

- MAHESHWARI, S. C. & BALDEV, B., 1958. A contribution to the morphology and embryology of *Commelina forskalaei* Vahl. *Phytomorphology* 8: 277-298.
- MAYNARD SMITH, J., 1966. Sympatric speciation. *Am. Nat.* 100: 637-650.
- MAYR, E., 1963. *Animal species and evolution*. Cambridge, Massachusetts: Harvard University Press.
- MAYR, E., 1970 *Populations, species and evolution*. Cambridge, Massachusetts: Harvard University Press.
- MILES, J., 1974. Effects of experimental interference with stand structure on establishment of seeds in *Callunetum*. *J. Ecol.* 62, 3: 675-687.
- PATERSON, H. E. H., 1978. More evidence against speciation by reinforcement. *S. Afr. J. Sci.* 74: 369-371.
- PATERSON, H. E. H., 1980 A comment on 'Mate Recognition Systems'. *Evolution* 34: 330-331.
- PATERSON, H. E. H., 1981. The continuing search for the unknown and unknowable: a critique of contemporary ideas on speciation. *S. Afr. J. Sci.* 77: 113-119.
- RAVEN, P. H., 1964. Catastrophic selection and edaphic endemism. *Evolution* 18: 336-338.
- RICHERSON, P. J. & LUM, K-L., 1980. Patterns of plant species diversity in California: relation to weather and topography. *Am. Nat.* 116: 504-536.
- RIEDL, R., 1977. A systems-analytical approach to macro-evolutionary phenomena. *Q. Rev. Biol.* 52: 351-370.
- SCHAFFER, W. M., 1977. Some observations on the evolution of reproductive rate and competitive ability in flowering plants. *Theoretical Population Biology* 11: 90-104.
- SCHEMSKE, D. W., 1978. Evolution of reproductive characteristics in *Impatiens* (Balsaminaceae): the significance of cleistogamy and chasmogamy. *Ecology* 59: 596-613.
- SIMPSON, B. B., 1977. Biosystematics and biogeography. In J. A. Romberger, (ed.), *Biosystematics in agriculture*, (Beltsville symposia in agricultural research; 2). Montclair, New Jersey: Allanhead, Osman.
- SLOBODICHKOFF, S. J., (ed.), 1976. *Concepts of species*. Stroudsburg, Pennsylvania: Dowden, Hutchinson & Ross.
- SOULE, M., 1973. The epistasis cycle: a theory of marginal populations. *A. Rev. Ecol. Syst.* 4: 165-187.
- STEBBINS, G. L., 1952. Aridity as a stimulus to plant evolution. *Am. Nat.* 86: 33-44.
- STEBBINS, G. L., 1972. Ecological distribution of centers of major adaptive radiation in angiosperms. In D. Valentine, (ed.), *Taxonomy, phytogeography and evolution*. London: Academic Press.
- STEBBINS, G. L., 1974. *Flowering plants, evolution above the species level*. London: Edward Arnold.
- TIGERSTADT, P. M. A., 1973. Studies on isozyme variation in marginal and central populations of *Picea abies*. *Hereditas* 75: 47-60
- TOTHILL, J. C., 1966. Phenological variation in *Heteropogon contortus* and its relation to climate. *Aust. J. Bot.* 14: 35-47.
- VALENTINE, D., 1967. The influence of climatic fluctuations on species diversity within the Tethyan provincial system. In C. G. Adams D. V. Ager, (eds.), *Aspects of Tethyan biogeography*. No 7: 153-166. London: Systematics Association.
- WALKER, B. H., 1980. Stable production versus resilience: a grazing management conflict? *Proc. Grassld Soc. 6th Afr.* 15: 79-83.
- WALKER, B. H., LUDWIG, D., HOLLING, C. S. & PETERMAN, R. M., 1981. Stability of semi-arid savanna grazing systems. *J. Ecol.* 69, 2: 473-498.
- WASER, N. M., 1978. Interspecific pollen transfer and competition between co-occurring plant species. *Oecologia (Berl.)* 34: 223-236.
- WHITE, M. J. D., 1968. Models of speciation. *Science* 159: 1065-1070.
- WHITTAKER, R., 1972. Evolution and measurement of species diversity. *Taxon* 21: 213-251.

