inner ones receive only 6-10 bundles (Fig.6). The median and the lateral bundles of both the whorls of the perianth divide many times to increase the number upwards (Fig.7). The outer perianth segments are more prominent (Fig.7).

The six stamens are adnate for short length with the inner whorls of perianth (Fig.6). The filaments are broad and flat at the base and narrow down considerably upwards. Each filament contains single vascular bundle which extends into the connective without a division (Figs.7-8) and ends beneath the tip of the anther (Fig.9). The stamens are simultaneously antheriferous (Fig.8) and are more or less of the same length (Fig.9). The anthers are dorsifixed, introrse and dithecous (Fig.8). The anthers show short non-vascular crest (Fig.9).

The ovary is unilocular for a short length in its basal part and trilocular upwards (Fig.6-9). In the unilocular zone, the ovules appear to arise laterally alongside the septa (Fig.6), whereas they are borne on axile placenta in its upper trilocular part (Figs.7-9). The numerous placental

bundles in the center beneath the ovary resolve into six bundles in the ovuliferous zone. These bear traces to the ovules (Figs.6-9). In the unilocular zone, two ventral bundles are within each septum and these bear traces to the ovules of adjacent carpels (Fig.6). In the trilocular part, the ventrals of a carpel gradually occupy a position opposite to the loculus and bear traces to the ovules of that carpel (Figs. 7-9). The ventrals are inversely oriented. The outer floral whorls are adnate to the base of the ovary for a short length (Fig.6). Within the ovary wall, the carpellary dorsals bear lateral branches on either side which establish as the median laterals of the carpels (Figs.7-9). The median laterals extend and end in the basal part of the style (Fig.11).

The ovarian loculi continue into the style as three canals (Fig.10) which merge into a triradiate stylar canal towards the middle of length of the style (Fig.11). The carpellary dorsals, median laterals and the branches of the carpellary ventrals extend into the style (Fig. 10). The former continue upto the stigma, whereas the latter two end at various levels in the style (Fig.11). The style ends in three stigmatic lobes (Fig.12), each of which further splits into two (Fig.13). The carpellary dorsals end beneath the stigmatic lobes (Fig.12). The style is longer than the stamens (Fig.13). The stylar canal is lined with transmitting tissue.

The septal nectaries are developed towards the middle of the ovuliferous zone (Fig.7). The carpellary ventrals bear branches which extend alongside them (Figs.7-8). The ovary wall develops three grooves opposite to the nectarines into which they open at the base of the style (Fig.10).

Discussion

The vascular anatomy of the flower presents some interesting features of morphological significance. The outer floral whorls are adnate to the base of ovary for a short distance. Such adnation is also observed in other species of the same genus[19]. This feature occurs sporadically in taxa of the Liliflorae[20-24] and represents a trend towards development of an inferior ovary. Taxonomic accounts describe the ovary as trilocular and the placentation as axile in *Yucca*[1,2,12]. The present study reveals that initially the placentae in the taxon do not meet in the center to render the ovary unilocular. They do so in the upper half to result in loculation of the ovary. This is, however, not very significant and occurs in many monocotyledons. Puri[25,26] refers to such a situation as a "Spatial Problem". The vasculature is indicative of a fact that the parietal placentation in the basal part of ovary is transitional leading to the axile type.

