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# THE MALESIAN SPECIES OF PASPALUM L. (GRAMINEAE)

R. DE KONING & M.S.M. SOSEF

Rijksherbarium, Leiden, The Netherlands

## SUMMARY

*Paspalum* L. (Gramineae: Paniceae) has 14 species in Malesia, 5 of which are cultivated only. In the *P. scrobiculatum*-complex 5 varieties have been distinguished. One of these (from Africa) needed a new name: var. *lanceolatum* Koning & Sosef, another (from Southeast Asia) a new combination: var. *horneri* (Henr.) Koning & Sosef.

## INTRODUCTION

*Paspalum* was described by Linné (1759), who included four species in it: *P. dimidiatum, P. distichum, P. paniculatum*, and *P. virgatum*. The first name was a new one for *Panicum dissectum* L. and therefore superfluous, an error he himself corrected in 1762. As this was the first species described by him, it has generally been accepted as the type of the generic name. The use of *P. virgatum* (e.g. Tsvelev, 1976) is therefore incorrect.

Subsequent authors have substantially expanded the genus, partly by describing new species, partly by the inclusion of species first included in genera as *Axonopus* Beauv., *Cynodon* Pers., *Digitaria* Haller, *Eriochloa* H.B.K., and *Syntherisma* Walt., whereby at present there are 200 (Jacques-Félix, 1962) to 250 (Clayton & Renvoize, 1982) species, most of them American. Unfortunately since Flugge's revision (1810) no attempt at an overall study has been made except for compilatory works as those by Roemer & Schultes (1817), Kunth (1833), and Steudel (1853). Most other work has been done on a regional scale as is the case in the present one. A major review is that of Chase (1929) for the North American taxa which, because of its thoroughness, must serve as the base for all subsequent work. Most South American taxa have been treated by Parodi (1937). The tropical African ones have been revised by Clayton & Renvoize (1982), the Indian ones by Bor (1960), and the Australian ones by Vickery (1961, 1975). Especially the latter four publications were of importance, as they included most of the species also occurring in Malesia.

## INTERGENERIC RELATIONSHIP

*Paspalum* is a member of the Paniceae and is usually regarded to be closely related to *Panicum* L. The principal generic character at first used by Linné to distinguish the two was the absence of the lower glume in *Paspalum*. As Chase (1911) has shown this feature is unreliable since in quite a number of taxa presently included in *Paspalum* this scale is more or less developed, either occasionally so (*P. distichum* in Malesia), or as a rule (*P. decumbens* Sw.).

Since Linné's time *Paspalum* has generally been regarded as a genus in its own rights. According to Chase (1911; 1929) it is distinct by the strictly racemose inflorescences, the plano-convex or slightly concavo-convex spikelets, which are abaxial, i.e. with the lower glume and sterile lemma turned away from the rachis, the fertile lemma with involute, not infolded or straight margins, and the obtuse, indurated fertile floret in fruit (fig. 5c). When this diagnosis is applied there have been few if any problems to recognize whether a species belongs to *Paspalum* or not.

## INFRAGENERIC DELIMITATION

Chase (1929) has divided the North American species into a number of groups, which system was more or less copied by Pilger (1940) in his global survey of the genus. At first sight the presence of solitary or geminate spikelets, or of glabrous or hairy ones would suggest some sort of affinity. We think, however, that Chase was correct when she nearly completely neglected these characters in her arrangement. For example *P. orbiculare* Forst. f. has both solitary and geminate spikelets within the same raceme, while *P. longifolium* Roxb. may have strongly pubescent to less pubescent, rarely even entirely glabrous spikelets. The two seem to us to be closely related because of the shape of the spikelets and the three distinctly dark-coloured nerves of the upper glume and sterile lemma. As we have dealt here with only a few taxa, no opinion on their distinctiveness is expressed. To exclude any suggestion of relationship we have arranged our taxa alphabetically.

Tsvelev (1973, 1976) has distinguished next to the typical section a section *Diplostachys* (Steud.) Tsvelev for 'all species with two digitately arranged racemes', typified by *P. distichum*. Such a distinction may be satisfactory for the U.S.S.R. with only four species, but on a worldwide scale the only distinction given is insufficient.

## SPECIFIC AND INFRASPECIFIC DELIMITATION

The Malesian taxa in general have offered little problems in their delimitation, except of course for the notorious *P. scrobiculatum*-complex.

