# CONTRIBUTIONS TO THE GRASS FLORA OF AFRICA

by

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(with 4 figures)

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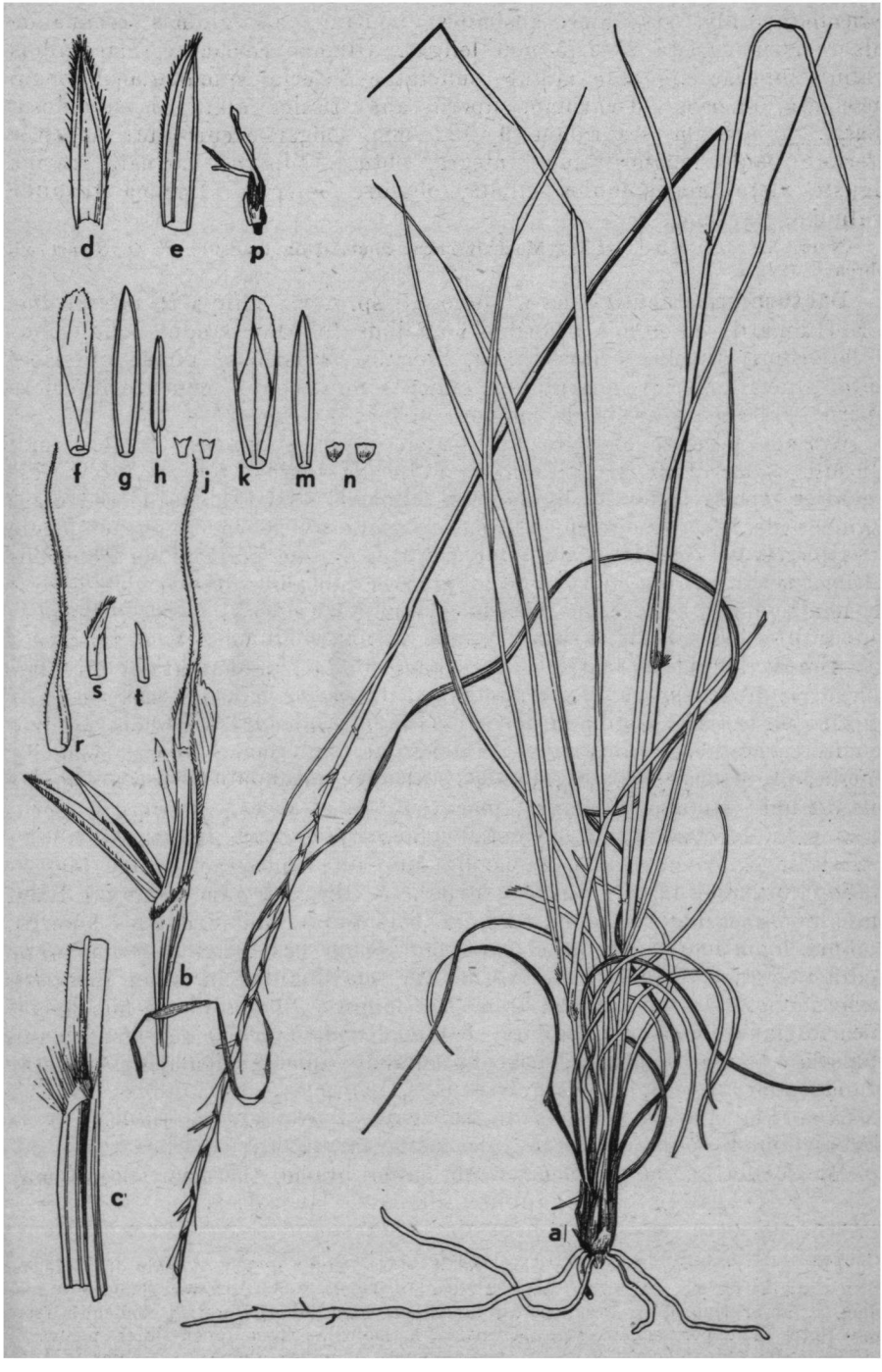
## PART I — THREE NEW GRASSES FROM TROPICAL AFRICA AND PANICUM LANIPES MEZ IN SOUTH AND SOUTH WEST AFRICA.

**Urelytrum Henrardii** Chippindall sp. nov.; ab *U. agropyroidei* Hack., cui e descriptione affine, culmis gracilibus, foliorum laminis non hirsutis, longe attenuatis, longioribus, racemis flavido-viridibus, spicularum sessilium gluma inferiore 5-nervi, arista breviore distinguendum — *Fig. 1.*

Gramen perenne caespitosum, usque ad 92 cm altum. Culmi erecti, simplices, graciles, pauci-nodes, glabri, racemos versus asperuli. Folia plerumque basalia; vaginae internodiis longiores, sublaxae, striatae, apicem versus carinatae, basales glabrae laevesque, superiores pilis patulis laxe pilosae, ore villoso-barbatae; ligulae scariosae, rotundato-obtusae, 0.8—1.25 mm longae; laminae lineares, apice tenuiter setaceae, planae vel leviter conduplicatae, usque ad 38 cm longae, 3—3.8 mm latae, marginibus scabridis, costis asperulis, pone ligulam pilis longis exceptis glabrae. Racemi ad culmi apicem solitarii, stricti, fragiles, subcylindrici, fere glabri, flavidi vel pallide flavido-virides, saltem 16 cm longi; articuli rhacheos compressi, infimo usque ad 2 cm longo, scaberuli, margine uno superne rigide ciliati, appendice membranacea inaequaliter dentata ciliolata; pedicelli articulis similes, sed appendice minore. Spiculae sessiles biflorae, anguste lanceolato-oblongae, 7.5—8.2 mm longae (callo excluso); callus crassus, rotundato-obtusus, basi barbatus. Glumae subaequales, minute punctatae; inferior spiculam aequans, coriacea, marginibus hyalinis, explanata lanceolata, subconvexa, subacuta, 5-nervis, dorso apicem versus parce spinuloso-ciliata, superne bicarnata, carinis angustissime alatis, alis spinuloso-ciliatis; superior inferiore paulo brevior, firme membranacea, marginibus hyalinis apice minute ciliolata, lanceolata, acuta, 3-nervis, superne carinata, carina anguste alata, ala spinuloso-ciliata. Anthoecium inferum ♂: lemma tenuiter hyalinum, lanceolato-ovatum, 6—6.5 mm longum, 2-nerve, minute bidentatum, marginibus apicem versus minute ciliolatum; palea lemmati similis sed angustior et paulo longior; antherae 3 mm longae; lodiculae glabrae. Anthoecium superum ♀: lemma lemmati anthoecii inferi simile sed 3-nerve, apice latius; palea angustior. Spiculae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pedicellatae illis sessilibus absimiles, neutrae, ad glumas lemmaque redactae, sine arista 2—2.75 mm longae. Glumae coriaceae, marginibus hyalinis superne ciliolatae, minute punctatae; inferior spiculae aequilonga, lanceolata, 5-nervis, ad carinam superne angustissime alata, ala spinuloso-ciliata, in aristam scabridam 9—12.5 mm longam excurrente; superior inferiore paulo longior, apice integra, obtusa, superne carinata, carina anguste alata, ala spinuloso-ciliata, obscure 5-nervis. Lemma tenuiter hyalinum, parvum.