Leaf anatomy of the South African Danthonieae (Poaceae). VI. *Merxmuellera arundinacea* and *M. cincta*

R. P. ELLIS*

ABSTRACT

The leaf blade anatomy and the abaxial epidermal histology of *Merxmuellera arundinacea* (Berg.) Conert and *M. cincta* (Nees) Conert are described and illustrated. These two species resemble one another morphologically and are the only representatives of the genus with open, expanded leaves. They are, nevertheless, clearly distinct anatomically, particularly in the structure of the leaf blade as viewed in transverse section. The anatomy of *M. cincta* is noteworthy in the possession of additional vascular bundles located immediately below the first order vascular bundles. This vertical arrangement of bundles at differing levels is a unique feature of *M. cincta* and possibly indicates a need for taxonomic adjustment.

INTRODUCTION

Merxmuellera arundinacea (Berg.) Conert [= *Danthonia arundinacea* (Berg.) Schweick.] and *M. cincta* (Nees) Conert (= *D. cincta* Nees) (Conert, 1970) are both robust, reed-like, tufted perennials forming large, dense tussocks, 0,5-1 m in diameter. Their leaf blades are long and lax being from 60-100 cm long. The growth form of these two species is therefore very similar and superficially they resemble one another very closely, especially in the vegetative condition. Anatomically these species both have open, expanded leaf blades — a condition not found in any of the other *Merxmuellera* species occurring in South Africa.

In contrast to these similarities, several morphological, anatomical and ecological differences satisfactorily separate these two species. Thus the fringe of hairs across the lemma, the longer glumes, the inconspicuous central awn and the longer ligule distinguish *M. cincta* from the smaller *M. arundinacea* (Chippindall, 1955). The stout culms of *M. arundinacea* are only up to 1 m high whereas in *M. cincta* they can reach 2 m. The present study also shows that these species are separated ecologically and that they bear very little anatomical resemblance to one another apart from having wide expanded leaf blades. This anatomical evidence does not indicate a close relationship between *M. arundinacea* and *M. cincta* and actually appears to suggest that *M. cincta* may be incorrectly placed in the genus *Merxmuellera* and possibly even in the Danthonieae.

The terminology used in the ensuing anatomical descriptions is according to Ellis (1976, 1979) and the following abbreviations will be used:

- * vb/s—vascular bundle/s
- 1'vb/s—first order vascular bundle/s
- 2'vb/s—second order vascular bundle/s
- ibs—inner bundle sheath; mestome sheath
- obs—outer bundle sheath; parenchyma sheath

ANATOMICAL DESCRIPTION OF *MERXMUELLERA* *ARUNDINACEA*

Leaf in transverse section

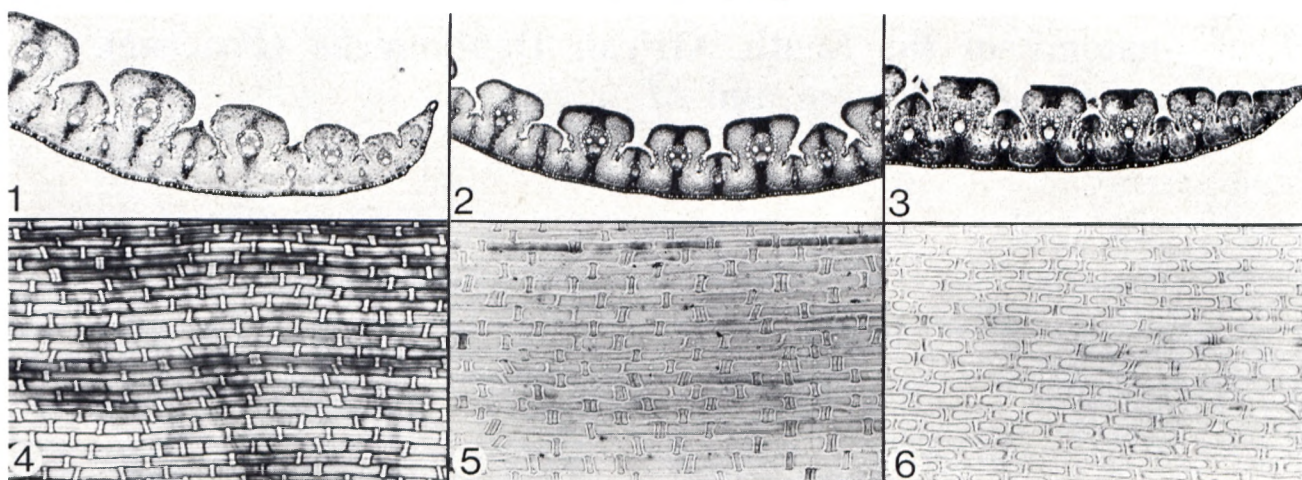
Leaf outline: flat, expanded; often broadly U-shaped; greater than 5 mm wide and between 0,36