This is a very variable group both in Malesia and elsewhere. Several authors have distinguished taxa of various ranks within it, but all failed to reach a satisfactory result. Henrard (1940) aptly stated that 'this is one of the most puzzling groups of grasses.' Similarly we do not dare to claim that the solution adopted here can be the final one although we of course think that it is the most acceptable and practical one.

The names usually found in literature of the taxa involved are *P. auriculatum* Presl, *P. cartilagineum* Presl, *P. commersonii* Lamk., and *P. scrobiculatum* L. If only the type material of these names is inspected it is easy to believe that they indeed represent different species. Additional material, however, brings them closer and closer and usually a complete range from one extreme to the other can be laid out in the end. To us it now seems that we have been dealing with a single species displaying an enormous variation. Singh's (1965) suggestion for African representatives that they represent an apomictic swarm deserves further research. The situation observed in the *Bothriochloa bladhii*-complex (De Wet & Harlan, 1970, as *B. intermedia*) is brought to mind, although that may even be more complicated, as what many have considered to be generic boundaries, are transgressed there.

To reduce all to a single species without further ado seemed to be a rather easy way out, especially when after the classical, descriptive approach a mathematical elaboration of the material was made, which showed the presence of a number of clusters in which about all of the specimens could be accommodated. Considering the final result we fully agree with Hooker f. (1896) who stated in another context that 'no two botanists working independently over the same material, would arrive at the same (conclusion), or agree in any other.'

Of the many possible analyses available for studying homogeneity of numerical data we chose Principal Component Analysis (Sneath & Sokal, 1979), modified for computer analysis by Zandee (cf. Zandee & Glas, 1982), whereby the possible existence of clusters can relatively easily be detected. The specimens are considered to rest in a multidimensional space where the number of dimensions is equal to the number of characters. The directions in which the largest, the one but largest, etc. variances occur can then be determined. These directions are called the 'principal axes' (P.A.). The projection of the specimens on these axes are called 'principal components' (P.C.). A large variance occurs when many specimens are far off the mean, i.e. where clustering takes place (roughly comparable to solar systems in stellar ones in galaxies in super-galaxies). The analysis shows how much each character contributes to each principal axis, the so-called 'variation load', i.e., the degree of variability present. For example, if character 'x' has a variation load of 80% in P.A. 'a', this means that 80% of the variation of 'x' is represented in P.A. 'a', or, more visually, that P.A. 'a' lies in about the same direction as the axis in the multidimensional space along which 'x' is represented. The higher the variation load, the more important that character is in that P.A. In this way 'heavy' characters are suggested. However, it must be realized that the load is composed of two parts: the variation within a cluster (internal variation) and of that between clusters (external variation). When a single taxon is very variable for a certain character a large variation load will result, but it is internal and for the delimitation of taxa it is then useless. The ones with the largest external variation which will cause disjunction between clusters can be detected by drawing plots in which the direction of each character (the direction cosine) is set out. On each P.A. each character has its own 'Eigenvector', a transformation of its variation load. In diagram 1 the P.A.'s are divided into arbitrary units to accommodate these values, from which then perpendiculars are drawn. From the point (0.0) derived vectors can be drawn to the resulting coordinates. These last vectors are measures of the external variation of the characters. Those that are both long and

Table 1. Characters used for the numerical analysis. For the dimensions the unit of approximation is given between brackets.

1. Plant length (cm)
2. Length of the sheath of the third leaf from top (cm)
3. The pubescence of 2: 1 = glabrous
   2 = margin hairy at the apex
   3 = margin hairy all along
   4 = hairy all over
4. Length of its ligule (0.1 mm)
5. Length of its blade (cm)
6. Ratio of length of blade/sheath
7. Width of this blade (mm)
8. Length/width ratio of blade
9. Pubescence of blade: 1 = short hairs behind the ligule
   2 = long hairs behind the ligule
   3 = as 2, lower part margin hairy
   4 = idem, lower part and midrib hairy
   5 = blade hairy all over
10. Diameter peduncle, 1 cm from top (0.1 mm)
11. Number of racemes/inflorescences
12. Length of lowest raceme (mm)
13. Width of rachis (0.1 mm)
14. Length of spikelet (from middle of raceme) (0.05 mm)
15. Width of spikelet (idem)
16. Length/width ratio of spikelet
17. Number of nerves of the upper glume
18. Number of nerves of the sterile lemma
19. Texture sterile lemma: 1 = membranous
   2 = slightly indurated
   3 = indurated

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point closest to the centre of a cluster separate this from others. The more the vectors point towards the same direction, the greater the positive correlation between the characters they represent.

