TAXONOMIC AND PHYLOGENETIC CONSIDERATIONS
Bentham and Hooker (1883) treat the family under the series Epigynae and include genera of Hypoxidaceae and Alstroemeriaceae within it.

Pax and Hoffmann (1930) in the Englerian scheme place the family in the Liliiflorae and divide into four sub-families -- Amaryllidoideae, Agavoideae, Hypoxidoideae and Campynematoideae.

The treatment of Rendle (1930) is essentially similar to that of Engler. The family is treated under the order Liliiflorae with five subfamilies -- Amaryllidoideae, Agavoideae, Alstroemerioideae, Hypoxidoideae and Vellozioideae.

It is in the treatment of Hutchinson (1973) that the family finds itself classified under the division Corolliferae, under the order Amaryllidales. Hutchinson does not regard the position of the ovary as more important than the type of inflorescence and accordingly the superior ovaried liliaceous tribes — Agapantheae, Allieae and Gilliesieae are submerged under the traditional Amaryllidaeae with an umbellate inflorescence. The family is the lone representative for his order Amaryllidales and he considers it as a "climax" group. The tribe Agavoideae is elevated not only to the rank of a family but treated
with the Xanthorrhoeaceae under the order Agavales. The Hypoxidioideae and the Vellozioideae are similarly elevated to the rank of family and treated under the order Haemodorales. Likewise, the two other taxa under the rank of family are put in the order Alstroemerales. Thus the taxa within the Englerian Amaryllidaceae find distributed over four orders.

In the latest Engler's Syllabus, the family is treated under the Liliiflorae and with two sub-families, Amaryllidoideae and Ixiolirioideae. The Hypoxidioideae and Vellozioideae and the Agavoideae are elevated to the rank of families. The Alstroemerioideae are included as a sub-family under the Liliaceae probably as a result of the contribution of Buxbaum (1954).

Takhtajan (1969) placed the family Amaryllidaceae, Agavaceae, Hypoxidaceae and Alstroemeriacae under the order Liliales of Superorder Lilianae of Subclass Liliidae. In his latest treatment, the Amaryllidaceae (sensu lato) are segregated in a number of families of which the Alstroemeriacae, Alliaceae, Phormiaceae, Agavaceae and the Amaryllidaceae (sensu stricto) are under the Suborder Lilianae. The Hypoxidaceae and Velloziaceae are under the Suborder Haemodorinae of Order Liliales.
The treatment of Cronquist (1969) submerges the traditional Amaryllidaceae into the Liliaceae. In his latest revision, Cronquist (1981) treats the Englerian tribes or sub-families (except alstroemerias) distinctly. He has thus Agavaceae and Velloziaceae, while the Amaryllidaceae and Alstroemeriaceae are submerged into the Liliaceae.

Cronquist (1968) is of the opinion that the type of inflorescence is not a reliable parameter for aligning taxa and that the position of the ovary, superior or inferior, is a fluid character as is also demonstrated by Buxbaum (1954) and, therefore, the Amaryllidaceae and the Alstroemeriaceae are submerged within the Liliaceae till the time the position is cleared.

In Traub's (1975) scheme all the five major groups are treated as families. Agavaceae, however, have a separate order — Agavales — while the Amaryllidaceae, Alstroemeriaceae, Hypoxidaceae and Velloziaceae are under the order Amaryllidales.

The treatment of Dahlgren and Rasmussen (1983), which closely follows to a great extent Takhtajan (1980), places the agavoid genera into at least four families and the amaryllidaceous genera into at least two families. The
hypoxids along with the two amaryllid families and the 
agavoid families are treated under the order Asparagales, 
while the vellozias are treated under family Velloziaceae 
under the order Vellozales of Superorder Bromeliiflorae 
and the Alstroemeriaceae are treated under the order 
Liliales.