mm and 0,45 mm thick. *Ribs and furrows:* deep, cleft-like adaxial furrows between all vbs; inversely Y-shaped. Massive, flat-topped (Figs 2 & 3) or rounded (Fig. 1) adaxial ribs associated with 1'vbs; smaller rounded or triangular ribs overlying 3'vbs. Abaxial surface without ribs and furrows. *Median vascular bundle:* not structurally distinct from lateral 1'vbs. *Vascular bundle arrangement:* one 3'vb between consecutive 1'vbs; no 2'vbs; 15 or more 1'vbs in section. All vbs located slightly to the adaxial side of the blade (Figs 1-3). *Vascular bundle structure:* vbs elliptical; metaxylem vessels narrow with circular lumens. No additional bundles developed in massive ribs associated with 1'vbs as in *M. cincta* (Figs 7-9). *Vascular bundle sheaths:* double; obs elliptical or horse-shoe-shaped; wide interruptions both adaxially and abaxially; no extensions; obs cells small; elliptical and not larger than mesophyll cells; chloroplasts lacking. Ibs complete with secondary walls very thick. *Sclerenchyma:* adaxial girders well developed; inversely anchor-shaped with long, sturdy stem in association with 3'vbs but T-shaped with short, sturdy stem and long horizontal cross-piece in association with 1'vbs. Continuous abaxial hypodermal band extending as trapezoidal or tall, stout vertical columns to the 1'vbs and 3'vbs; these girders interrupt the obs; consist of very thick-walled fibres. Leaf margin with small sclerenchyma cap (Figs 1 & 3). *Mesophyll:* not radiate; composed of small, isodiametric cells; tightly packed with insignificant air-space system even adjacent to the stomata; mesophyll tissue in W-shaped groups occupying sides and bases of furrows. *Colourless cells:* absent. *Adaxial epidermal cells:* small fan-shaped groups of bulliform cells located at the bases of furrows; cells small, not larger than obs cells. No macro-hairs, hooks, prickles or cuticular papillae. Outer tangential cell walls somewhat arched. *Abaxial epidermal cells:* no bulliform cells, stomata, macro-hairs, hooks or papillae. Angular prickles developed near margin (Fig. 1). Continuous, thick cuticular layer covers outer tangential wall of all cells.

Abaxial epidermis

Intercostal zones: not differentiated. *Stomata:* none present. *Papillae:* absent. *Hairs:* micro-hairs, macro-hairs, hooks and prickles not present on this surface except along margin where angular prickles

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FIGS 1-6.—Leaf blade anatomy of *Merxmuellera arundinacea*. 1-3, leaf blade in transverse section. All $\times 100$. (1, Ellis 2503; 2, Ellis 1707; 3, Ellis 2474.) 4-6, abaxial epidermis as seen in surface view. All $\times 400$. Note absence of intercostal zones. (4, Ellis 1707; 5, Ellis 1149; 6, Van Breda & Joubert 1999.)

are found; large bases with barbs of medium length. *Silica bodies*: tall and narrow, vertically elongated rectangular; smooth; regular outlines; same width or sometimes slightly wider than costal long cells in same file; present equally throughout abaxial epidermis; usually solitary but sometimes paired (Figs 4-6). Silica often not developed in silica cells. *Costal cell arrangement*: single, seldom paired, costal short cells alternate with single costal long cells throughout the abaxial epidermis; long cells elongated, with straight walls (Fig. 4), pitted (Figs 5 & 6) and often filled with air (Fig. 6). Arrangement of adjacent horizontal files alternates.

Specimens examined:

CAPE.—3119 (Calvinia): Kobe Mts, Vanrhynsdorp (-CA), Ellis 2448. 3219 (Wuppertal): Pakhuis Pass, Clanwilliam (-AA), Ellis 709, 1149, 1707; Blinkberg Pass, Skurweberge (-CD), Ellis 2503. 3318 (Cape Town): Honigberg, Piketberg (-BB), Acocks 23433. 3319 (Worcester): Gouda, near Tulbagh (-AC), Esterhuysen 18828; Swarttruggensberge (-BA), Ellis 2474; Robertson (-DD), Von Breda & Joubert 1999.

