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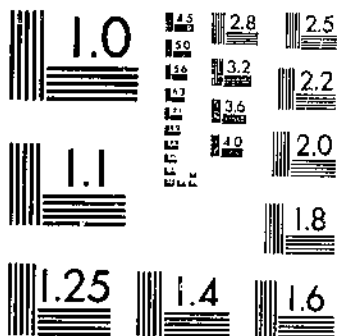
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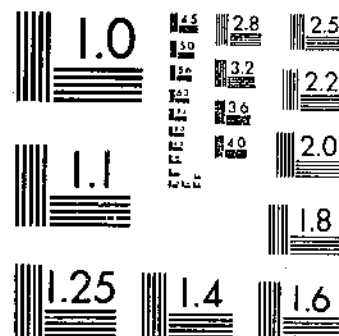
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**UNITED STATES
DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.**

Vegetative Characteristics of Some Wild Forms of *Saccharum* and Related Grasses¹

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INTRODUCTION AND DISCUSSION

The significant results attained in utilizing wild sugarcanes for the improvement of cultivated varieties have led to a study of the properties and growth habits of these wild forms and of closely related plants that may hybridize with sugarcane.

¹ Submitted for publication May 24, 1946.

² Acknowledgment is made to Mrs. Eugenia Arischwager for the preparation of the drawings.

An analysis of the vegetative characteristics of one important group of wild canes (*Saccharum spontaneum* L.) has already been published (4).² A similar analysis of equally important groups—*S. robustum* Brandes and Jeswiet ex Grassl (6), *S. edule* Hassk., and a residual assembly of a few wild forms of *Erianthus*—is the object of this investigation.

The clones of *robustum* (5) form large canebrakes in their native habitat along the river banks of New Guinea, but they may also occur in individual clumps at more elevated and drier places. The plants that grow along the river banks develop stolons that traverse the flood banks—reaching to the water's edge during the dry season—and when the rivers are in flood, the stolons float on the surface of the water. The plants are, for the most part, strong growers, with stalks about 1 inch in diameter and a height of 20 to 30 feet. A most characteristic feature is the swollen growth ring, which has a larger diameter than the node or internode. The clones of *robustum*, with the exception of N. H. 1, Imp. 933,³ were obtained from New Guinea or New Britain. Clone N. H. 1, Imp. 933, came from the New Hebrides, where it forms great canebrakes along the river banks. The *robustum* clones with a Molokai number originated from seed collected by Lennox (9) and Pemberton from *robustum* plants in various parts of New Guinea and New Britain. These were grown in quarantine on Molokai Island.

Somewhat related to the *robustum* forms are a small group of clones (28 N. G. 38, Imp. 477; 28 N. G. 49, Imp. 639; 28 N. G. 82, Imp. 647; 28 N. G. 201, Imp. 509; 28 N. G. 270, Imp. 669; and 28 N. G. 272, Imp. 670) from New Guinea that are cultivated by the natives for the edible tassels. They belong to *S. edule*. These primitive canes reproduce only vegetatively and probably cannot survive without the aid of man, but because of their relationships, they are included in this study of wild forms.

Of the numerous wild grasses that are related to *Saccharum* those in the genus *Erianthus* are of interest and importance from the point of view of relationship to the cultivated sugarcanes. The ease with which *Saccharum* and *Erianthus* may be hybridized (Janaki-Annal (7), Runkle (10)) makes it desirable to understand the vegetative characteristics of this genus. For this reason, special attention is given to *E. maximus* Brongn., which is considered (6) to be involved in the origin of the cultivated sugarcanes.

Some of the canes from the Fiji Islands (Fiji 1, Imp. 860; Fiji 2, Imp. 861; Fiji 3, Imp. 862; and the Duruka clones) appear intermediate between the cultivated canes and *Erianthus maximus* Brongn. The latter is of interest because it closely resembles *Saccharum* and has been used in generic crosses. *E. maximus* is represented in this collection by N. C. [New Caledonia] 1, Imp. 1004; N. C. 132, Imp. 921; and Raiatea 1, Imp. 923. These clones show great genetic and taxonomic variability and are probably variants of *E. maximus*. N. C. 100, Imp. 918, is a wild grass of doubtful lineage, with very slender stalks. In many vegetative characteristics it is akin to *S. spontaneum*.

² Italic numbers in parentheses refer to Literature Cited, p. 69.

³ Imp. Importation number assigned by the Division of Sugar Plant Investigations.

Erianthus arundinaceus (Retz.) Jesw., represented by 28 N. G. 7, Imp. 631, is quite different from *E. maximus*, especially in structure of ligule and dewlaps, although the chromosome number ($2n=80$)⁵ of this New Guinea example of this species is identical with that of many cultivated canes.

The vegetative characters may be of some assistance in making an artificial classification of the wild clones of *Saccharum*. The taxonomic aspects in this genus are uncommonly difficult from the standpoint of delimiting species. This difficulty is not confined to *Saccharum* but is mainly true for all groups of plants in which the only or predominant mode of reproduction is asexual. All criteria of specific distinction are inapplicable in such forms, and clearly delimited species within the complex will not be found.

BRIEF GENERAL MORPHOLOGY AND ANALYSIS OF THE VEGETATIVE CHARACTERS USEFUL IN THE IDENTIFICATION OF THE CLONES STUDIED

Since the structure of the vegetative organs has been described in detail in previous publications (1, 2, 3, 4), illustrations of the salient features of sugarcane morphology (figs. 1, 2, 3) will suffice for an understanding and evaluation of the characters used in the description of the clones and in the construction of an analytical key.

Not all morphological characters used in the description of the clones reported in this study are of value in the construction of an analytical key. Of those suitable, some are qualitative and serve for primary grouping; others indicate differences in degree and are of value in segregating smaller groups and individual clones.

The hair groups of the leaf are of reliable, and of these the villous pubescence of the leaf blade (group 67, fig. 1, A) is of primary importance. It is definitely a qualitative character with a wide range of distribution (table 1). Quantitative differences are indicated, sometimes by a restricted distribution of these hairs to the region just above the dewlaps and the outer margin of the midrib (Molokai 4360, Imp. 1005), whereas normally the hairs are scattered more or less evenly over both surfaces.

The pubescence of the leaf sheath is also of great importance in making determinations. About 70 percent of the forms studied have a hairy sheath, and the young organs of a few additional forms show a sporadic appearance of small deciduous hairs. In most of the hairy clones the surface of the sheath is covered evenly, except that the hairs of the central zone are often long and declinate. Some clones show prominent lateral patches (group 60, fig. 1, A) that are confluent with the marginal hairs of dewlaps and auricles. The upper overlying sheath margin is occasionally fringed (group 56, fig. 1, A). This character is found only in three clones, and the fringe is never so pronounced as in the clones of *Saccharum spontaneum* (4).

In about one-third of the clones there is a definite fringe of hairs at the sheath base (group 59, fig. 2). The hairs are medium long or long and ascending. They rarely encircle the sheath completely but occupy

⁵ According to Ruth C. McGuire (formerly Ruth C. Starrett), assistant cytologist. Unpublished studies of chromosome counts mentioned in this paper are in the files of the Division of Sugar Plant Investigations.

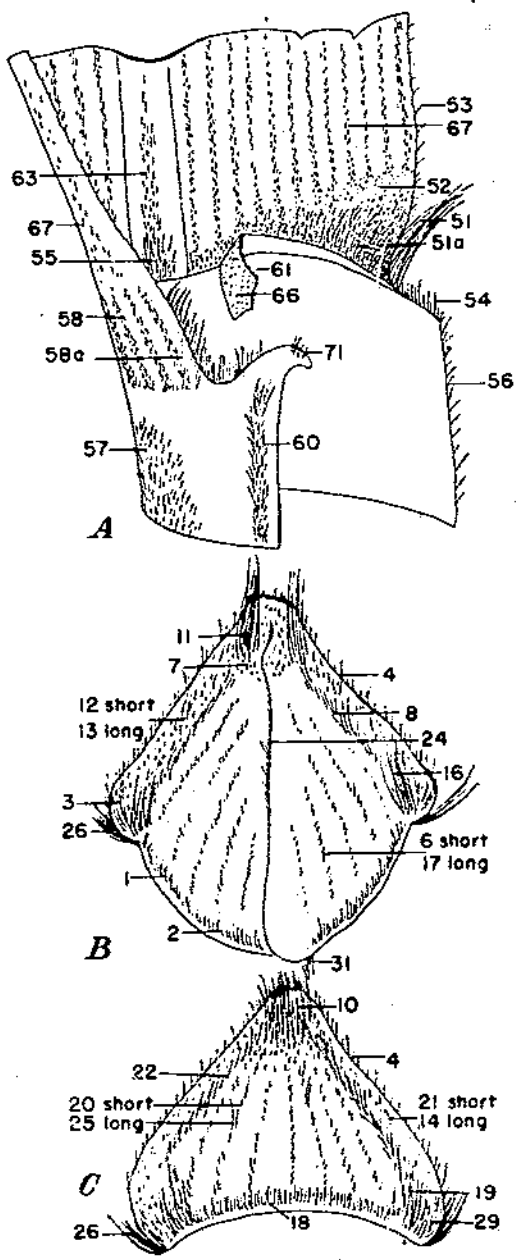


FIGURE 1.—A, Inner surface of blade joint, ligule folded back to expose the different hair groups (numbered); B, front side (diagrammatic) of prophyllum, showing location of hair groups; C, back side of prophyllum, showing location of hair groups.

a narrow or broad sector. Sometimes a narrow sector is located in the region that overlies the bud (group 69, fig. 2). In Molokai 5549, Imp. 1030, there is in juxtaposition with group 69 a hair group in the middle of the wax band that has never been recorded before for any cane variety.

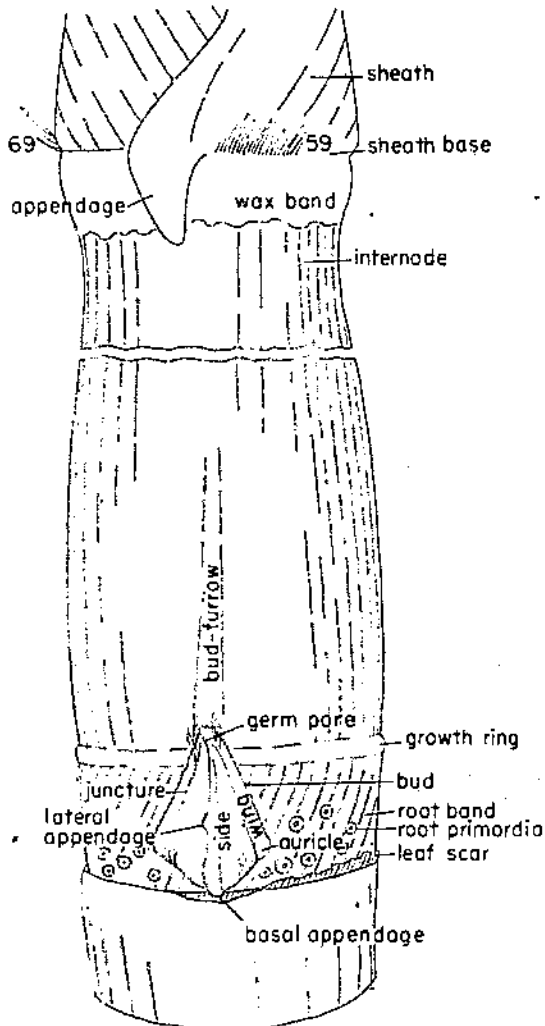


FIGURE 2.—Node and internode (diagrammatic), showing location of hair groups on sheath base.

The significance of the blade joint in the classification scheme lies in the nature of the pubescence of the dewlaps, midrib, and ligule. About half the clones have the outer dewlap surface only slightly hairy, occasionally glabrous (N. C. 100, Imp. 918, and N. C. 132, Imp. 921). In the remaining forms the pubescence is usually very prominent. In addition to the short feltlike hair (group 58, fig. 1, 21), more

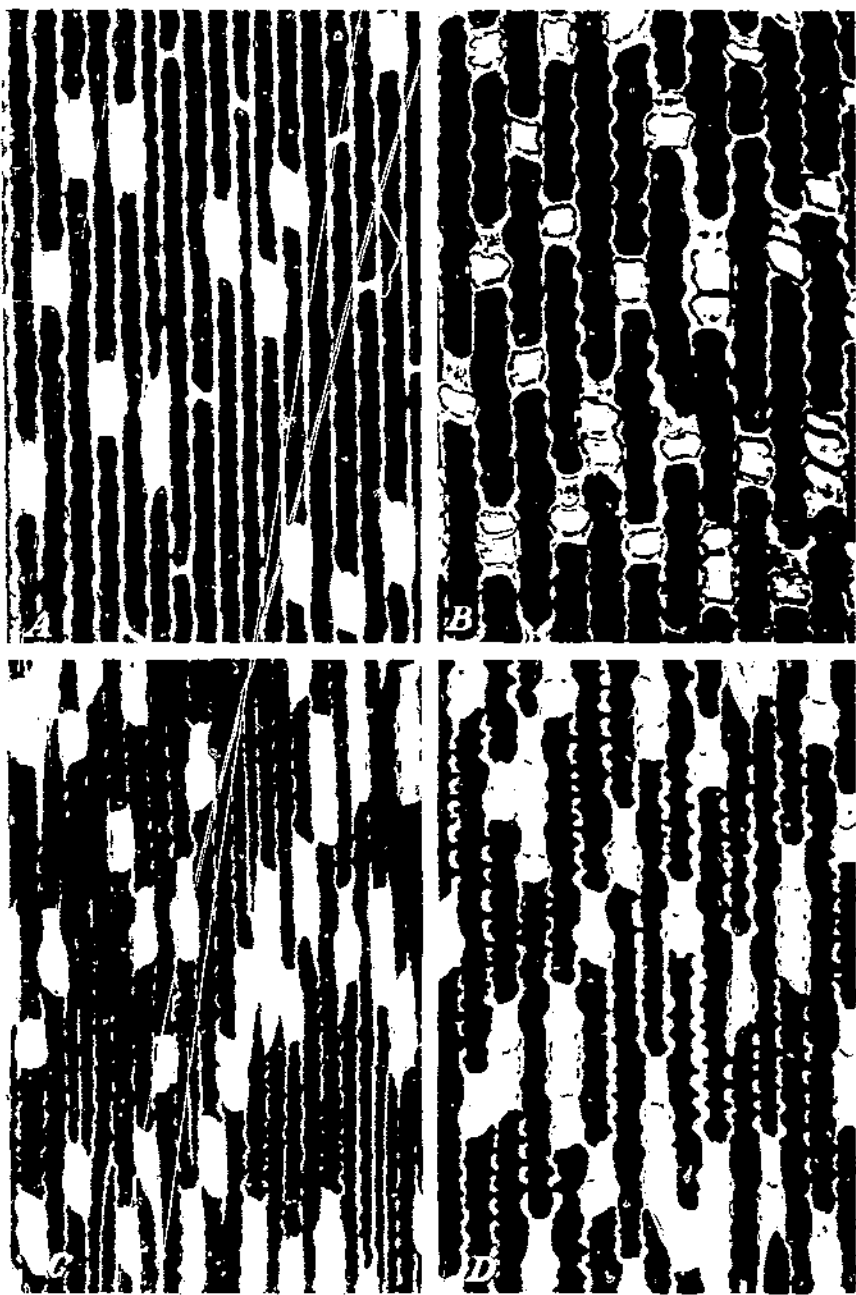


TABLE 1.—Relative prominence of various morphological features in clones of wild canes and related grasses

Clone	Hair groups ¹											Culm color ²	Bud furrow ¹	Epidermal pattern ³	Number of rows of root primordia	Sheath length	Sheath pubescence ¹	Height of ligule
	Dewlaps				Midrib		Leaf sheath			Lamina	Ligule							
	58	59a	51	51a	55	63	56	60	60	67	61							
G. 38, Imp. 477	+	+	0	+	+	0	+	0	+	+	+	Red	+	2	3-1	25	+	4
G. 49, Imp. 639	+	0	0	+	+	0	+	0	+	+	+	Red	+	5+3	2-3	21	+	3
G. 82, Imp. 617	+	+	0	+	+	0	+	0	+	+	+	Red	+	4	3	21	+	3
G. 104, Imp. 653	+	+	0	+	+	0	+	0	+	+	+	Red	+	5+6	4-5	31	+	3
G. 105, Imp. 651	+	+	0	+	+	0	+	0	+	+	+	Red	+	4	2-3	30	+	6
G. 201, Imp. 569	+	+	0	+	+	0	+	+	+	+	+	Red	+	3+5	4-5	28	+	2
G. 218, Imp. 663	+	0	0	+	+	0	+	+	+	+	+	Red	+	3	3-5	35	+	3
G. 216, Imp. 975	+	+	0	+	+	0	+	+	+	+	+	Red	+	3+5	4-5	45	+	3.5
G. 216, Imp. 976	+	+	0	+	+	0	+	+	+	+	+	Red	+	3	4-5	41	+	3
G. 251, Imp. 496	+	+	0	+	+	0	+	+	+	+	+	Red	+	3	4-5	30	+	4
G. 270, Imp. 689	+	+	0	+	+	0	+	+	+	+	+	Red	+	3	3-4	32	+	4
G. 272, Imp. 674	+	+	0	+	+	0	+	+	+	+	+	Red	+	3+4+5	3-4	27	+	2
G. 286, Imp. 677	+	+	0	+	+	0	+	+	+	+	+	Red	+	4+5	3	25	+	2
G. 290, Imp. 622	+	+	0	+	+	0	+	+	+	+	+	Red	+	5+1	3	35	+	3
Molokai 1360, Imp. 1005	+	+	+	+	+	+	+	+	+	+	+	Red	+	5+2+3	3-4	29	+	3.5
Molokai 4503, Imp. 1006	+	0	0	+	+	0	+	0	+	+	+	Red	+	1	2	23	+	3
Molokai 4575, Imp. 1007	+	0	0	+	+	0	+	0	+	+	+	Red	+	2	2-3	23	+	1.5
Molokai 4730, Imp. 1027	+	0	+	+	+	0	+	+	+	+	+	Red	+	3	2	24	+	1.5
Molokai 4826, Imp. 1028	+	0	0	0	0	0	+	0	+	+	+	Red	+	1	3	24	+	1.5
Molokai 4861, Imp. 1010	+	0	0	0	0	0	+	0	+	+	+	Red	+	2	3	23	+	3
Molokai 4972, Imp. 1011	+	0	0	0	0	0	+	0	+	+	+	Red	+	2+3+6	2-3	26	+	2.5
Molokai 5099, Imp. 1012	+	0	0	0	0	0	+	0	+	+	+	Red	+	4+3	2-3	25	+	3
Molokai 5198, Imp. 1014	+	0	0	0	0	0	+	0	+	+	+	Red	+	2+3	2-3	27	+	2.5
Molokai 5549, Imp. 1030	+	0	0	+	+	0	+	0	+	+	+	Red	+	5+3	2-3	30	+	2.5
N. H. 1, Imp. 934	+	0	+	+	+	0	+	0	+	+	+	Red	+	3+6	2-3	29	+	2
Duruka Coq-coq, Imp. 1020	+	+	+	+	+	0	+	0	+	+	+	Red	+	2+3+5	2-3	23	+	3
Duruka Memanu, Imp. 1021	+	+	+	+	+	0	+	0	+	+	+	Red	+	5+3+3	2-3	25	+	3.5
Duruka Vico Tapanu, Imp. 1018	+	+	+	+	+	0	+	0	+	+	+	Red	+	4	2-3	25	+	6
Duruka Vico Tainiloka, Imp. 1019	+	+	+	+	+	0	+	0	+	+	+	Red	+	3+1	2-3	25	+	6
Duruka Vico Vula, Imp. 1017	+	+	+	+	+	0	+	0	+	+	+	Red	+	4	2-3	21	+	4
Fiji 1, Imp. 860	+	+	0	+	+	0	+	0	+	0	+	Red	+	3+5	2-3	20	+	2
Fiji 2, Imp. 861	+	+	0	+	+	0	+	0	+	0	+	Red	+	3+5	2-3	22	+	3

SOME WILD FORMS OF SACCHARUM

TABLE 1.—Relative prominence of various morphological features in clones of wild canes and related grasses—Continued

Clone	Hair groups ¹											Culm color ²	Bud furrow ¹	Epidermal pattern ³	Number of rows of root primordia	Sheath length	Sheath pubescence ¹	Height of ligule		
	Dewlaps			Midrib		Leaf sheath				Lamina	Ligule									
	5s	5Sa	5l	51a	55	63	56	60	59	69	67								61	
Fiji 3, Imp. 862	O		+O	+	+							O		+	3	2	Cm.	20	+	3
N. C. 1, Imp. 1004	O-		G		+O		+					+O		+	2	2		32		4
N. C. 100, Imp. 918	O-		C												2	2		32		6
N. C. 132, Imp. 921	O-		O				+O					+O	Red.	O	2	2		29		4.5
Rainier 1, Imp. 923	+	+O		+	+	0					+	O		+O	3	1		34	+	3.5
28 N. G. 7, Imp. 631	O	O		+	+				+			O			2	1		45		2

¹ + = Well developed; O = poorly developed; +O = medium developed; O- = very poorly developed; blank space = absent; * = separate midrib group.

² Color other than red shown in individual text description.

³ Epidermal patterns used are as follows: 1, Cork and silica cells, in single pairs alternating with long cells; 2, silica cells lacking; 3, silica cells lacking in about 50 percent of the short cell groups; 4, majority of cork cells pointed; 5, occurrence of numerous elongate-rectangular cork cells—epidermal cells in general very narrow; 6, cork and silica cells in multiple pairs. (See fig. 3.)

or less conspicuous marginal tufts of long hairs (group 58a, fig. 1, A) are present in some clones. The inner dewlap surface always has a primary covering of short hair (group 52, fig. 1, A) completely or partially overlaid by a longer pubescence. The long hairs form corner tufts (group 51, fig. 1, A) or are dispersed over the entire dewlap surface (group 51a, fig. 1, A). In many clones, groups 52 and 51a extend into the midrib and some of the short hairs may even ascend the midrib for a certain distance. The midrib pubescence was originally subdivided by Jeswiet (8) into several groups, depending on whether the hair formed central tufts, lateral groups, or single basal files. Since in practically every instance, however, the hairs of the midrib are laterally continuous with the pubescence of the dewlaps, any midrib pubescence reported in this bulletin will be designated as group 55 (fig. 1, A). The aggregation of short hairs some distance above the ligule will retain the group number 63 (fig. 1, A). In a few clones the midrib pubescence is limited to a few scattered hairs; such midribs will be considered glabrous in making determinations.

The marginal cilia of the ligule (group 61, fig. 1, A) are long or inconspicuous. They are of uniform length, but occasionally those along the flanges are conspicuously longer. The dorsal pubescence (group 66, fig. 1, A) is usually semiadnate, the hairs being either short or long. Only slight adnation is found in the region of the flanges and the hairs are as long as the marginal cilia—often several times the height of the ligule. Prominence of ligular fringe is an important character and is frequently used in the separation of clones.

The auricles are always heavily fringed (group 54, fig. 1, A). In the large lanceolate or unciform type of auricle the fringe is prominent only in the basal region, the cilia growing shorter and sparser toward the tip. The surface pubescence of the auricles (groups 70 (*B. p. 511*) and 71, fig. 1, A) is seldom discrete but is related to the lateral patches (group 60, fig. 1, A) of the sheath, the long hairs of which extend into the auricle and become confluent with the auricular surface hairs.

The hair groups on the prophyll of the buds (fig. 1, B, C), while interesting and important in characterizing clones, are not utilized in the key. A large majority have hairy prophylls, and the smooth types (N. C. 1, Imp. 1004; N. C. 100, Imp. 918; and N. C. 132, Imp. 921) are more easily classified by making use of other morphological characters. The hairy types differ among themselves in the relative development of the different hair groups. Usually the hairs on juncture and wing are most prominent, but occasionally the basal groups also are rather massive. Special hair groups, such as 24 and 31 (fig. 1, B) are only occasionally seen, and even then reliance can be placed only on group 24.

Less readily evaluated, unless proper care is exercised, are differences in development of the various organs (leaf sheath, auricles, ligule, bud, root primordia) and relative prominence of bud furrow, general bloom, and wax bands.

The length of the leaf sheath is fairly constant within varietal limits. Conspicuous differences in length often afford an easy separation of large groups into smaller units or in the characterization of clones (for example, 28 N. G. 7, Imp. 631, with a 45-cm. sheath, is easily separated from N. C. 100, Imp. 918, with a 22-cm. sheath).

The outer auricles are of the transitional type or small deltoid; in a few clones they are conspicuous. The inner auricle is frequently large and specialized—hauceolate, falcate, or uniforn. On the whole, auricles are of minor importance in making determinations.

Most ligules are narrow-crescentiform or subarcuate; a few are tall and half-moon-shaped (N. C. 100, Imp. 918) or very specialized, as in 28 N. G. 7, Imp. 631. Except for conspicuous differences in ligular fringe, ligules have a very limited usefulness in a taxonomic key.

The buds of most clones have ovate prophylls; a few are round (28 N. G. 105, Imp. 654) or squarish (28 N. G. 272, Imp. 670). Occasionally the juncture line is absent. Such prophylls exhibit a uniform concave structure in which the specialized regions of wing, sides, and auricles are only faintly differentiated (N. C. 1, Imp. 1004).

From the standpoint of classification, the root band has a certain value, notwithstanding variations in the number of rows of root primordia within culm limits. Only two clones have root bands with one or one to two rows of root primordia (28 N. G. 7, Imp. 631, and N. C. 100, Imp. 918) and only seven have a root band with four or more rows. In the latter, the root primordia are usually very small and crowded and the rows are interlocked and staggered. In the majority of clones the number of rows is limited to two even rows, with the root primordia widely spaced or the rows are staggered and may vary between two and three or three and four. For lack of other suitable characters, some use has been made of the root band for the delimitation of smaller groups, but more than common care will have to be exercised to avoid errors in determinations.

The culms of many clones, notably those of the robustum type, have a prominent nodal region associated with a slightly conoidal internode that is thinnest just below the sheath base. When the nodes are less bulging the internodes are cylindrical or slightly bobbin-shaped. The cross section of the culm is terete or slightly oval.

The internodes of all clones studied have a coating of wax, which is always thickest below the sheath base, so that a division into wax band and general bloom is often possible. In many forms, however, there is a more or less complete merging of the wax of the ring with that of the general bloom, especially when the latter is very heavy.