Northern Rhodesia: Munshiwemba, common on roadside, *F. O. Stohr 759*, February 1942.

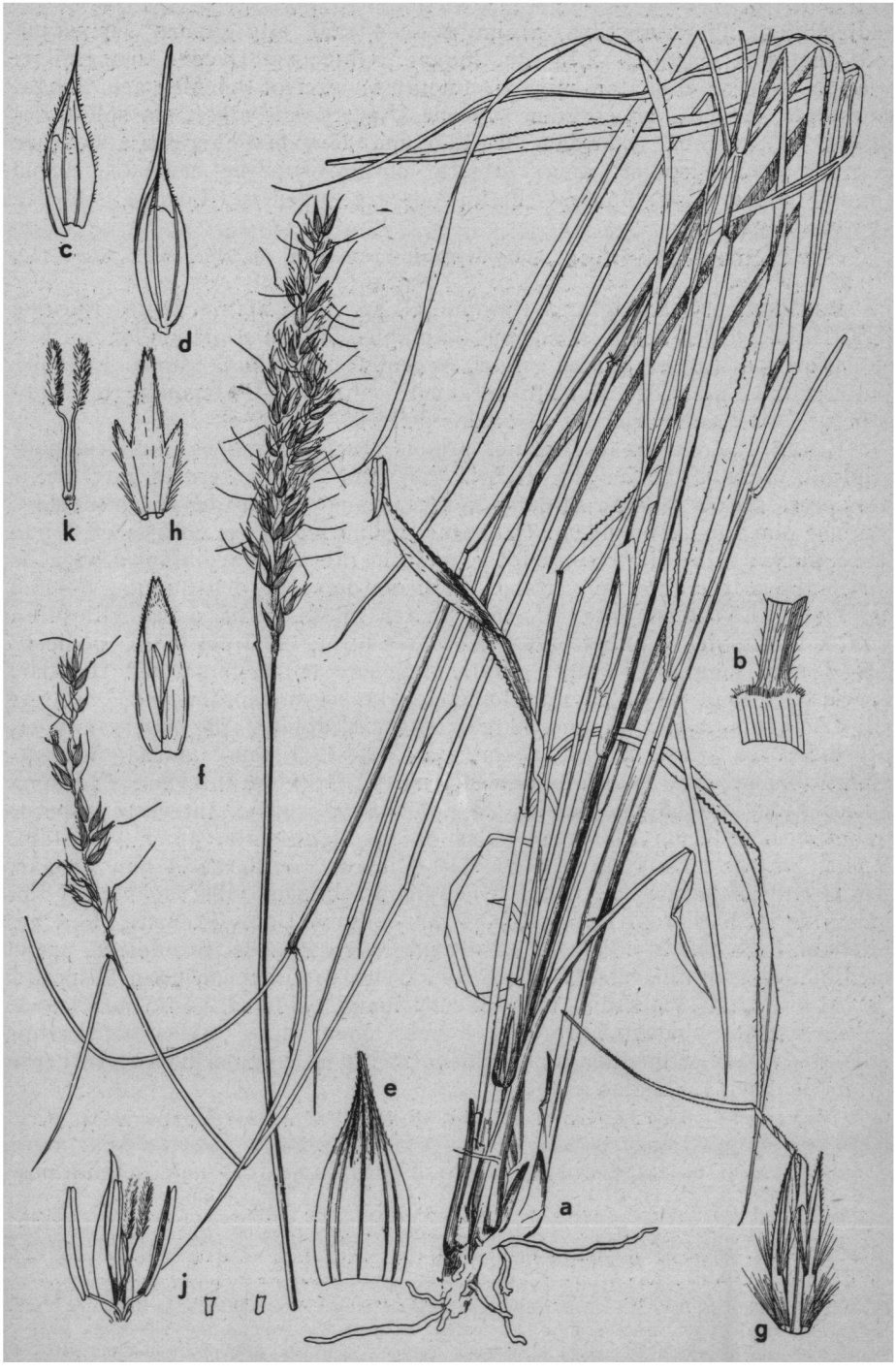
**Danthoniopsis acutigluma** Chippindall sp. nov.; affinis *D. intermediae* C. E. Hubbard, sed culmis altioribus 3-nodibus, foliorum laminis longioribus et latioribus, rhachi leviter pilosa, spiculis majoribus, gluma inferiore acuta, gluma superiore marginibus superne pubescente, lemmate inferiore superne pubescente aristaque longiore differt — *Fig. 2.*

Gramen perenne caespitosum. Culmi erecti, simplices, 3-nodes, nodi villosuli, usque ad 80 cm alti, glabri. Foliorum vaginae teretes, internodiis breviores, sparse pilosae; ligulae ad ciliorum seriem densam redactae; laminae lineares, in acumen attenuatae, usque ad 26 cm longae et 9 mm latae, planae vel siccitate convolutae, molliter pilosae, marginibus scaberulis cartilagineis, margine uno crispo. Panicula linearis, densiuscula, 8—11.5 cm longa, 1.5—2 cm lata; rhachis leviter pilosa nodis dense villosulis; rami solitarii, dense pubescentes, inferiores usque ad 5 cm longi; pedicelli 0.5—4 mm longi. Spiculae elliptico-lanceolatae, acuminatae, flavidae, nervis viridibus, 11—12.5 mm longae. Glumae membranaceae; inferior elliptico-ovata, acuta, 8 mm longa, 3-nervis, apice pilis paucis minutis praedita; superior rostrato-acuminata, 11—12.5 mm longa, 5-nervis, marginibus superne minute pubescentibus. Anthoecium inferum ♂: lemma lanceolatum, 9—9.5 mm longa, 5—sub-7-nerve, parte interiore superne pubescente, ceterum glabrum; palea oblongo-lanceolata, apice bidentata, 7 mm longa, carinis apicem versus ciliolata; antherae 4 mm longae. Anthoecium superum ☿: callus brevissimus, obtusus, pilis usque ad 3 mm longis dense barbatus; lemma 6.5—7 mm longum (lobis exclusis), 9-nerve, bilobum, lobis acutis, ciliolatis, 1.2—3 mm longis, basi longe pilosum, prope medium pilorum alborum fasciculis 8 in seriem transversam unam dispositis barbatum; arista scaberula, 15.5—17 mm longa, columna 4.5—5 mm longa; palea anguste oblongo-lanceolata, 6 mm longa, apice bidentata, carinis ciliolatis e basi ad medium alatis, alis ciliolatis apice auriculatis. Antherae 3 mm longae. Lodiculae glabrae.