ANATOMICAL DESCRIPTION OF *MERXMUELLERA CINCTA*

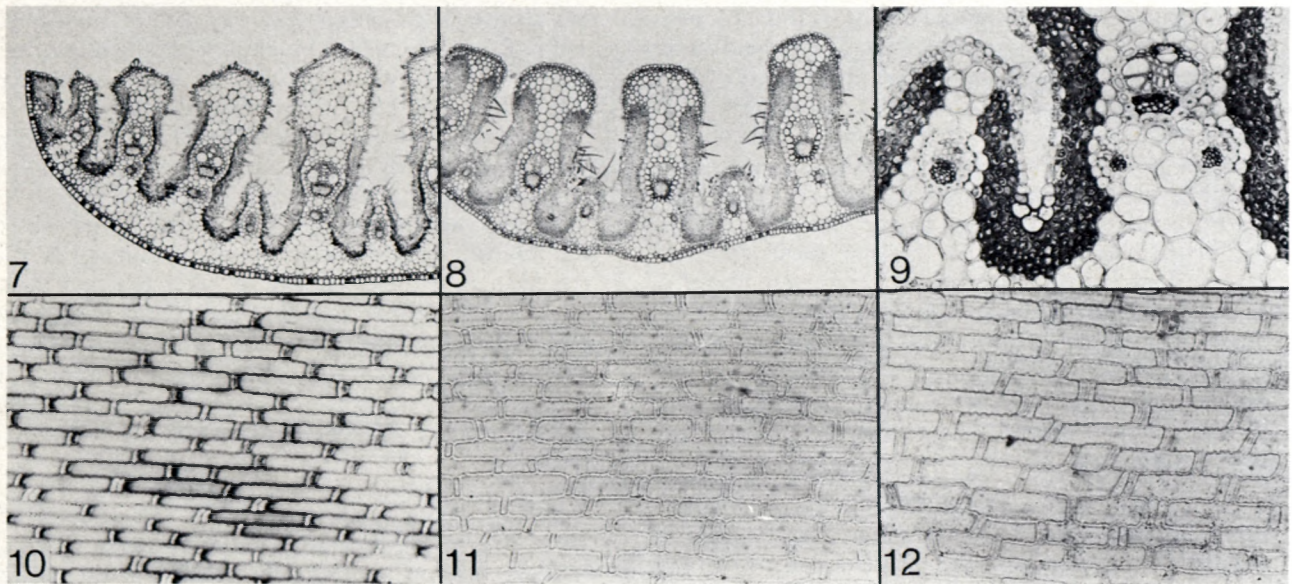
Leaf in transverse section

Leaf outline: U-shaped; either open, almost fully expanded to tightly infolded and elliptical. Leaves wide (1,5 mm-3,5 mm) and exceptionally thick ($> 0,5$ mm). *Ribs and furrows*: tall, massive adaxial ribs associated with 1'vbs; more than $3\times$ taller than ribs over 3'vbs; bases narrow and broad apices either angled (Fig. 7) or rounded (Fig. 8). Furrows deep, more than half the leaf thickness but width varies depending on degree of infolding of leaf; Y-shaped in tightly infolded leaves. No abaxial ribs or furrows. *Median vascular bundle*: distinguishable by location only. *Vascular bundle arrangement*: one 3'vb between successive 1'vbs; no 2'vbs; 9-13 1'vbs in blade; bundles located centrally in blade. *Vascular bundle structure*: unique additional small bundles associated with all 1'vbs in all specimens except Comins 974 where they are absent; these bundles consist of second, third and even fourth groups of

