OBSERVATIONS ON THE GENUS ASCOLEPIS

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ABSTRACT. The inflorescence structure of the genus *Ascolepis* (Cyperaceae) has been re-investigated. It is an indeterminate head, with the main inflorescence axis contracted or condensed and appearing as a receptacle. The incrassate organ partly or completely clasping the flower is considered as a glume, and together with the abaxially subtending glume-like bract forms the spikelet unit. This spikelet unit is then subtended by a glume-like bract abaxially. An infrageneric grouping of two subgenera (subgen. *Ascolepis* and *Platylepis*) is proposed based on the form of the glume, number of stylar arms, and shape of the fruit and embryo.

INTRODUCTION

The incrassate organ, which is more or less membranous and found clasping the flower partly or completely in the genus *Ascolepis*, is of restricted occurrence in the family Cyperaceae. The arrangement of this organ within the inflorescence unit has been a subject of controversy. It has often been called a squamella following Nees' initial idea of the limits of the genus, or hypogynous scale (Hooper 1972). In establishing the homology of this organ, Clarke (1901–1902, p. 473) described it as "probably made up of 2 lateral organs coalescent completely on the anticous side, imperfectly or not at all on the posticous side; they would be 2 lateral bracteoles". Earlier, Clarke (1897–1900, p. 266) had referred to the same organ as "scales at anterior position, parallel with the glume, longer than it, thickened, in the Cape species utricular enclosing the flower perhaps representing two lateral partially connate bracteoles". Hooper (1972) keyed out the genus by the following diagnosis:—"ovary and the stamens enclosed or enwrapped by a squamella more conspicuous than the glume".

Palla (1905), working on *Ascolepis leucocephala* (Nees) L. T. Eiten traced the homology of the squamella from an anatomical standpoint. He referred to it as a "Deckblatt" or bract and considered it as homologous with the ordinary glumes found in such genera as *Kyllinga*.

Recent investigations into the leaf and culm anatomy (Metcalfe 1971, p. 82; Oteng-Yeboah 1972), floral morphology and fruit anatomy (Oteng-Yeboah *l.c.*) and embryo structure (Van der Veken 1965) of the genus, suggest that *Ascolepis* shows affinities to *Lipocarpha*. Further considerations on the overall features of these two genera also suggest that they are members of the tribe *Cypereae*, sharing similar characteristics with *Kyllinga*, *Mariscus*, *Remirea*, etc. With this in mind, therefore, the isolated position of *Ascolepis* without a fertile glume is rather disconcerting.

It therefore seemed necessary to re-examine the inflorescence of the various species of the genus to ascertain the situation, and bring the spikelet structure in the genus into line with the other genera mentioned above.

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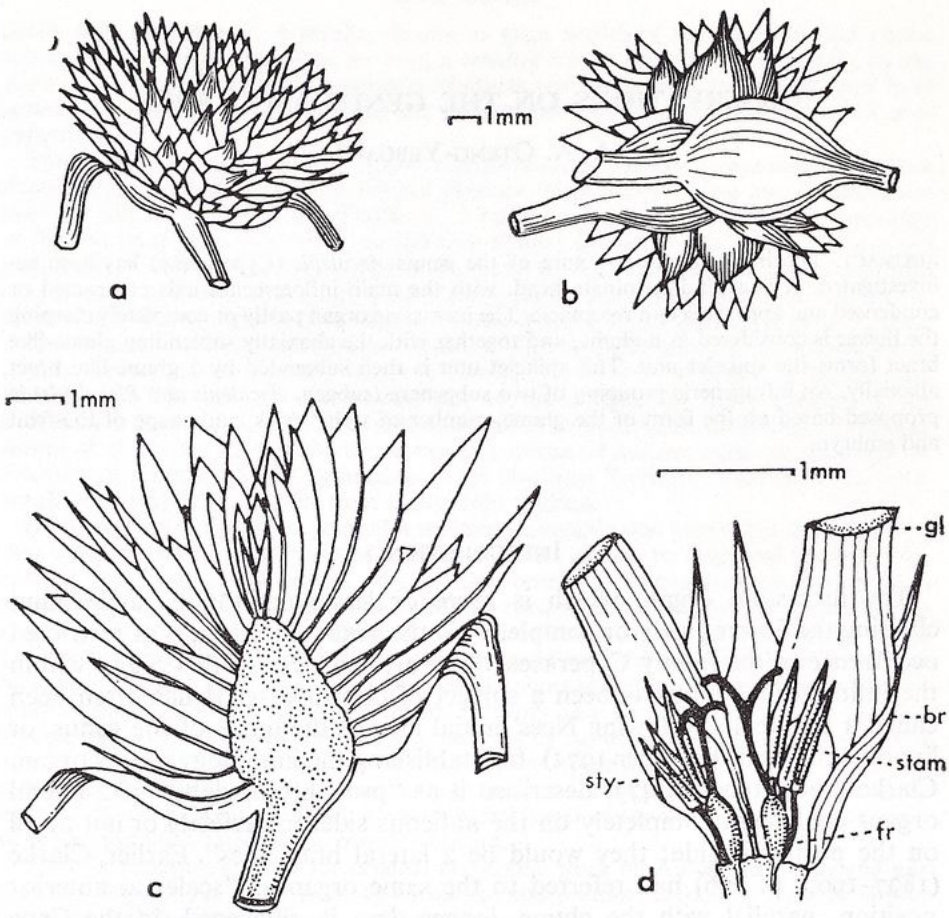