A resume of the taxonomic treatment of these families 
in the earlier and even in the current systems of 
classifications would reveal considerable diversity of 
opinion in regard to their position. Part of it is due to 
the splitter approach employed by recent taxonomists 
(Takhtajan, 1980; Dahlgren et al., 1985). Another extreme 
is seen in the lumpier approach (Cronquist, 1981). This is 
mainly on account of certain inaccurate observations by 
Buxbaum (1954) on the flower of alstroemerias (cf. Kulkarni, 
1973), which have apparently overwhelmed Cronquist to 
submerge the traditional Amaryllidaceae into Liliaceae. 
The present author working as he is with the treatment of 
Hutchinson (1973) in mind sticks to this treatment in this 
discussion.

The present study brings forth certain features which 
are characteristic and distinctive to the three taxa, and 
may also be employed to delineate them. It has its 
limitations in a comprehensive assessment of the taxonomic
and phylogenetic aspects of the three families. Any such assessment has to take into account data from other disciplines, while employing anatomical evidence. Though the following paragraphs is attempted a discussion of the relationships of the three families.

Earlier studies in vegetative anatomy on amaryllids are too few and far between and are not that extensive enough to provide a fund of data. With whatever is available, it seems that there do exist anatomical features which can be employed as criteria of taxonomic distinctiveness amongst the three families.

The stomata in both the Amaryllidaceae and Alstroemeriaceae are perigenous and anomocytic, while they are tetracytic in the Hypoxidaceae. The stomatal ledges occur in the Amaryllidaceae and Hypoxidaceae and are absent from the Alstroemeriaceae. The T-shaped thickenings of the polar ends of guard cells occur in the Amaryllidaceae and Alstroemeriaceae. They are absent in Curculigo. In addition, the Alstroemeriaceae are characterised by a peculiar resupination of the leaf.

The endodermis of the root in Amaryllidaceae is uniformly thin-walled with casparian dots, while it is thick-walled with a distinctive 'U'-shape type of thickening in the Hypoxidaceae.
The vessels in both the families are more or less at the same level of specialization and are restricted to the roots, while in Alstroemeriaceae they are little more specialized and occur even in the stem (Cheadle and Kosakai, 1971). Unfortunately, the present author does not have root material of Alstroemeria to add to these observations.

In regard to the leaf, the amaryllidaceous leaf is characterised by a distinct midrib even in the broad-leaved forms as against a parallelly disposed prominent vein-system in the Hypoxidaceae. The Alstroemeriaceae do resemble the amaryllids in this respect.

It is chiefly collenchyma that contributes to the rigidity to the midrib in the amaryllids, while the hypoxids are characterised by sclerotic mechanical tissue. By and large the Amaryllidaceae and the Alstroemeriaceae have thin and even ribbon-like leaves, while they are rather tough and coriaceous in the hypoxids.

The growth form is also very characteristic of the Hypoxidaceae in that it is a tuberous rhizome. The Amaryllidaceae are predominantly bulbous, while it is a sympodial rhizome with fusiform roots in Alstroemeriaceae.
The structure of the velamen reveals rather a uniformity. At the same time, it indicates that the velamen in the two taxa studied is a little more specialized than that of many Liliaceae. This aspect is taken up again later in this section.

The development of a scapose determinate umbellate type of inflorescence is characteristic of the Amaryllidaceae. It is umbel-like and apparently similar with the partial inflorescences comprised of helicoid cymes in the Alstroemeriaceae. The Hypoxidaceae are also scapose with the inflorescence spicate, racemose or in umbel-like clusters.

The ovary is inferior in all the taxa. Although Buxbaum (1954) holds the flower of Alstroemeria as pseudo-epigynous, studies in this laboratory have indicated it to be truly epigynous (Kulkarni, 1973).

The stamens are characteristically six in both Amaryllidaceae and Alstroemeriaceae. A reduction to three stamens is noted in the Hypoxidaceae. In the Hypoxidaceae and the Alstroemeriaceae septal nectaries are absent, while they are characteristic of most Amaryllidaceae except the tribe Galantheae. In these amaryllid taxa and Alstroemeria the perianth is nectariferous. Daumann (1970) states that the septal nectaries occur in Alstroemeria which is
obviously an incorrect inference (cf. Dahlgren et al., 1985).