vascular tissue located immediately below the 1'vbs near the bases of the massive ribs at a lower plane (Fig. 9); phloem tissue of these bundles well developed and they are surrounded by a distinct, thickened sheath (Fig. 9). 3'vbs relatively large and circular or elliptical in shape; 1'vbs egg-shaped; metaxylem vessels relatively wide; no sclerosis of the phloem. *Vascular bundle sheaths*: double; obs tall and complete; cells round, inflated and without chloroplasts; broad, well-developed adaxial and abaxial extensions of large, thin-walled colourless cells present in association with 1' and 3'vbs; adaxial extensions somewhat inversely anchor-shaped and abaxial extension may extend into continuous abaxial hypodermal parenchyma layer (Fig. 7). Ibs entire; walls uniformly thickened; cells about same size as adjacent obs cells. *Sclerenchyma*: adaxial strands in 1'vb ribs subepidermal and arched to follow shape of rib; abaxial sclerenchyma thin, continuous hypodermal layer not associated with vbs. Cells relatively large in T.S., lignified, but with little secondary wall development (Fig. 9). *Mesophyll*: not radiate; small isodiametric cells, tightly packed but tending to become circular with development of an air-space system (Fig. 9); confined to W-shaped groups on sides and bases of furrows. Lacunae appear to be present in the mesophyll at the bases of furrows in some of the herbarium specimens from which sections were made. *Colourless cells*: abaxial side of leaf almost entirely comprised of regular, colourless collenchyma (Fig. 7). *Adaxial epidermis*: fan-shaped groups of small bulliform cells present at bases of furrows; elongated prickles common on sides of furrows (Fig. 9); no papillae; costal zones at apices of massive ribs, intercostal zones along sides. *Abaxial epidermis*: distinct, thick cuticle continuous over abaxial epidermal cells; no bulliform cells, papillae, prickles or stomata; not divided into costal and intercostal zones.

Abaxial epidermis

Intercostal zones: not differentiated. *Stomata*: not present on abaxial surface. *Papillae*: absent. *Hairs*: prickles, micro-hairs and macro-hairs not present on



FIGS 7-12.—Leaf blade anatomy of *Merxmuellera cincta*. 7-9, leaf blade in transverse section. (7, *Acocks* 20044, $\times 100$; 8, *Ellis* 2332, $\times 100$; 9, *Ellis* 3268, $\times 400$. Note presence of small vascular bundles beneath first order bundle.) 10-12, abaxial epidermis. All $\times 400$. Note absence of intercostal zones. (10, *Ellis* 3268; 11, *Ellis* 2331; 12, *Ellis* 2332.)

this surface. *Silica bodies*: vertically elongated; tall and narrow to elliptical in shape; outline smooth and regular; no granules; same width as adjacent long cells; similar silica bodies present throughout abaxial epidermis. *Costal cell arrangement*: paired or single costal short cells alternate with single costal long cells along all horizontal files; long cells only about $3\times$ as long as wide; arrangement and structure similar throughout abaxial epidermis except that adjacent horizontal files arranged so that long cells and silica cell pairs are opposite one another in a brick-work pattern.

Specimens examined:

CAPE.—3228 (Butterworth): Kei Mouth (-CB), *Flanagan* 2586. 3318 (Cape Town): Jonkershoek, Stellenbosch (-DD), *Taylor* 4511. 3325 (Port Elizabeth): near Sea View (-DC), *Acocks* 21447. 3326 (Grahamstown): Grahamstown Nature Reserve (-BC), *Comins* 974. 3418 (Simonstown): Cape Hangklip (-BD), *Ellis* 2331, 2332. 3419 (Caledon): Riviersonderend (-BB), *Taylor* 4492. 3423 (Knysna): Tsitsikama, Storms River (-BB), *Ellis* 3268. 3424 (Humansdorp): Karreedouw (-BB), *Acocks* 20044.

DISCUSSION AND CONCLUSIONS

The anatomy of *M. arundinacea* is typical of the genus and it resembles the *M. disticha* (Nees) Conert

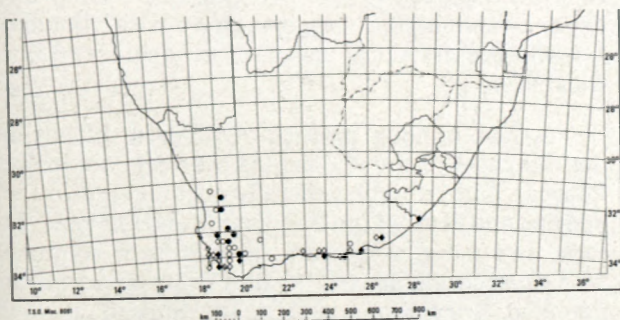


FIG. 13.—Distribution of *Merxmuellera arundinacea* (O) and *M. cincta* (◇) in the Cape Province of South Africa. Shaded symbols represent localities of specimens studied anatomically. Compiled from specimens in the National Herbarium, Pretoria (PRE).