Northern Rhodesia: north side of Mwendafye near Munshiwemba, *F. O. Stohr 786*, March 1942.

By reason of its distinctly acute lower glume, the new species may

*Fig. 1, Urelytrum Henrardii* Chippindall — a. Plant, × ½; b. pair of spikelets, × 3; c. ligule, ± natural size; d. to p. sessile spikelet, × 3: d. lower glume, e. upper glume, f. lower lemma, g. lower palea, h. anther from lower floret, j. lodicules from lower floret, k. upper lemma, m. upper palea, n. lodicules from upper floret, p. ovary; r. to s. pedicelled spikelet, × 3: r. lower glume, s. upper glume; t. lemma — del. *Rhona Brown.*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also be compared with *D. wasaënsis* (Vanderyst) C. E. Hubbard, but differs from it in having rigid, not compressible culms, villosulous nodes, a shorter, narrower panicle, larger spikelets, pubescent glumes and lower lemma and a longer awn. From *D. viridis* (Rendle) C. E. Hubbard, it may be distinguished by its lowermost leaf-sheaths being glabrous, its nodes not bearded, much smaller panicle, acute lower glume, pubescent lower lemma and longer awn.

*D. intermedia* C. E. Hubbard is described as having the lowest internode "sublanate to glabrous". There is no indication of lana on Dr Stohr's specimen, and the leaf-sheaths are sparsely, not densely pilose. The pubescence in the upper part on the inner surface of the lower lemma appears to be a character not found in the other species of the genus.

**Trichopteryx elegantula** Stapf var. **katangensis** Chippindall var. nov.: a typo pedicellis apice pilis albidis rigidis barbatis, spiculis minoribus 2.5—3 mm longis differt — *Fig. 3.*

Belgian Congo: Haut-Katanga, Elizabethville, in shady situation on roadside, growing in light, rich soil. Very rare, *P. Quarré 1097*, January 1927.

*Trichopteryx stolziana* Henrard, *T. Glanvillei* Hubbard and *T. elegantula* Stapf appear to be very closely allied. None of them, unfortunately, is represented in the National Herbarium at Pretoria, so that my observations are based on the descriptions given in the Flora of Tropical Africa, Vol. X (1937).

*T. elegantula* is separated from the other two species by reason of having its "uppermost internode (peduncle) more than half the length of the culm". Plate 2394 in Hooker's Icones Plantarum XXIV (1895) of this species depicts three plants, each of which has small panicles partly enclosed in the tightly rolled sheaths of leaves below the terminal inflorescence — a character found in twelve of the twenty plants constituting the duplicate of *Quarré 1097* in the National Herbarium, and shown in Fig. 3 b and c. These lateral panicles, however, are borne on very slender branches of the central culm and the plants cannot be described as having the "uppermost internode more than half the length of the culm". The culms are simple in the other eight units of the specimen (Fig. 3 a).

It differs from *T. stolziana* in having bearded nodes and its upper glume loosely pilose; from *T. Glanvillei* in having the intermediate leaf-sheaths shorter than the internodes. *T. stolziana* is described as having the "panicle exserted at maturity", while in *T. Glanvillei* it is "enclosed at the base in the uppermost leaf-sheath". In M. Quarré's specimen there are seven plants with exserted, and thirteen with enclosed panicles. They vary in height from 6—16.5 cm, including the inflorescences.

They differ from all the allied species in having somewhat smaller spikelets and their pedicel-tips bearded — a character confined hitherto to the five perennial species of the genus so far described.

*Fig. 2. Danthoniopsis acutigluma* Chippindall — a. Plant, × ½; b. ligule, × c. 2; c. lower glume; d. upper glume; e. lower lemma; f. lower palea; g. upper lemma; h. upper palea; j. bisexual flower with lodicules; k. stigmas and immature ovary — Dissections × 3½ — del. *Rhona Brown.*