A random sample of a hundred specimens sufficiently representing '*P. auriculatum*', '*P. commersonii*' and '*P. scrobiculatum*' was drawn whereby only complete material was included. A number of characters were measured, standardized and checked for their variation loads in the first five P.C.'s. The nineteen most important ones used for the preparation of the final diagrams are listed in table 1.

Table 2. Percentage variation load of original characters in the first principal components.

| Character | P.A. 1 | P.A. 2 | P.A. 3 | P.A. 4 | P.A. 5 |
|---|---|---|---|---|---|
| 1. | 66.72 | 3.42 | 0.07 | 3.46 | 2.98 |
| 2. | 61.06 | 5.51 | 8.81 | 9.06 | 2.36 |
| 3. | 25.69 | 19.38 | 0.31 | 8.74 | 13.68 |
| 4. | 19.74 | 3.21 | 9.35 | 1.43 | 33.25 |
| 5. | 81.04 | 0.01 | 3.27 | 5.35 | 0.95 |
| 6. | 8.76 | 1.83 | 0.42 | 66.08 | 0.11 |
| 7. | 68.42 | 4.90 | 13.09 | 3.74 | 0.05 |
| 8. | 8.86 | 12.10 | 50.92 | 0.00 | 3.21 |
| 9. | 28.24 | 7.51 | 4.24 | 4.25 | 23.45 |
| 10. | 67.97 | 3.82 | 6.98 | 0.94 | 0.50 |
| 11. | 48.72 | 9.30 | 15.20 | 0.65 | 0.00 |
| 12. | 75.47 | 2.32 | 0.00 | 0.04 | 2.17 |
| 13. | 38.18 | 15.36 | 2.80 | 3.18 | 0.02 |
| 14. | 0.36 | 77.08 | 0.09 | 0.90 | 3.27 |
| 15. | 1.45 | 78.72 | 9.07 | 0.38 | 0.24 |
| 16. | 1.81 | 8.13 | 33.74 | 0.24 | 21.22 |
| 17. | 0.67 | 58.38 | 0.54 | 5.84 | 1.01 |
| 18. | 1.31 | 46.12 | 1.04 | 5.94 | 0.34 |
| 19. | 1.35 | 4.57 | 19.84 | 14.27 | 10.27 |

Table 2 presents the variation loads for these features. The largest variance in the data, shown by the first P.A., is to be found especially in the length and width of the leaf, diameter of the peduncle (an unusual feature), and in the length of the raceme. The second P.A. contains variation of the spikelet characters (dimensions, number of nerves). The third P.A. derives its importance mainly from the shapes of the leaves and of the spikelets.

Since each specimen occupies its own place along each P.A. it is possible to visualize the clusters possibly present by plotting pairs of P.A.'s against each other. Diagram 1 shows three such plots, i.e., those of the first three P.A.'s.

Table 3 presents the standardized, normalized Eigenvectors for the first five P.A.'s from which the combined vectors in the plots have been derived.

In the first plot (diagram 1a, P.A. 1/P.A. 2) three clusters can be distinguished, one containing all '*P. scrobiculatum*' specimens, another those of '*P. commersonii*' and a third those of '*P. auriculatum*'. In the last one the grouping around a distinct main centre is weak and one might still doubt whether it really is disjunct from the '*P. commersonii*'-cluster.