group of species in leaf anatomy and epidermal histology (Ellis, 1981a). The alternating sequence of the first and third order vascular bundles along the width of the lamina is characteristic of this group of species which includes *M. disticha*, *M. davyi* (C. E. Hubb.) Conert and *M. macowanii* (Stapf) Conert. The adaxial ribs and furrows, the shape of the mesophyll groups and the structure of the silica bodies and costal long cells conform closely to the condition described for *M. macowanii* (Ellis, 1981a). The open, expanded nature of the leaf blade and the absence of adaxial prickles and papillae in *M. arundinacea* are the only anatomical differences noted between these two species. Even these differences are not absolute, however, and in some specimens of *M. arundinacea* a few prickles-like protuberances can be seen (Fig. 1) and the leaves of *M. macowanii* appear to be capable of opening to at least 45° (Ellis, 1981a). The relationships of *M. arundinacea* would, therefore, appear to be closest to *M. macowanii* and its relatives and leaf anatomy confirms its placement in this genus.

Ecologically *M. arundinacea* is a species found on barren, quartzite mountain slopes of the Cape folded belt of the southern and south-western Cape Province (Fig. 13). It appears to be restricted to Table Mountain Sandstone and may become dominant on lower slopes, particularly those with a hot, northern aspect. It therefore has a more southerly distribution than *M. macowanii* which is only found as far south as the Stormberge of the north-eastern Cape but which also occurs on Table Mountain Sandstone in the midlands of Natal.

M. arundinacea obviously favours arid conditions but it is unusual in possessing wide expanded leaf blades and not acicular, permanently infolded leaves which are usually associated with grasses from dry environments. Closer examination of the anatomy of *M. arundinacea* does reveal that it actually possesses several adaptations that undoubtedly limit water loss. Thus the leaves have no abaxial stomata and

the abaxial epidermis is underlaid by well-developed and heavily lignified sclerenchyma. The stomata are localized in a narrow band on the lower parts of the vertical sides of the cleft-like adaxial furrows. The upper parts of the massive ribs are sclerified and without stomata. Contact with the external atmosphere is consequently restricted to a very narrow aperture beneath the bulge of the ribs (Figs 1–3). *M. arundinacea* is notable in that these furrows retain their narrow, cleft-like form even in fully turgid, expanded leaves. In addition, the whole blade is capable of inrolling from both margins forming a hollow cylinder. This probably occurs under extremely adverse drought conditions and further limits evapotranspiration to a narrow opening between the closely opposed leaf margins.

M. cincta has a distributional range closely approximating that of *M. arundinacea* except that it occurs on the seaward side of the Cape mountain ranges (Fig. 13). In contrast to *M. arundinacea* it is a water-loving species found on streambanks, small vleis and in seepage areas. Sandy, poorly drained soil is preferred and it is sometimes found near the sea-shore to within about 50 m of the high water mark. These habitat differences between these two species are reflected in their leaf anatomy as described above.

The leaf anatomy of *M. cincta* is not typically that of a hydrophyte however, and the anatomical indications are that it may be a halophyte similar to *Ammophila arenaria* Link. of the Agrostideae — a species it resembles closely in anatomical and epidermal structure. It is, therefore, possible that *M. cincta* prefers moist conditions with high salinity or is adapted to survive regular dry conditions. *M. cincta* accordingly displays several desiccation reducing characteristics. The leaves can thus infold tightly forming a narrow adaxial channel, there are no abaxial stomata and it has a well-developed abaxial cuticle and waxy layer. When moisture conditions are favourable or excessive it would appear that transpiration can be enhanced by the leaf expanding with a consequent opening up of the adaxial furrows containing the stomata. There is also a well-developed vascular system with wide metaxylem vessels (Fig. 9) and a tendency for the development of an air-space system with diffuse mesophyll cell arrangement immediately adjacent to the stomatal apertures (Fig. 9). This condition has also been noted in the alpine bog forms of *M. disticha* (Ellis, 1980) and *M. stricta* (Schrader) Conert (Ellis, 1980a), two other hygrophilous *Merxmuellera* species. In these respects *M. cincta* differs considerably from *M. arundinacea*.