The pollen grain is monosulcate in all the three families, while bisulcate grains do occur in the Amaryllidaceae (Erdtman, 1952).

The embryosac is mostly of the Polygonum type with the Allium type recorded in Hypoxidaceae and Amaryllidaceae (Dahlgren et al., 1985). The parietal cell or tissue is lacking both in the Alstroemeriaae and Hypoxidaceae, while it does occur in many of the Amaryllidaceae.

The steroidal saponins are absent in the Amaryllidaceae and Hypoxidaceae. They are characteristic of Alstroemeriaae. Chelidonic acid is characteristic of Hypoxidaceae and Alstroemeriaae, while the Amaryllidaceae have the characteristic unique alkaloids. (Traub, 1975).

It is thus evident that the three families do share certain characters that enable one to align them as has been done by some earlier taxonomists. However, there do exist a number of features which help delineate the three taxa. They appear to be derivatives from liliaceous stocks that developed the Liliaceae as well. It is significant that this line of development is referred to as the so
called petaloid monocotyledonous line or Corolliferae by Hutchinson. A significant feature that characterises the taxa is the occurrence of the velamen in the taxa of this line.

It may be noted that the Amaryllidaceae are thought to be derived from Liliaceae and considered as the progenitors of Iridaceae (Engler and Diels, 1936). It may also be noted that while the Amaryllidaceae are derivatives of the Liliaceae, they do not appear to be the progenitors of the irids. Rather the Amaryllidaceae and the Iridaceae appear to be derivatives from a common liliaceous stock as is held by Hutchinson (1973). The growth form in the Amaryllidaceae is predominantly a bulb. It is a rhizome or corm in most irids. The Liliaceae have rhizomatous, bulbous and cormous types, to further testify that the two major families are derivatives from the Liliaceae.

The vessels in Iridaceae are as primitive as those in Amaryllidaceae to preclude an origin of irids form Amaryllidaceae (cf. Cheadle, 1963). Stebbins and Khush (1961) rightly opine that the taxa with two guard cells and no subsidiary cells have emerged along one or a few, related and parallel, lines of increasing specialization starting with the primitive Liliales. The present study and collateral data from other disciplines would indicate
that the three families are best considered as derived parallelly from ancestral liliaceous stocks. The resemblances and differences in structural features as noted above reflect parallelism in evolution.

Mulay and Deshpande (1961) support the transfer of Agapantheae to the Amaryllidaceae on the basis of velamen structure. They try to relate it along the *Hemerocallis-Agapanthus-Crinum* sequence. The vessel structure of Agapantheae, however, militates this inference. While it is true that *Agapanthus* has primitive vessels, they are highly specialised in *Tulbaghia*. In fact, the vessels in the latter are more specialised than in the amaryllids (*sensu stricto*) in general. Cheadle and Kosakai (1971) hold the two genera uneasy tribe-mates.

It may be noted that floral morphology and cytology aligns *Hemerocallis* more with *Amaryllis* (cf. Vaikos, Markandeya and Pai, 1981; Sato, 1942; Sen, 1975). It is evident that data from velamen structure is insufficient and inadequate in taxonomic realignments.

The above discussion reveals that the amaryllids are at a comparatively low level of evolution. Whether one is justified in describing them as a "climax group" is open to doubt and debate.
The above discussion, while adducing data of pertinent phylogenetic significance, would also reveal that considerable scope for further studies exists. It is also apparent that some of the genera particularly of Hypoxidaceae and Alstroemeriaceae which have been worked out in respect to certain aspects, need further studies in other disciplines. Collection of plant material is a difficult task. This is especially so of the critical genera which are restricted to South Africa (Paurida) and Chile (Leontochir and Schickendantzia). A more comprehensive discussion should await studies on these genera.