Table 3. Standardized normalized Eigenvectors.

| Character | P.A. 1 | P.A. 2 | P.A. 3 | P.A. 4 | P.A. 5 |
|---|---|---|---|---|---|
| 1. | 0.9073 | -0.2083 | -0.0374 | 0.2289 | 0.2996 |
| 2. | 0.8680 | -0.2647 | 0.4159 | 0.3703 | 0.2662 |
| 3. | -0.5630 | 0.4962 | -0.0777 | -0.3637 | 0.6413 |
| 4. | 0.4935 | 0.2019 | 0.4285 | -0.1469 | -1.0000 |
| 5. | 1.0000 | -0.0089 | 0.2536 | -0.2846 | 0.1688 |
| 6. | 0.3288 | 0.1523 | 0.0911 | -1.0000 | -0.0577 |
| 7. | 0.9188 | 0.2495 | -0.5070 | -0.2379 | 0.0381 |
| 8. | 0.3307 | -0.3921 | 1.0000 | 0.0051 | 0.3109 |
| 9. | -0.5903 | 0.3088 | -0.2886 | -0.2537 | 0.8397 |
| 10. | 0.9158 | 0.2204 | -0.3704 | -0.1196 | 0.1228 |
| 11. | 0.7754 | -0.3437 | -0.5464 | -0.0995 | 0.0117 |
| 12. | 0.9650 | 0.1717 | -0.0094 | -0.0255 | 0.2557 |
| 13. | 0.6864 | 0.4417 | -0.2344 | 0.2193 | -0.0271 |
| 14. | 0.0666 | 0.9895 | 0.0414 | 0.1165 | -0.3135 |
| 15. | 0.1338 | 1.0000 | 0.4220 | 0.0754 | 0.0846 |
| 16. | -0.1496 | -0.3214 | -0.8140 | 0.0607 | -0.7989 |
| 17. | -0.0906 | 0.8612 | -0.1029 | 0.2974 | -0.1739 |
| 18. | 0.1271 | 0.7654 | -0.1426 | 0.2998 | 0.1013 |
| 19. | 0.1289 | -0.2409 | -0.6241 | 0.4647 | 0.5558 |

The second plot (diagram 1b, P.A. 1/P.A. 3) shows no really disjunct clusters.

The third plot (diagram 1c, P.A. 2/P.A. 3), however, shows two more obviously disjunct ones. One contains all specimens of '*P. auriculatum*' and '*P. scrobiculatum*', the other one all those of '*P. commersonii*'.

This separation is especially due to the dimensions of the spikelets (characters 14 and 15) and the number of nerves in the husks (characters 17 and 18). The apparent gap between the two clusters lies at spikelet-size 2.6 by 2.15 mm. After intensive study of all the material, both that used for the analysis and that of the remainder, it turned out that only very few specimens with this particular set of dimensions could be found. There was more overlap in the number of nerves (5–7 versus 7–13).

In this way it has become clear that there are three distinct clusters present which might be depicted in a three-dimensional plot. They correspond with the three classical taxa.

Characters to distinguish between them are in decreasing importance of their contribution to the first three P.A.'s: width of the spikelet (character 15), width of the blade (7), its length (5), diameter of the peduncle (10), length of the lowermost raceme (12), length of the spikelet (14), length of the third sheet from top (2), num-