Lacunae, which are typical of most hydrophytes, are not present in *M. cincta* specimens except in some plants collected from the eastern Cape at Port Elizabeth, Grahamstown and Kei Mouth (*Acocks* 21447, *Comins* 974 and *Flanagan* 2586). These plants appear to have lacunae developed at the bases of the adaxial furrows between the bulliform cells and the mesophyll. These cavities are remarkably regular and consistent in size and occurrence and occur in association with all the furrows, particularly the lateral ones. These lacunae are lined by more or

less disintegrated cells and surrounded by mesophyll tissue. It is possible that breakdown of the mesophyll brought about the formation of these lysigenous canals but another explanation is also possible. Unfortunately no plants with lacunae were freshly-fixed for this study and herbarium material only was examined. In the rehydration process it may have happened that the mesophyll cells became separated due to differential water uptake resulting in the appearance of these 'air canals'. It is felt that these actually are lacunae and that specimens with them may represent a segregate from the more southerly and westerly populations. These three plants are all very robust specimens with very long glumes and may actually be polyploids occurring in fresh water localities.

The most outstanding feature of the anatomy of *M. cincta* is the unique additional small vascular bundles located immediately below the first order vascular bundles in the massive adaxial ribs (Fig. 9) in all specimens examined except *Comins* 974. A single bundle only may occur below the first order bundle (Fig. 7) or a pair of additional bundles may be present alongside one another but at a lower plane than that of the first order bundles (Fig. 9). In other specimens three additional bundles are located at two different levels below the first order bundles. These extra bundles contain both phloem and protoxylem tissue (Fig. 9) and are always surrounded by an inner bundle sheath of thickened cells which may, or may not, be in direct contact with the abaxial part of the mestome sheath of the first order bundles. In addition a typical parenchyma sheath does not normally surround them entirely (Fig. 9) and they usually are completely embedded in the collenchyma tissue of the abaxial girders.

These fascinating bundles are unlikely to represent interconnecting transverse veins because in the eight specimens in which they were observed they were always sectioned in exactly the same plane as the normal vascular bundles. From this it can be reasonably inferred that at least throughout the middle part of the leaf lamina, these additional bundles lie parallel to the standard vasculature, that no actual fusion occurs with these bundles and they do not traverse the mesophyll or the hypodermal collenchyma. In some instances they lie in such close proximity to the first order vascular bundles that they may appear to be diverging from them but closer examination reveals that both bundles actually possess entire and discreet inner, mestome sheaths.

Vascular bundles inserted at different planes in the thickness of the leaf lamina are very rare in the Poaceae and are only generally encountered in the midribs and keels of the Bambuseae and Oryzeae. In these two tribes a complex vasculature is common with superposed, adaxial bundles being present near the adaxial epidermis and in the interior as well (Jacques-Felix, 1955; Schweickerdt & Marais, 1956; Metcalfe, 1960; Tateoka, 1963 and Launert, 1965). It is significant that in the bamboos and rices this complex system of vascular bundles is restricted to the midrib and keel only and that the vascular

bundles are arranged in a single horizontal row along the width of the rest of the blade.

The only other grass in which the vascular bundles of the lamina have been reported to be in different planes is *Porteresia coarctata* (Roxb.) Tateoka (Tateoka, 1963, 1965). In this species each adaxial rib contains a single, small, superposed amphivasal bundle located above the typical first and third order bundles. In view of this unique feature, combined with differences in embryo anatomy and morphology, *P. coarctata* has been removed from *Oryza* and referred to the monotypic genus *Porteresia* (Tateoka, 1965).

The considerable taxonomic importance attached to the presence of the additional bundles in *Porteresia* has created a precedent and it seems appropriate to reconsider the classification of *M. cincta* in the light of this evidence. In *M. cincta* there are several differences in the structure and location of the additional bundles but both species agree in not having a midrib or keel. It is significant also that *M. cincta* does not have oryzoid silica bodies or arm cells in the mesophyll and, consequently, does not show any relationship with the Oryzoideae.