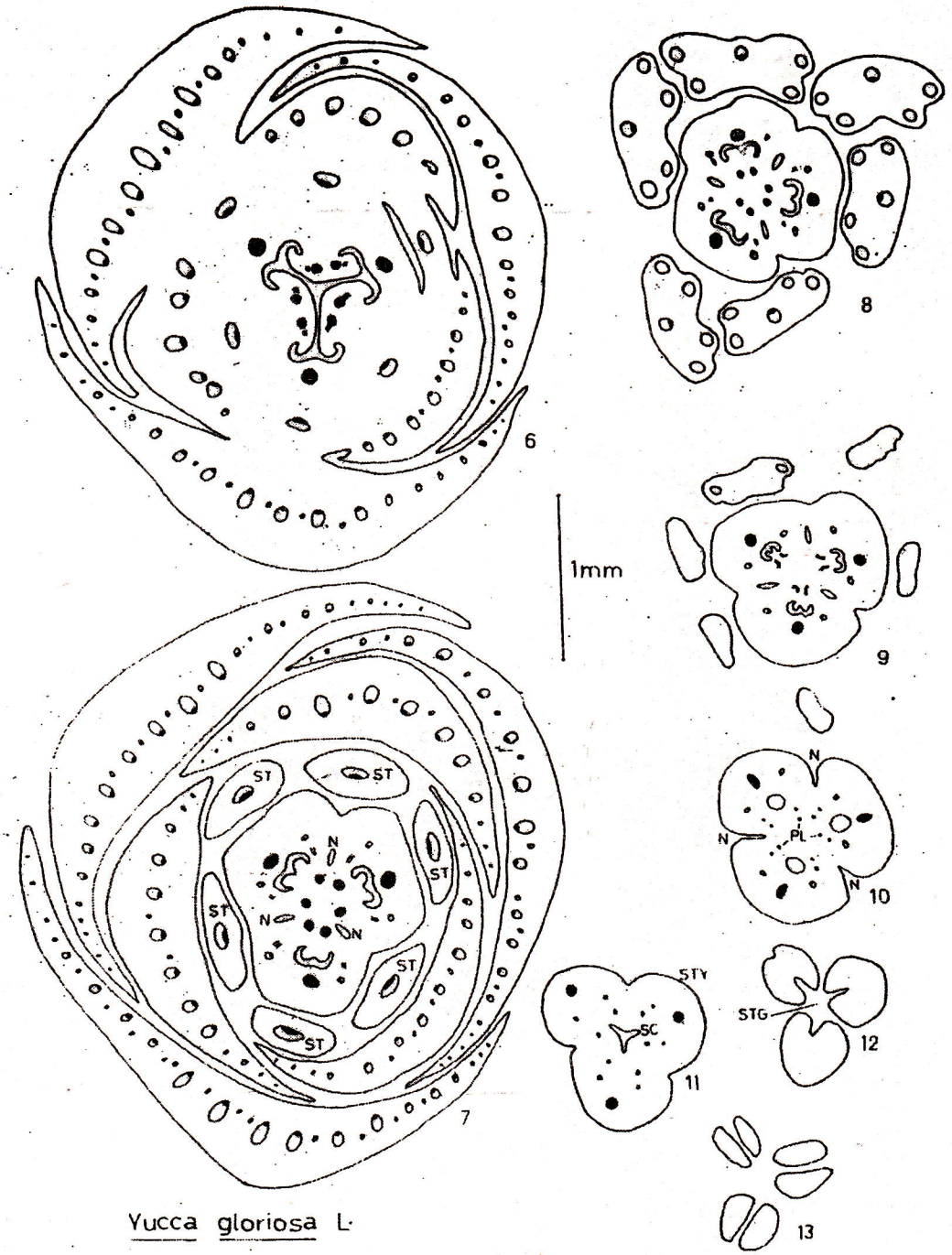
The six members of the perianth are in two whorls of three each. They are free. The outer perianth members are basically 5-traced, whereas the inner segments have basically 3-traced supply. Carpenter[27] described 5-traced outer and 3-traced inner segments in *Urginea*. Vaikos[20] observed both 1-traced and 3-traced condition in other species of the same genus. Also, he noticed further increase on account of the development and branching of the lateral bundles. These authors contended that there is an elaboration in the vascular supply to the perianth rather than a reduction. The increase in number of bundles may not be considered in any other way[27,28].

The androecium comprises six stamens. They are slightly adnate to the base of the inner perianth members and receive a 1-traced vascular supply. The dithecous anthers are dorsifixed and introrse. The connective is prolonged beyond anther in a short non-vascular crest. Taxonomic descriptions[1,2,4,5,12] do not make a reference to the occurrence of an anther crest in the taxon. The prolongation of the connective sometimes thought as a less specialized condition[29], does not appear to be of particular phylogenetic significance as it occurs sporadically in most monocotyledons[17-18].

The ovarian nectarines are typically septal glands. They are developed towards the middle of the length of ovary and open at base of the style. The placental bundles which give rise to ovular traces also bear off-branches into the septa which extend alongside the nectaries and can be said that they are associated with them in their function[13,30-36]. The extension of the residual placental bundles into the style is sometimes regarded as a primitive feature[34,36]. In Agavaceae it does not appear to be so as it is common in all the tribes studied[17-18].

The genus has been variously treated in contemporary taxonomic systems[1-12]. However, in a number of characters like arborescent habit, secondary thickening growth in stem, and xeric habitat, in cytology[37-39], in embryology[19, 40], in palynology[41], in chemistry[40], in vegetative anatomy[40,42-48], *Yucca* resembles the tribe Agaveae[12]. The floral anatomical features of *Yucca* are also similar to it. The origin of the lateral traces to the perianth members from a common commissural bundle, dorsifixed and introrse anthers, occurrence of septal nectaries, ovules many per locule and trend towards the development of an inferior ovary etc. ally the genus with the Agaveae studied[14,15,49,50]. Wundelich[19] also noted adnations of outer floral whorls to the ovary. She has not recognized a separate tribe for the genus. Present authors concur with her standpoint and consider the taxon as the least specialized genus of the Agaveae under Agavaceae. This may be supported by occurrence of ruminate endosperm in *Yucca*, a feather often thought primitive[40]. Mckelvey and Sax's[37] inference Mexico as a common center of their origin and Joshi and Pantulu's[51] view of their

Figs. 1-5. Transections of pedicel to base of flower.



Figs. 6-13. Transections from base of flower upto tip.
(D : Carpellary Dorsal; IS : Inner Staminal Strand; LP : Lateral Trace of a Petal; LS : Lateral Trace of a Sepal; LS--LP : Lateral Trace of a Sepal-cum-Lateral Trace of Petal; MP : Median Bundle of a Petal; MP-IS : Median Bundle of a Petal-Cum-Inner Staminal Stand; MS : Median Bundle of a Sepal; MS-OS-D : Median bundle of a sepal-cum-outer staminal strand-cum-carpellary dorsal; N : Nectary; OS : Outer Staminal Strand; OS-D : Outer Staminal Strand-Cum-Carpellary Dorsal; PL : Placential Bundle; SC : Stylar canal; ST : Stamen; STG : Stigma; STY : Style)

derivation from a common ancestral liliaceous stock appears amply justified.

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