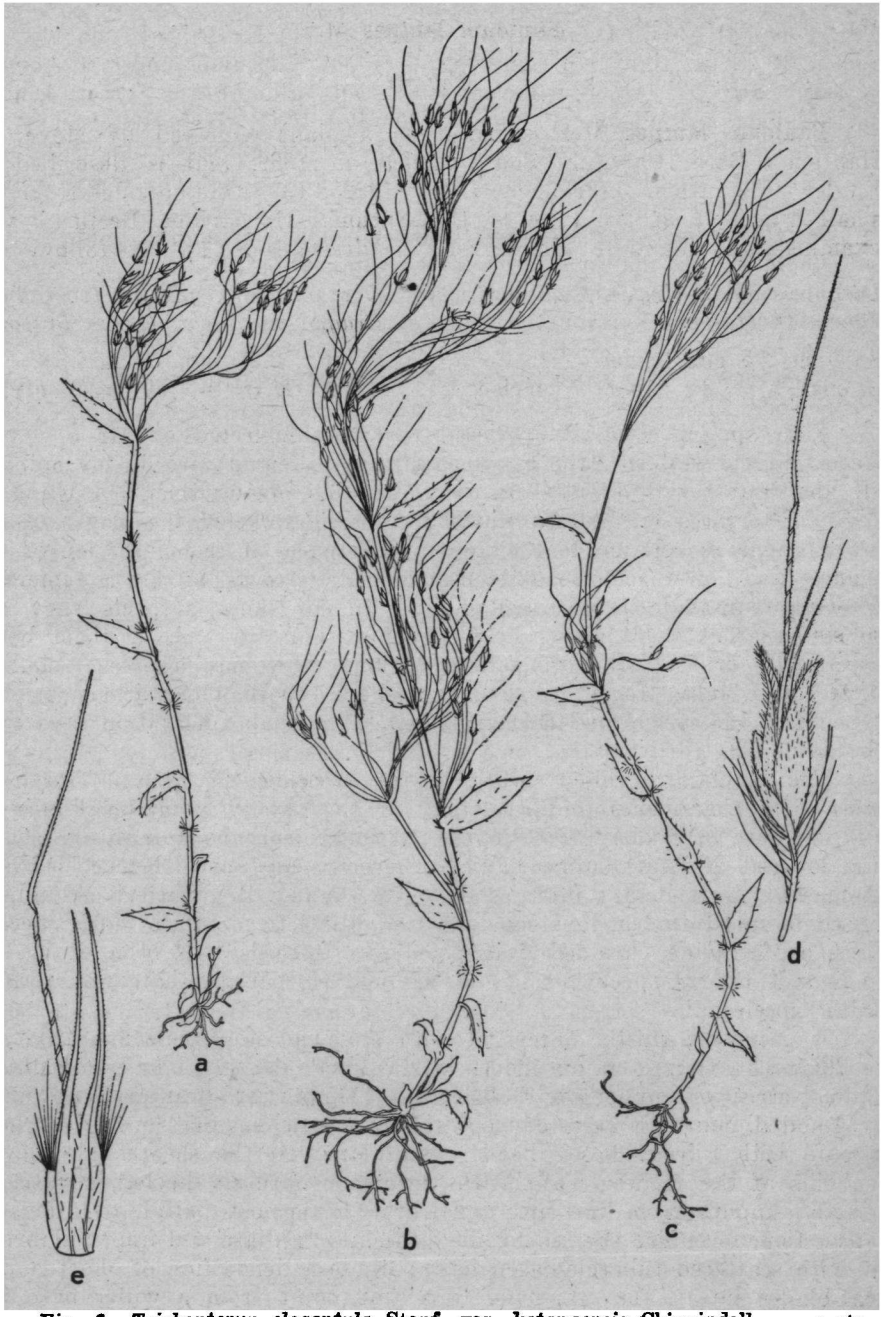


*Fig. 3, Trichopteryx elegantula* Stapf. var. *katangensis* Chippindall — a. to c. Plants, natural size, showing a. simple culm, b. branched culm with the terminal panicle enclosed at the base, c. branched culm with the terminal panicle exserted; d. single spikelet with bearded pedicel, ± 8 ×; e. upper lemma, ± 8 ×. — del. *Rhona Brown.*

## Panicum lanipes Mez.

*Fig. 4.*

**Panicum lanipes** Mez is based on a plant collected by Meyer at Hantam's Berg, Calvinia, South Africa, in 1869, and is described in Engler's Botanische Jahrbücher LVII (1922), 187. One spikelet from the small fragment of the type at the National Herbarium, Pretoria, was examined and found to differ from the description (l.c.) as follows:

| *Diagnosis by C. Mez in Engl. Bot. Jahrb. LVII, 187.* | *Diagnosis of Spikelet from Type Fragment at Nat. Herb., Pretoria.* |
|---|---|
| Spiculae 2.5 mm longae. | Spicula 2.25 mm longa. |
| Glumae I. = 3-, II. = 7-nerviae. | Gluma I. = 4-, II. = 9-nerviae. |

Four specimens of woolly-based *Panicums* collected by Mr J. P. H. Acocks in the western Cape Province (the type region) are, in my opinion, all identifiable with this species, the variation among them consisting of slight differences in the size and shape of the spikelet, the length of the lower glume in relation to the upper, differences in the nervation of the glumes and lower lemma, and in one case (*Acocks 7590*), a somewhat geniculate instead of an erect habit. In all other respects they are so similar that there seems little possibility of any one of them being specifically distinct from the others, although they may represent slightly different edaphic forms. Furthermore, the above observations on the type of *P. lanipes* prove that variation in size and nervation occurs in the same plant.

The plants are closely allied to the broad-leaved variety (*Panicum minus* Stapf var. *planifolium* Stapf) of *Panicum Stapfianum* Fourcade. Indeed, the very distinctive woolly tomentum of the innovation shoots and lowest leaf-sheaths appears to be the only constant difference between them, but until it has been established whether this variety should be raised to specific rank, it is considered advisable to maintain Mez's species.

The following emended description of *P. lanipes* has been drawn up to include the six specimens in the National Herbarium that are referable to the species.

A glaucous, tufted perennial with a short, stout rhizome, from 30 to 70 cm high; innovation shoots intravaginal, densely lanate-tomentose; Culms erect or geniculately ascending, simple or branched upwards, 3—4-noded, nodes finely to densely pubescent. Leaves glabrous or sparsely hirsute with tubercle-based hairs, particularly on the sheaths and lower margins of the blades; leaf-sheaths terete or obtusely keeled, striate, at length slipping from the internodes, the lowermost pallid and densely lanate-tomentose like the innovations, the intermediate and upper glabrous or with scattered tubercle-based hairs; ligule a dense line of short hairs; leaf-blades linear, flat, tapering to a fine point from a wider base, up to 22 cm long and 5 mm wide, rather rigid, glabrous and smooth or with scattered tubercle-based hairs near the margins and flanking the mid-rib, closely and finely nerved, mid-rib indistinct, margins cartilaginous and minutely scaberulous. Panicle at first contracted, ultimately wide