The bud furrow is used repeatedly in the key for the purpose of separating small groups and individuals, although its occurrence is often erratic. In certain clones, a bud furrow is wanting; in others, it is always prominent. Borderline forms, however, are apt to give trouble in making determinations unless supported by other evidence. Such borderline forms may show considerable variations in a single culm, making it essential to study the stalk in its entirety instead of putting reliance on chance cuttings.

The color of the stalk, and to a limited extent that of the midrib, is an important character if limited to two primary colors, red and green. But many culms that are normally green show a pronounced reddish or purplish flush on exposure to light and air.

Striking color differences are sometimes noted in freshly cut stem sections: the outer zone of the cross section is usually green or olive, whereas the center is grayish, or white and pithy. Occasionally the white central region is lacking, leaving the color of the entire section a uniform green, somewhat lighter in hue toward the center. In two

clones (28 N. G. 219, Imp. 975, and 28 N. G. 219, Imp. 976) the flesh of the stalk is deep red throughout.

Although the epidermal pattern of the stem (fig. 3) is important in the characterization of a clone, it is not used in the key, chiefly because the method is not practical as a ready means for field identification. The epidermal patterns used in the description of clones may be briefly designated as follows: Pattern 1, cork and silica cells, in single pairs alternating with long cells; pattern 2, silica cells lacking; pattern 3, silica cells wanting in about 50 percent of the short-cell groups; pattern 4, majority of cork cells pointed; pattern 5, occurrence of numerous elongate-rectangular cork cells—epidermal cells in general very narrow; pattern 6, cork and silica cells in multiple pairs.

The distribution and preponderance of epidermal patterns are erratic. Pattern 2 is characteristic of N. C. 1, Imp. 1004; N. C. 100, Imp. 918; and N. C. 132, Imp. 921, but it is also found in Molokai 4575, Imp. 1007; Molokai 4861, Imp. 1010; 28 N. G. 33, Imp. 477; and 28 N. G. 82, Imp. 647. It is also present in 28 N. G. 7, Imp. 631, which is a representative of *Erianthus arundinaceus*, but in Ratatea 1, Imp. 923, which is a representative of *E. maximus*, only half the short-cell groups lack silica cells. Pattern 1, which is most common among noble canes, is found only in Molokai 4503, Imp. 1006, and Molokai 4826, Imp. 1028. In many clones the epidermal pattern is somewhat complex and may be best designated by a formula. Thus, 3+4+5 (characteristic of 28 N. G. 272, Imp. 670) signifies that many of the short-cell groups lack silica cells, that many cork cells are pointed or of the elongate-rectangular type, and that, in general, the epidermal cells are very narrow.

CLONE 28 N. G. 38, IMP. 477

(Fig. 4, C)

ORIGIN.—Medeni, Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=70$ to 76.

CLIMS.—Garnet red, with wide, poorly defined wax bands; internodes bobbin-shaped, 22 mm. across; bud furrow long and shallow; outer flesh green, center white and pithy; stem-epidermal pattern 2, most cork cells short-squarish, some long-pointed, average width of long cells 7μ ; stomates not observed; growth rings reddish green or maroon, narrow to medium wide, tumescent; root bands concolorous with internode, 8 to 9 mm. high, cylindrical and obconoidal on side opposite bud, with three to four rows of root primordia; buds reddish, medium large (9 by 6 mm.), inserted low and reaching growth ring; prophylls ovate-triangular, wing poorly defined and very narrow at basal region, inserted below middle of prophyll, tip acute or round-pointed; group 32 on basal appendage conspicuous.

LEAVES.—Leaf sheaths 25 cm. long and very hairy; sheath base slightly saccate and sectorially fringed (group 59); blades 100 cm. long and 6.2 cm. broad and hairy (group 67); dewlaps deltoid-ligulate, green edged in light red, outer dewlap surface prominently hairy (groups 58 and 58a), inner surface with prominent groups 52 and 51a, the latter extending through midrib to form a conspicuous group 55, some short hairs ascend midrib for short distance to form an incon-

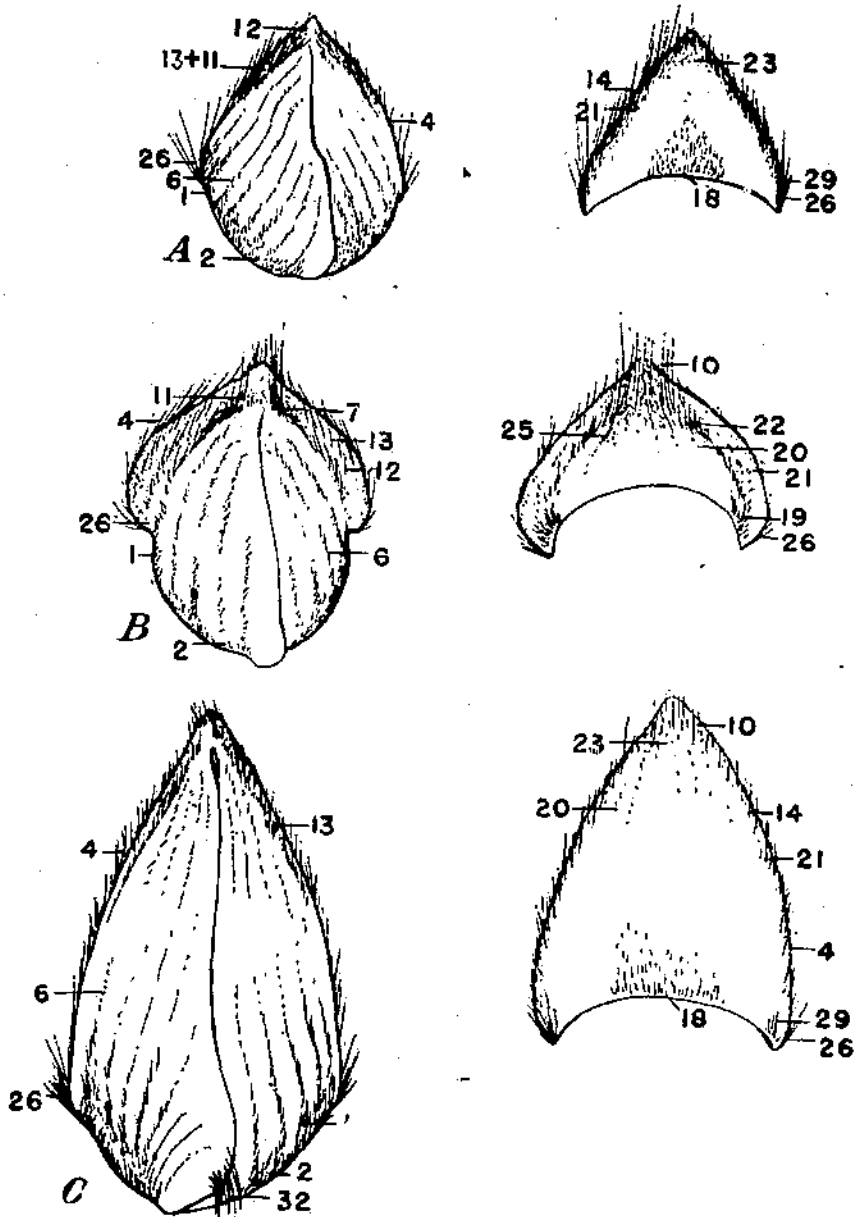


FIGURE 4.—Anterior side (left) and posterior side (right) of propyl with hair groups of (A) clone 28 N. G. 82, Imp. 647; (B) clone 28 N. G. 49, Imp. 639; and (C) clone 28 N. G. 38, Imp. 477.

spicuous group 63, corner tufts (group 51) small; both auricles small, deltoid, and fringed (group 54), surface of auricles with group 70 and 71, the hairs constituting an upward extension of the long hairs of the lateral patches (group 60); ligules subarcuate, 4 mm. high, with very long marginal fringe (group 61).

DISTINGUISHING CHARACTERS.—Both outer and inner dewlap surface hairy, midrib group 55 especially prominent, but group 63 inconspicuous; hairy blade and sheath; sectorial group 59 on sheath base; group 32 (fig. 4) a basal appendage of prophyll.

CLONE 28 N. G. 49, IMP. 639

(Fig. 4, B)

ORIGIN.—Jovi, Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=90$ to 94.

STEMS.—Green, with scant or heavy bloom and prominent wax bands; internodes somewhat bobbin-shaped, 22 mm. across, lacking bud furrow; outer flesh green, center white and pithy; stem-epidermal pattern 5+3, width of long cells, 7.8μ ; stomates medium abundant; growth rings olive, medium high, and tumescent; root bands ivory olive or green, 6 mm. high with two to three rows of very small brownish root primordia; buds small ($7\frac{1}{2}$ by 7 mm.), inserted low and reaching lower edge of growth ring; prophylls pentagonal, wing inserted at middle of prophyll, uniformly wide, tip round-pointed; dominant pubescence in wing region.

LEAVES.—Leaf sheaths 24 cm. long and very hairy; sheath base straight and not fringed; blades 140 cm. long, 5.5 cm. broad, and covered with hair (group 67), midrib medium wide and fairly massive; dewlaps dark olive, squarish-ligulate, outer dewlap surface covered with hair (group 58), a sub-basal group 58a may be present in young organs, inner surface with well-developed groups 52 and 51a, group 55 in midrib prominent and continuous with group 52 of dewlap; inner auricle uniform, outer auricle broad transitional, both auricles fringed (group 54); ligule subarcuate, narrow (3 mm.), and prominently fringed (group 61).

DISTINGUISHING CHARACTERS.—Hairy sheath and blade; hairy inner dewlap with midrib group 55 present; narrow root band with very small root primordia; small pentagonal buds.

CLONE 28 N. G. 82, IMP. 647

(Fig. 4, A)

ORIGIN.—Budogoro, Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=84$.

STEMS.—Green, with scant bloom and poorly defined wax bands; internodes cylindrical or bobbin-shaped, 17 mm. across; long and inconspicuous bud furrow, outer flesh green, center white and pithy; stem-epidermal pattern 2, cork cells mostly short-squarish, a few short and long-pointed, width of long cells 10μ ; stomates not observed; growth rings reddish green, tall, and somewhat tumescent; root bands 8 to 9 mm. high, cylindrical-obconoidal with three rows of root primordia; buds brownish rose, green with rose tip when young, medium

large (10 by 8 mm.) or small; prophylls ovate-deltoid, wing poorly defined and very narrow at basal region, inserted below middle of prophyll; somewhat prominent pubescence in upper wing zone.

LEAVES.—Leaf sheaths 21 to 28 cm. long and very hairy; sheath base sectorially fringed (group 59 and sometimes group 60); blades 120 cm. long, 5.0 cm. broad, and hairy (group 67); dewlaps olive, deltoid-ligulate; outer dewlap surface very hairy (groups 58 and 58a), inner surface with prominent groups 52 and 51a, the latter extending through midrib to form a conspicuous group 55; a few short hairs ascend for a short distance to form an inconspicuous group 63; corner tufts (group 51) small but may extend as narrow band inward as far as midrib, more or less continuous with upward-extending hairs of lateral patches (group 60); inner auricle unciform and fringed (group 54), outer auricle transitional and also fringed; ligule crescentiform or arcuate, 3 mm. high, and very conspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—This variety is identical with 28 N. G. 38, Imp. 477, except for stem color, size of inner auricle, and number of chromosomes. Prophylls are large and hairy.

CLONE 28 N. G. 104, IMP. 653

(Fig. 5)

ORIGIN.—Kemp Welsh River, Territory of Papua, 1928.

CHROMOSOME NUMBER.— $2n=98$.

STEMS.—Light olive, with scant bloom and prominent wax bands; internode somewhat bobbin-shaped, thickest in region of growth ring (20 to 22 mm. across); bud furrow long and shallow, outer flesh green and center white and pithy; stem-epidermal pattern 5+6, cork cells short or long-squarish, occasionally pointed, average width of long cells 8.1μ ; stomates fairly abundant; growth rings tall, dark olive, and tumescent; root bands up to 11 mm. tall, greenish olive, cylindrical or tumescent-obconoidal with four to five crowded rows of root primordia; buds very large (13 by 10 mm.), red olive; prophylls ovoid-deltoid, wing inserted below middle of prophyll, medium wide, tip acute or round-pointed; prominent hair groups in region of juncture.

LEAVES.—Leaf sheaths 34 cm. long and uniformly covered with red spines, which are most prominent in dorsal region; sheath base straight and not fringed; blades 176 cm. long and 6.5 cm. broad; midrib broad and shallow; dewlaps squarish-ligulate or shallow-deltoid, green with rose edge when young, outer dewlap surface covered with short white pubescence (group 58) and long dense marginal hairs (group 58a), inner dewlap surface covered with short hairs (group 52), which extend sparingly into midrib, forming an inconspicuous midrib group 55, marginal tufts (group 51) small and confluent with auricular fringe (group 54); outer auricle broad and transitional or somewhat deltoid, inner auricle unciform or lanceolate and prominently fringed (group 54), although near tip of auricle hairs are sparse and short; ligule crescentiform, 3 mm. tall, and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Swollen nodal region; root bands with four to five rows of root primordia; prominent wax bands and bud furrows; large hairy buds; unciform or lanceolate inner auricles; shallow inconspicuously fringed ligule; marginal dewlap group 58a and inconspicuous midrib group 55.

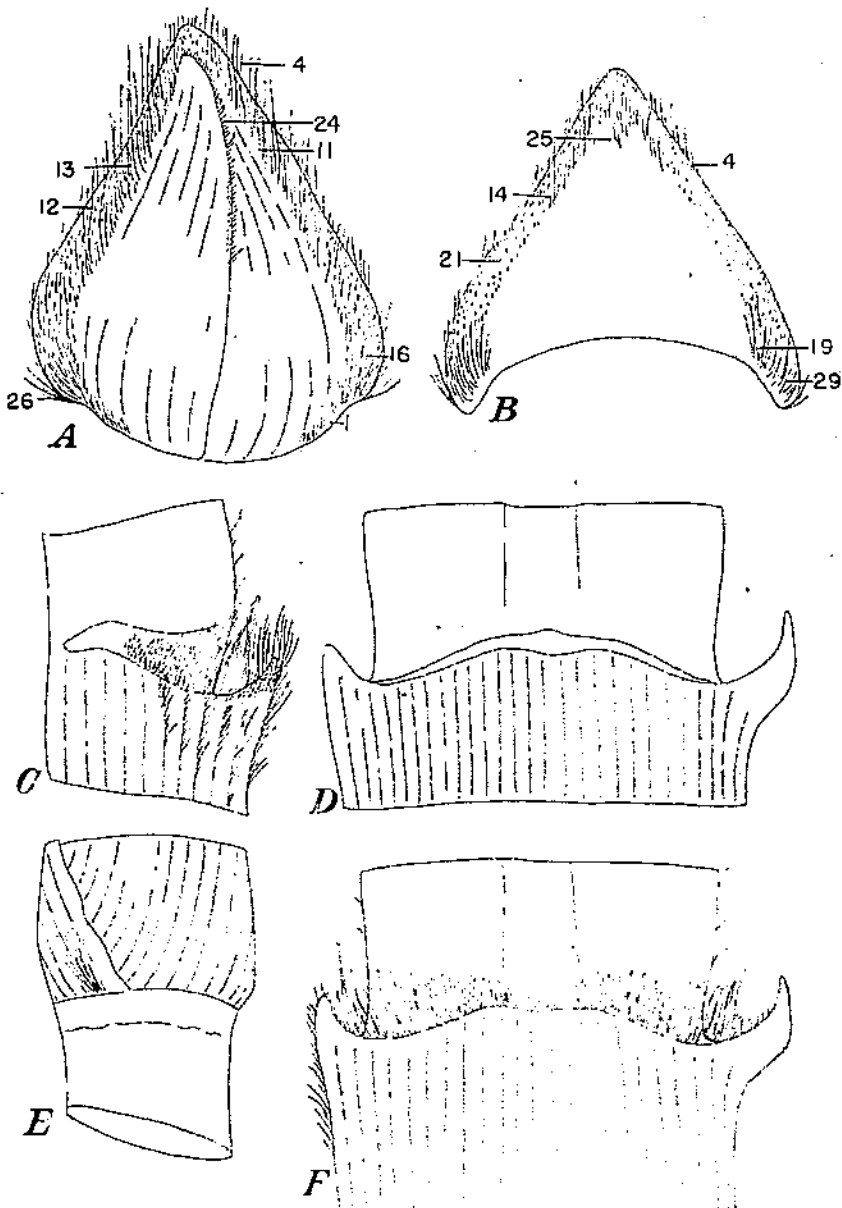


FIGURE 5.—Clone 28 N. G. 104, Imp. 653: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of blade joint with ligule; *D*, inner surface of blade joint with dewlap and blade parts; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

CLONE 28 N. C. 105, IMP. 654

(Fig. 6)

ORIGIN.—Kemp Welsh River, Territory of Papua, 1928.

CHROMOSOME NUMBER.— $2n=140$ to 148.

CULMS.—Reddish purple and heavily waxed; internodes cylindrical and flush with nodal region, 25 mm. across, outer flesh olive, center slightly pithy; stem-epidermal pattern 4, cork cells squarish, pointed, or bean-shaped, average width of long cells 9.5μ ; stomates medium abundant; growth rings fairly high, ivory olive, flush or slightly tumescent; root bands 9 mm. high on bud side, ivory tinged with red, cylindrical, with two to three rows of root primordia; buds medium large (9 by 9 mm.), flush or protruding; prophylls round or squarish; wings inserted at middle of prophyll or somewhat higher, broad, reddish with dense pubescence, tip broadly truncate and notched.

LEAVES.—Leaf sheaths up to 39 cm. long and sparingly covered with acicular hair; sheath base saccate and not fringed; blades 165 cm. long and 5.5 cm. broad; midrib broad and shallow; dewlaps green olive, narrow-ligulate, outer surface almost glabrous, inner surface uniformly covered with short hair (group 52) and long hair (group 51a) that extend into midrib forming group 55, marginal tufts (group 51) small and continuous with marginal dewlap fringe; inner auricle small lanceolate or calcariform, outer auricle broad transitional or deltoid, both auricles heavily fringed (group 54); ligule shallow-deltoid or crescentiform, 6 mm. high, and sparingly fringed (group 61).

DISTINGUISHING CHARACTERS.—Cylindrical heavily waxed internodes flush with nodal region and lacking bud furrow; round buds with reddish hairy wings; large auricles and tall inconspicuously fringed ligule. Sheath with dorsal patch of rather short hair; outer dewlap surface practically glabrous.

CLONE 28 N. C. 201, IMP. 509

(Fig. 7)

ORIGIN.—Narrow coastal plain, near Lei, north coast of Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=84$ to 88.

CULMS.—Rose olive with a medium heavy or scant bloom and prominent wax bands; internodes somewhat bobbin-shaped, 17 by 19 mm. across, bud furrow wanting, outer flesh light olive, small center white and pithy; stem-epidermal pattern 3+5, cork cells rhomboid, short, or long-squarish or pointed, average width of long cells 6.9μ ; stomates numerous; growth rings greenish, narrow, and tumescent; root bands green or rose, 9 mm. high, somewhat tumescent with four to five rows of root primordia; buds flush or protruding, reddish, medium large (10 by 6 mm.); prophylls elongate-ovate, wings with inconspicuous auricles inserted at middle of prophyll, medium wide, tip round-pointed; wing, juncture, and basal regions very hairy.

LEAVES.—Leaf sheaths 28 cm. long and hairy; overlying sheath margin fringed for a distance of 8 cm. (group 56); sheath base straight, occasionally slightly appendaged and not fringed; blades 142 cm. long and 6.4 cm. broad and villous on both surfaces (group 67), edges of

older leaves inconspicuously serrate, but basal region of young leaves prominently ciliate (group 53); midrib somewhat narrow and medium massive, faintly pink in old material; dewlaps dark olive, reddish when young, broad ligulate or deltoid; outer dewlap surface densely

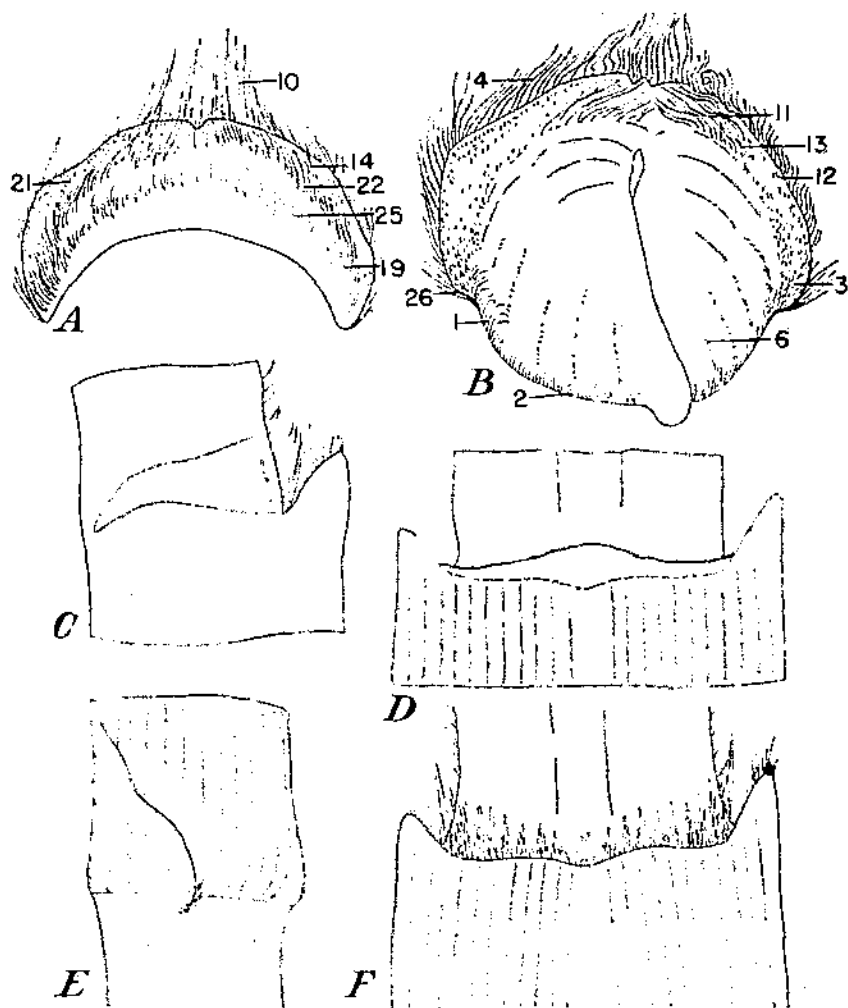


FIGURE 6.—Clone 28 N. G. 105, Imp. 654: *A*, Posterior side of propyll with hair groups; *B*, anterior side of propyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

pubescent (groups 58 and 58a), inner surface covered with a silvery mat of short (group 52) and long (group 51a) hairs that extend sparingly into midrib to form an inconspicuous group 55; outer auricle small, narrow-transitional, and fringed (group 54), inner auricle

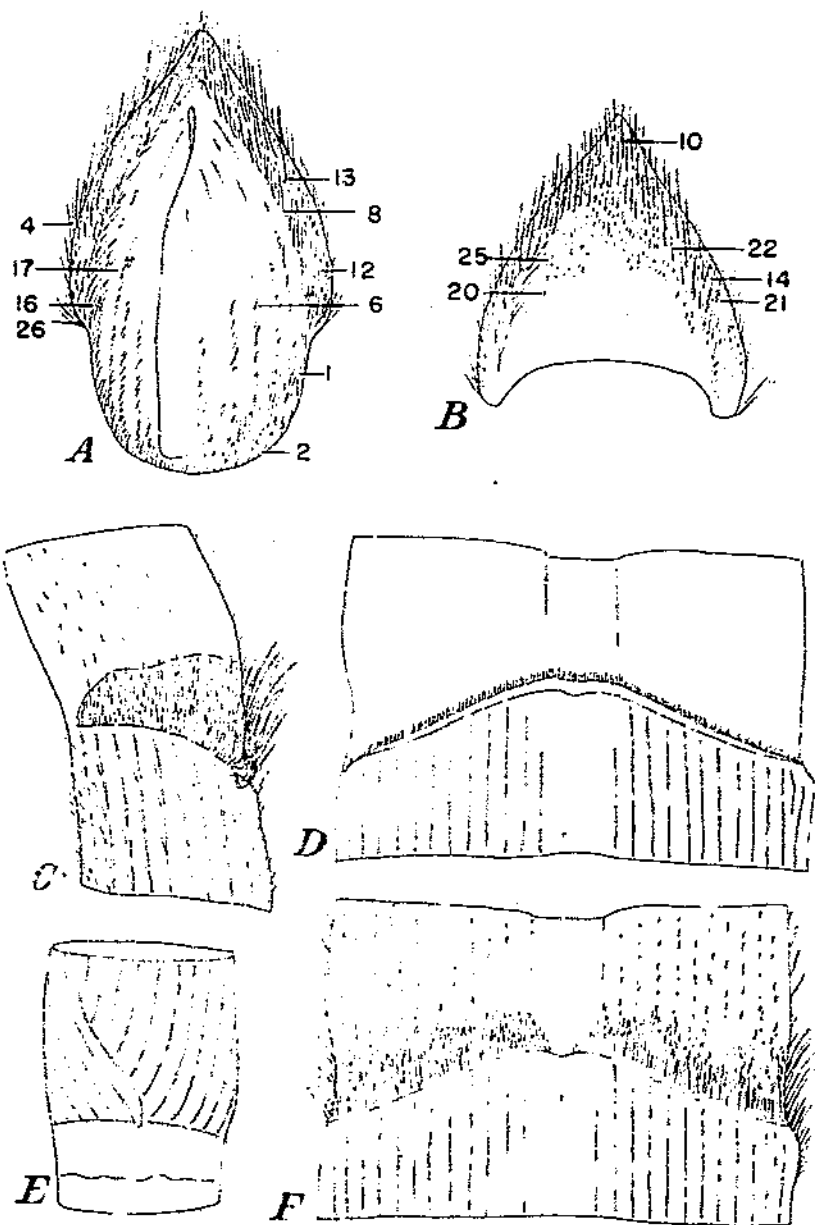


FIGURE 7.—Clone 28 N. G. 201. Imp. 509: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

large, calcariform, and only sparingly fringed; ligule very narrow (2 mm.), crescentiform with conspicuous marginal fringe (group 61).