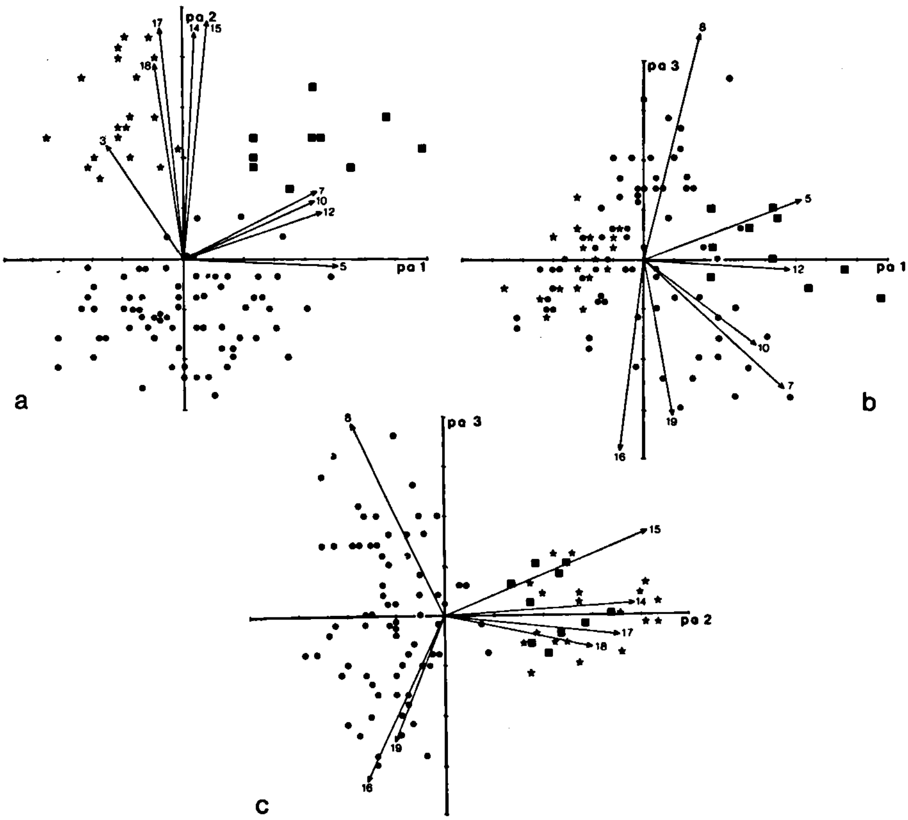


Diagram 1. *Paspalum scrobiculatum* L. Plots of the first three principal components against each other. ■ var. *auriculatum* ('*P. auriculatum*'), ● var. *bispicatum* ('*P. commersonii*'), ★ var. *scrobiculatum* ('*P. scrobiculatum*').

ber of racemes (11), etc. Since these do not appear to be very impressive features it seemed best to regard the clusters as varieties. These are then to be called *P. scrobiculatum* var. *scrobiculatum*, var. *auriculatum* (Presl) Merr. and var. *bispicatum* Hackel. The latter is the required combination for '*P. commersonii*' as *P. scrobiculatum* var. *commersonii* (Lamk.) Stapf (1920) is antedated by Hackel's combination of 1914 proposed for specimens that are fairly aberrant by the presence of two subopposite racemes, but otherwise belong to this taxon. The well-known epithet '*commersonii*' can therefore unfortunately not be retained.

We have mentioned the presence of a species called '*P. cartilagineum*', which supposedly would be distinct by the presence of an indurated sterile lemma. The specimens thus identified turned out to be spread out rather evenly over the three other varieties, the type lodging itself in the cluster of var. *bispicatum*. Moreover, some specimens have been seen with indurated and non-indurated lemmas within the same inflorescence whereby the value of this character is brought to nought and cannot be maintained to distinguish a taxon.

The large variation found within this complex in Malesia may be caused partly by ecological effects, e.g., soil type, shade, moisture, etc. A field study would result in a better understanding of the causes and a possible explanation for the intermediary forms occasionally encountered.

It is interesting to note that a similar variability is present in the continental Asian material, but that in Africa the situation seems to be different (as far as could be judged from literature and the material available in L). Here var. *bispicatum* and another taxon of the complex, which is not represented in Asia, occur. This latter form has unfortunately been confused with *P. auriculatum* (Clayton, 1974; Singh, 1965; Clayton & Renvoize, 1982), but is quite different from that because of the rather loose sheaths, the relatively short and very wide leaves, with a rounded base, and spikelets up to 2.5 mm long. These characters are similar to those used to distinguish the varieties in *P. scrobiculatum* and we therefore regard this taxon not as a species as has been done by the authors mentioned above, but also as a variety. A correct combination seems to be lacking for it and we here therefore propose the combination *P. scrobiculatum* var. *lanceolatum* Koning & Sosef (see Appendix, p. 312, and the Key, p. 288).

## ALIEN AND EXCLUDED SPECIES

A number of species occur only as cultigens apparently without escaping. They are: *P. decumbens* Sw., *P. notatum* Fluggé, *P. plicatulum* Michx., *P. virgatum* L., and *P. wettsteinii* Hackel. These have not been treated here formally but to avoid confusion in the identification with the native or escaped taxa (and also to hedge our bets in case they may escape in the future) we have included them in our key and in some notes at the end of this paper.

## CHROMOSOME NUMBERS

We have not made any counts ourselves, but have cited those reported in the literature. The basic number apparently is $x = 10$, as was to be expected for a panicoid genus. Aneuploidy ($2n = 54$) has been observed in *P. orbiculare*, q.v. Unfortunately no vouchers have been seen. In some cases misidentifications seem unlikely (e.g. of *P. conjugatum, P. dilatatum* and *P. paniculatum*), while in others descriptions were provided that showed how the name used was to be applied. Within the *P. scrobiculatum*-complex, however, there is less certainty. In the case of var. *bispicatum* one can usually be fairly sure that the material was correctly identified, but for the other ones this is doubtful and the data for the latter have therefore been omitted. Counts of $2n = 40, 60$ have been made for the aggregate species, e.g. by Hsu (1971).