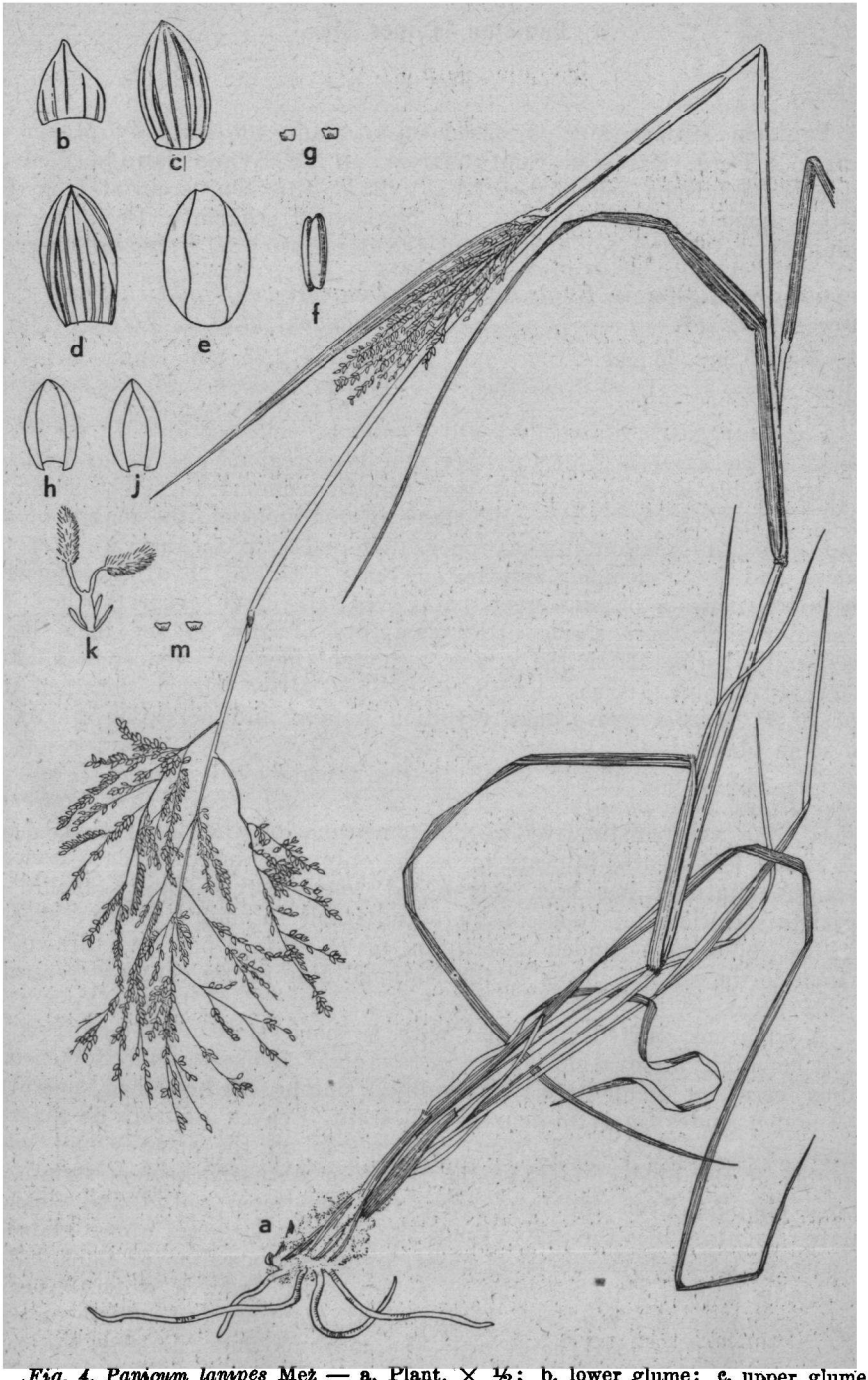


*Fig. 4, Panicum lanipes* Mez — a. Plant, × ½; b. lower glume; c. upper glume; d. lower lemma; e. lower palea; f. anther from lower floret; g. lodicules from lower floret; h. upper lemma; j. upper palea; k. ovary with anthers attached; m. lodicules from upper floret — Dissections × 8½ — del. *Ehona Brown*.

open and very loose, up to 20 cm long, divided to the 3rd or 4th degree, glabrous; primary axis and all divisions slender, striate, glabrous, minutely scaberulous; primary branches solitary or binate, the lowest up to 12 cm long, undivided for up to 3.5 cm and up to 3 cm apart; ultimate divisions mostly 2-spiculate; pedicels with cupular tips, the longer up to 3 mm long. Spikelets glabrous, 2—2.5 mm long, pale green variegated with purple, subobtuse to subacute or acute, gaping at maturity. Glumes unequal; lower broadly ovate, subobtuse to acute, from $^1/_3$ to $^2/_3$ the length of the spikelet, with 1 percurrent midnerve and 1—2 shorter nerves on either side of it; upper broadly lanceolate, as long as the spikelet, subobtuse to acute, compressed towards the apex, 7—9-(rarely 6-)nerved. Lower floret ♂: lemma similar to the upper glume but narrower and 7—11-nerved; palea ovate-lanceolate, hyaline; anthers 0.65—1.4 mm long; lodicules glabrous. Upper floret ♀: lemma elliptic-lanceolate, up to 1.8 mm long, faintly 7-nerved, chartaceous to thinly crustaceous, smooth, white or yellowish; palea similar to the lemma but slightly shorter and narrower, 2-nerved; anthers 0.8—1.5 mm long; lodicules glabrous. Grain unknown.

South Africa: Cape Province: Calvinia Div., Hantam's Berg, *Meyer*, anno 1869. Fragment of type in Nat. Herb., Pretoria. — Carnarvon Div. (i) In silty karroo soil on alluvial flats at Rhenoster Kolk. After heavy rains this becomes extremely common on a sandy slope among the Draaibos, Rainfall 7″, *J. P. H. Acocks 7553*, February, 1937; (ii) Occasional mats on rocky or stony (dolerite hill overlooking van Wijk's Vlei. Plants glaucous, spikelets purplish, Rainfall 5″, *J. P. H. Acocks 7590*, February 1937. — Prieska Div. Occasional in stony jasper veld at Prieska Poort, Rainfall 9″, *J. P. H. Acocks 7595*, February 1937. — Hay Div. Rare in hard red sandy loam on the floor of valley through stony hills in jasper hardeveld at Hardcastle, Rainfall 9″, *J. P. H. Acocks 7842*, March 1937.

South West Africa: without locality, *Dinter 2196*. Fragment ex Herb. Carl Mez (Herb. Mus. Bot. Berol.) in Nat. Herb., Pretoria.

## PART II — A BRIEF SURVEY OF SOME LESSER KNOWN DISPERSAL MECHANISMS IN AFRICAN GRASSES.

The highly specialised seed dispersal mechanisms found in many grasses are very well known and need no introduction here. Most of them occur in species that are widely distributed over the surface of the earth and those belonging to genera such as *Aristida, Stipa, Tragus, Heteropogon, Cenchrus, Pseudechinolaena, Centotheca, Leptaspis* and *Streptogyne* constitute the best examples of elaborate equipment for dissemination in Africa no less than in other countries.

There is, however, a large number of grasses on our continent whose inflorescences show an interesting variety of less conspicuous devices which, in the light of our present knowledge of plant evolution, appear to have the same purpose. A brief survey of some of these might be of interest as an introduction to the study of one of "the many outstanding problems with the distribution and dispersal of grasses". (Arbor, 1).

A monotypic genus whose distribution is given as "mountains of tropical Africa, Réunion, Java and the Philippine Islands" (15) is *Streblochaete*. Until recently, *S. longiarista* had been recorded from two

localities only in South Africa — both in the eastern Cape Province — but is now known to be "locally abundant in deep shade" in the Gudu Forest on Mont-aux-Sources (Natal). The spikelet of this plant is in my opinion equipped with a more elaborate dispersal mechanism than that of any other South African hylophytic or sciophytic grass, with the possible exception of *Oplismenus hirtellus*, whose viscid awns are undoubtedly very efficient agents in seed dispersal. The inflorescence in *Streblochaete* is a narrow panicle; above the glume, the florets (ranging from three to five in the African specimens) are borne on elongated calli which are attached obliquely to the rachilla internodes. The lowest of these is scarcely 0.5 mm long between the insertion of the glumes and the lowest floret, but the others are long and slender. Above its hard, rounded tip, the callus is densely bearded with stiff, short hairs (*Fig. 5 a*). The lemma is minutely scaberulous and from between two acute lobes is produced into an antrorsely scabrid awn which may be up to 4 cm long. Each spikelet, therefore, is armed with from three to five awns, whose action has been described by Maitland (3) thus: "Their long, slender, barbed awns are peculiar in that they form a rope-like twist so that numbers of the spikelets are linked up and when ripe become detached from the spike in a bunch-like fashion" (*Fig. 5 b*).