DISCRIMINATING CHARACTERS.—Internodes with prominent wax bands, but lacking bud furrow; root bands with four or five rows of root primordia; hairy dewlaps; inconspicuous midrib group 55, 8-cm. strip of marginal cilia on overlying sheath margin (group 56); villous pubescence of blade (group 67); calcariform inner auricle.

CLONE 28 N. C. 218, IMP. 663

(Fig. 8)

ORIGIN.—Near Ambunti, Sepik River, Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=84$ to 86.

STEMS.—Apple green, yellow green with rusty blotches where exposed to sun, scant bloom but prominent wax bands and without bud furrows; outer flesh light green, center white and pithy; internodes cylindrical, 23 mm. across, flush with nodal region; stem-epidermal pattern 2, cork cells short or long-squarish; often in double pairs, average width of long cells 8.3μ ; stomates medium abundant; growth rings reddish olive or dark olive when young, later colorless with internode above, medium high, and slightly tumescent; root bands 9 mm. high, cylindrical, with 3 to 5 rows of small root primordia; buds small (7 by 5 mm.), flush or plump; prophylls ovate with rose-colored wings inserted at middle of prophyll, tip acute or irregular; wing and base hairy.

LEAVES.—Leaf sheaths 38 cm. long and covered with short hair; sheath base straight and not fringed; blades 172 cm. long and 6.2 cm. broad, edges conspicuously serrate (group 53) above dewlaps, midrib fairly wide and massive; dewlaps dark olive, broad ligulate, outer dewlap surface densely hairy (group 58 and occasionally group 58a), inner surface also hairy (group 52), corner tufts (group 51) small and continuous with auricular fringe; outer auricle broad, transitional, and heavily fringed (group 54); inner auricle deltoid and also prominently fringed; ligule crescentiform, 3 mm. high, and very inconspicuously fringed (group 61).

DISCRIMINATING CHARACTERS.—Internodes flush with nodal region; covered with scant bloom; broad wax bands but lacking bud furrows; usually four rows of root primordia; sheath covered with medium long hair; inconspicuous ligular fringe.

CLONE 28 N. C. 219, IMP. 975

(Fig. 9)

ORIGIN.—Sepik River region, Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=70$.

STEMS.—Carmine red, later dark purple, covered with heavy bloom; internodes short, cylindrical, 26 by 30 mm. across, bud furrow faint or wanting, outer flesh red, large center white and pithy; stem-epidermal pattern 3+5, cork cells rhomboid, short, or elongated-squarish, average width of long cells 7.8μ ; stomates numerous; growth rings dark red, high or medium high, and slightly tumescent; root bands dark

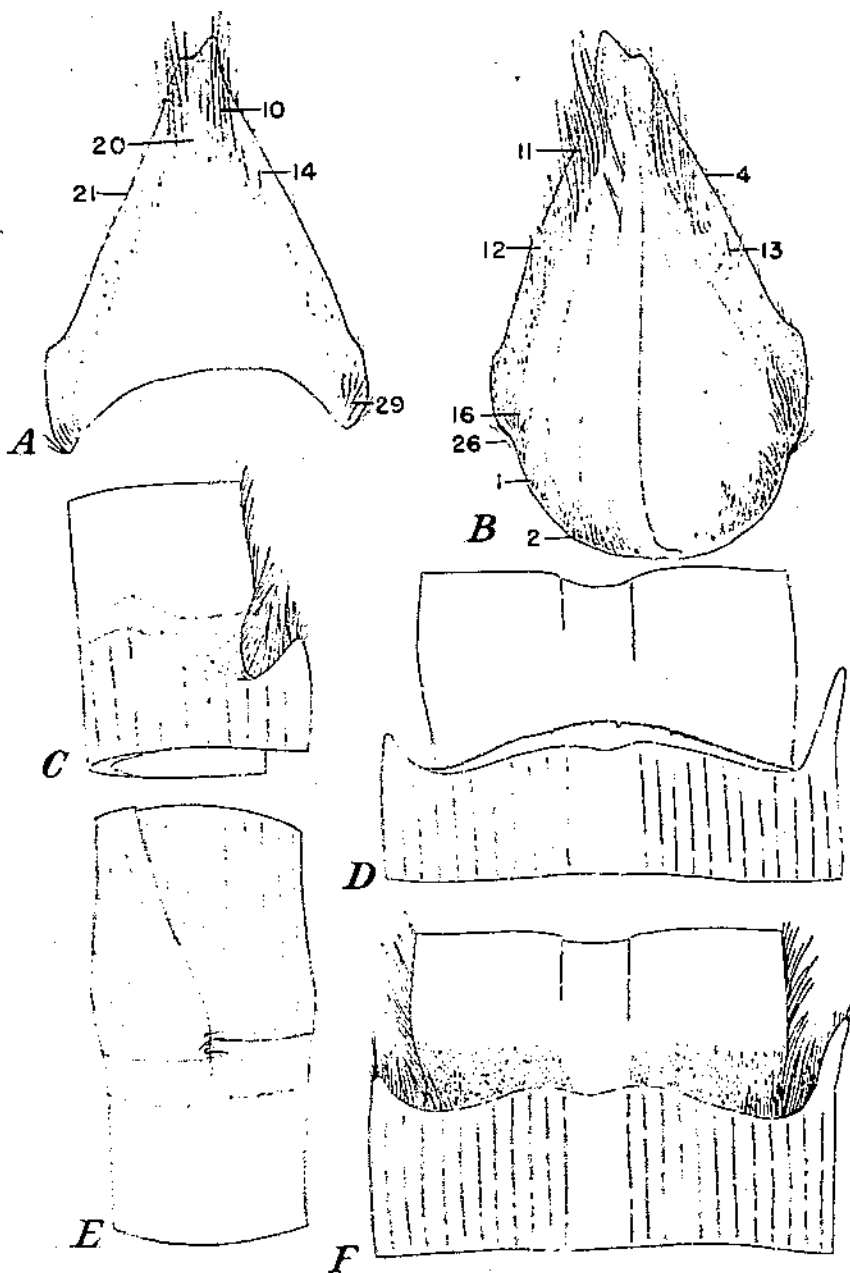


FIGURE 5.—Clone 28 N. C. 218, Imp. 663: *A*, Posterior side of prophyll with hair groups; *B*, anterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

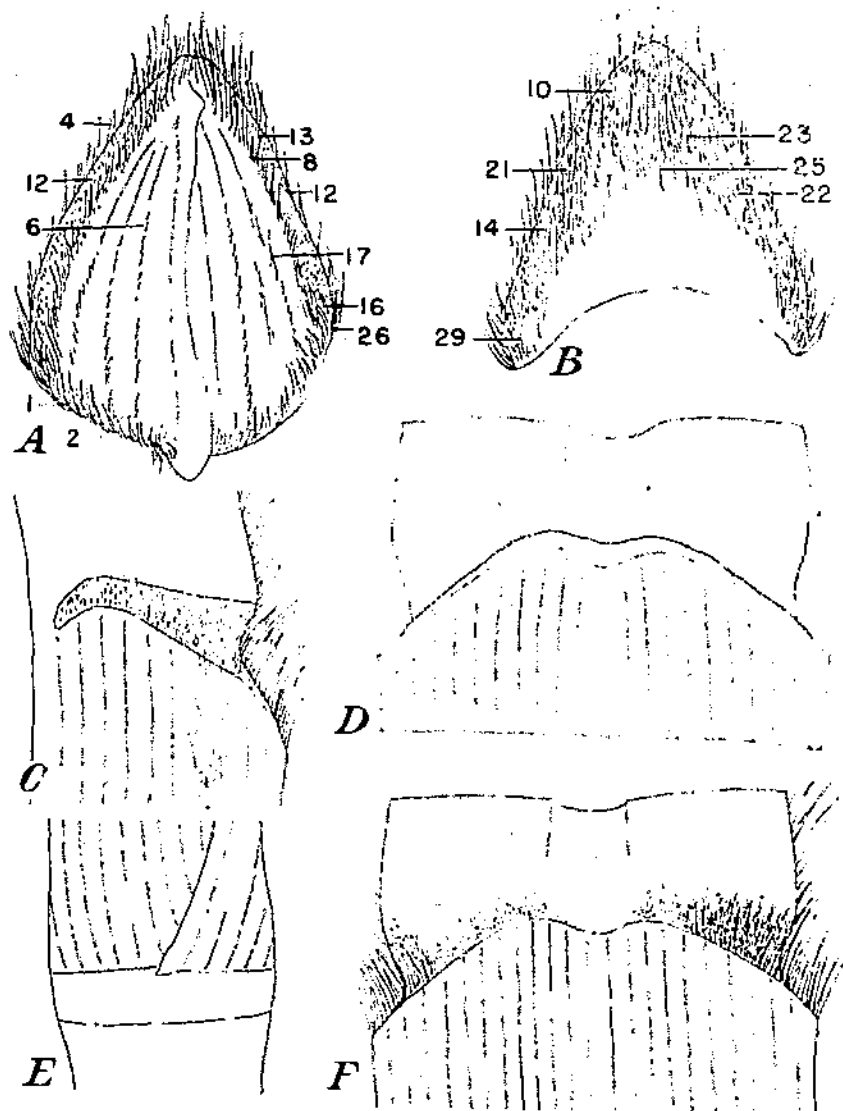


FIGURE 9.—Clone 28 N. C. 219, Imp. 975; A, Anterior side of propyll with hair groups; B, posterior side of propyll with hair groups; C, lateral view of outer surface of dewlap with adjoining sheath and blade parts; D, inner surface of blade joint with ligule; E, sheath base with adjoining internode and sheath parts; and F, inner surface of blade joint with ligule removed to show hair groups.

red, 8 mm. high, cylindrical with four or more irregular rows of root primordia; buds medium large (10 by 7 mm.), inserted low and reaching up to growth ring; prophylls ovate-deltoid, wing attached below middle, tip round-pointed; hair groups most prominent on wing and basal zone.

LEAVES.—Leaf sheaths 45 cm. long and very hairy; sheath base straight and not fringed; blades 236 cm. long and 8 cm. broad, edge indistinctly scabrous, but basal part of lamina prominently fringed (group 53); midrib massive; dewlaps broad ligulate, deep red; outer dewlap surface very hairy (groups 58 and 58a), the long hairs (group 58a) confluent with the long apical sheath hairs (group 60), inner dewlap surface also densely pubescent (groups 52 and 51a), but hairs do not extend into midrib; outer auricle broad transitional and sloping and heavily fringed (group 54), inner auricle transitional-deltoid and also prominently fringed; ligule arcuate, 3.5 mm. high, with very inconspicuous marginal fringe (group 61).

DISTINGUISHING CHARACTERS.—Outer flesh of stem dark red; root bands with four or more rows of small root primordia; internodes dark red and heavily waxed; outer dewlap surface with prominent hair groups 58 and 58a, the latter confluent with group 60; sheath very long.

CLONE 28 N. G. 219, IMP. 976

(Fig. 10)

ORIGIN.—Sepik River region, Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=70$.

STEMS.—Rose or olive green, with scant bloom and prominent wax bands; internodes short, somewhat hobbin-shaped oboconoidal, 26 by 29 mm. across, bud furrow wanting or inconspicuous, outer flesh red, large center white and pithy; stem-epidermal pattern 3, cork cells short-squarish, a few elongated or short-pointed, average width of long cells 7.0μ ; stomates medium abundant; growth rings deep red, medium high or high, flush or slightly tumescent; root bands greenish red or red, slightly concave with four to five rows of very small root primordia; buds red, medium large (10 by 6 mm.), inserted low and reaching up to growth rings; prophylls ovate-deltoid, wing inserted somewhat below middle of prophyll, tip row d-pointed, overlying membranaceous margin with prominent basal appendage; pubescence concentrated in upper wing region.

LEAVES.—Leaf sheaths 41 cm. long and very hairy; sheath base straight and not fringed; blades 209 cm. long and 7.5 cm. broad, basal edge of lamina with long cilia (group 53); dewlaps red and heavily waxed, broad-ligulate, outer dewlap surface with medium-prominent groups 58 and 58a, inner surface with prominent groups 52 and 51a; outer auricle transitional and heavily fringed (group 54), inner auricle obtuse-deltoid, and also prominently fringed; ligule somewhat arcuate, 3 mm. high, with very inconspicuous marginal fringe (group 61).

DISTINGUISHING CHARACTERS.—Dewlaps, growth rings, buds, and outer flesh of stem dark red; root bands shallow with four or five rows of small root primordia; internodes with scant bloom and prominent wax bands; prominent dewlap groups 51a and 58a; sheaths long and hairy.

CLONE 28 N. G. 251, IMP. 496

(Fig. 11)

ORIGIN.—Left bank of Laloki River, Territory of Papua, 1928.

CHROMOSOME NUMBER.— $2n=83$ to 85.

STEMS.—Green, yellow olive where exposed to sun, heavy bloom, broad but not well-defined wax bands; internodes medium long, some-

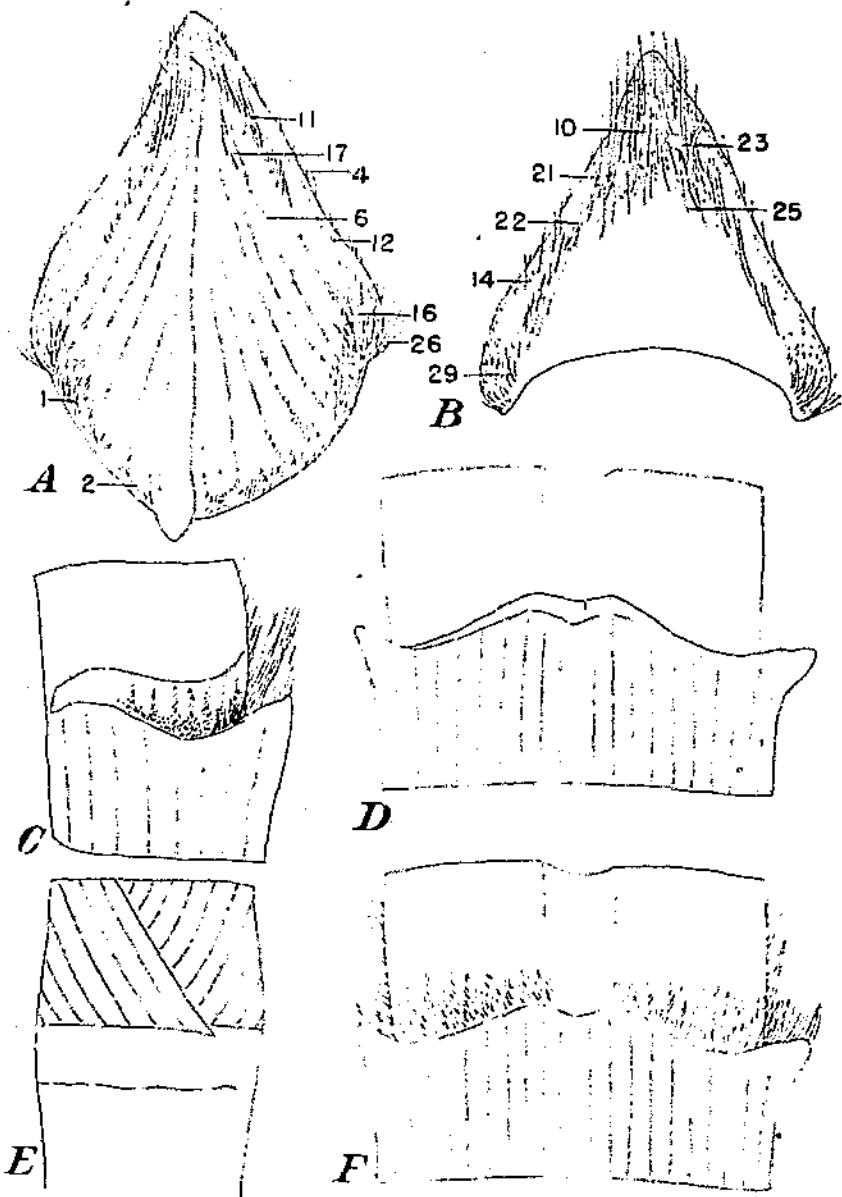


FIGURE 10.—Clone 28 N. G. 219, Imp. 976: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

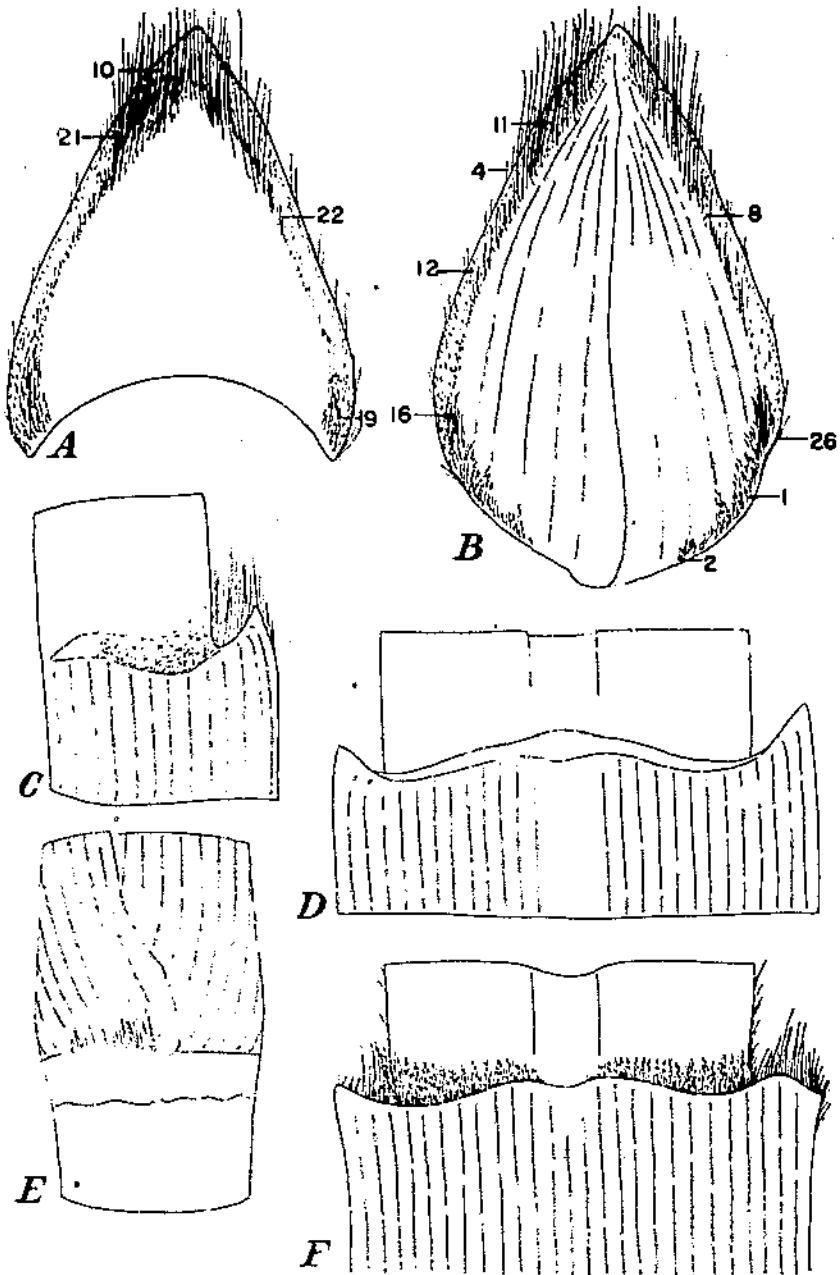


FIGURE 11.—Clone 28 N. G. 251, Imp. 406: *A*, Posterior side of propyll with hair groups; *B*, anterior side of propyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

what bobbin-shaped with prominent swollen nodal region, 19 mm. across, bud furrow shallow and short, outer flesh green, center white and pithy; stem-epidermal pattern 3, cork cells short-squarish or pointed, average width of long cells 8.1μ ; stomates medium abundant; growth rings reddish brown, narrow, and tumescent; root bands yellow green, 9 mm. high, somewhat tumescent-obconoidal, with four to five rows of root primordia; buds greenish red, large (12 by 7 mm.); prophylls elongate-ovate, wing inserted below middle of prophyll, medium wide, tip acute and often notched; prophyll relatively smooth with hairs concentrated in upper wing and base.

LEAVES.—Leaf sheaths 30 cm. long and hairy; sheath base straight and sectorially fringed (group 59); blades 160 cm. long and 5.8 cm. broad, midrib fairly massive; dewlaps maroon when young, later brown olive, ligulate, outer dewlap surface with prominent group 58, inner surface with group 52 inconspicuously overlaid with hairs of group 51a; outer auricle transitional deltoid and heavily fringed, inner auricle usually lanceolate and also fringed; short group 56 on overlying sheath margin as a continuation of auricular fringe; ligule crescentiform, 4 mm. high, and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Swollen nodal region; prominent bloom but indistinct wax bands; inconspicuous bud furrow, root band with four to five rows of root primordia; red dewlaps (when young); sectorial group 59.

CLONE 28 N. C. 270, IMP. 669

(Fig. 12, A)

ORIGIN.—Ututi (village on Kikori River), Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=116$ to 122.

STEMS.—Yellow green, with heavy general bloom and broad wax bands; internodes bobbin-shaped, 15 mm. across, lacking bud furrow; outer flesh green, center white and pithy, stem-epidermal pattern 3, cork cells short-squarish and a few are pointed, average width of long cells 8.1μ ; stomates medium abundant; growth rings olive, medium broad, and somewhat tumescent; root bands concolorous with upper internode, 8 mm. high, cylindrical or tumescent-obconoidal, with three to four irregular rows of root primordia; buds small (5 by 5 mm.), greenish, inserted low and not reaching growth ring; prophyll ovate or round, with wing inserted below middle of prophyll, tip round-pointed, occasionally notched; hairs prominent in juncture region.

LEAVES.—Leaf sheaths 32 cm. long and hairy; sheath base straight and not fringed; blades 200 cm. long, 7 cm. broad, and hairy (group 67); midrib broad and medium massive; dewlaps olive, ligulate-deltoid or squarish; outer dewlap surface with medium prominent group 58 and less prominent group 58a, inner surface with prominent group 52, which may extend through midrib to form an inconspicuous group 55, marginal tufts (group 51) small; outer auricle transitional and fringed (group 54), inner auricle deltoid and also fringed (group 54); ligule subarcuate, 4 mm. tall, and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Hairy sheath, occasional midrib group 55, small buds; sparse blade pubescence (group 67).

CLONE 28 N. G. 272, IMP. 670

(Fig. 12, B)

ORIGIN.—Near village of Darua Darua, on Kikori River, Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=80$ to 82 .

CULMS.—Green, covered with heavy general bloom; internodes bobbin-shaped, 22 mm. across, bud furrow wanting; outer flesh green, center white and pithy; stem-epidermal pattern $3+4+5$, cork cells

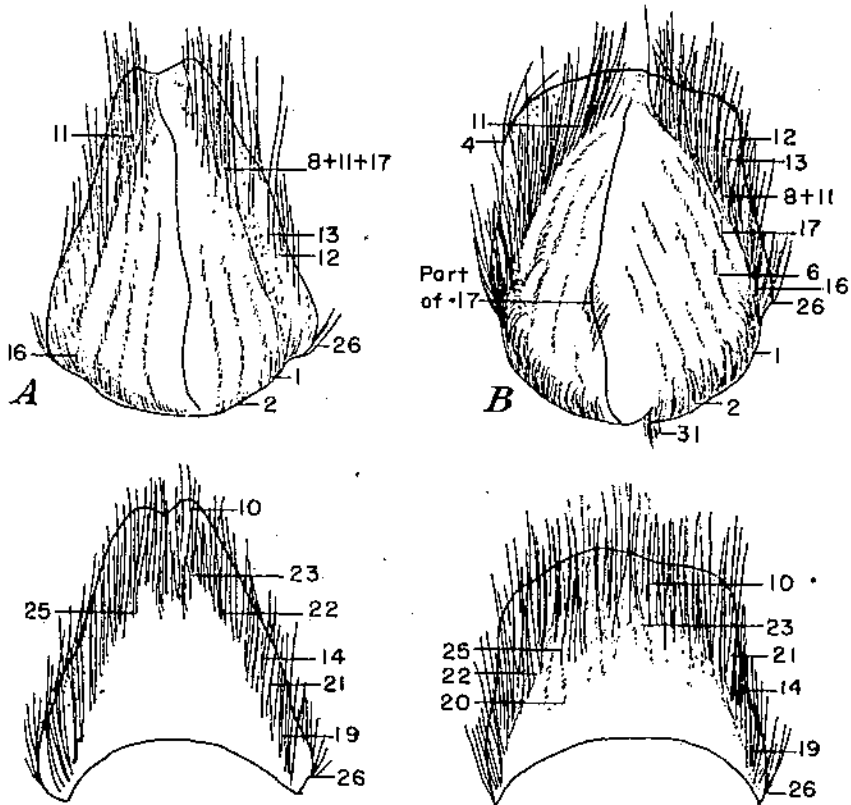


FIGURE 12.—Anterior side (top) and posterior side (bottom) of prophyll with hair groups of (A) clone 28 N. G. 270, Imp. 669, and (B) clone 28 N. G. 272, Imp. 670.

short- and long-squarish or short- and long-pointed, average width of long cells 6.5μ ; stomates medium abundant; growth rings orange green, medium high, and slightly tumescent; root bands ivory green, 9 mm. high, cylindrical, with three to four rows of root primordia; buds small (6 by 5 mm.), olive with purplish base, inserted low and extending to growth ring; prophylls broad-ovate or squarish with fairly prominent basal appendage, wing inserted below middle of prophyll, very narrow near point of insertion but broadening toward tip, the latter roundish or broad-truncate; except for central region

prophyll very hairy, group 24 inserted low and very characteristic, backside of prophyll covered with dense mat of long hair.

LEAVES.—Leaf sheaths 27 cm. long and very hairy; sheath base straight and not fringed; blades 150 cm. long, 6 cm. broad and hairy (group 67); dewlaps reddish olive and broad-ligulate; outer dewlap surface covered with short hair (group 58), outlined below by long hairs of group 60 and above by long villous pubescence (group 67) of the lamina; inner dewlap surface covered with short (group 52) and semilong hairs (group 51a) that extend into midrib to form an inconspicuous group 55; group 63 wanting or inconspicuous; group 51 forms inconspicuous corner tufts, but some of the long hairs of the group may extend in a single file some distance inward; outer auricle deltoid and covered by upward-extending hairs of group 60; inner auricle lanceolate and also hairy; ligule arcuate with depression in center, very narrow (2 mm.), and prominently fringed (group 61).