FIG. 1. Morphology of the inflorescence in *Ascolepis capensis*: a, general inflorescence (lateral view); b, general inflorescence (ventral view; c, L.S. of general inflorescence; d, one-flowered spikelets (in *A. elata*). br, bract; fr, fruit; gl, glume; stam, stamen; st, style.

In so doing, it became quite clear that there were two forms of the incrassate organ in the genus. This, apparently, had formed the basis of Kunth's (1837) segregation of the genus into two distinct genera viz: *Ascolepis* and *Platylepis*. Clarke (1901–02) reduced the status of *Platylepis* to that of a section and this has been its status to the present.

MATERIAL AND METHODS

Five species of *Ascolepis*, namely *A. brasiliensis* Benth. ex C. B. Clarke, *A. capensis* Ridley, *A. elata* Welw., *A. pinguis* C. B. Clarke and *A. protea* Welw., were studied. The following specimens housed in the Edinburgh herbarium (E) were consulted: *Kassner, J. Steinbach* 6727 for *A. brasiliensis; Irvine* 2473, *Baum* 209, *Cooper* T. 911 for *A. capensis*; *Hilliard & Burtt* 4362 for *A. elata*; *Kassner Expd.* 2550 for *A. pinguis*; and *Baum* 627 for *A. protea.*

Whole inflorescences were cut longitudinally into halves, using a razor. Hand transverse sections of the squamella were made.

Observations and discussion

The inflorescence is terminal, head-like, subtended by 2–3 large leaf-like involucral bracts whose bases are dilated (fig. 1a, b).

A longitudinal section of the inflorescence shows a torus-like organ which is cone-shaped and spongy, and bears the flowers and other inflorescence structures on its surface (fig. 1c). The flowers develop and mature acropetally, the older ones below, younger ones above. Each flower consists of 1–3 stamens, 2–3-fid styles and a small, narrowly, ellipsoid, lenticular to trigonous ovary. The whole flower is enclosed by the incrassate squamella which in turn is subtended abaxially by a smaller, glume-like hyaline structure (fig. 1d). The incrassate squamella assumes two main forms: one being narrow, thin and slightly hollowed at the lower part to hold the flower, with its upper part much elongated, less flattened and with a conical beak (fig. 2a, b); the other being obovate, strongly flattened at the lower part with acute scarious wings and the flower held in a smaller pouch on the anterior side, with its upper part suddenly contracting into a short flattened beak (fig. 2c, d). Between these two forms are various transitional states: as, for example, in *A. pusilla* Ridl. where the base of the squamella shows a tendency for the hollow free margins to unite (Clarke 1909) and in *A. eriocauloides* (Steud.) Nees. *A. elata* and *A. protea* where the hollow free margins just meet over the top of the flower, but do not fuse.

In transverse sections through the first form of the squamella in the area above the insertion of the flower (fig. 3b, c), there is only one mid-nerve or vasculation which is median in position. This is the same in the other form of the squamella. The ground tissue in the squamella is made up of spongy, translucent cells, bordered abaxially and adaxially by uniformly shaped epidermal cells. There are a number of peripheral nervules below some epidermal cells which are traces from the main nerve or vasculation. These nervules give a sulcate appearance to the external surface of the organ.