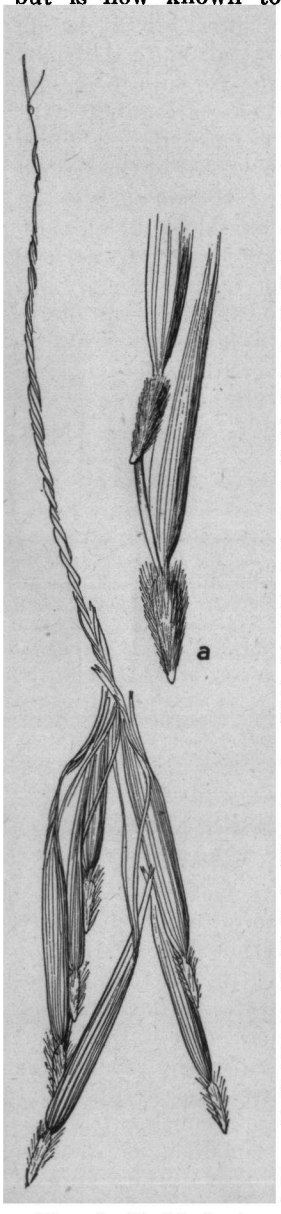


*Fig. 5, Streblochaete longiarista* Pilg.

This description is also applied to *Acritochaete Volkensii*, another monotypic grass of mountain forests. Its distribution, however, seems to be restricted to Mts. Kilimanjaro, Elgon and Kenya in East Africa (3). It lacks the bearded callus of *Streblochaete* — and this, as is well-known, has proved a powerful agent in seed dispersal — but has an advantage over the latter genus in the scanty armature of bristles found on its upper glume and lower lemma. Here we have two grasses of similar habitat and with the same awn mechanism: it is indeed tempting to suggest that the callus, as an additional specialisation in *Streblochaete*, has to some extent influenced its wider distribution.

*Potamophila prehensilis*, a climbing hylophyte recorded in South Africa from the northern Transvaal, eastern Cape Province, Natal and Zululand has a stiff open panicle. The spikelet disarticulates above the rudimentary glumes and the articulation is extraordinarily effective. When the caryopses are mature, it is hardly possible to touch the inflorescence without causing the spikelets to break off. Furthermore, the lemma and palea enclosing

the flower are armed with short, rigid bristles, thus facilitating the adhesion of the whole unit to skins, fur and feathers. It is interesting to note that the palea is 3-keeled, very acutely down the middle and obtusely near each margin. The two lateral keels are tightly enclosed within the lemma and are smooth, while the middle one, which is exserted, is sharply scabrid.

*Microstegium nudum*, a delicate, stoloniferous inhabitant of the forests of the eastern Cape Province and Natal (and of India, China and Japan) has adaptations typical of many other genera in the *Andropogoneae* — a fine beard of hairs at the base of each spikelet and a slender, twisted awn from the fertile lemma.

It also has the method of articulation common to many genera in the *Andropogoneae*, which has a very extensive occurrence in Africa. Efficient articulation is obviously a mechanism that has some bearing on seed dispersal and the extreme fragility of the racemes in several genera of this huge sub-tribe is noteworthy. As the grass matures, the articulated rhachis becomes so brittle that the most delicate handling will not save it from breaking. Outstanding examples of this may be found in genera like *Urelytrum, Elyonurus, Rottboellia, Schizachyrium, Thyrsia* and *Rhytachne*. It will be observed in the plate of *Urelytrum Henrardii*, described and figured in this paper (*Fig. 1*), that the raceme is not complete, and every inflorescence the specimen contains is in a similar condition.

The above instance is one of the rare examples of a dispersal mechanism having more nuisance value than anything else in taxonomy. The opposite is usually true and the method of articulation in the spikelet is of such taxonomic significance that it is one of the characters used to separate the two great sub-families into which the *Gramineae* is divided. Every agrostologist must know the difficulties of classifying the enormous genus *Eragrostis* and as far as African species are concerned, C. E. Hubbard's masterly key to the West African species (13) is the only really successful one I know of. Full use has been made of the spikelet articulation and such dispersal mechanisms as *Eragrostis* possesses. But these are comparatively few, which may account for the taxonomist's trials with the genus! There is no doubt that where these devices are sufficiently developed, their degree of interspecific constancy has proved a sound basis for artificial grouping. Henrard, in his excellent work "A Critical Revision and Monograph of the Genus Aristida" (10, 11) has used them exclusively to separate not only the seven sections of the genus, but also some of the species. The success of his method may be judged by the fact that Schweickerdt, who had the opportunity of studying living material as well as herbarium sheets, found that for his account of the South African species of *Aristida* (17), he could do no better than adopt and in some cases enlarge on the earlier keys.

Some of the mechanisms found in grass spikelets are not as obviously dispersal devices as are, for example, hooked spines or bearded calli. However, the fact that they are almost entirely confined to those parts of the spikelet that are not, on reaching maturity, separated from the grain by disarticulation, is some justification for assuming them to be teleological. Out of numerous examples that might be chosen to illustrate

this, *Eragrostis* affords an exceptionally good one. Here we have two types of articulation (apart from the rare instances where the spikelet falls as a whole, as it does in *E. superba*). In one group of species, the lemma and palea are both deciduous and enclose the grain, in the other the palea is persistent and the grain free. Several species of *Eragrostis* have paleae with special devices on their keels, the commonest of which are spreading, rather stiff cilia as in *E. ciliaris*, *E. amabilis* and a number of others; broad, well-developed wings as in the West African *E. Glanvillei*; or tooth-like appendages as in the South African *E. echinochloidea*. Without exception, these elaborations occur in species where the palea is deciduous and the grain enclosed. Furthermore, the species with the widest distribution appear to be those whose keels are ciliate, as *E. ciliaris* and *E. amabilis*.

One more example might be cited. The two best known genera whose spikelets are subtended by an involucre of bristles are *Pennisetum* and *Setaria*. In the former genus this involucre is deciduous with the spikelet and we find such adaptations as one bristle elongated and stouter than the rest, for example *P. trachyphyllum*; plumose or ciliate bristles as in *P. villosum*; and bristles "densely ciliate around the spikelet with long interwoven crinkled silky hairs" as in the very common *P. polystachyon* (15). The bristles in *Setaria*, on the other hand, are persistent and show none of these modifications and are never more than scabrid, though it should not be forgotten that the retrorse barbs of the well-known *S. verticillata* are responsible for one of the most effective adhesion mechanisms known among plants.

In many cases we have proof that the hairs and awns on a spikelet are dispersal mechanisms, their use and efficiency as such being gauged by their modifications. But in others, a great deal of careful observation and experiment is needed to assess the value of their particular structures and arrangements. Here again, the fact that they occur on the bracts that enclose the grain on disarticulation is our reason for believing them to be involved in the distribution plan.