In the case of *M. cincta*, these unique vascular bundles do not seem to provide any clues as to the taxonomic relationships of *M. cincta*. They do, however, serve to emphasise that this species differs considerably in anatomical structure from the other *Merxmuellera* species (Ellis 1980; 1980a; 1981; 1981a and in press). Of the South African grasses anatomical resemblances between *M. cincta* and *Ammophila arenaria* of the Agrostideae have already been mentioned but similarities with some Australian danthonoid genera, such as *Chionochloa* and *Notadhanthonia*, can be inferred from the illustrations of Clifford & Watson (1977). This observation is in agreement with the statement of Conert (1971) that there is no genus of African grasses to which *Merxmuellera* shows any relationship but that *Merxmuellera* agrees in certain characters with *Chionochloa* from New Zealand and *Cortaderia* from South America. *M. cincta* may, therefore, provide anatomical evidence for this relationship. This in turn raises problems with tribal definitions as *Merxmuellera* and *Chionochloa* are placed in the Danthoneae whereas *Cortaderia* is grouped with the Arundineae. The affinities of *M. cincta* are truly puzzling and will undoubtedly reward further investigation.

UITTREKSEL

Die anatomiese struktuur van die blaar in dwarsnee en die abaksiale epidermis, van Merxmuellera arundinacea (Berg.) Conert en M. cincta (Nees) Conert word beskryf en geïllustreer. Hierdie twee spesies toon duidelike morfologiese ooreenkomste aan en is die enigste verteenwoordigers van die genus met oop, uitgespreide blare. Nietemin is hulle maklik onderskeibaar op anatomiese kenmerke, veral dié van die blaar in dwarsnee. Die anatomie van M. cincta is veral merkwaardig omdat dit addisionele vaatbondels besit wat reg onder die gewone vaatbondels geleë is. Hierdie vertikale rangskikking van vaatbondels op verskillende vlakke is 'n unieke eienskap van M. cincta en dui moontlik die behoefte aan vir taksonomiese regstelling.

REFERENCES

- CHIPPINDALL, L. K. A., 1955. In D. A. Meredith (ed.), *The grasses and pastures of South Africa*. Johannesburg: CNA.
- CLIFFORD, H. T. & WATSON, L., 1977. *Identifying grasses: data, methods and illustrations*. Queensland: University of Queensland Press.
- CONERT, H. J., 1970. *Merxmuellera*, eine neue Gattung der Gramineen. *Senckenberg biol.* 51: 129–133.
- CONERT, H. J., 1971. The genus *Danthonia* in Africa. *Mitt. bot. St. Samml., Münch* 10: 299–308.
- ELLIS, R. P., 1976. A procedure for standardizing comparative leaf anatomy in the Poaceae. I. The leaf blade as viewed in transverse section. *Bothalia* 12: 65–109.
- ELLIS, R. P., 1979. A procedure for standardizing comparative leaf anatomy in the Poaceae. II. The epidermis as seen in surface view. *Bothalia* 12: 641–672.
- ELLIS, R. P., 1980. Leaf anatomy of the South African Danthoneae (Poaceae). II. *Merxmuellera disticha*. *Bothalia* 13: 185–189.
- ELLIS, R. P., 1980a. Leaf anatomy of the South African Danthoneae (Poaceae). III. *Merxmuellera stricta*. *Bothalia* 13: 191–198.
- ELLIS, R. P., 1981. Leaf anatomy of the South African Danthoneae (Poaceae). IV. *Merxmuellera drakensbergensis* and *M. stereophylla*. *Bothalia* 13: 487–491.
- ELLIS, R. P., 1981a. Leaf anatomy of the South African Danthoneae (Poaceae). V. *Merxmuellera macowanii*, *M. davyi* & *M. aureocephala*. *Bothalia* 13: 493–500.
- JACQUES-FELIX, H., 1955. Notes sur les Graminées d'Afrique tropicale. VIII. Les tribus de la série Oryzoïde. *J. Agric. trop. Bot. appl.* 2: 600–619.
- LAUNERT, E., 1965. A survey of the genus *Leersia* in Africa. *Senckenberg biol.* 46: 129–153.
- METCALFE, C. R., 1961. *Anatomy of the Monocotyledons. I. Gramineae*. Oxford: Clarendon Press.
- SCHWEICKERDT, H. G. & MARAIS, W., 1956. Morphologische untersuchung an *Oryza barthii*. *Bot. Jb.* 77: 1–24.
- TATEOKA, T., 1963. Notes on some grasses. XIII. Relationship between Oryzeae and Ehrharteae, with special reference to leaf anatomy & histology. *Bot. Gaz.* 124: 264–270.
- TATEOKA, T., 1965. *Porteresia*, a new genus of Gramineae. *Bull. natn. Sci. Mus., Tokyo* 8: 405–406.