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## PASPALUM

*Paspalum* L., Syst. Nat. ed. 10, 2 (1759) 855; Fluggé, Gram. Monogr., Paspalum (1810) 53; R. & S., Syst. Veg. 2 (1817) 13; Nees, Agrost. Bras. (1829) 18; Steudel, Syn. 1 (1853) 16; Benth. & Hook. f., Gen. Pl. 3 (1883) 1097; Chase, Proc. Biol. Soc. Washington 24 (1911) 137; Contr. U.S. Nat. Herb. 28, 1 (1929) 7; Parodi, Rev. Mus. La Plata n.s. 1 (1937) 211; Pilger in E. & P., Nat. Pfl. Fam. ed. 2, 14e (1940) 58. – *Sabsab* Adans., Fam. Pl. 2 (1763) 31, 599, nom. superfl. – Lectotype: *P. dimidiatum* L., nom. superfl. = *P. dissectum* L. (Typotype: Pluk., Almagesti ... Mantissa (1700) 94, t. 350, f. 2.)
For further synonyms see Chase (1929).

The following description is based on the Malesian taxa only. Some of the specific characters they have in common have been included here to prevent unnecessary repetitions.

Annuals or perennials, branching intra-vaginally at base. Sheaths slightly compressed. Ligule entire, membranous, glabrous. *Blades* erecto-patent, margins scabrous. Peduncle exserted, smooth. Racemes 1–many, spreading to drooping at maturity, all shortly stalked. Stalk terete. Rachis subterete to distinctly winged. *Spikelets* abaxial, plano-convex or sometimes unequally biconvex or concavo-convex, subsessile or shortly pedicelled, falling as a whole, solitary or paired (once ternate) (hence 'inner' and 'outer' spikelets), in two rows on one side of the rachis, the groups alternate. Articulation of pedicel straight, top broadened. *Lower glume* usually absent. *Upper glume* present, membranous, smooth, margins usually involute, rarely flat, outer nerve(s) submarginal. *Sterile lemma* as the upper glume, epaleate. *Fertile lemma* slightly shorter than the spikelet, chartaceously indurated, rarely but slightly so, margins involute, germination flap long-trapezoid, c. 0.8 times as long as the lemma, its margins usually visible as pale lines. *Palea* similar to and enclosed by the lemma (fig. 5c) slightly shorter, margins membranous, involute at the apex and in the lower half. Lodicules obtrapezoid, thin, veinless, free, glabrous. Anthers 3. Styles 2, free at base. Embryo c. 0.33 times as long as the caryopsis. Hilum subbasal, oblong.

Distribution. About 200–250 species, mainly tropical, 14 in Malesia, of which 5 apparently native or archaeophytical, 4 introduced and escaping, 5 only known from cultivation.

### KEY TO THE MALESIAN TAXA

The unnumbered taxa are either cultivated ones that have not yet been observed to escape, or an African one distinguished in this paper and included here for clarity's sake.

1a. Upper glume with a marginal fringe of relatively long, white hairs framing the spikelet . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2
b. Upper glume without such a frame . . . . . . . . . . . . . . . . . . . . . . . . . . . . 4
2a. Racemes 3–20, alternate. Spikelets paired . . . . . . . . . . . . . . . . . . . . . . . . 3
b. Racemes 2, subopposite, rarely 3, then the upper two subopposite. Spikelets solitary . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1. **P. conjugatum**