Where wind can act as a means of dispersal, the hair structure is usually of such a nature, namely fine, slender and often silky, as to increase the power of this agent, in contrast to the spiny bristles, with their various modifications, developed on grasses whose habitat is not exposed to the wind. Common ruderals, however, like species of *Tragus* and *Cenchrus*, whose hooked and spiny bristles are typically adhesion devices, are by no means confined to windless localities. Conversely, *Microstegium nudum* appears to be equipped for wind dispersal, but lives in the woods.

In considering some of the modifications of the awn, we find that in several grasses this mechanism acts both as an adhesion apparatus and as an aid to wind dissemination. Species of *Aristida* and *Chloris* are well-known examples, while the long, very scabrid awns of *Bromus rigidus*, *Urelytrum squarrosum* and some species of *Hordeum* might also be chosen as illustrations. It is geniculate and hygroscopically twisted in the majority of grasses belonging to the *Andropogoneae*, *Arundinelleae* and *Aveneae*, and in some of these it is hirsute or pubescent as well, e.g. *Hyparrhenia*,

*Heteropogon, Trachypogon, Themeda, Loudetia, Tristachya* spp., etc. The twisting together of the awns in *Streblochaete* and *Acritochaete* has already been described and *Hetropogon* is supplied with a similar mechanism. In very numerous cases, the awn is reduced to a subula, as in *Entoplocamia aristulata* from South West Africa. This grass is reported to be "a nuisance to cattle and sheep in the Windhoek area".

The awn may be plumose, as in the nine-awned lemmata of most species of *Enneapogon*, and in several species of *Aristida*, thus providing added efficiency for wind dispersal. The 3-partite awn may have one or all of its branches plumose in the latter genus and it is noticeable that the species with this character are chiefly, though not entirely, confined to the desert-like areas of Africa — an indication of a further response to xerophytic conditions than that shown by most species of the more temperate regions. The genus *Schmidtia*, represented by two species in South Africa, has a five-awned lemma, while *Triraphis*, which is well distributed in the dry western regions, has three slender awns to each lemma. *Lophachme digitata*, endemic in the Transvaal, has a cluster of barren lemmata reduced to awns above the fertile ones.

Hairs developed on the spikelet (other than where they are reduced to spiny excrescences as adhesion devices) are often clustered in various ways and do not cover the surface of the glume or lemma uniformly, or are not of uniform density and size. Where they are present in the *Panicoideae*, they usually occur on the upper glume and lower lemma; for example, *Brachiaria Marlothii*, which is common in parts of the Cape Province, has a lateral tuft of short hairs near the apex of each of them; they are covered with silky hairs in many species of the widespread genus *Rhynchelytrum*, these either being distributed evenly or concentrated on the lower or upper half; *Brachiaria serrata*, common in tropical and South Africa, has a fringe of soft hairs across the back of the upper glume and two tufts on the lower lemma; while several species of *Urochloa*, *Digitaria* and *Paspalum* have longitudinal fringes on one or both of these bracts.

Silky hairs may result in their being used as dispersal mechanisms by more interesting agents than the wind. I once examined some old nests of a masked weaver bird (*Hyphantornis velatus arundinarius*) and found that the satin-soft linings consisted entirely of racemes of *Paspalum urvillei* exquisitely woven into the Cyperaceous frame-works. This bird, incidentally, is a destructive little creature who is no mean distributor of vegetation. The fact that he is a seed-eater; the way in which he will tear one of his beautiful nests to pieces and scatter its contents to the four winds, apparently because either he or his fastidious mate disapproves of it; the frequency with which he will perch on a tree or shrub and happily remove every leaf, twig, flower or fruit that saves his immediate surroundings from complete nudity; and finally, the fact that his immediate surroundings usually overhang a river or stream — all are indicators that in the eye of Nature, if not in that of *Homo sapiens*, he must be of considerable economic value.

In some genera of the *Aveneae* and *Arundinelleae*, both widely represented in Africa, the hairs are grouped in tufts on various parts of the

lemma. In the large genus *Danthonia*, the arrangements are numerous, ranging from a straight transverse fringe, as in *D. cincta*, to from one to five transverse, oblique or longitudinal, symmetrical tufts on each side of the lemma.

*Danthoniopsis* either has a transverse beard of hairs below each lobe of the fertile lemma, as in *D. barbata* and *D. Chevalieri*, or from six to eight transverse tufts below the lobes or at the middle of the lemma (*Fig. 2 g*). Both species found in the Union of South Africa (*D. Dinteri* from the northern Transvaal and *D. pruinosa* ? var. *gracilis* from the eastern Transvaal) belong to the latter category. *Trichopteryx*, represented here by *T. dregeana*, has a straight tuft of fine hairs below each lobe of the fertile lemma (*Fig. 3 e*) and a single tuft also occurs on either side in *Alloeochaete* (12). The curious *Phaenanthoecium Kostlinii*, from North Africa, bears two tufts on each margin near the middle of the lemma.

It is interesting to note the considerable number of hygrophilous grasses in Africa with plumose panicles — an obvious adaptation to wind dispersal that does not occur, as far as I am aware, in forest grasses. Species of *Phragmites* and *Saccharum*, and *Imperata cylindrica* are well-known examples here as in other countries; we have, in addition, species of *Miscanthidium, Andropogon huillensis, A. eucomus* and the lovely golden brown panicles of *Eriochrysis Munroana* in our vleis and pans and on our river banks.

It is known that glume, lemma and palea may act as wings in aiding wind dissemination. Very frequently they develop appendages which are even more wing-like and these are sometimes highly developed. An excellent illustration is afforded by *Andropterum variegatum*, an African grass recorded from Nyasaland, Northern Rhodesia and Portuguese East Africa, in which the upper glume of the sessile and both glumes of the pedicelled spikelet bear wing-like crests. There are many less conspicuous examples among the *Andropogoneae*, as in species of *Cymbopogon, Urelytrum, Ischaemum*, etc. In the *Phalarideae*, the glumes of *Phalaris* species commonly have winged keels. In some genera, particularly in the *Festuceae*, the grain adheres to the lemma and palea, thus ensuring their aid as wings.

There is a possibility that rugae on the spikelet may have some significance in the dispersal programme. They occur chiefly in the *Panicoideae*: to a greater degree on the glumes in the genera of the *Andropogoneae*, where these bracts are deciduous with the rest of the fertile spikelet, for example, in the tropical African and Indian *Thelepogon elegans* and the widely distributed *Hackelochloa granularis*; to a lesser degree on the fertile lemma in the *Paniceae*, where the upper floret is often deciduous from the rest of the spikelet, as in the well-known *Panicum maximum* and in several species of *Brachiaria* and *Setaria*, of which *S. glauca* and *S. pallide-fusca* are widespread.