DISTINGUISHING CHARACTERS.—Very hairy sheath and blade; medium prominent or inconspicuous group 55; group 63 inconspicuous or wanting; large lanceolate inner auricle; both auricles covered by upward-extending hair of group 60; very narrow ligule conspicuously fringed; small hairy buds.

CLONE 28 N. C. 289, IMP. 677

(Fig. 13)

ORIGIN.—Rocky dry place near Rabaul, New Britain, Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=108$ to 110.

CULMS.—Olive yellow, speckled with red where exposed to sun, scant bloom, and prominent, narrow wax bands; internodes short, cylindrical or bobbin-shaped conoidal with sharp constriction below sheath base, 21 mm. across; bud furrow shallow and long, outer flesh green, large center white and pithy; stem-epidermal pattern 4+5, cork cells short- or long-squarish, some pointed, average width of long cells 7.0μ ; stomates medium-abundant; growth rings green olive, narrow and tumescent; root bands olive, 8 mm. high, cylindrical or slightly depressed or tumescent-conoidal in bud region, with three irregular rows of root primordia; buds small (8 by 7 mm.), flush with stalk or protruding, inserted at or below middle of prophyll, medium wide, tip round-pointed and sometimes notched; prophyll very hairy in region of upper wing, juncture, and sides.

LEAVES.—Leaf sheaths 25 cm. long and very hairy, hairs of lateral patch (group 60) very long and declinate in region of dewlaps; sheath base somewhat saccate occasionally and sectorially fringed (group 59); blades 133 cm. long and 5 cm. broad, villous (group 67), edge of blade somewhat scabrous but with prominent long cilia (group 53) just above dewlaps; midrib small and shallow; dewlaps deltoid-ligulate, dark olive, outer dewlap surface with inconspicuous group 58, inner surface covered with short hair (group 52), corner tufts (group 51) small; inner auricle large, lanceolate, and covered with extremely long white hairs (group 71) that are continuous with the long sheath hairs of group 60; outer auricle deltoid and also hairy (group 70); auricular fringe (group 54) not well defined; ligule crescentiform, 2 mm. high, and inconspicuously fringed (group 61).

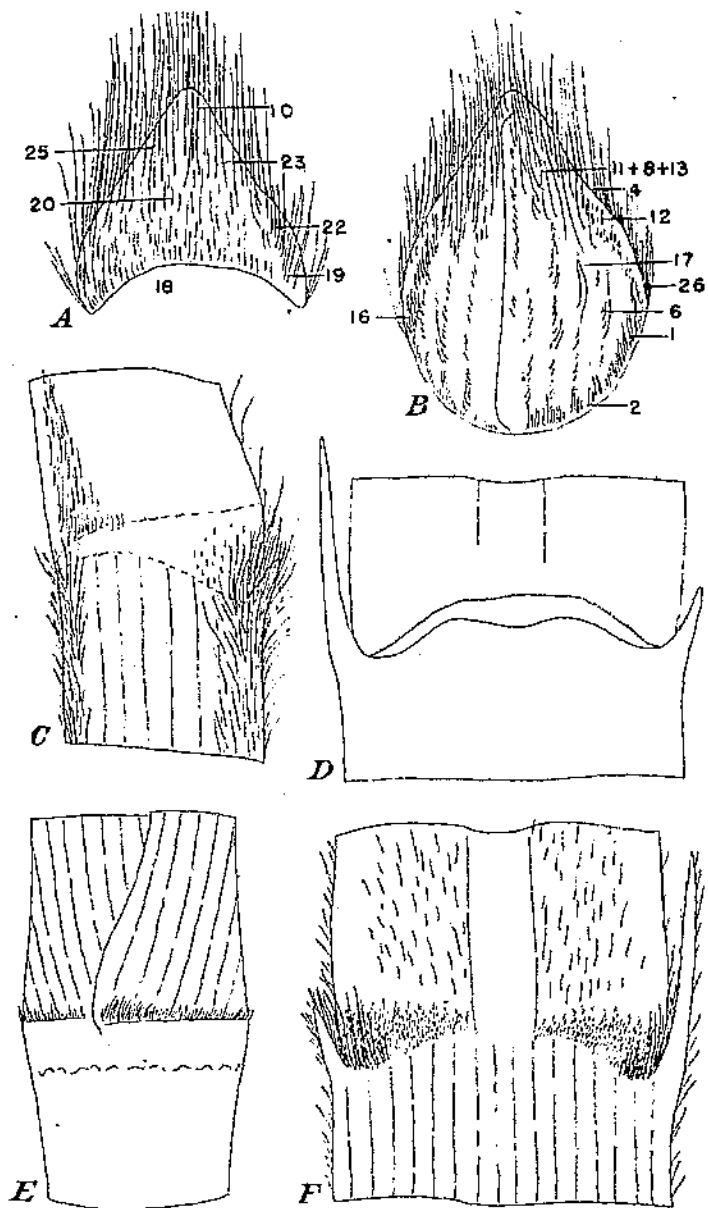


FIGURE 13.—Clone 28 N. G. 230, Imp. 677; *A*, Posterior side of prophyll with hair groups; *B*, anterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

DISTINGUISHING CHARACTERS.—Internodes with prominent, narrow wax bands and long bud furrows; large hairy auricles; shallow inconspicuously fringed ligule; small hairy buds; nearly smooth outer dewlap surface.

CLONE 28 N. G. 290, IMP. 622

(Fig. 14)

ORIGIN.—Rabaul, New Britain, Territory of New Guinea, 1928.

CHROMOSOME NUMBER.— $2n=116$ to 118.

CULMS.—Green or olive yellow to straw-colored, scant bloom, prominent wax bands and irregular corky patches; internodes short, cylindrical, or slightly bobbin-shaped, with sharp depression below sheath base, 16 by 17 mm. across, bud furrow long and shallow, outer flesh green, large center white and pithy; stem-epidermal pattern $5+4$; cork cells short or elongated-squarish, some pointed, average width of long cells 8.3μ ; stomates fairly abundant; growth rings green olive, narrow, and tumescent; root bands ivory green, 6 mm. high, cylindrical or somewhat concave, with three staggered rows of root primordia; buds greenish rose, medium large (9 by 7 mm.), flush with stalk, and extending some distance above growth rings; prophylls ovate-squarish, wing inserted below middle of prophyll, tip round-pointed; pubescence of bud prominent in region of upper wing, juncture, and sides.

LEAVES.—Leaf sheaths 26 cm. long and very hairy, hairs of lateral patches (group 60) very long and declinate just below dewlaps; sheath base straight and not fringed; blades 121 cm. long, 4.6 cm. broad, and hairy (group 67), hairs conspicuous, especially in basal region and along flanges of lower midrib; blade margin only slightly serrate, except just above dewlap region; dewlaps ligulate-deltoid, dark olive; outer dewlap surface densely covered with short hair (group 58), inner surface also covered with short hair (group 52); both auricles very small, deltoid with prominent surface hairs (groups 70 and 71) that are continuous with the long hairs of group 60; ligule shallow (3 mm.), crescentiform, and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—This variety resembles 28 N. G. 289, but lacks groups 59 and 51 and has a more prominent group 58 and much smaller auricles.

CLONE MOLOKAI 4360, IMP. 1005

(Fig. 15)

ORIGIN.—Seed from headwaters of Rainu River (5,500 feet elevation), Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=80$.

CULMS.—Apple green and heavily waxed; internodes short, bobbin-shaped, conoidal with prominent nodal region, 15 mm. across, bud furrow usually wanting and when present, short and shallow; outer flesh green, center white and pithy; stem-epidermal pattern $5+2+3$; cork cells short or medium-long squarish; average width of long cells 6.5μ ; stomates medium abundant; growth rings olive, very tall, tumescent; root bands ivory green, 9 mm. high, obconoidal with three to four rows of root primordia; buds large (11 by 9 mm.), prophylls

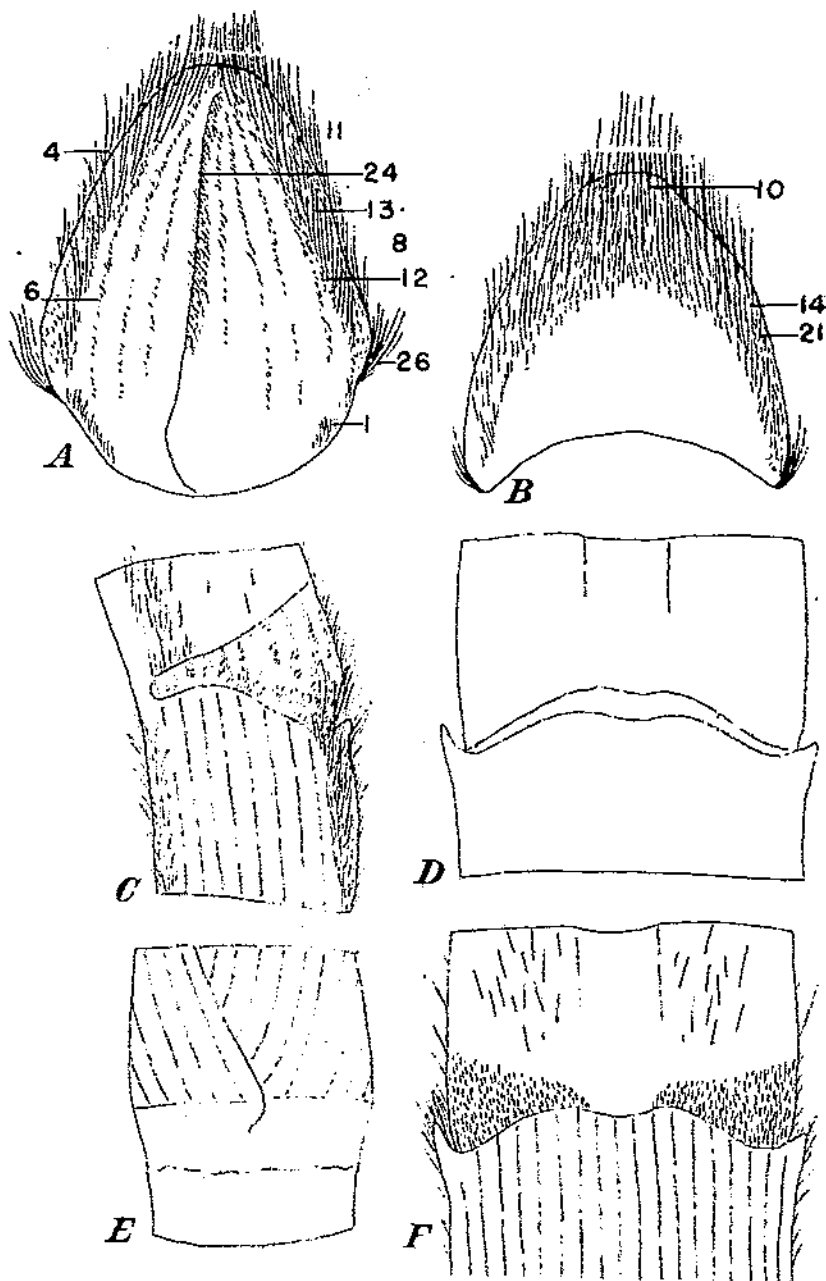


FIGURE 14.—Clone 28 N. G. 290, Imp. 622: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

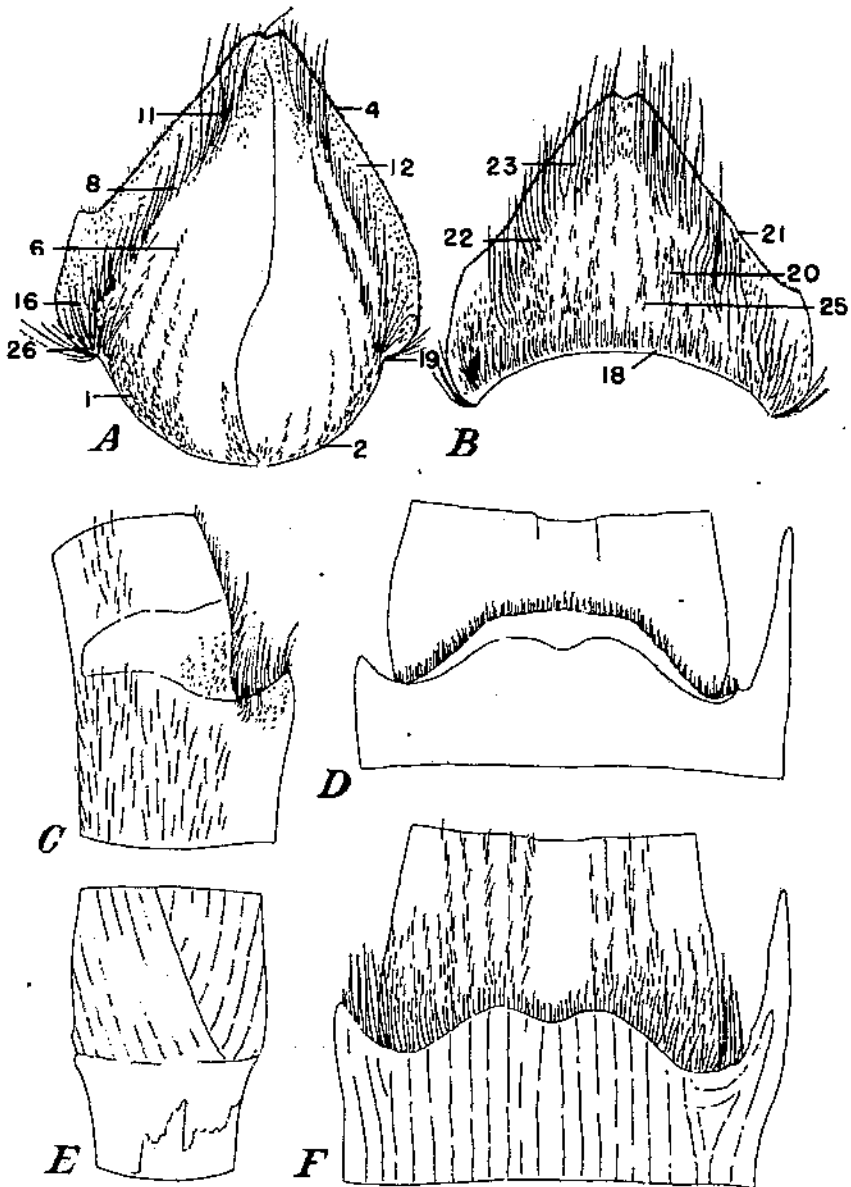


FIGURE 15.—Clone Molokai 4360, Imp. 1005: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

broad-ovate, reddish wing inserted below middle of prophyll or close to base, wing very broad, tip round-pointed; hairs prominent in region of juncture, auricular triangle, and base.

LEAVES.—Leaf sheaths 35 cm. long and very hairy; sheath base straight, occasionally with small sectorial group 59 or 69; blade 160 cm. long and 4.5 cm. broad, hairy (group 67), with hairs restricted to basal region of lamina above dewlaps, edge with medium-prominent serration; midrib medium wide and fairly massive; dewlaps olive, ligulate-deltoid, outer dewlap surface with very inconspicuous pubescence (group 58), inner surface very hairy (groups 51a, 51, and 52), midrib group 55 prominent; inner auricle very long lanceolate but not fringed, outer auricle deltoid and heavily fringed (group 54); ligule crescentiform or arcuate, 3.5 mm. high, with very prominent marginal fringe (group 61).

DISTINGUISHING CHARACTERS.—Swollen nodal region; very tall root bands and growth rings; hairy sheath and blade; inner dewlap surface very hairy, outer surface almost smooth; midrib group 55 prominent; sheath base with small sectorial fringe; very large inner auricle.

CLONE MOLOKAI 4503, IMP. 1006

(Fig. 16)

ORIGIN.—Seed from Markham River (500 feet elevation), Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=80$.

STEMS.—Green, heavy general bloom; internodes bobbin-shaped conoidal, 19 mm. across, bud furrow short and fairly prominent; outer flesh green, large center white and pithy; stem-epidermal pattern 1, cork cells usually short-squarish, a few solitary, average width of long cells 8.2μ ; stomates medium abundant; growth rings light olive, tall, and slightly tumescent; root bands ivory olive, 7 mm. tall, tumescent-obconoidal, with two or two to three rows of root primordia; buds greenish, medium large (10 by 6 mm.); prophylls elongated deltoid, with wing inserted below middle of prophyll or near base; tip sharp-pointed; region of juncture with very long white hairs.

LEAVES.—Leaf sheaths 29 cm. long and covered with long reddish hairs, which are especially prominent in region just below dewlaps; sheath base straight with small sectorial group 69; blades 169 cm. long and 4.5 cm. broad, hairy (group 67), edge serrate, midrib medium wide and fairly shallow; dewlaps ligulate-deltoid, dark olive but reddish when young, outer dewlap surface with inconspicuous groups 58 and 58a, inner surface with medium-prominent group 52, which extends through midrib to form group 55; a few short hairs occasionally ascend midrib to form an inconspicuous group 63; corner tufts (group 51) small; outer auricle small, deltoid, and fringed (group 54), inner auricle large, lanceolate, and not fringed. Hairs of lateral patch (group 60) encroach on base of dewlap and join dewlap fringe (group 54); ligule shallow (3 mm.) crescentiform, and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Very hairy sheath and blade; midrib group 55, inconspicuous group 63; inner auricle large lanceolate; inconspicuous group 69 on sheath base.

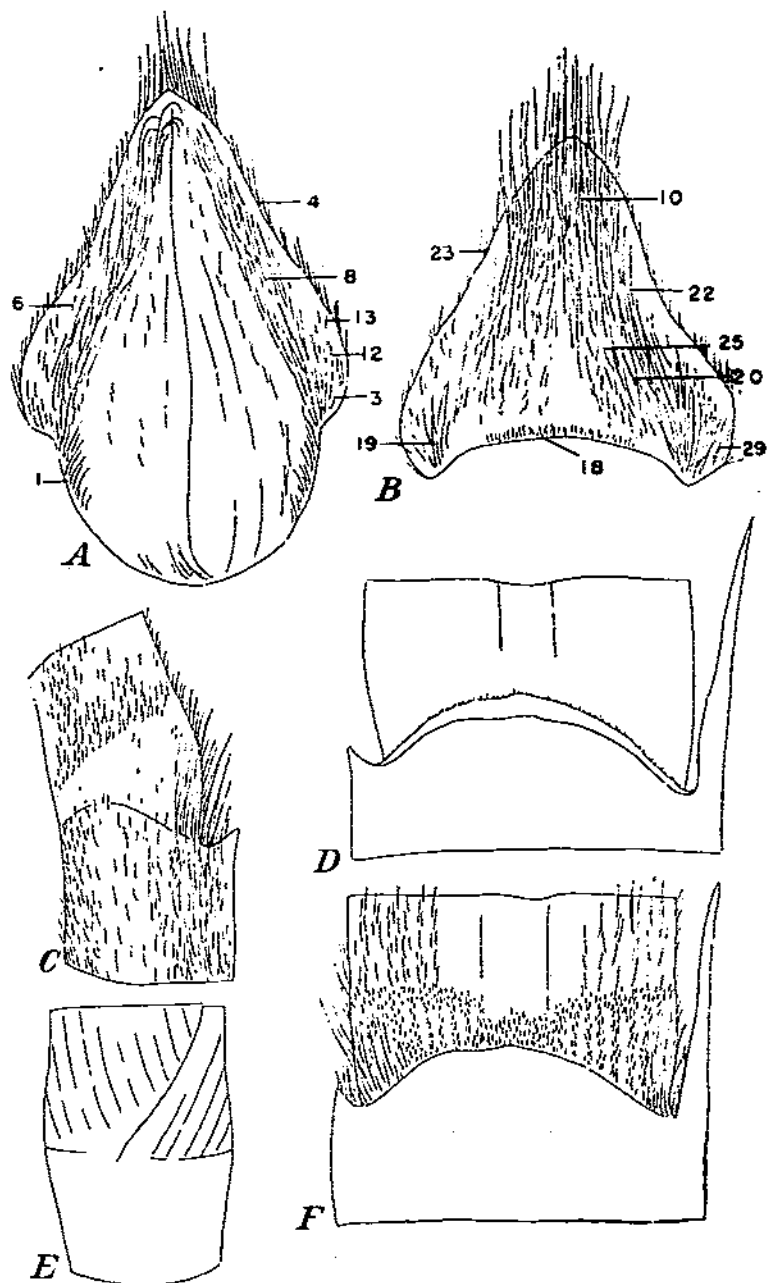


FIGURE 16.—Clone Molokai 4563, Imp. 1006: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of blade joint with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

CLONE MOLOKAI 4575, IMP. 1007

(Fig. 17)

ORIGIN.—Seed from Warangoi River, Gazelle Peninsula, New Britain, Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=90$.

CULMS.—Olive yellow, with medium or scant bloom and prominent wax bands; internodes short cylindrical or slightly bobbin-shaped, depressed below sheath base, 20 mm. across; outer flesh light olive, large center white and pithy, prominent bud furrow; stem-epidermal pattern 2, cork cells short- or medium-long-squarish, a few pointed, average width of long cells 8.1μ ; stomates medium abundant; growth rings rose, medium high, and tumescent; root bands ivory, 7 mm. high, cylindrical with two to three rows of root primordia; buds ivory with rose-colored wing and base regions, medium large (10 by 7), attached high and extending above growth rings; prophylls ovate, wings narrow and indistinctly separated from sides, inserted without distinct auricular set-off below middle of prophyll, apex round-pointed; surface covered with short hairs, except for auricular triangle (groups 16 and 26) where hairs are very long.

LEAVES.—Leaf sheaths 23 cm. long and smooth; blades 116 cm. long and 6 cm. wide; midrib broad and shallow, light olive; dewlaps deltoid-ligulate, bright red when young, olive red later, outer dewlap surface with inconspicuous group 58, inner surface densely covered with short hairs (group 52), which may extend through midrib forming group 55, marginal tufts (group 51) composed of a few long hairs confluent with group 54; outer auricle broad-deltoid or transitional, inner auricle deltoid-calcariform, both auricles fringed (group 54); ligule very shallow (1.5 mm.), crescentiform, with medium fringe (group 61).

DISTINGUISHING CHARACTERS.—Very shallow prominently fringed ligule; group 55 in midrib may be present; dewlaps red when young; very similar to Molokai 4861, Imp. 1010, except for occasional development of group 55, and medium-prominent ligular fringe.

CLONE MOLOKAI 4730, IMP. 1027

ORIGIN.—Seed from Francisco River (10 feet elevation), Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=80$.

CULMS.—Light green or olive, yellow where exposed to sun, covered with prominent discolored bloom; internodes medium long, cylindrical, 19 by 20 mm. across; outer flesh dark green, center ivory green but not white and pithy; stem-epidermal pattern 3, cork cells narrow, squarish-ovate, a few pointed, average width of long cells 6.5μ ; stomates fairly abundant; growth rings olive, medium high, and tumescent; root bands 7 to 8 mm. high, cylindrical or somewhat obconoidal, usually with two rows of root primordia; buds small or medium large (9 by 7 mm.), inserted low and reaching up to growth ring, prophylls ovate-squarish, wing inserted below middle of prophyll, somewhat lobed, tip broad truncate with shallow notch; pubescence concentrated in lower wing, juncture, and auricular triangle.

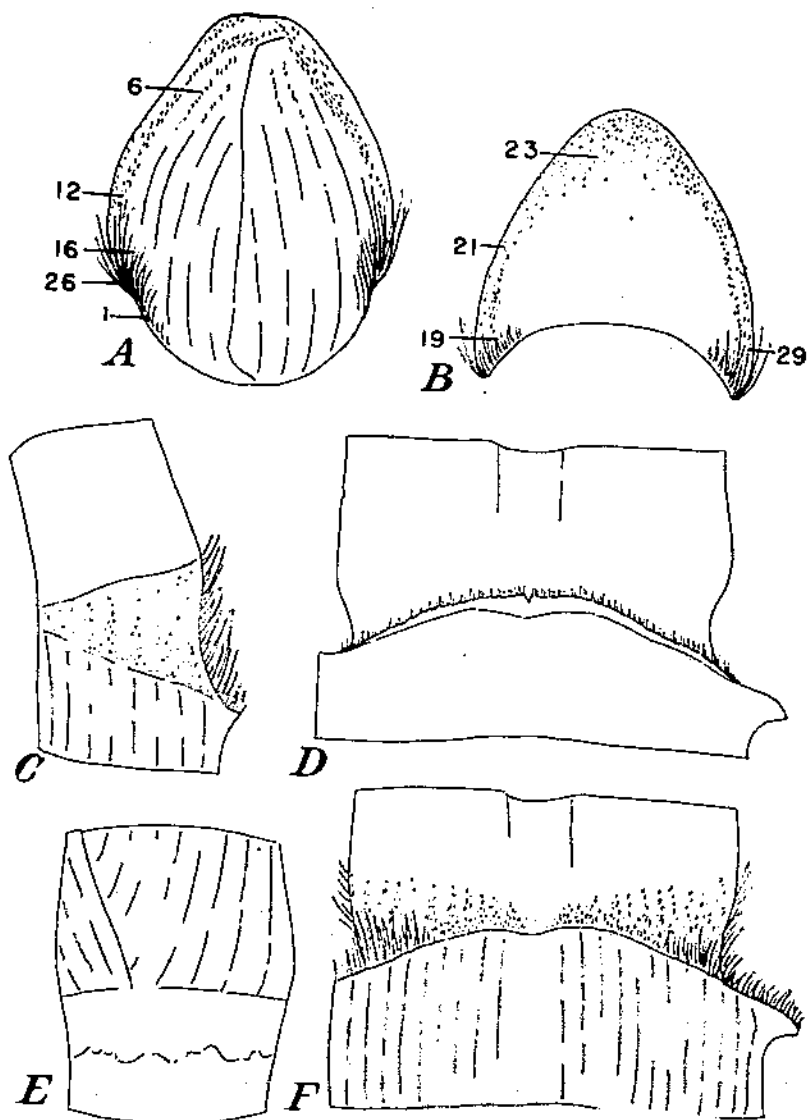


FIGURE 17.—Clone Molokai 4575, Imp. 1007: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

LEAVES.—Leaf sheaths 22 cm. long and hairy; sheath base straight, sectorially or completely fringed (group 59); blades 123 cm. long and 7 cm. broad and hairy (group 67); edge conspicuously serrate; midrib broad and prominent; dewlaps green, ligulate, outer dewlap surface with inconspicuous group 58, inner surface with poorly developed group 52 but medium-prominent corner tufts (group 51), which are continuous with the long marginal fringe of the dewlaps; group 55 inconspicuous, discrete, and not continuous with group 52 and not always present; both auricles very broad and steeply sloping, often terminating in a small deltoid hook, auricular fringe (group 54) prominent; ligule very narrow (1.5 mm.), subarcuate with marginal fringe (group 61), inconspicuous, or medium well-developed.