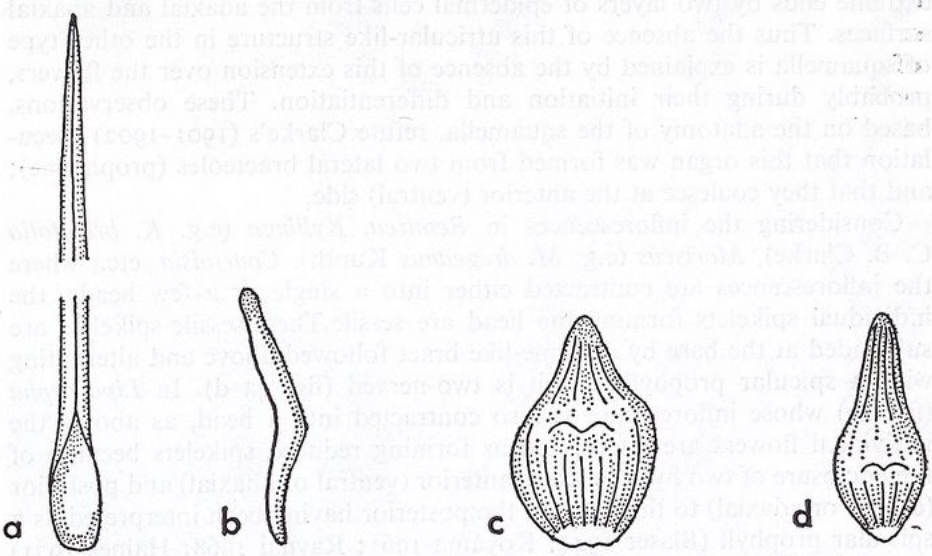

FIG. 2. The two forms of squamella in *Ascolepis*: a, *Ascolepis pinguis* and b, *A. protea*; c, *A. brasiliensis* and d, *A. capensis*.

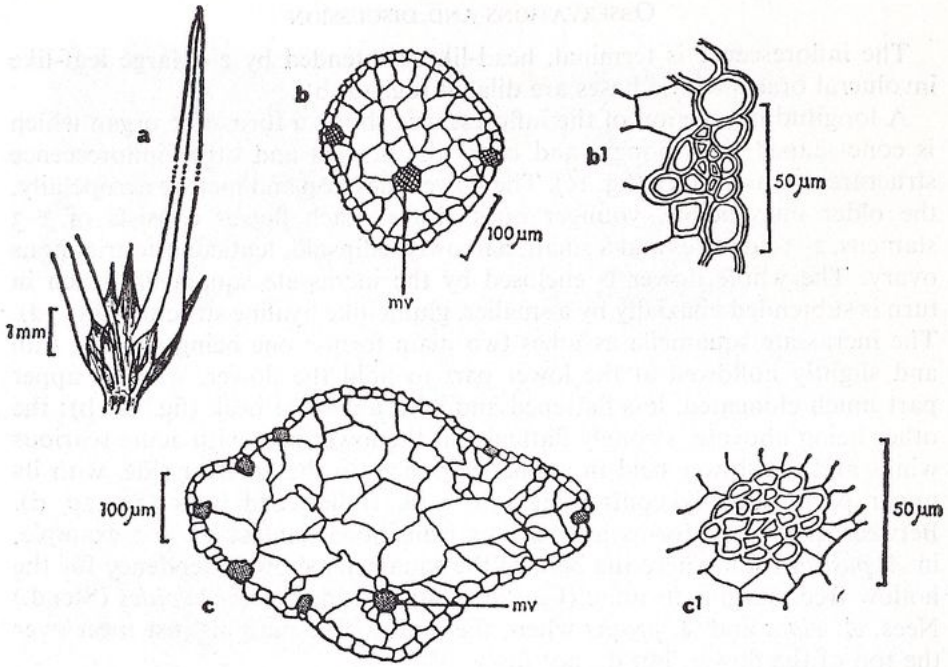

FIG. 3. T.S. of squamella in *Ascolepis elata*: a, one-flowered spikelets; b, T.S. (distal region); b1, sector of 'b' showing lateral vascular tissue; c, T.S. (middle region); c1, sector of 'c' showing mid-vascular (mv) tissue.