*Trichoneura grandiglumis* and *Aristida bipartita* may be considered the South African equivalents of the famous tumble-weed, *Panicum obscurans*. Their inflorescences are of a similar nature, being stiff, widely open panicles which break off from the rest of the plant at maturity and are rolled along the ground by the slightest breeze. We call them "Rolling Grass" or "Rolgras".

There are so many common grasses in Africa whose dispersal mechanisms appear to be negligible that they are an inducement to rate the important factor of adaptability as of far greater significance in the dispersal scheme; especially in considering the amazingly wide distribution of such a genus as *Eragrostis* and of stoloniferous grasses like *Cynodon Dactylon, Paspalum distichum* and some species of *Digitaria, Chloris, Eleusine, Pennisetum, Dactyloctenium*, etc., whose creeping habit gives them a distinct advantage in establishing themselves. Of these the cosmopolitan *Cynodon Dactylon*, with its creeping rhizomes and surface stolons, may be singled out as a remarkable tribute to the power of adaptability, since it lacks the efficient wind disseminating device which, combined with strong, spreading rhizomes, has resulted in *Phragmites communis* and *Imperata cylindrica* being two of the most widely distributed flowering plants in the world (according to Ridley [6], the former heads the list). Usefulness to man is another factor that influences their distribution, though it is not always easy to say whether they are used by man because they are common, or common because they are used by man, or both. Apart from the cereals, for whose wide distribution man is obviously responsible to a large extent, there are numerous records to indicate that adaptability and efficient dispersal mechanisms are the primary factors involved in the grasses' success or failure to establish themselves in as many localities as possible. *Aristida junciformis* is used extensively for broom-making by natives in the Transvaal, but *A. congesta* and *A. barbicollis* are just as common without this economic value. This example, however, is possibly an ill-chosen one, since their extensive occurrence may in any case be attributed to man. They are easily ousted by other grasses but, unlike these, are capable of flourishing in very impoverished soils. Such is the terrible misuse of land in South Africa that, with the soil factor eliminating serious competition, large tracts of overgrazed veld become their happy hunting ground.

It should be remembered too, that our knowledge of the means by which grasses are disseminated is very scanty indeed, and much careful observation is needed on those of them that appear to be ill-equipped for dispersal. *Poa annua* is a common ruderal in this country as in other parts of the world and, provided it has a certain amount of moisture, has great powers of adaptibility. In discussing its dispersal by wind, Ridley (6) says "the boat-like glume projecting beyond the sides of the grain acts as a wing so that the grain in it is readily blown away to a considerable distance." I have found, however, that in this country at least, its edibility is also a factor that must be considered. Time and again I have watched parties of the swee waxbill (*Coccopygia melanotis*) choose it from among the grasses bordering the coastal bush in the eastern Cape Province and devour the grains greedily. I once asked a friend why he picked a piece of *Poa annua* every morning. He replied "Because Peter (his budgerigar) likes it better than any other greenstuff." (I should add here that if "*Urochloa panicoides*" be substituted for "*Poa annua*" you have the exact reply of another budgerigar owner whom I often saw picking this common ruderal on his way home from work).

The rare and lovely black heron (*Melanophoyx ardesiaca*) comes to

Pretoria as a migrant during the summer months. One day I watched five of them shading the water with their sooty wings while searching for food in a shallow river-bed that was covered with *Paspalum distichum*, and while they were thus engaged, three sacred ibises (*Threskiornis a. aethiopica*) arrived. The herons with one accord stretched their elegant necks and took to their wings. As they rose, I noticed that one of them had a long stolon of *P. distichum* caught up in his yellow feet. It dropped before he was a hundred yards from the mud he had been standing in, and as it fell among its own, the significance of this incident is decidedly doubtful. However, on the strength of it, it is not unreasonable to assume that some of our numerous water birds are responsible for dispersing this widely distributed weed.

Many of our forest grasses are very puzzling. *Panicum trichoides* is a common weed in South America and it is thought to have been introduced into Africa. It is recorded from the Gold Coast, Angola, Zanzibar and Portuguese East Africa. It has tiny, pubescent spikelets with no specialised dispersal mechanism, as is the case in many species of *Panicum* (such as *P. chusqueoides, P. perlaxum, P. aequinerve, P. laticomum, P. filiculme* and *P. hymeniochilum*), in *Setaria Chevalieri, S. lindenbergiana* and the widespread ruderal, *Ehrharta erecta*, all of which are common in our forests. *Centotheca mucronata*, the only species of this genus occurring in South Africa, lacks the downward-pointing hairs that act as an adhesion apparatus in *C. lappacea*. It is true that the two *Setaria* species are merely shade-loving and may easily grow in wind-blown habitats; they are common under bushes and trees on hillsides, while *Ehrharta erecta* is even less particular. But the distribution of the others remain a problem.

*Centotheca mucronata*, for example, is by no means confined to southern Africa. From personal observation, I would say that birds at least may be eliminated as possible dispersal agents in cases such as this, though they may be responsible in some measure for spreading species that occur only within our limits. The one forest-loving bird I know of that breeds here and goes to tropical Africa ("Nyasaland, and beyond the Zambesi-Congo watershed, in the southern Congo basin" [7] ) for the winter months is the grey-throated Paradise flycatcher (*Tchitrea plumbeiceps*). By reason of his confiding and inquisitive nature, he is a fascinating and simple subject for any bird-lover, for he will not only allow you to watch him from within a few yards, but he is so common that his challenging "who's there?" call may be heard from almost any wooded area here, from October to March. The close observation that is possible has convinced me that he is not responsible for any grass distribution. Being a flycatcher, he spends his time in trees, from whose branches he darts out at passing insects and thence back to the same perch. His nest consists of fine rootlets, fibres, and spider-webs woven into a compact cup and plastered with lichens on the outside to make the whole a neat masterpiece of camouflage. The only possibility is that in gathering material for it, grass spikelets are caught on his body or in his streaming brown tail feathers; but even then, two or three months elapse between his nest-building operations and his departure for tropical Africa and, knowing the fastidiousness of birds as far as their toilet is

concerned, I find it difficult to believe that any foreign object could remain on them for so long a time.

Bews (2) attributes the "overwhelming success" of the grasses to the fact that, being wind-pollinated, they "spend none of their energy or material on the elaboration of methods of securing insect pollination, and what they save in this direction they are able to expend in other ways". This, no doubt, is one of the reasons for the subject of their possible dispersal devices being almost inexhaustible. We know so little about the function in dissemination of most of the innumerable mechanisms found in a grass inflorescence, that it is almost impossible to be accused of looking for a reason where none exists. I can but hope that this very brief attempt to outline some of the more obvious structures in African grasses that have not been dealt with by Ridley (6) in particular, will not add to the "welter of unrelated detail" and "chaos of information" (Arbor, 1) that exists at present; but rather that it will be of some use as a first step in the scientific investigation of the distribution of grasses throughout our continent.

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