DISTINGUISHING CHARACTERS.—Hairy sheath and blade; sectorial or complete sheath base fringe (group 59); sporadic occurrence of small and discrete group 55; squarish buds; steeply sloping transitional auricles; narrow inconspicuously fringed ligule with prominent dorsal pubescence (group 66). This variety greatly resembles Molokai 4826, Imp. 1028.

CLONE MOLOKAI 4826, IMP. 1028

ORIGIN.—Seed from Francisco River (10 feet elevation), Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=66$ to 70.

CULMS.—Green or yellow rose, heavily waxed; internodes medium long, somewhat bobbin-shaped with depression below sheath base, 18 by 20 mm. across, prominent bud furrow; outer flesh ivory green, central region very pale green; stem-epidermal pattern 1, average width of long cells 7.3μ ; stomates sparse; growth rings medium high, olive, tumescent; root bands 8 to 9 mm. high, cylindrical, with four rows of root primordia; buds large (12 by 9 mm.); prophylls ovate with red upper juncture and wing regions, wing inserted below middle of prophyll or close to base, tip round-pointed and prominently notched; prophyll smooth except for short hairs in wing region.

LEAVES.—Leaf sheaths 24 cm. long and hairy in dorsal region; sheath base somewhat succate, with small appendage and not fringed; blades 87 cm. long, 5.1 cm. wide at middle and erratically covered with short or medium-long hair (group 67), especially on lower surface; midrib shallow and medium prominent; dewlaps broad-ligulate, olive outlined in red, outer dewlap surface with inconspicuous groups 58 and 58a, inner surface with poorly developed group 52 and small corner tufts (group 51), which are continuous with the marginal fringe of the two broad transitional auricles; midrib group 55 is small and discrete or wanting, not confluent with group 52; ligule arcuate, very shallow (1.5 mm.), and practically without fringe.

DISTINGUISHING CHARACTERS.—Occasional development of discrete midrib group 55; blade slightly villous (group 67); sheath with short hairs; dewlaps almost smooth; auricles of broad transitional type and prominently fringed; very narrow ligule; buds with inconspicuous pubescence.

CLONE MOLOKAI 4861, IMP. 1010

(Fig. 18)

ORIGIN.—Seed from Toriu River, Gazelle Peninsula, New Britain, Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=80$.

CULMS.—Dark green, scant discolored bloom and prominent wax bands; internodes short, somewhat bobbin-shaped with constriction below sheath base. 8 to 20 mm. across, bud furrow short and shallow but fairly conspicuous; flesh green throughout, but center may be white and pithy; stem-epidermal pattern 2, a few cork silica groups usually present, cork cells short-squarish, average width of long cells 8.1μ ; stomates medium abundant; growth rings reddish olive, narrow or medium high, and tumescent; root bands green. 8 mm., obconoidal with three staggered rows of root primordia; buds greenish olive with rose-colored wings, large (12 by 9 mm.), prophylls ovate, with wing inserted below middle of prophyll or close to base, tip round-pointed and notched; wing covered with short brown hairs, groups at base and auricular triangle more prominent.

LEAVES.—Leaf sheaths 25 cm. long and smooth except for a few solitary spines, sheath base straight and not fringed; blade 133 cm. long and 5.8 cm. broad, edge prominently serrate; midrib light olive and medium massive; dewlaps reddish, deltoid-ligulate, outer dewlap surface with inconspicuous group 58, inner surface with short sparse pubescence (group 52) and small corner tufts (group 51); outer auricle deltoid and heavily fringed, inner auricle deltoid-unciform and fringed (group 54); ligule 3 mm. high, crescentiform with flanges extending part way into auricle, ligular fringe inconspicuous (group 61).

DISTINGUISHING CHARACTERS.—Smooth sheath, sheath base, and blade; dewlaps with inconspicuous pubescence, reddish growth rings and dewlaps; inner auricle deltoid or unciform; inconspicuous ligular fringe.

CLONE MOLOKAI 4972, IMP. 1011

(Fig. 19)

ORIGIN.—Seed from Toriu River, Gazelle Peninsula, New Britain, Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=80$.

CULMS.—Olive green, but yellow where exposed to sun, scant sooty bloom and prominent wax bands not well delimited basally; internodes slightly bobbin-shaped, with sharp constriction below sheath base, 25 mm. across, prominent bud furrow; flesh greenish throughout or slightly pithy in very center; stem-epidermal pattern 2+3+6, cork cells short- or long-squarish, occasionally pointed, in groups of two, three, or more, average width of long cells 9.1μ ; stomates medium abundant; growth rings greenish olive, narrow, and slightly tumescent; root bands ivory olive, 7 mm. high, with two to three rows of root primordia; buds very large (15 by 9 mm.), prophylls elongate-deltoid with wing attached near base of prophyll; tip round-pointed; entire prophyll very hairy, but pubescence most prominent in wing region.

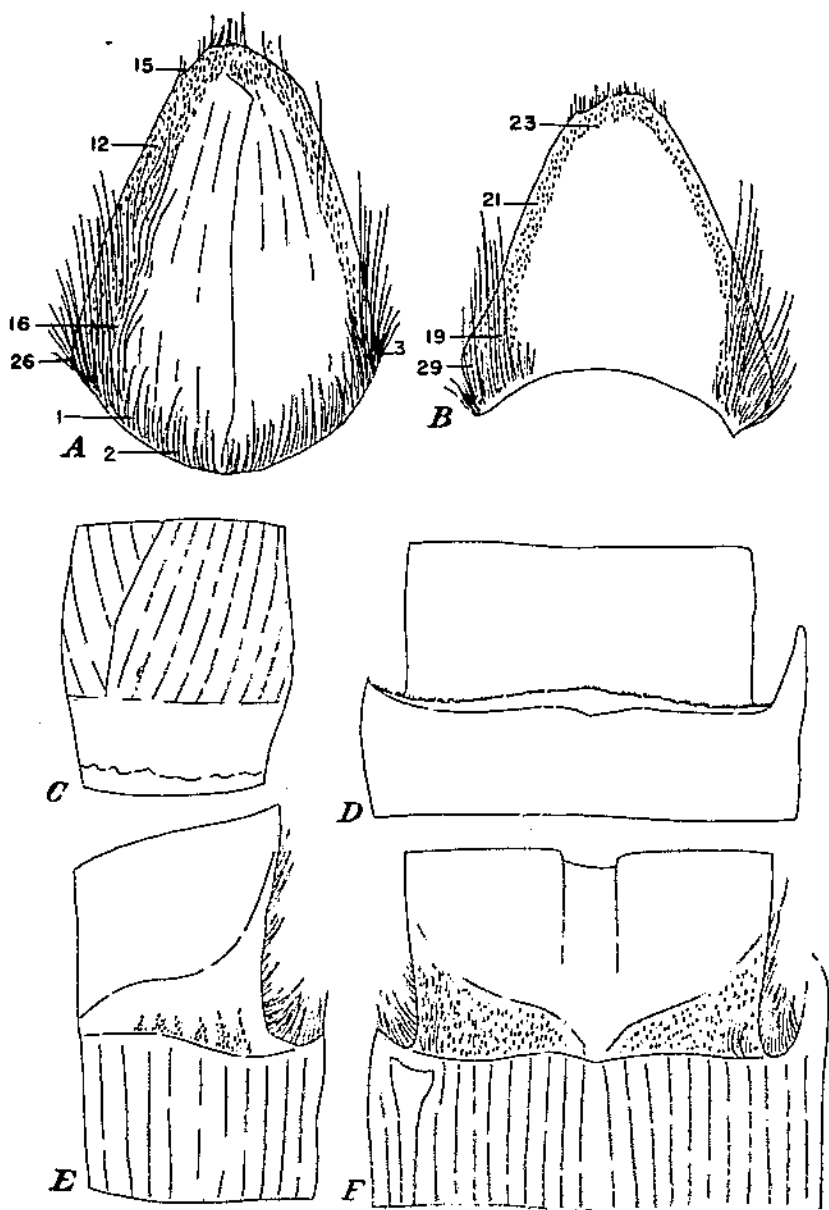


FIGURE 18.—Clone Molokai 4861, Imp. 1010: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, sheath base with adjoining internode and sheath parts; *D*, inner surface of blade joint with ligule; *E*, internal view of outer surface of dewlap with adjoining sheath and blade parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

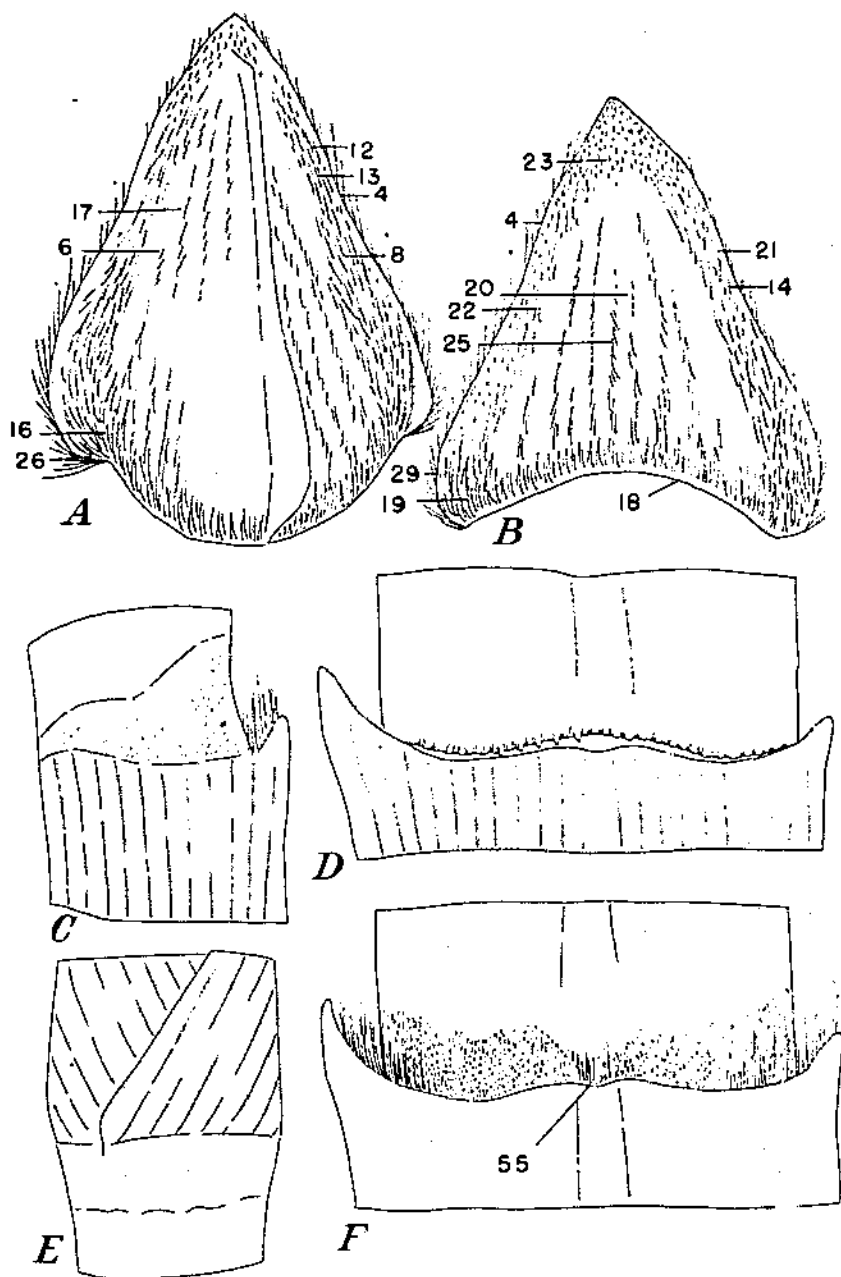


FIGURE 19.—Clone Molokai 4972, Imp. 1911: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

LEAVES.—Leaf sheaths 26 cm. long and smooth, though occasionally young sheath may have a few solitary spines in dorsal sheath region, sheath base straight and not fringed; blades 130 cm. long and 5.5 cm. broad; midrib medium broad and massive; dewlaps broad ligulate, olive; outer dewlap surface with inconspicuous group 58, inner surface covered with short hairs (group 52), corner tufts (group 51) small, but hairs may extend inward for a short or longer distance; outer auricle deltoid or blunt-lanceolate and heavily fringed (group 54), inner auricle large lanceolate but only partly fringed; ligule 2.5 mm. high, crescentiform, inconspicuously fringed (group 61), and with row of long slightly aduate hair near base (group 66).

DISTINGUISHING CHARACTERS.—Smooth sheath blade and sheath joint; sporadic occurrence of solitary spines on young sheaths; more or less smooth outer dewlap surface; large auricles; large buds.

CLONE MOLOKAI 5099, IMP. 1012

(Fig. 20)

ORIGIN.—Seed from Rabaul, Gazelle Peninsula, New Britain, Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=100$.

CULMS.—Green olive, reddish-brown splotches where exposed to sun, scant bloom, and prominent wax bands; internodes short, cylindrical or slightly bobbin-shaped, with greatest diameter in region of growth ring, 20 by 21 mm. across; bud furrow prominent; outer flesh green, large center white and pithy; stem-epidermal pattern 4+3, cork cells short or elongated-squarish or pointed, long cells very irregular, often with pointed ends, average width of long cells 7μ ; stomates not observed; growth rings reddish, narrow, and usually flush; root bands very narrow (5 mm.) and cylindrical, with two to three irregular rows of small root primordia; buds somewhat reddish, medium large (10 by 8 mm.), prophylls broad-ovate with wing inserted at or slightly below middle of prophyll; tip round-pointed but very hairy.

LEAVES.—Leaf sheath 27 cm. long and hairy, with hairs prominent, especially just below dewlaps where they become continuous with those of group 54; sheath base somewhat saecate and not fringed; blades 147 cm. long and 5 cm. broad, edge smooth; midrib broad and fairly shallow; dewlaps broad-ligulate, red, outer surface with sparse pubescence (group 58), inner surface with a very prominent group 52, which may extend sparingly into midrib to form a small group 55, corner tufts (group 51) small and continuous, with long hairs on outer dewlap margin; outer auricle short-deltaid and prominently fringed (group 54), inner auricle deltoid with ununiform extension, the latter not fringed; ligule 3 mm. high, crescentiform, with inconspicuous fringe (group 61).

DISTINGUISHING CHARACTERS.—Prominent wax bands and long bud furrows; very narrow root band, fairly large ovate bands; sheath pubescence especially prominent below dewlaps; group 55 inconspicuous or wanting, very narrow root band. This variety greatly resembles N. H. 1, Imp. 933.

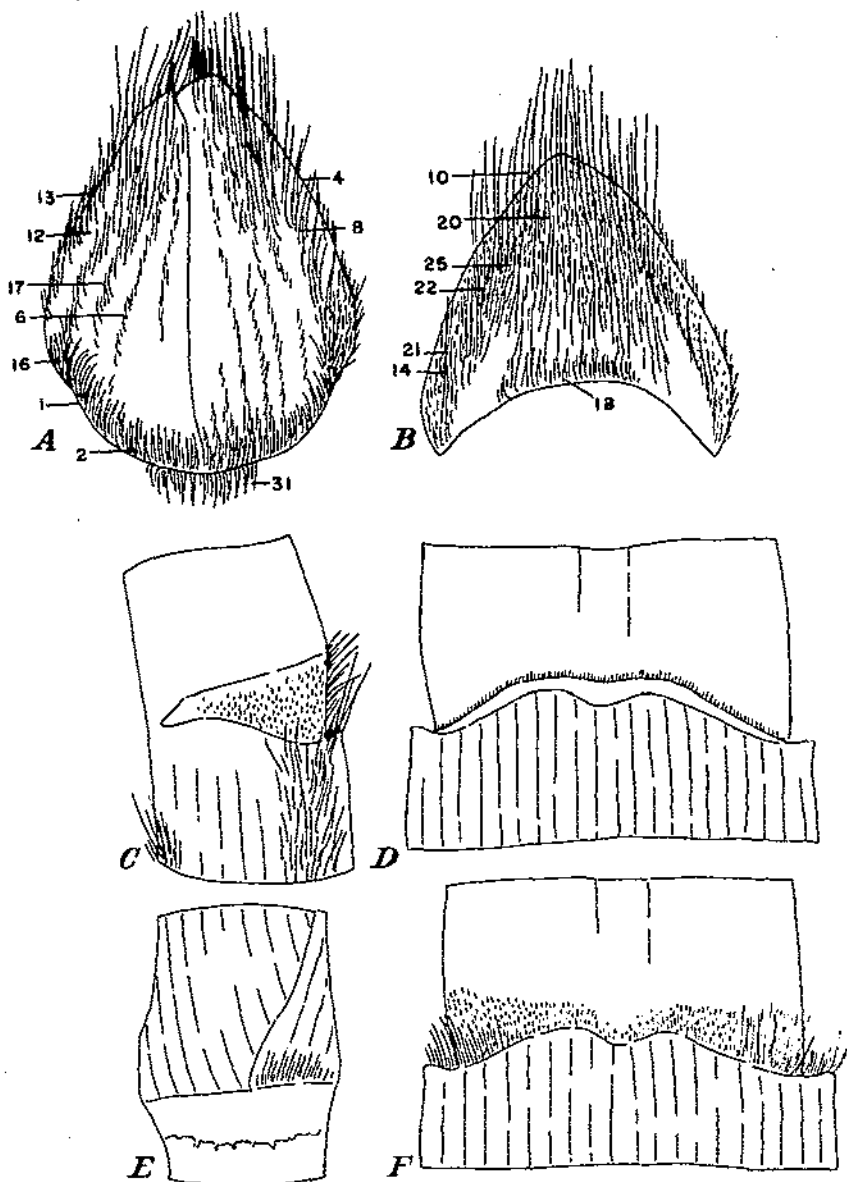


FIGURE 20.—Clone Motokai 5000, Imp. 1012: *A*, Anterior side of propyll with hair groups; *B*, posterior side of propyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

CLONE MOLOKAI 5498, IMP. 1014

(Fig. 21)

ORIGIN.—Seed from Bulolo River (2,000 feet elevation), Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=80$.

CULMS.—Yellow green, scant discolored bloom, broad but poorly defined wax bands; internodes bobbin-shaped, 12 mm. across, bud furrow well developed or wanting; outer flesh green, center white and pithy; stem-epidermal pattern 2+3, cork cells short or medium long-squarish, a few pointed, average width of long cells 7.8μ ; stomates medium abundant; growth rings narrow or medium wide and tumescent; root bands 9 mm. high, tumescent-obconoidal, with three rows of large root primordia; buds large (10 by 7 mm.), extending above growth ring; prophyll ovate, wing inserted below middle of prophyll, tip acute or round-pointed; pubescence prominent in wing and basal region.

LEAVES.—Leaf sheaths 30 to 35 cm. long and very hairy; sheath base straight and sectorially fringed (group 69), blades 180 cm. long, 4.5 cm. broad, and densely pubescent (group 67), midrib white and fairly massive; dewlaps dark olive, deltoid-ligulate; outer dewlap surface sparsely pubescent (group 58), inner surface with prominent group 52 and small corner tufts (group 51), midrib group 55 prominent, but group 63 is formed by the upward extension of some short hairs in midrib, inconspicuous; outer auricle broad-transitional and heavily fringed, inner auricle lanceolate and also fringed; ligule subarcuate, 2.5 mm. high, with inconspicuous marginal fringe (group 61).

DISTINGUISHING CHARACTERS.—Hairy sheath and blade; sheath base with sectorial group 69; prominent root band with three rows of primordia, midrib groups 55 and 63.

CLONE MOLOKAI 5549, IMP. 1030

ORIGIN.—Seed from plateau (5,500 feet elevation) at headwaters of the Purari River, Territory of New Guinea, 1937.

CHROMOSOME NUMBER.— $2n=60$.

CULMS.—Dark green or olive, brownish where exposed to sun, scant discolored bloom, and prominent narrow wax bands; internodes long, slightly bobbin-shaped, and thickest in region of growth ring, strongly depressed below sheath base, 16 to 17 mm. across; bud furrow long and shallow; outer flesh green, center white and pithy; stem-epidermal pattern 5+3, most cork cells medium long-squarish, a few short-pointed, average width of long cells 7.7μ ; stomates scarce; growth rings green, narrow, and somewhat tumescent; root bands 9 mm. high, tumescent-obconoidal with two or two to three rows of sparse root primordia; buds green with red wings, very large; prophylls ovate, wing inserted without distinct auricular set-off near base of prophyll, tip round-pointed and notched; prominent hair groups at juncture and base.

LEAVES.—Leaf sheaths 30 cm. long and very hairy, with hairs extending from sheath base to dewlaps where they are especially long and declinate; sheath base straight and very prominently fringed (groups 59 and 69); in center of wax band in juxtaposition with group

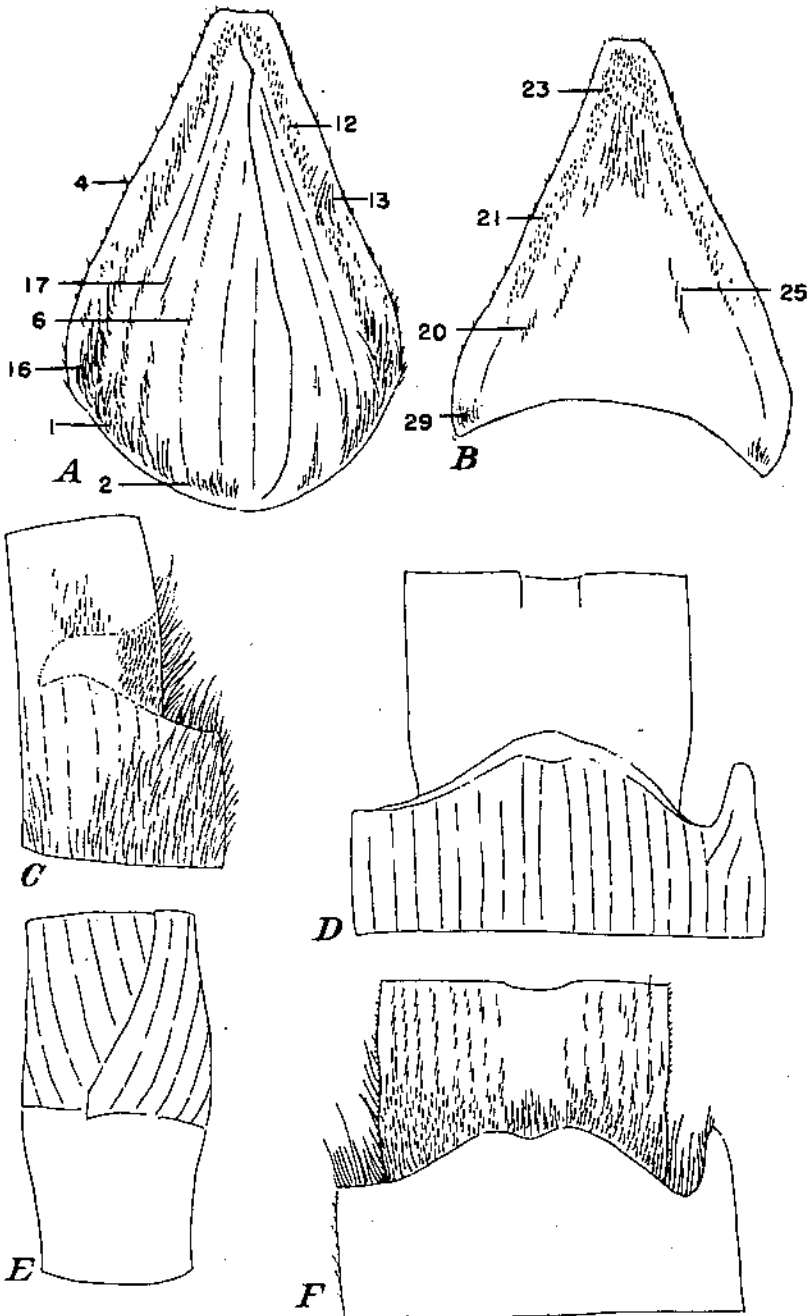


FIGURE 21.—Clone Molokai 540S, Imp. 1014: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

69 there is an additional small hair group and though not always present it has not been observed in any other variety; blades 120 cm. long, 3.5 cm. broad, and hairy (group 67), hairs most prominent in basal region just above dewlaps and along flanges of midrib; dewlaps green, broad-ligulate, outer surface with medium-prominent group 58 and inconspicuous group 58a, inner dewlap surface with dense group 52 and 51a, which extend into midrib forming group 53; outer auricle transitional-deltoid and conspicuously fringed (group 54), inner auricle unciform or lanceolate and fringed, corner tufts formed by upward-extending sheath hairs of group 60, the marginal hairs of the dewlaps, and the auricular fringe (group 54); ligule crescentiform, 2.5 mm. high, with very prominent fringe (group 61).

DISTINGUISHING CHARACTERS.—Groups 59 and 60 with special wax band groups in juxtaposition with group 69; blade group 67 encroaching on upper dewlap margin; tall root bands; very hairy sheath.

CLONE N. H. 1. IMP. 933

(Fig. 22)

ORIGIN.—Imera, Efate, New Hebrides, 1936.

CHROMOSOME NUMBER.— $2n=80$.

STEMS.—Reddish or tan with scant bloom and prominent wax bands, swollen nodal region; internodes long, bobbin-shaped or somewhat conoidal with sharp depression below sheath base, 18 mm. across, prominent long or medium-long bud furrow; outer flesh green, large center white and pithy; stem-epidermal pattern 3+6, cork cells rhomboid, short, or long-squarish, a few short-pointed, average width of long cells 8.3μ ; stomates medium abundant; growth rings red purple, medium high, and tumescent; root bands reddish, tall (9 mm.), obconoidal-tumescent, with two to three rows (basal internodes with three to four rows) of root primordia; buds reddish brown, fairly large (11 by 7 mm.), and extending a considerable distance above growth rings, prophylls broad-ovate with reddish wing (in young organs) inserted below middle of prophyll, tip round-pointed, wing and base very hairy.