From Palla's (1905) observation on the second form, the squamella can be seen to have formed from extensions of the adaxial epidermal cells in the adaxial concavity where the flower normally lies. The adaxial epidermal extensions meet over the flower, forming a single layer. The lateral sides of the structure converge into acute, wing-like margins, bordered at their extreme ends by two layers of epidermal cells from the adaxial and abaxial surfaces. Thus the absence of this utricular-like structure in the other type of squamella is explained by the absence of this extension over the flowers, probably during their initiation and differentiation. These observations, based on the anatomy of the squamella, refute Clarke's (1901–1902) speculation that this organ was formed from two lateral bracteoles (prophyllae); and that they coalesce at the anterior (ventral) side.

Considering the inflorescences in *Remirea*, *Kyllinga* (e.g. *K. brevifolia* C. B. Clarke), *Mariscus* (e.g. *M. dregeanus* Kunth), *Courtoisia*, etc., where the inflorescences are contracted either into a single or a few heads, the individual spikelets forming the head are sessile.These sessile spikelets are subtended at the base by a glume-like bract followed above and alternating with a spicular prophyll, which is two-nerved (fig. 4a–d). In *Lipocarpha* (fig. 4e) whose inflorescence is also contracted into a head, as above, the individual flowers are interpreted as forming reduced spikelets because of the enclosure of two hyaline scales anterior (ventral or abaxial) and posterior (dorsal or adaxial) to the flowers; the posterior having been interpreted as a spicular prophyll (Blaser 1944; Koyama 1961; Raynal 1968; Haines 1971) and the anterior as the fertile glume with the stamens placed between it and the fruit. In *Hemicarpha* and *Nelmesia*, (fig. 4g, h) there is an anterior scale

which is considered homologous to the anterior scale in *Lipocarpha*. This scale is sometimes found to be absent altogether in *Hemicarpha* (Clarke 1901–2; Palla 1905; Friedland 1941). Whether this anterior scale can be interpreted as a fertile glume is debatable, considering that the original glume-like structure is immediately behind the scale and encloses it.

The situation in *Ascolepis* (fig. 4f) can be compared to that in *Hemicarpha* and *Nelmesia*. They are similar in the sense that the incrassate organ is anterior and subtended by a glume-like structure; but different in the sense that the former completely or partially surrounds the flower on a seemingly separate whorl from the latter. In *Ascolepis dipsacoides* (Schumach.) Raynal, a spicular prophyll alternates with the basal glume-like structure and the squamella (Raynal 1968). This points to the fact that the flower enclosed in the squamella, with or without a spicular prophyll, forms a reduced spikelet