LEAVES.—Leaf sheaths 29 cm. long and hairy; sheath base somewhat saccate in bud region, not fringed or with inconspicuous sectorial group 59; blades 147 cm. long and 5.8 cm. broad, margin inconspicuously serrate except in dewlap region; midrib broad and shallow; dewlaps at first dark red, later olive, broad-ligulate, outer dewlap surface covered with short hairs (group 58), which become somewhat longer in marginal zone forming an inconspicuous group 58a, inner surface with prominent group 52, which extends sparingly into midrib, forming an inconspicuous group 53, corner tufts (group 51) medium prominent; outer auricle transitional or small-deltoid and prominently fringed (group 54), inner auricle falcate or unciform with upper part only sparingly fringed; ligule very shallow (2 mm.), crescentiform, and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Swollen nodes and tall obconoidal root bands; prominent wax bands and bud furrows; red growth rings and red dewlaps (in young organs); small group 55, which, however, is often wanting.

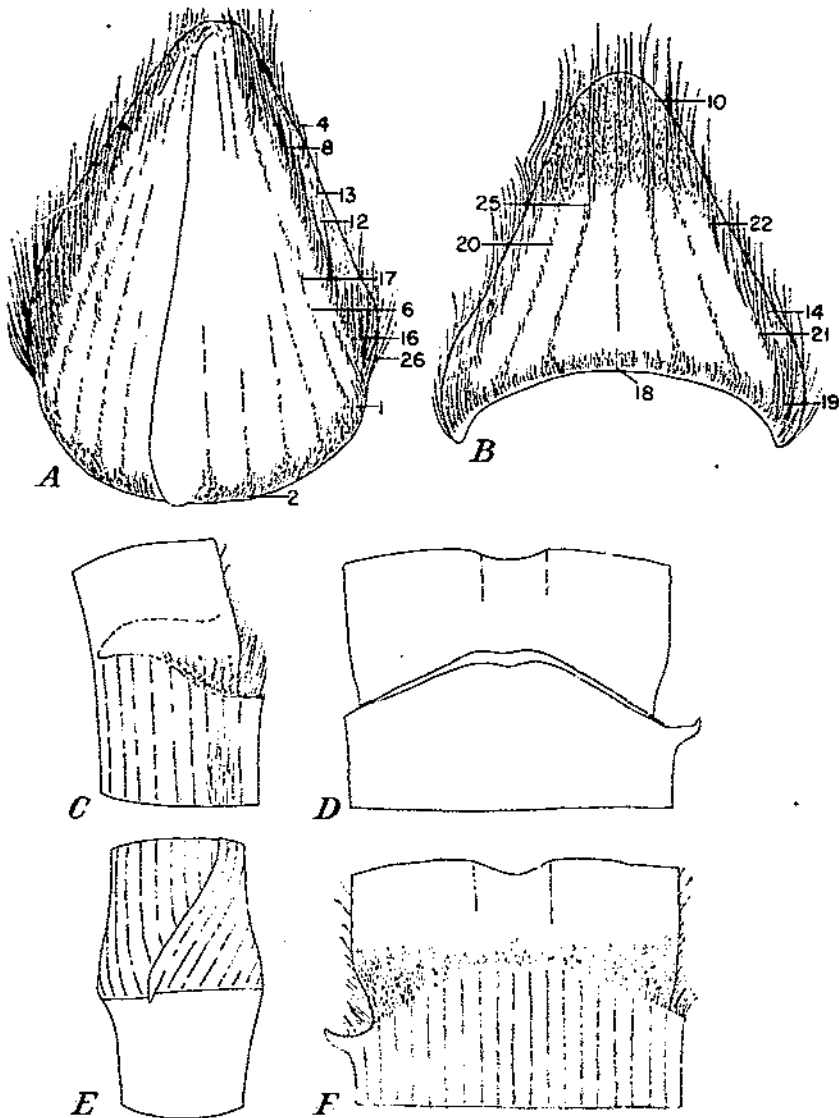


FIGURE 22.—Clone N. H. 1, Imp. 933: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

CLONE DURUKA COQECOQE, IMP. 1020

(Fig. 23)

ORIGIN.—Imported from Nausori, Fiji, in 1940.

CHROMOSOME NUMBER.— $2n=80$.

CULMS.—Olive red with scant bloom and generally prominent wax bands; internodes slightly bobbin-shaped, 17 mm. across, long but

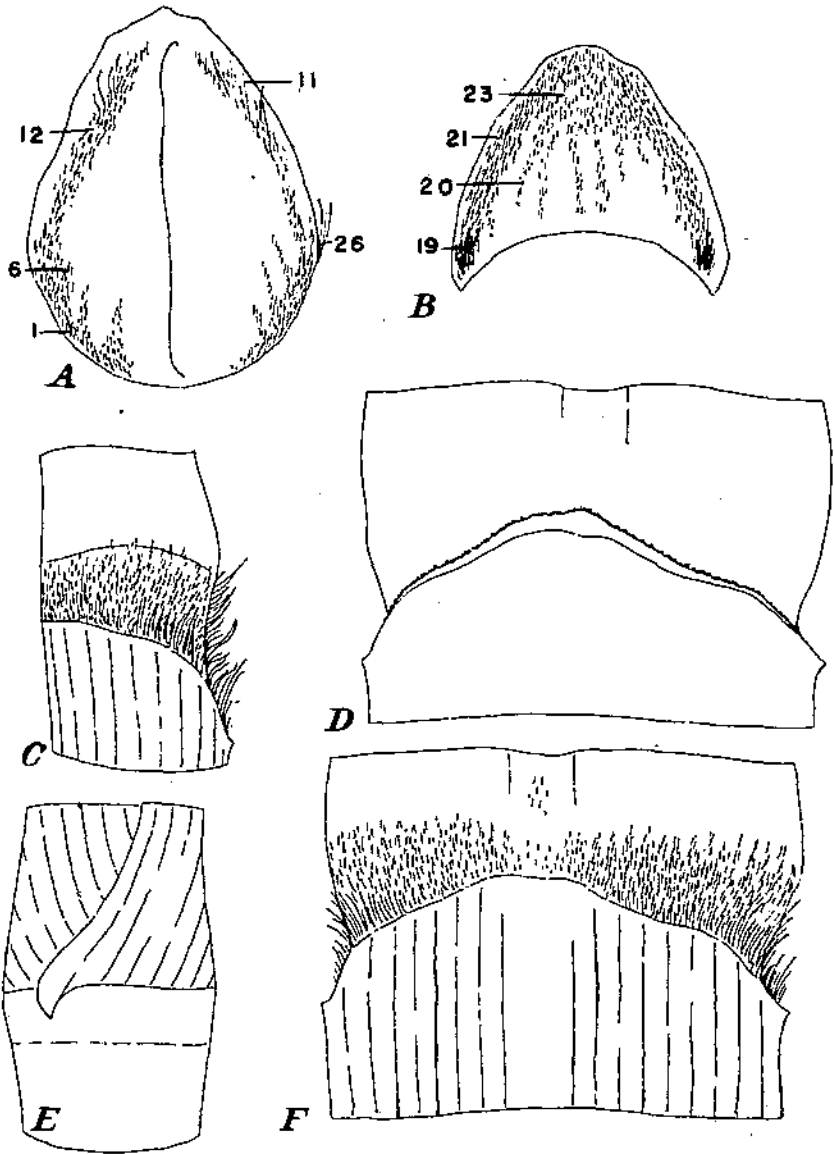


FIGURE 23.—Clone Duruka Coquecoque, Imp. 1020: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

inconspicuous bud furrow; outer flesh olive green, large central region white and pithy; stem-epidermal pattern 2+3+5, cork cells short or long-squarish, some pointed, average width of long cells 6.5μ , stomates fairly abundant; growth rings green, tall, and tumescent; root bands rose ivory, 5 mm. tall, tumescent-obconoidal with two rows of small and sparse root primordia; buds small (7 by 5 mm.), inserted low and reaching up to growth ring, prophylls ovate, wing inserted at middle of prophyll, tip round-pointed; pubescence prominent in wing region.

LEAVES.—Leaf sheaths 23 cm. long and smooth; sheath base straight but overlying sheath margin, appendaged; blades 125 cm. long and 4.6 cm. broad; midrib broad and shallow; dewlaps ligulate-squarish, outlined in red when young, later dark olive; outer dewlap surface covered with short hair (group 58), inner surface also densely pubescent (group 52), marginal tufts (group 51) not well defined, usually hairs extend in a single line toward midrib, upper midrib group 63 small but usually present; outer auricle transitional and steeply sloping, terminating in a small deltoid lobe, edge prominently fringed (group 54), the hairs continuous with the long marginal hairs of the dewlap, inner auricle also steeply sloping and transitional but terminating in a more pronounced calcariform hook; ligule narrow (3 mm.), crescentiform with flanges terminating before reaching auricular zone, flanges of ligule deeply scalloped with flanges medium and central region inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Thin cane with smooth sheath; small buds; short ligular fringe; extension of group 51 as a single line toward midrib; upper midrib group 63.

CLONE DURUKA MEMANU, IMP. 1021

(Fig. 24)

ORIGINS.—Imported from Nausori, Fiji, in 1940.

CHROMOSOME NUMBER.— $2n=80$.

STEMS.—Olive green, scant bloom, and prominent wax bands; internodes short, bobbin-shaped, 23 mm. across, prominent bud furrow, outer flesh green, medium-large central zone white and pithy; stem-epidermal pattern 5+3, cork cells short-squarish, a few elongated, occasionally pointed, solitary silica cells relatively numerous, average width of long cells 7μ ; stomates medium abundant; growth rings greenish, narrow, and flush; root bands ivory rose, narrow (5 mm.), with two to three rows of small root primordia; buds greenish and edged in rose, large (12 by 6 mm.); prophylls elongate-ovate, with narrow wing inserted below middle of prophyll or near base; tip round-pointed; wing and juncture region covered with short hair.

LEAVES.—Leaf sheaths 25 cm. long and smooth; sheath base with very prominent appendage; blades 119 cm. long and 6 cm. broad, edge more or less smooth; midrib shallow and reddish; dewlaps squarish, green, outlined in red when young, outer dewlap surface prominently hairy (groups 58 and 58a), inner surface densely covered with short hairs (group 52), which are longer and more prominent in outer marginal region, corner tufts (group 51) small, but hair may extend inward for a short or longer distance; outer auricle broad-transitional and very sloping; inner auricle also broad-transitional with a secondary

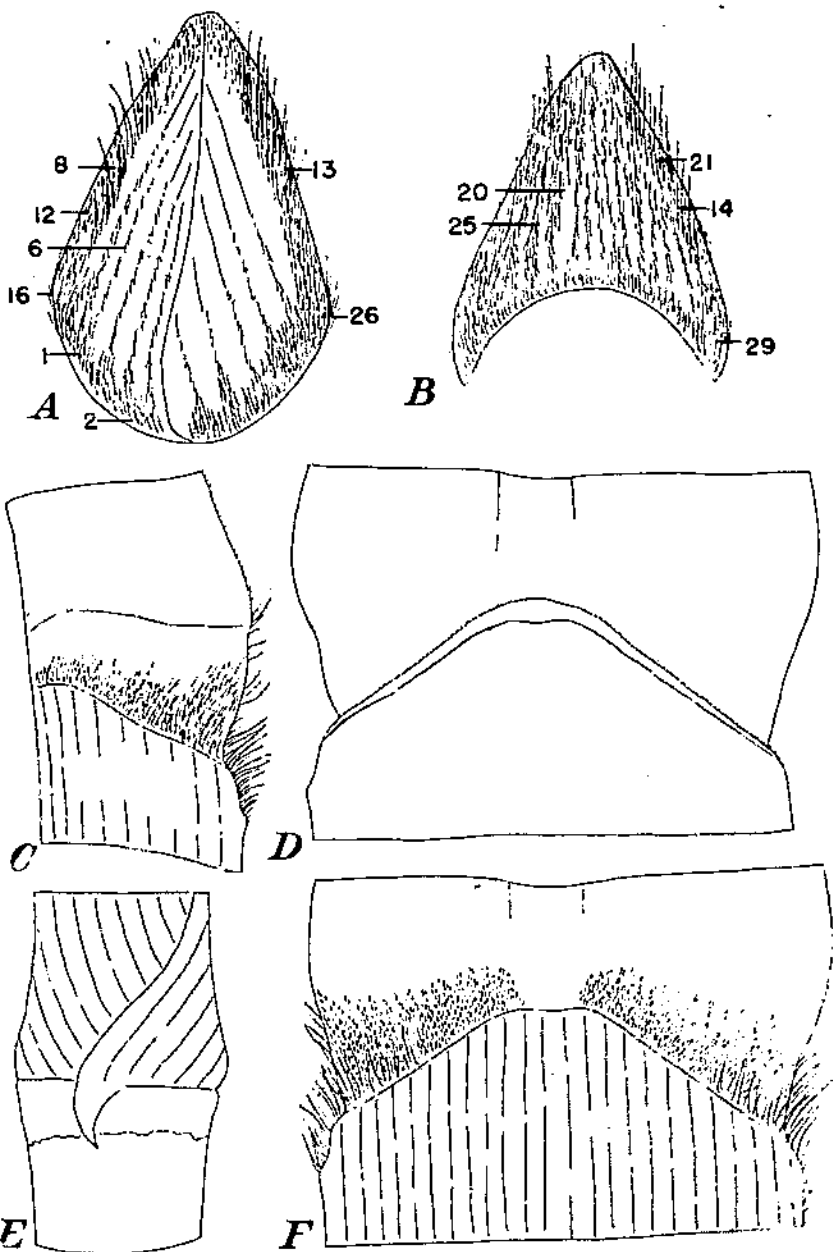


FIGURE 24.—Clona Duruka Memann, Imp. 1021: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

slope 1.5 cm. long, terminating in a small deltoid lobe; both auricles prominently fringed (group 54); ligule narrow (2.5 cm.), crescentiform, and inconspicuously fringed.

DISTINGUISHING CHARACTERS.—Reddish midrib; sheath base with prominent appendage; sloping transitional auricles; narrow inconspicuously fringed ligules; hairy dewlaps; prominent bud furrow and wax bands.

CLONE DURUKA VICO DAMU, IMP. 1018

(Fig. 25)

ORIGIN.—Imported from Nausori, Fiji, in 1940.

CHROMOSOME NUMBER.— $2n=100$.

STALKS.—Dark red or purple, prominent wax bands in young internodes; internodes short, cylindrical, or slightly conoidal, with sharp depression below sheath base, 16 by 18 mm. across, bud furrow prominent or wanting, outer flesh dark green, large central region white and pithy; stem-epidermal pattern 4, cork cells short or long-squarish or pointed, solitary or in multiples, average width of long cells, 7.7μ ; stomates few; growth rings yellow green, later red, medium high, and tumescent; root bands 7 to 8 mm. high, red, with two to three rows of sparse regular root primordia; buds reddish, medium large (9 by 7 mm.), prophylls elongate-ovate, with wing inserted below middle of prophyll, tip acute or round-pointed, often notched; prophylls generally hairy, but with hairs especially prominent in basal and wing region.

LEAVES.—Leaf sheaths 25 cm. long and very hairy; blades 125 cm. long and 4.5 cm. broad, edge serrate; midrib rather narrow and medium massive; dewlaps broad-ligulate, green or dark olive; outer dewlap surface with inconspicuous group 58, inner surface covered with dense medium-long hair (group 52) (the hairs are longer than those normally constituting group 52 and in the youngest dewlap there is a distinct group 51a overlying group 52), corner tufts (group 51) medium prominent, midrib group 55 prominent and composed of rather long hair; group 63 may be present or wanting, but never prominent; outer auricle deltoid and partly fringed (group 54), inner auricle lanceolate or unciform and basally fringed; ligule very tall (6 mm.), semiround, with prominent marginal fringe (group 61).

DISTINGUISHING CHARACTERS.—Red stalk with large pithy center; very tall ligule; prominent pubescence on inner dewlap surface (groups 52, 51, 51a, 55, and occasionally group 63); hairy sheath and bud.

CLONE DURUKA VICO TEINILOKA, IMP. 1019

(Fig. 26)

ORIGIN.—Imported from Nausori, Fiji, in 1940.

CHROMOSOME NUMBER.— $2n=50$.

STALKS.—Dark purple, scant bloom, and prominent wax bands; internodes slightly bobbin-shaped with depression below sheath base, 18 mm. across, outer flesh green olive, large central region white and pithy; stem-epidermal pattern 3+4, cork cells short or long-squarish, some short or long-pointed, solitary or in multiples, average width of long cells 7.9μ ; stomates medium abundant, growth rings at first

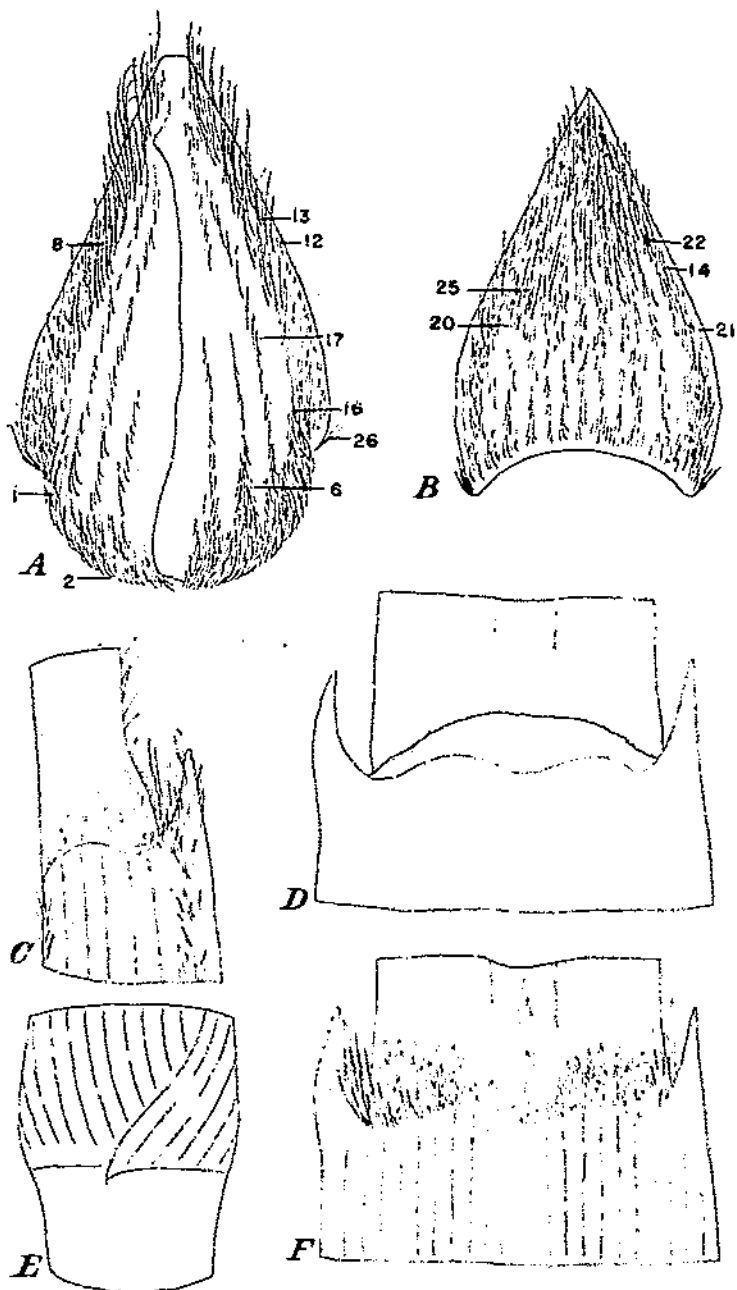


FIGURE 25.—Clupea duruka Vieo Damu, Imp. 1018: A, Anterior side of prophyll with hair groups; B, posterior side of prophyll with hair groups; C, lateral view of outer surface of dewlap with adjoining sheath and blade parts; D, inner surface of blade joint with ligule; E, sheath base with adjoining internode and sheath parts; and F, inner surface of blade joint with ligule removed to show hair groups.

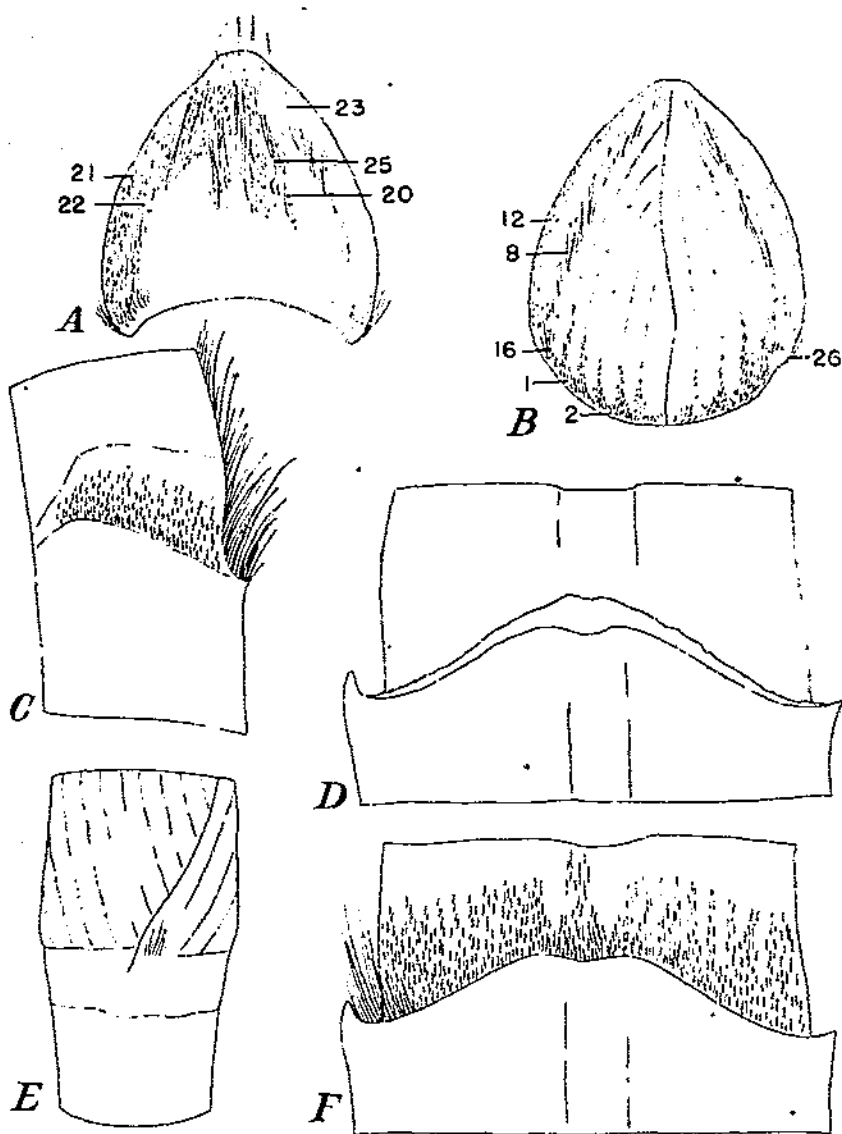


FIGURE 26.—Clome Duruka Vico Teinloka, Imp. 1619: *A*, Posterior side of prophyll with hair groups; *B*, anterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

greenish, later red, narrow, and slightly tumescent; root bands red, 6 to 8 mm. high, cylindrical or locally obconoidal with two to three rows of root primordia; buds dark red, large (12 by 8 mm.), prophylls broad-ovate with wing inserted at middle of prophyll, tip round-pointed; pubescence most conspicuous in auricular triangle and upper juncture.

LEAVES.—Leaf sheaths 29 cm. long and somewhat hairy; sheath base with small sectorial group 59; blades 143 cm. long and 5.5 cm. broad, edge with medium-prominent serration, midrib broad, shallow, light purple; dewlaps olive purple, squarish, outer dewlap surface densely covered with short hair (group 58), inner surface also densely hairy with all groups (52, 51, 51a, and midrib group 55) equally well developed; some short or semilong hair ascend midrib for short distance to form an inconspicuous group 63; outer dewlap margin fringed with very long hair; inner auricle deltoid and fringed, outer auricle broad transitional and also fringed (group 54) (outer auricle is really a part of dewlap with marginal dewlap fringe continuing the auricular curve); ligule crescentiform, tall (4 mm.), and extending with its flanges to outer margin of outer auricle and part way into inner auricle, marginal fringe (group 61) formed by medium-long sparse hairs.

DISTINGUISHING CHARACTERS.—Stem with red buds and dewlaps; leaf sheaths and midrib light purple; small sectorial group 59; very prominent midrib group 55, whose rather long hairs extend upward to form group 63.

CLONE DURUKA VICO VULA, IMP. 1017

(Fig. 27)

ORIGIN.—Imported from Nausori, Fiji, in 1940.

CHROMOSOME NUMBER.— $2n=80$.

STEMS.—Ivory green, with scant bloom and prominent wax bands; internodes slightly bobbin-shaped with depression below sheath base, 12 by 13 mm. across, bud furrow medium long and inconspicuous; outer flesh green, large central region white and pithy; stem-epidermal pattern 2+3+4, cork cells short or medium long-squarish, some pointed, solitary or in multiples, average width of long cells 9.4μ ; stomates medium abundant; growth rings light olive, tall, and tumescent; root bands olive green, 6 to 7 mm. high, cylindrical, with two rows of sparse root primordia; buds with bright-red tips when young, medium large (9 by 6 mm.), and extending above growth ring; prophylls elongate-ovate, with wing inserted below middle of prophyll, tip acute or round-pointed, long hairs, especially in upper juncture region.

LEAVES.—Leaf sheaths 29 cm. long and hairy; sheath base straight and sectorially fringed (groups 59 and 60); blades 124 cm. long and 4 cm. broad, occasionally slightly pubescent (group 67), wide shallow midrib; dewlaps ligulate-deltoid, outer dewlap surface sparingly hairy (group 58), inner surface densely pubescent (groups 52 and 51a), corner tufts (group 51) small, but midrib group 55 prominent; some short hairs ascend midrib for short distance forming an inconspicuous group 63; both auricles small and deltoid, inner one occasionally with long surface hairs (group 71); ligule tall (4 mm.), crescentiform, and projecting with rather broad flanges into auricular zone, ligular fringe (group 61) inconspicuous.

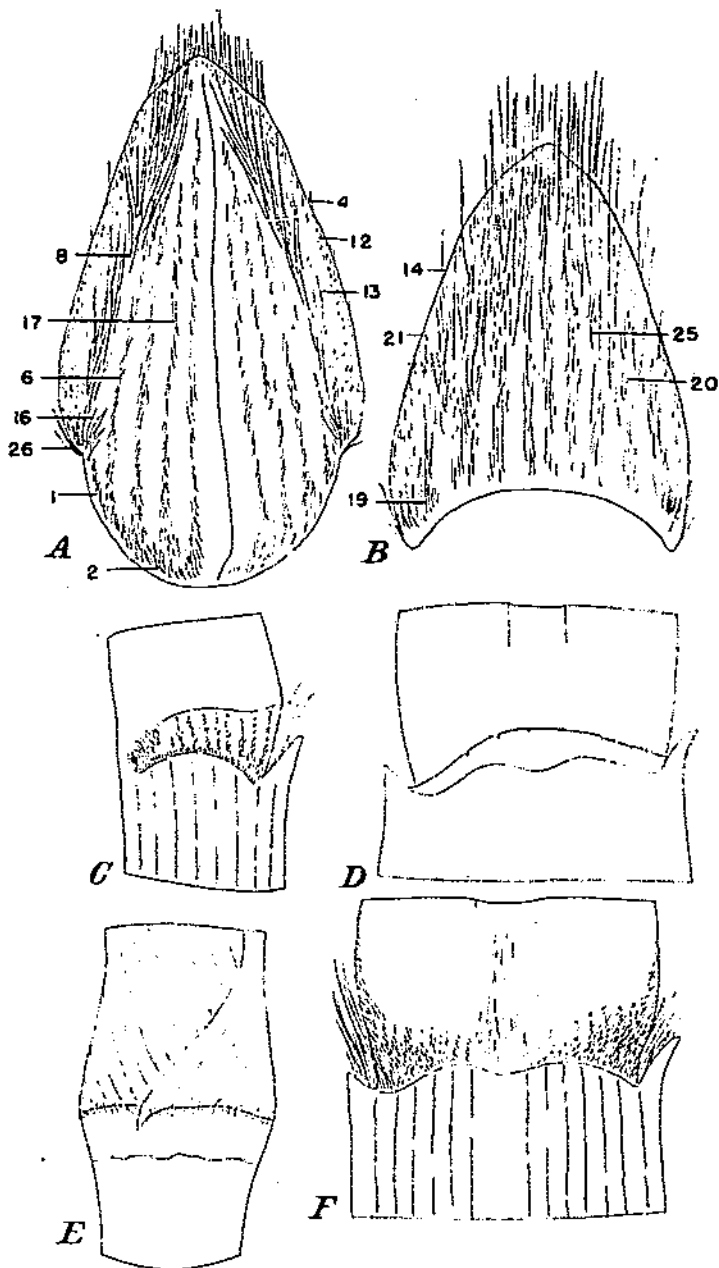


FIGURE 27.—Clone Duruka Vico Vula, Imp. 1017: A, Anterior side of prophyll with hair groups; B, posterior side of prophyll with hair groups; C, lateral view of outer surface of dewlap with adjoining sheath and blade parts; D, inner surface of blade joint with ligule; E, sheath base with adjoining internode and sheath parts; and F, inner surface of blade joint with ligule removed to show hair groups.

DISTINGUISHING CHARACTERS.—Tall growth rings and root bands; two rows of small and sparse root primordia; small sectorial group 69; conspicuous midrib group 55 and inconspicuous group 63; inner dewlap surface very hairy, outer surface almost glabrous; tall, semi-round ligule with inconspicuous fringe; small deltoid auricles. A few short hairs (group 67) may be found on lower side of young leaves.

CLONE FIJI 1, IMP. 860

(Fig. 28)

ORIGIN.—Nausori, near Suva, Viti Levu, Fiji Islands, 1935.

CHROMOSOME NUMBER.— $2n=68$ to 70.

STEMS.—Olive, scant general bloom, but prominent wax bands; internodes relatively long, bobbin-shaped conoidal, with sharp depression below sheath base, greatest diameter in growth ring region, 18 mm. across, bud furrow prominent, outer flesh greenish, center white and pithy; stem-epidermal pattern 3+5, cork cells short or long-squarish, occasionally pointed, average width of long cells 6.5μ ; stomates medium abundant; growth rings bright green, later olive, medium wide, and slightly tumescent; root bands olive, 7 mm. high, tumescent, with two to three staggered rows of root primordia; buds small (8 by 6 mm.), inserted low and reaching growth ring; prophylls ovate with wing inserted below middle of prophyll, medium wide, tip round-pointed and often notched, apical and lateral appendage of overlying membranaceous margin sometimes prominent; prophylls medium hairy.

LEAVES.—Leaf sheaths 24 cm. long and smooth; sheath base prominently appendaged; blades 124 cm. long and 4.7 cm. broad, occasionally slightly pubescent (group 67), margin inconspicuously serrate; midrib in general shallow, medium wide, and grayish in color; dewlaps olive, somewhat squarish, outer surface with prominent groups 58 and 58a, inner surface densely covered with short hairs (group 52), corner tufts (group 51) small, but hairs may extend in a single file toward midrib, simulating a prominent ligular fringe; outer auricle broad-transitional and prominently fringed (group 54), inner auricle also broad, but more sloping-transitional and terminating in a small calcariform hook; ligule very narrow (2 mm.), crescentiform, with depression in center, and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Prominent wax bands; smooth sheath, sheath base with prominent appendage; dewlaps quite hairy; auricles of transitional type; very narrow inconspicuously fringed ligule; small or medium-large hairy buds.

CLONE FIJI 2, IMP. 861

(Fig. 29)

ORIGIN.—Nausori, near Suva, Viti Levu, Fiji Islands, 1935.

CHROMOSOME NUMBER.— $2n=60$ to 64.

STEMS.—Olive green, scant bloom, and prominent wax bands; internodes short, bobbin-shaped with prominent nodal region, 22 mm. across, long and narrow bud furrow, outer flesh olive green, center white and pithy; stem-epidermal pattern 3+5, cork cells short-squarish and mostly solitary, some long-squarish and a few pointed, average

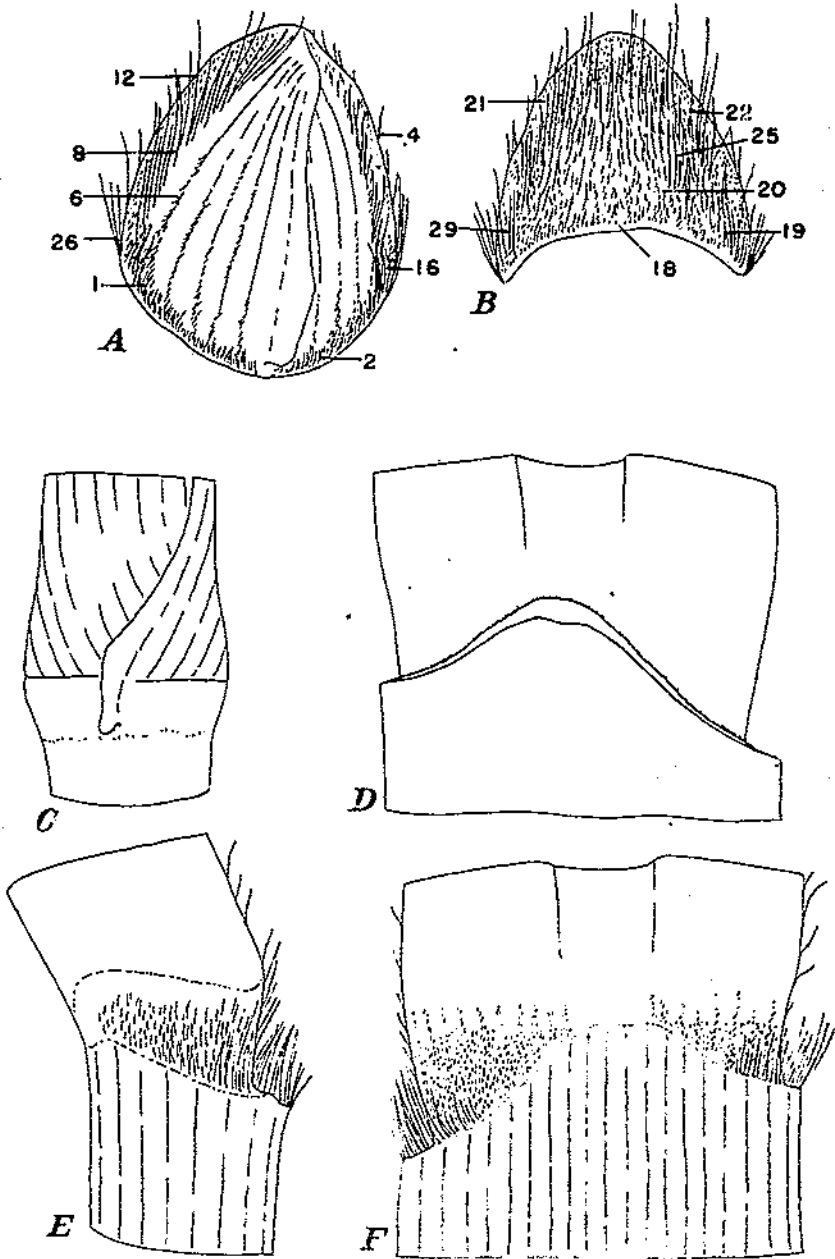


FIGURE 28.—Clome Fiji 1, Imp. 860: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, sheath base with adjoining internode and sheath parts; *D*, inner surface of blade joint with ligule; *E*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

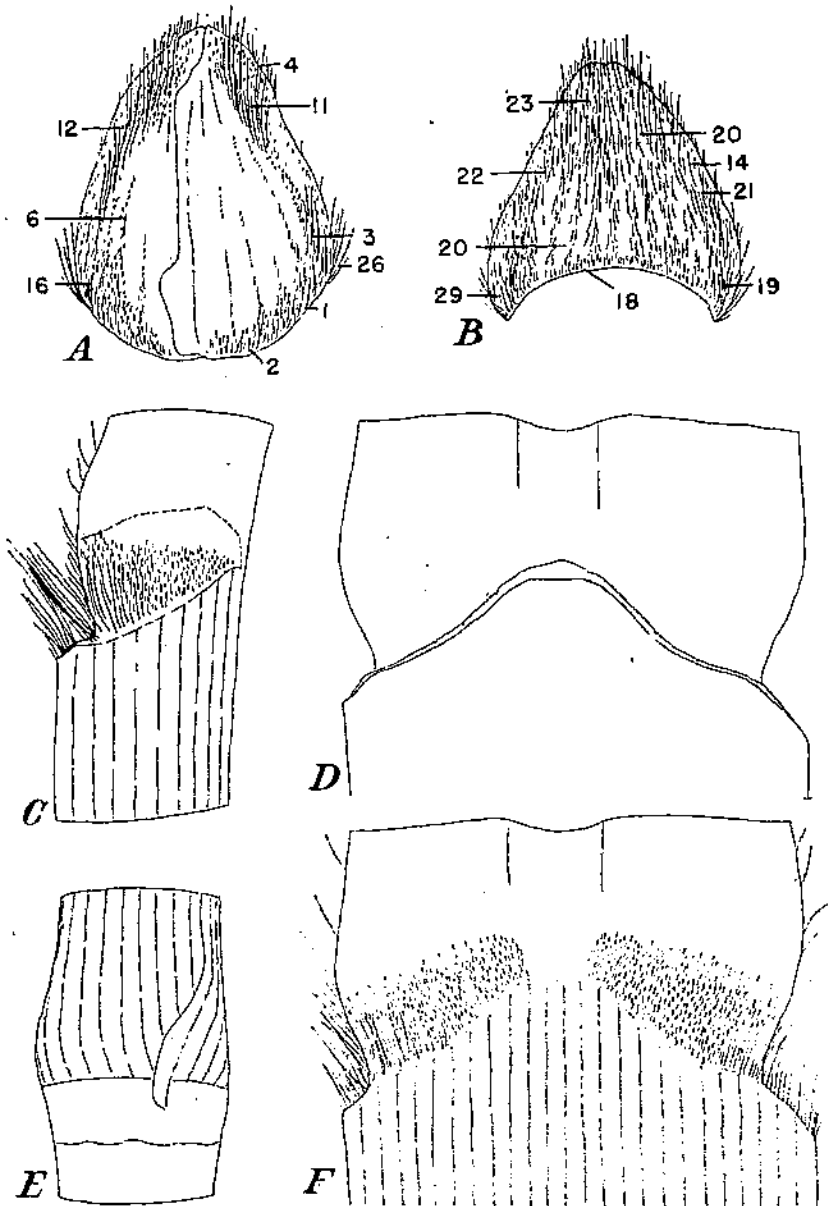


FIGURE 29.—Clone Fiji 2, Imp. 861: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of sheath base with adjoining internode and sheath parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

width of long cells 6.2μ ; stomates medium abundant; growth rings green, narrow, and somewhat tumescent; root bands light olive, 6 to 7 mm. high, tumescent-obconoidal, with two or three staggered rows of root primordia; buds green tipped with red, medium large or large (11 by 7 mm.), inserted low and projecting above growth rings; prophylls elongate-ovate, wing inserted at or below middle of prophyll, medium wide, tip round-pointed, overlying membranaceous margin usually with prominent basal and lateral appendages; wing and juncture region prominently hairy.

LEAVES.—Leaf sheaths 22 to 26 cm. long and smooth, except for sporadic appearance of a few solitary dorsal spines on young sheath; sheath base with prominent appendage; blades 112 cm. long and 7.9 cm. broad, with blade margin inconspicuously serrate except just above dewlap region; midrib shallow, reddish or purplish; dewlaps large and squarish, olive faintly outlined in red, outer dewlap surface with well-developed group 58 and less prominent group 58a, which is often restricted to dewlap side in continuity with overlying sheath margin, inner dewlap surface with prominent group 52, marginal tuft (group 51) narrow and confluent with group 54, but a few long hairs of group 51 extend inward along ligule base simulating a tall ligular fringe; both auricles transitional-sloping and very prominently fringed (group 54); ligule 3 mm. tall, crescentiform, and very inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Prominent wax bands and bud furrow; smooth sheaths; sheath base prominently appendaged; purplish midrib; transitional-sloping auricles.

CLONE FIJI 3, IMP. 362

(Fig. 30)

ORIGIN.—Rarawai, Viti Levu, Fiji Islands, 1935.

CHROMOSOME NUMBER.— $2n=90$.

STEMS.—Apple green, scant bloom, and prominent wax bands; internodes conoidal or bobbin-shaped with sharp depression below sheath base, 15 mm. across, lacking bud furrow, outer flesh green, center white and pithy; stem-epidermal pattern 3, cork cells squarish, short-pointed, occasionally long-pointed, average width of long cells 10μ ; stomates fairly abundant; growth rings pale olive, high or medium high, and usually flush; root bands ivory green, 8 mm. high, cylindrical or somewhat tumescent, with two rows of small and sparse root primordia; buds green with reddish wings, medium large or small (6 by 5 mm.), reaching growth rings or extending somewhat beyond; prophylls elongate-ovate, wing inserted below middle of prophyll, narrow, tip sharp-pointed; hairs relatively sparse and limited to wing and juncture regions.

LEAVES.—Leaf sheaths 26 cm. long and very hairy; sheath base straight and not fringed; blades 156 cm. long and 4.2 cm. broad; midrib broad and fairly massive; dewlaps olive, deltoid, outer dewlap surface slightly hairy (group 58), inner surface with prominent groups 52, 51a, and midrib group 55, marginal tufts (group 51) medium prominent; outer auricle wanting or transitional; inner auricle small, unciform; ligule 3 mm. tall, shallow-deltoid with sparse, medium-long marginal hairs (group 61).

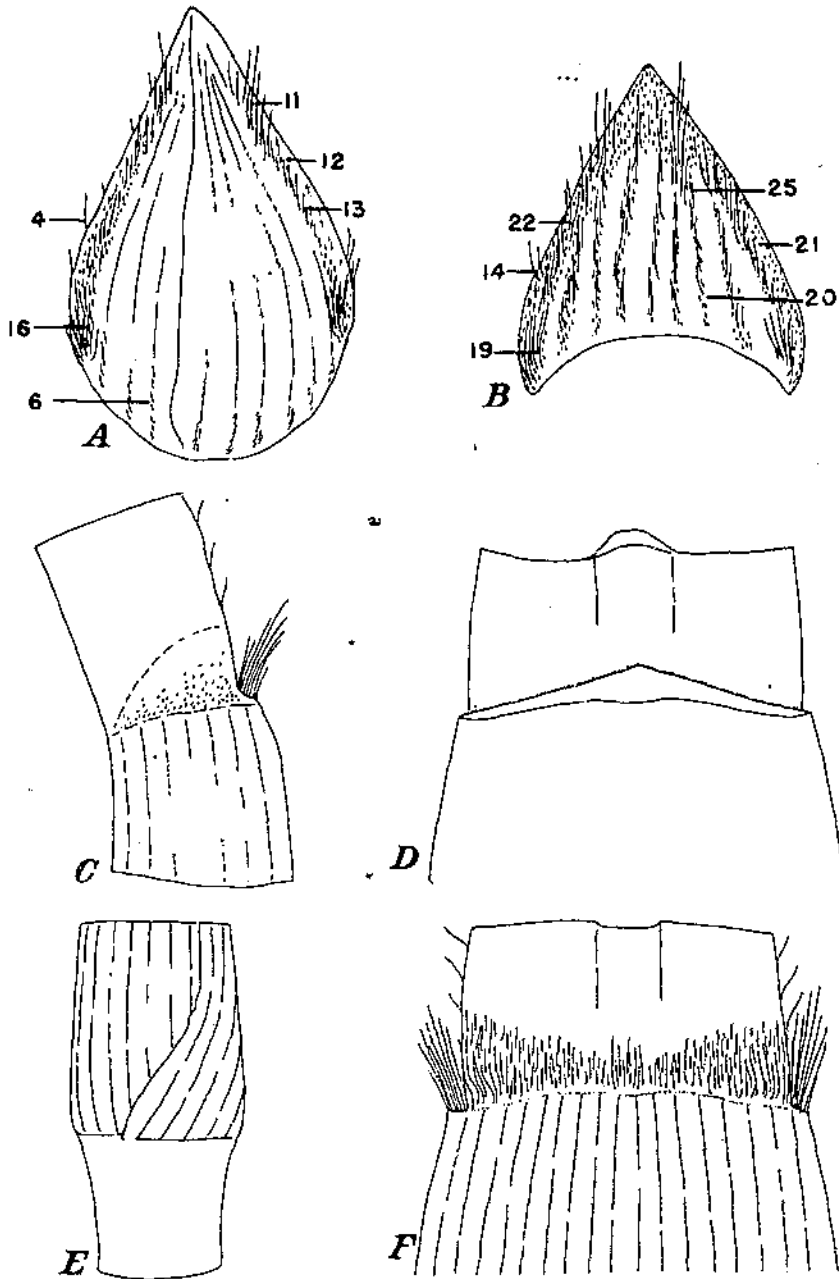


FIGURE 30.—Clone FIJI 3, Imp. S62: A, Anterior side of prophyll with hair groups; B, posterior side of prophyll with hair groups; C, lateral view of outer surface of dewlap with adjoining sheath and blade parts; D, inner surface of blade joint with ligule; E, sheath base with adjoining internode and sheath parts; and F, inner surface of blade joint with ligule removed to show hair groups.

DISTINGUISHING CHARACTERS.—Inner dewlap surface with prominent groups 52, 51a, and 55; internodes with prominent wax bands and bud furrows; sheath hairy.

CLONE N. C. 1, IMP. 1004

(Fig. 31)

ORIGIN.—New Caledonia, 1939.

CHROMOSOME NUMBER.— $2n=90$ to 100.

CULMS.—Rose purple or greenish and heavily waxed; internodes long, cylindrical or slightly conoidal with sharp depression below sheath base, 16 mm. across, lacking bud furrow, outer flesh green, large central region white and pithy; stem-epidermal pattern 2, all cork cells short-squarish; average width of long cells 10.7μ ; stomates medium abundant, growth rings rose green or green, medium high, and tumescent; root bands green or rose, 8 mm. high, somewhat tumescent with two regular rows of large and sparse root primordia; buds green and prominently tipped with red, rather large (15 by 8 mm.), prophylls ovate or squarish, wing inserted without distinct auricular set-off near middle of prophyll, sides and wing merge with one another with typical juncture line lacking; tip round-pointed; prophylls almost glabrous.

LEAVES.—Leaf sheaths 32 cm. long and smooth except for a short, sometimes very long, group 56 on overlying sheath margin; blades 114 cm. long and 5 cm. broad, with prominent serrated edge; midrib small and shallow; dewlaps green and outlined in red, deltoid or squarish, outer surface almost smooth, inner surface with poorly developed group 52, which extends sparingly into midrib forming midrib group 55, corner tuft (group 51) very small and continuous with the marginal fringe of overlying sheath (group 56); ligule crescentiform and rather tall (4 mm.), the flanges broad and extending to outer margin of small deltoid or transitional auricles, or ligule is decurrently continuous with sheath margin, marginal fringe prominent.

DISTINGUISHING CHARACTERS.—This variety is similar to N. C. 132, Imp. 921, except for the presence of group 55, which, however, may often be present in N. C. 132, and 51; group 56 often quite long.

CLONE N. C. 100, IMP. 918

(Fig. 32)

ORIGIN.—Northern New Caledonia, Diahot River, near Wegwa, 1935.

CHROMOSOME NUMBER.— $2n=70$ to 72.

CULMS.—Very slender, apple green, and heavily waxed; internodes medium long, cylindrical or slightly bobbin-shaped, 12 mm. across, outer flesh dark green, center white and pithy; stem-epidermal pattern 2, cork cells solitary, short-squarish or rhomboid, average width of long cells 10μ ; stomates medium abundant; growth rings olive, tall, tumescent; root bands ivory olive, 8 mm. high, tumescent, with one to two rows of sparse root primordia; buds green, very large (12 by 6 mm.), extending a long distance above growth ring; prophylls ovate, wings inserted without auricular set-off near base of prophyll, sides

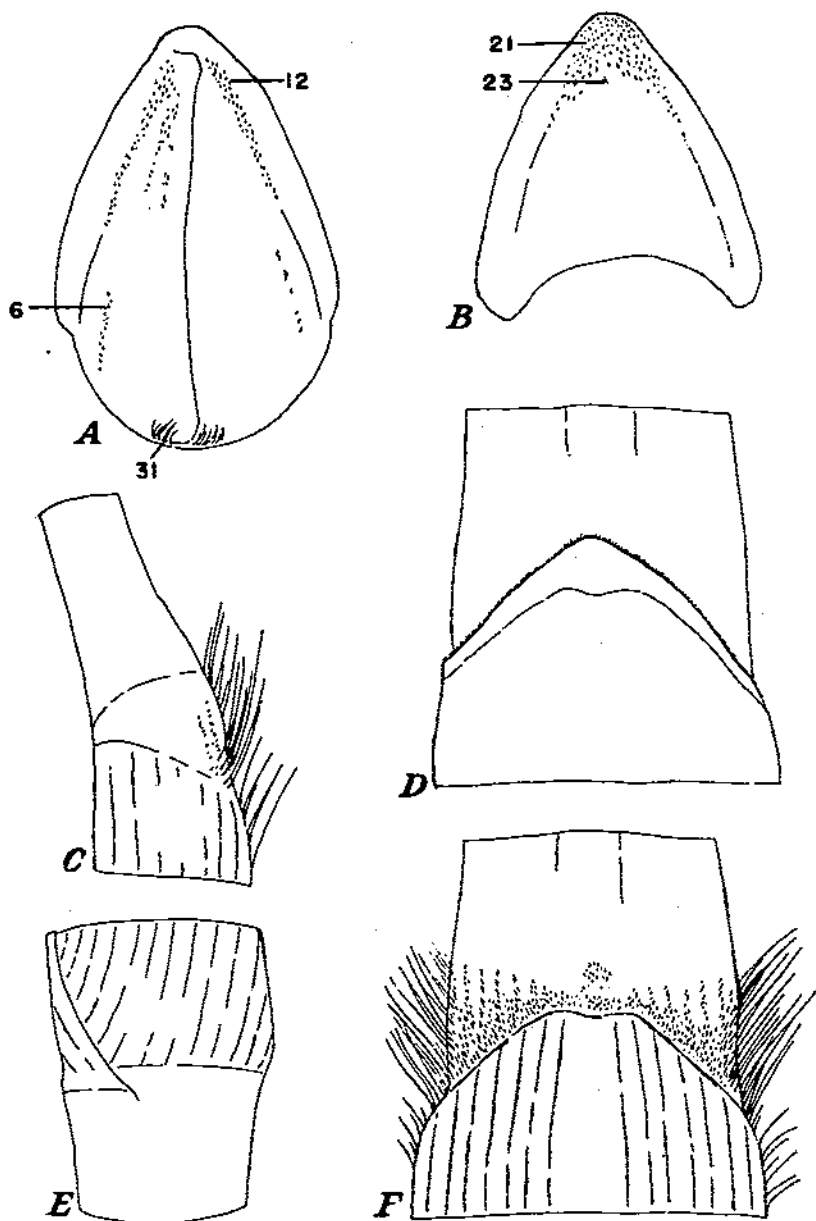


FIGURE 31.—Clone N. C. 1, Imp. 1004: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

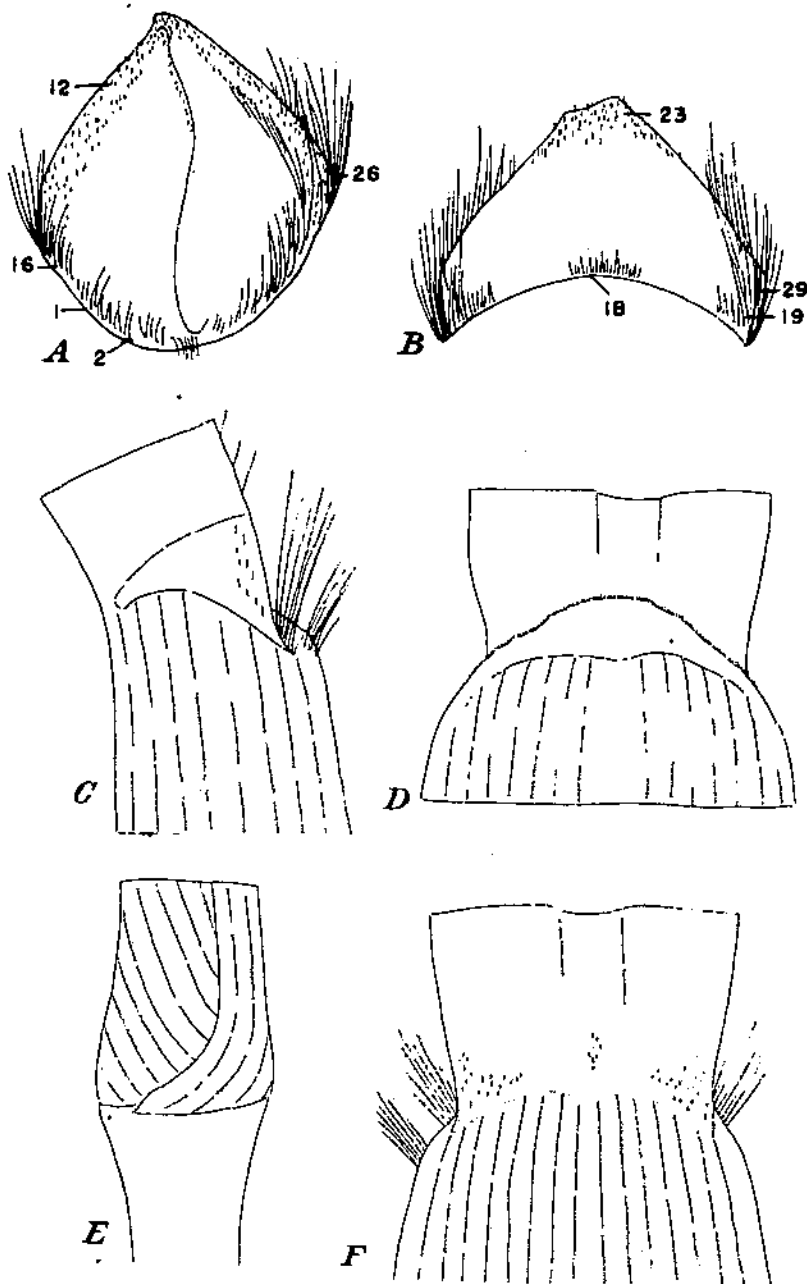


FIGURE 32.—Clone N. C. 100, Imp. 918: *A*, Anterior side of propyll with hair groups; *B*, posterior side of propyll with hair groups; *C*, lateral view of outer surface of blade joint with ligule; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

and wing of prophyll coalesce with typical juncture line lacking, tip of prophyll acute or round-pointed; prophylls smooth, except for groups at base and auricular triangle.