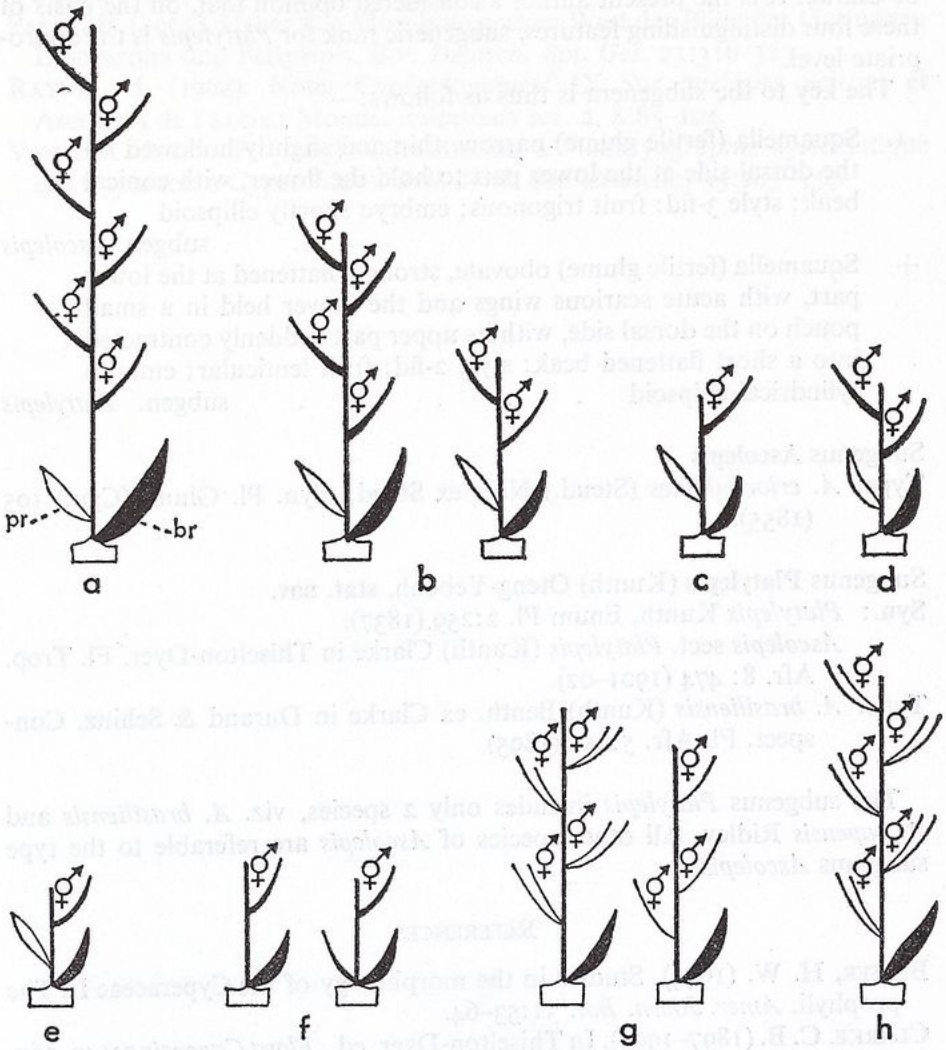

FIG. 4. Schematic spikelet structure of: a, *Cyperus*; b, *Mariscus*; c, *Kyllinga*; d, *Remirea*; e, *Lipocarpha*; *f*, *Ascolepis*; g, *Hemicarpha*; h, *Nelmesia*. br, bract; pr., spicular prophyll.

unit. In this case, therefore, the squamella can be interpreted as a glume, and the subtending glume-like structure as a reduced bract.

The inflorescence of *Ascolepis* can thus be compared to those of *Lipocarpha*, *Remirea*, *Kyllinga* p.p., *Mariscus* p.p. and *Courtoisia* in containing one-flowered spikelets that are made up of reduced inflorescence bracts, a spicular prophyll (that may be present or absent), a fertile glume and a flower.

The fertile glume (squamella) in *Ascolepis* has already been described as having two forms. These two forms are easily identified from the inflorescence. The one with elongated conical beak makes the inflorescence appear as an expanded ray; while the one with the shortened flattened beak makes the inflorescence appear as a contracted ray. Correlating with these are, respectively 3- and 2-fid styles, trigonous and lenticular fruits, and shortly ellipsoid and cylindrical-ellipsoid embryos. These features separate the genus into two: one group corresponding to the genus *Platylepis* of Kunth or sect. *Platylepis* of Clarke. It is the present author's considered opinion that, on the basis of these four distinguishing features, subgeneric rank for *Platylepis* is the appropriate level.

The key to the subgenera is thus as follows:—

1. Squamella (fertile glume) narrow, thin and slightly hollowed on the dorsal side at the lower part to hold the flower, with conical beak; style 3-fid; fruit trigonous; embryo shortly ellipsoid . . . . subgen. *Ascolepis*

\+ Squamella (fertile glume) obovate, strongly flattened at the lower part, with acute scarious wings and the flower held in a small pouch on the dorsal side, with its upper part suddenly contracted into a short flattened beak; style 2-fid; fruit lenticular; embryo cylindrical-ellipsoid . . . . . subgen. *Platylepis*

Subgenus **Ascolepis**

Type. *A. eriocauloides* (Steud.) Nees ex Steud., Syn. Pl. Glum. (Cyp.) 105 (1855).

Subgenus **Platylepis** (Kunth) Oteng-Yeboah, **stat. nov.**

Syn.: *Platylepis* Kunth, Enum Pl. 2:259 (1837).
Ascolepis sect. *Platylepis* (Kunth) Clarke in Thiselton-Dyer, Fl. Trop. Afr. 8: 474 (1901–02).

Type. *A. brasiliensis* (Kunth) Benth. ex Clarke in Durand & Schinz, Conspect. Fl. Afr. 5:651 (1895).

The subgenus *Platylepis* includes only 2 species, viz. *A. brasiliensis* and *A. capensis* Ridley. All other species of *Ascolepis* are referable to the type subgenus *Ascolepis*.

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