LEAVES.—Leaf sheaths short (22 cm.) and smooth; sheath base straight and not fringed; blades 76 cm. long and 5.2 cm. broad; midrib greenish and inconspicuous; dewlaps green, deltoid, outer surface practically smooth, inner surface almost glabrous except for a few short hairs constituting group 52, corner tufts (group 51) very small; ligule tall (6 mm.), semiround, and decurrently continuous with membranaceous sheath margins, edge of ligule inconspicuously fringed (group 61), auricles wanting or very inconspicuous.

DISTINGUISHING CHARACTERS.—Very slender cane with short, smooth sheaths and blades; buds large and rather smooth; dewlaps also smooth; ligule tall and decurrently continuous with membranaceous sheath margins.

CLONE N. C. 132, IMP. 921

(Fig. 33)

ORIGIN.—Imported from east coast near Kanala, New Caledonia, 1935.

CHROMOSOME NUMBER.— $2n=80$.

CULMS.—Reddish purple with heavy general bloom; internodes long, cylindrical but depressed below sheath base, 19 to 20 mm. across, bud furrow shallow, medium wide, and very short, outer flesh green, center pithy; stem-epidermal pattern 2, cork cells short-squarish, solitary, average width of long cells 11.5μ ; stomates numerous; growth rings green, narrow, slightly tumescent; root bands 8 to 10 mm. high, greenish rose, cylindrical, but obovate on side opposite bud, two rows of large root primordia; buds green with red tip, later uniformly red, very large (15 by 7 mm.); prophylls elongate-ovate, wing inserted without auricular set-off somewhat below middle of prophyll, sides and wing similar and not separated by juncture zone, tip round-pointed and notched; surface almost smooth except for a few short hairs.

LEAVES.—Leaf sheaths 29 cm. long, smooth, except for group 56 which extends for a short or longer distance along overlying sheath margin; sheath base straight and not fringed; blades 115 cm. long and 5.8 cm. broad, margin serrate; midrib small and shallow; dewlaps deltoid, green outlined in red, outer dewlap surface practically smooth, inner surface almost smooth with sparse group 52 which may extend into midrib (group 55); small corner tufts (group 51) formed by single row of hairs on lower outer dewlap margin and continuous with auricular fringe (group 54); inner auricle very small, deltoid, outer auricle also small, deltoid, with fringe (group 54) and a few long surface hairs (group 70); ligule tall (4.5 mm.), broadly rounded, with medium-prominent fringe (group 61).

DISTINGUISHING CHARACTERS.—Red-purple stem with green flesh, greenish growth rings and red root bands and buds; outer auricle with small group 70; overlying sheath margin with group 56; tall root bands with two rows of large primordia; smooth sheath; smooth buds and dewlaps.

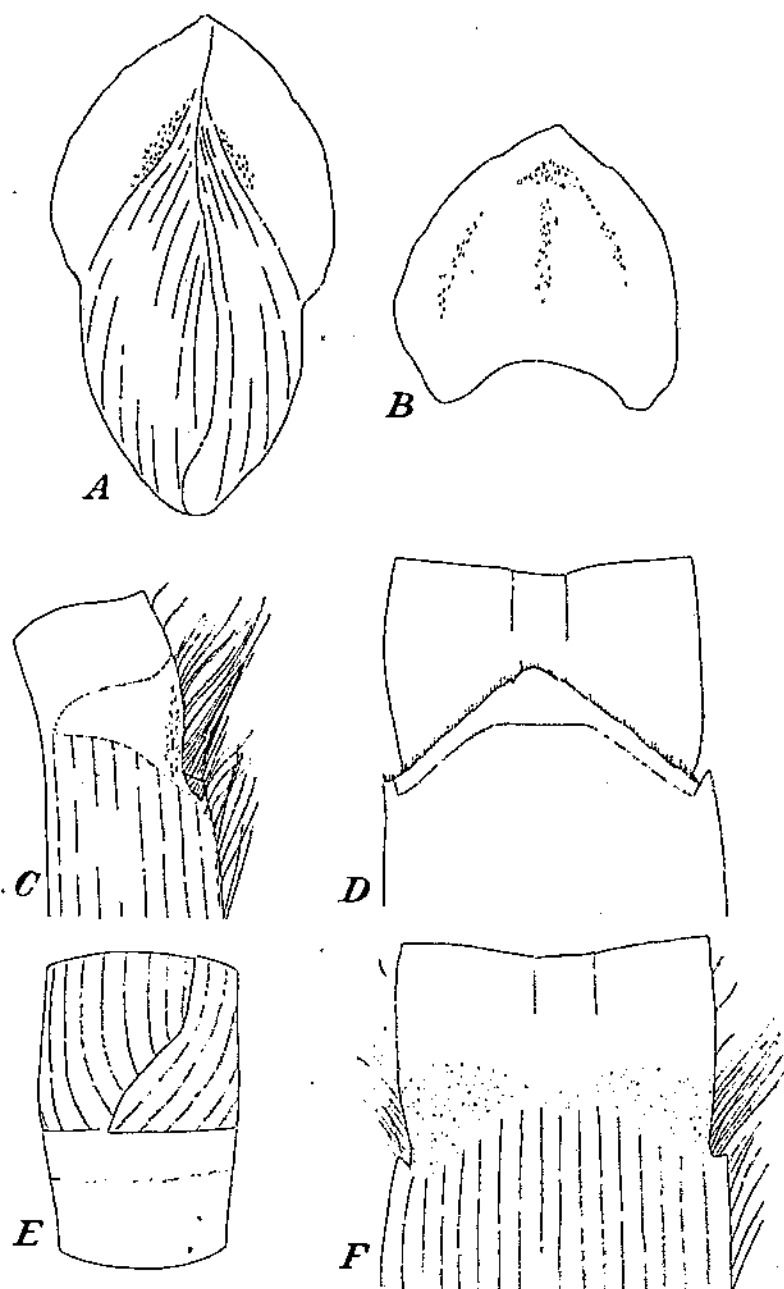


FIGURE 33.—Clone N. C. 132, Imp. 921: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

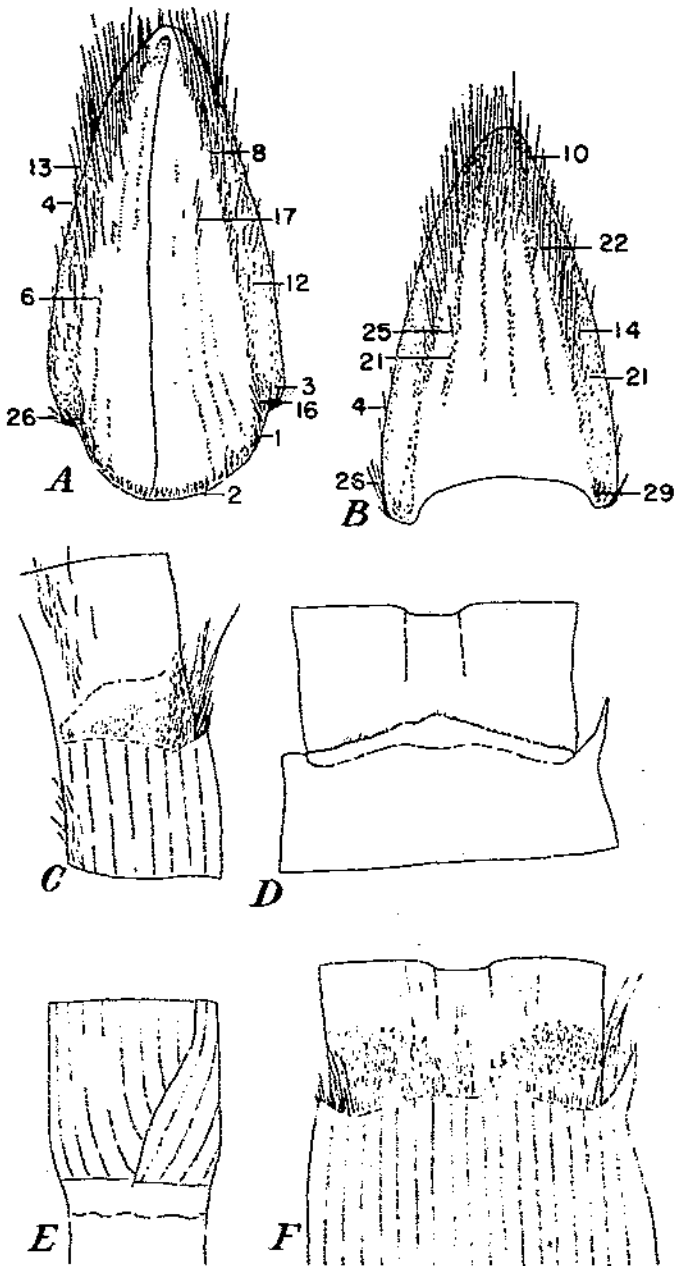


FIGURE 34.—Clone Raiatea 1, Imp. 923: *A*, Anterior side of prophyll with hair groups; *B*, posterior side of prophyll with hair groups; *C*, lateral view of outer surface of dewlap with adjoining sheath and blade parts; *D*, inner surface of blade joint with ligule; *E*, sheath base with adjoining internode and sheath parts; and *F*, inner surface of blade joint with ligule removed to show hair groups.

CLONE RAIATEA 1, IMP. 923

(Fig. 34)

ORIGIN.—Raiatea, Society Islands, 1935.

CHROMOSOME NUMBER.— $2n=60$ to 62.

CELS.—Green, medium-discolored bloom and wax bands in young internodes; internodes medium long, cylindrical, 16 to 18 mm. across, fairly prominent, narrow bud furrow, outer flesh light green, center white and pithy; stem-epidermal pattern 3, cork cells short-squarish, solitary or in pairs, average width of long cells 9.5μ ; stomates abundant; growth rings olive, medium high, somewhat tumescent; root bands ivory, later greenish, 6 mm. high, cylindrical with three to four very irregular rows of root primordia; buds green with red wings, large (14 by 7 mm.); prophylls long, narrow-ovate, wing inserted below middle of prophyll medium wide and lacking auricles; tip acute or round-pointed; prominently hairy especially in wing region and base.

LEAVES.—Leaf sheaths 34 cm. long and very hairy; blades 150 cm. long, 5.2 cm. broad, and hairy (group 67); midrib broad and fairly shallow; dewlaps bright green and heavily waxed, deltoid-ligulate, outer dewlap surface with prominent group 58 and less conspicuous group 58a, inner surface very hairy (groups 52 and 51a), midrib group 55 conspicuous, some short hairs ascend midrib for short distance to form group 63; outer auricle inconspicuous, inner auricle lanceolate-unciform, especially prominent in young sheaths; auricular edge not fringed; ligule strap-shaped or crescentiform, 3.5 mm. high, not decurrently continuous with sheath margin, group 61 inconspicuous.

DISTINGUISHING CHARACTERS.—Prominent groups 51a, 55, 63, and 67; sheath very hairy; inner auricle lanceolate-unciform and not fringed; buds large and hairy.

CLONE 28 N. C. 7, IMP. 631

(Fig. 35)

ORIGIN.—Lake Murray region, Territory of Papua, 1928.

CHROMOSOME NUMBER.— $2n=80$.

CELS.—Bright green with scant bloom, wax bands in young internodes; internodes medium long, cylindrical, 18 mm. across, outer flesh green, large central region white and pithy; stem-epidermal pattern 2, cork cells short-squarish or rhomboid, average width of long cells 11μ ; stomates numerous; growth rings light olive or rose, medium wide, and tumescent; root bands ivory olive, 4 mm. high, with only one row of sparse root primordia; buds medium large (9 by 8 mm.), inserted low and extending slightly above growth rings; prophylls broad with wing inserted below middle of prophyll, tip round-pointed and notched; prophylls very hairy, especially at juncture and base.

LEAVES.—Leaf sheaths 45 cm. long and smooth; sheath base with heavy sectorial group 59; blades 156 cm. long and 5 cm. broad, becoming narrow in region of dewlaps and merging imperceptibly with sheath. There is no typical dewlap, but its position on outside is indicated by a light-colored sloping line; outer region smooth except for a small marginal group 58a, inner dewlap surface and midrib

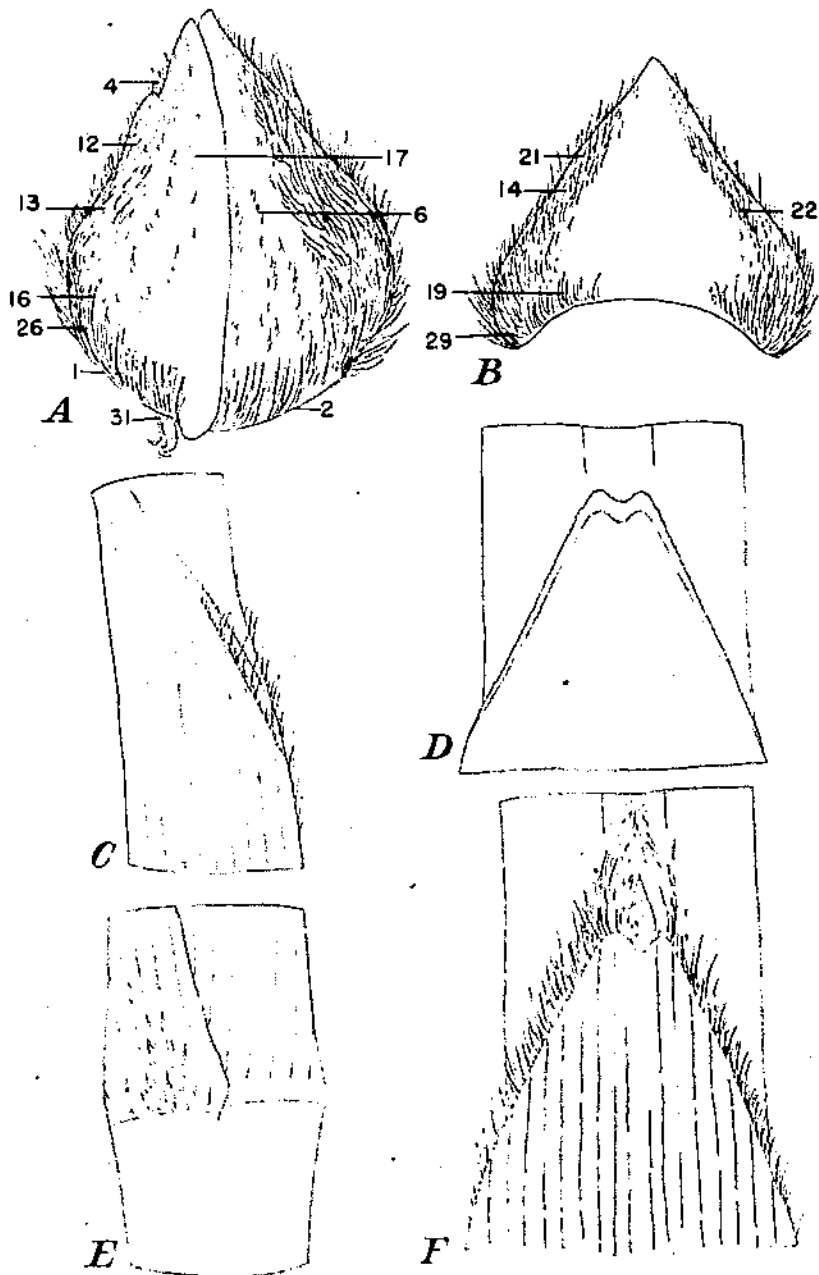


FIGURE 35.—(June 28 S. G. 7, Imp. 631 (*Erianthus arundinaceus*): A, Anterior side of prophyll with hair groups; B, posterior side of prophyll with hair groups; C, lateral view of outer surface of dewlap with adjoining sheath and blade parts; D, inner surface of blade joint with ligule; E, sheath base with adjoining internodes and sheath parts; and F, inner surface of blade joint with ligule removed to show hair groups.

region covered with a dense mat of long white hairs, outlining the narrow ligule (2 mm.); ligule steeply sloping, truncate, or slightly depressed in center and inconspicuously fringed (group 61).

DISTINGUISHING CHARACTERS.—Very pithy stem with inconspicuous bloom and wax bands in young stem; sheath very long and smooth; sectorial group 59; inner dewlap region covered with a dense mat of long white hair; only one row of root primordia.

KEY

- A. Leaf lamina villous (group 67).
 B. Sheath base fringed (group 59). Fringe often wanting in 28 N. G. 289 and Molokai 4260.
 C. Hairs on midrib behind ligule (group 55).
 D. Short hairs (group 63) above group 55. Often wanting in Molokai 4360.
 E. Leaf sheath long (about 35 cm.). Somewhat less in Molokai 4503.
 F. Group 67 restricted to leaf base.----- MOLOKAI 4360, IMP. 1005.
 FF. Distribution of group 67 uniform.
 G. Culms heavily waxed.----- MOLOKAI 4503, IMP. 1006.
 GG. Culms covered with scant bloom.----- MOLOKAI 5498, IMP. 1014.
 EE. Leaf sheath short (21 to 28 cm.).
 F. Culms red.----- 28 N. G. 38, IMP. 477.
 FF. Culms green.----- 28 N. G. 82, IMP. 647.
 DD. Group 63 wanting; hair group in wax band.----- MOLOKAI 5549, IMP. 1030.
 CC. Group 55 wanting or very inconspicuous.
 D. Inner auricle lanceolate; group 55 often wanting.----- 28 N. G. 289, IMP. 677.
 DD. Inner auricle transitional.----- MOLOKAI 4730, IMP. 1027.
 BB. Sheath base not fringed.
 C. Group 55 present. Very inconspicuous in 28 N. G. 201, and Molokai 4826.
 D. Group 63 present. May be wanting in 28 N. G. 272.
 E. Ligular fringe (group 61) inconspicuous; ligule tall.----- RALATEA 1, IMP. 923.
 EE. Ligular fringe prominent; ligule narrow.----- 28 N. G. 272, IMP. 670.
 DD. Group 63 wanting.
 E. Outer dewlap 58a present.
 F. Root band with 4 to 5 rows of root primordia.
 G. Sheath margin fringed (group 56); group 55 inconspicuous.----- 28 N. G. 201, IMP. 509.
 GG. Sheath margin not fringed.----- MOLOKAI 4826, IMP. 1028.
 FF. Root band with 2 to 3 rows of root primordia.----- 28 N. G. 49, IMP. 639.
 EE. Outer dewlap group 58a wanting or present.----- 28 N. G. 270, IMP. 669.
 CC. Group 55 wanting; group 67 prominent above dewlaps.----- 28 N. G. 290, IMP. 622.
 AA. Leaf lamina smooth. A few hairs occasionally showed in Fiji 1 and Duruka Vico Vula.
 B. Leaf sheath smooth (a few short spines may be found on young organs).
 C. Root band with 1 to 2 rows of root primordia.
 D. Leaf sheath very long (45 cm.); 1 row of root primordia.----- 28 N. G. 7, IMP. 631.
 DD. Leaf sheath very short.----- N. C. 100, IMP. 918.

AA. Leaf lamina smooth—Continued

B. Leaf sheath smooth—Continued

CC. Root band with more than 1 to 2 rows of root primordia.

D. Root band with 3 to 4 rows of root primordia with 2 to 3 rows sometimes dominating.

Young dewlaps bright red..... MOLOKAI 4575, IMP. 1007.

DD. Root band with 2 to 3 rows of root primordia.

E. Sheath margin fringed (group 56).

F. Group 55 present..... N. C. 1, IMP. 1004.

FF. Group 55 wanting, occasionally present..... N. C. 132, IMP. 921.

EE. Sheath margin not fringed.

F. Group 58 on dewlap very inconspicuous.

G. Inner auricle large, lanceolate..... MOLOKAI 4972, IMP. 1011.

GG. Inner auricle deltoid or uncliform..... MOLOKAI 4861, IMP. 1010.

FF. Group 58 prominent.

G. Group 63 small but usually present... DURUKA COCECOQE, IMP. 1020.

GG. Group 63 wanting, sheath base appendage prominent.

H. Group 67 represented occasionally by a few hairs.....

FIJI 1, IMP. 860.

HH. Group 67 always wanting.

I. Sheath smooth..... DURUKA MEMANU, IMP. 1021.

II. Sheath with a few deciduous hairs.....

FIJI 2, IMP. 861.

BB. Leaf sheath very hairy (except 28 N. G. 105).

C. Root band with 4 or 5 rows of root primordia.

D. Bud furrow prominent, group 55 inconspicuous.....

28 N. G. 104, IMP. 653.

DD. Bud furrow inconspicuous or wanting.

E. Leaf sheath very long (up to 45 cm.).

F. Culms rose or olive green..... 28 N. G. 210, IMP. 976.

FF. Stem purple..... 28 N. G. 219, IMP. 975.

EE. Leaf sheath medium long (about 30 cm.)..... 28 N. G. 251, IMP. 496.

CC. Root band with 2 to 3, rarely 3 to 5, rows of root primordia.

D. Leaf sheath long (about 38 cm.).

E. Root band with 2 to 3 rows of root primordia.....

28 N. G. 105, IMP. 654.

EE. Root band with 3 to 5 rows of root primordia.....

28 N. G. 218, IMP. 663.

DD. Leaf sheath short (23 to 30 cm.).

E. Group 55 present.

F. Stem green.

G. Sheath base fringed (group 59).... DURUKA VICO VULA, IMP. 1017.

GG. Sheath base not fringed..... FIJI 3, IMP. 862.

FF. Stem red.

G. Sheath base fringed (group 59).... DURUKA VICO TEINILOKA, IMP. 1019.

GG. Sheath base not fringed (slightly in N. H. 1, Imp. 933).

H. Ligule narrow, group 61 short..... N. H. 1, IMP. 933.

HH. Ligule very tall..... DURUKA VICO DAMU, IMP. 1018.

EE. Midrib group 55 wanting or very inconspicuous.....

MOLOKAI 5099, IMP. 1012.

LITERATURE CITED

- (1) ARTSCHWAGER, E.
1930. A COMPARATIVE STUDY OF THE STEM EPIDERMIS OF CERTAIN SUGARCANE VARIETIES. *Jour. Agr. Res.* 41: 853-865, illus.
- (2) ———
1930. ILLUSTRATED OUTLINE FOR USE IN TAXONOMIC DESCRIPTION OF SUGARCANE VARIETIES. *Internatl. Soc. Sugar Cane Technol. Sixth Cong. Proc.* (1938): 116-128, illus.
- (3) ———
1940. MORPHOLOGY OF THE VEGETATIVE ORGANS OF SUGARCANE. *Jour. Agr. Res.* 60: 503-549, illus.
- (4) ———
1942. A COMPARATIVE ANALYSIS OF THE VEGETATIVE CHARACTERISTICS OF SOME VARIANTS OF SACCHARUM SPONTANEUM. *U. S. Dept. Agr. Tech. Bul.* 811, 55 pp., illus.
- (5) BRANDES, E. W., SARTOIS, G. B., and GRASSE, C. O.
1939. ASSEMBLING AND EVALUATING WILD FORMS OF SUGARCANE AND CLOSELY RELATED PLANTS. *Internatl. Soc. Sugar Cane Technol. Sixth Cong. Proc.* (1938): 128-153, illus.
- (6) GRASSE, C. O.
1946. SACCHARUM ROBUSTUM AND OTHER WILD RELATIVES OF "NOBLE" SUGAR CANES. *Arnold Arboretum Jour.* 27 (2): 234-252, illus.
- (7) JANAKI-AMMAL, E. K.
1941. INTERGENERIC HYBRIDS OF SACCHARUM. *Jour. Genet.* 41: 217-253, illus.
- (8) JESWIET, J.
1916. BESCHRIJVINGDERSOORTEN VAN HET SUKKERRIET. EERSTE BIJLAGE. MORFOLOGIE VAN HET SUKKERRIET. *Arch. v. Suikerindus, Nederland, Indis Meded. Proefstn. v. Java-Suikerindus.* 24: [67]-137, illus.
- (9) LENNON, C. G.
1938. SUGARCANE COLLECTION IN NEW GUINEA DURING 1937. *Internatl. Soc. Sugar Cane Technol. Sixth Cong. Proc.* (1938): 171-182.
- (10) RUMKE, C. L., Jr.
1934. SACCHARUM-ERLANTHUS PASTAARDEN. *Arch. v. Suikerindus, Nederland, Indis Meded. Proefstn. v. Java-Suikerindus.* 1934 (2): 211-253, illus.

END