3a. Racemes 3–5(–9). Spikelets 1.8–2.5(–3.1) mm wide . . . . . **2. P. dilatatum**
b. Racemes (5–)10–20. Spikelets 1.2–1.5 mm wide . . . . . . . . . . **8. P. urvillei**
4a. Rachis 0.3–0.7 mm wide . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5
b. Rachis more than 0.8 mm wide . . . . . . . . . . . . . . . . . . . . . . . . . . 6
5a. Spikelets 1.2–1.4 mm long. Upper glume hirsute all over . . **6. P. paniculatum**
b. Spikelets 2.5–3 mm long. Upper glume glabrous or pubescent along the margins only . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **P. wettsteinii**
6a. Spikelets paired, at least in the middle of the raceme, one sometimes reduced to minute glumes . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 7
b. Spikelets solitary . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 11
7a. Inflorescence solitary from the uppermost sheath. Racemes 2–many. Lower glume absent . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 8
b. Inflorescence 2–8 together from the uppermost sheath. Racemes 1 (or 2). Lower glume developed . . . . . . . . . . . . . . . . . . . . . . . . . . **P. decumbens**
8a. Plants not robust, (10–)30–125(–150) cm tall. Blades 4–10 mm wide . . . 9
b. Plants robust, 100–200 cm tall. Blades 10–34 mm wide . . . . . . . **P. virgatum**
9a. Spikelets broadly ovate to obovate, monochromate. Fertile lemma and palea pale to brown, dull . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10
b. Spikelets oblong to ovate or obovate, with a conspicuously dark centre and paler margin. Fertile lemma and palea shiny dark brown . . . . . **P. plicatulum**
10a. Racemes (3–)5–12(–16). Rachis (1.5–)2–3.5(–5) mm wide. Both spikelets of a pair usually well-developed in the middle of the raceme. Upper glume pubescent, very rarely glabrous . . . . . . . . . . . . . . . . . . . . **4. P. longifolium**
b. Racemes 2–4(–6). Rachis 1–1.5(–1.9) mm wide. One of the spikelets of a pair usually reduced. Upper glume glabrous . . . . . . . . . . . . . **5. P. orbiculare**
11a. Plant stoloniferous. Spikelets oblong, acute . . . . . . . . . . . . . . . . . . . . . 12
b. Plants tufted, stolons absent. Spikelets ovate or obovate, rarely broadly so, blunt . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 13
12a. Racemes 2, subopposite, rarely 3, then the upper 2 subopposite. Rachis spikeled from the base. Lower glume present in at least some spikelets. Upper glume pubescent . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **3. P. distichum**
b. Racemes 2, strictly opposite, rarely up to 5, then the upper two strictly opposite. Rachis at base partly without spikelets. Lower glume very rarely present. Upper glume glabrous . . . . . . . . . . . . . . . . . . . . . . . . . . **9. P. vaginatum**
13a. Racemes 1–many, usually alternate. Spikelets 1.7–3.1 mm long. – Spikelets and fertile lemma yellow brown to dark brown . . . . . . . . . . . . . . . . . 14
b. Racemes 2, subopposite, rarely 3, then the upper 2 subopposite. Spikelets 3–4 mm long. – Spikelets green. Fertile lemma yellow . . . . . . . . . . . **P. notatum**
14a. Blades rarely hirsute all over. Peduncle glabrous. Spikelets broadly ovate to broadly obovate . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 15
b. Blades usually hirsute all over. Peduncle usually sparsely hairy. Spikelets broadly elliptic to ovate . . . . . . . . . . . . . . . . . **7d. P. scrobiculatum var. horneri**

15a. Spikelets usually suborbicular, brown to dark brown. Upper glume 5–13-nerved. Sterile lemma 5–9-nerved. Nerves concolorous. Fertile floret dark brown in fruit . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 16
b. Spikelets usually broadly obovate, yellow-brown to brown. Upper glume and sterile lemma 3- or 5-nerved. Nerves distinctly darker than the intervenium. Fertile floret yellow-brown to brown in fruit . . . . . . . . . . . . **5. P. orbiculare**
16a. Blades linear, 4–53 cm by 3–19 mm (index 13 or more), narrowed towards the base . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 17
b. Blades linear-lanceolate, 7–21 cm by 12–27 mm (index up to 10), distinctly rounded at base. – Africa . . . . . . . . . . . . . **P. scrobiculatum var. lanceolatum**
17a. Spikelets 2.55–3.25 by 2.1–2.6 mm. Upper glume 7–13-nerved. Sterile lemma 7–9-nerved. – Racemes solitary or paired, then 1.5–7 cm long, or 3–8, then 8–15.5 cm long . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 18
b. Spikelets 1.8–2.6 by 1.45–2.15 mm. Upper glume and sterile lemma 5–7-nerved. – Racemes (1 or) 2–6(–14), 1.5–9(–11) cm long
**7c. P. scrobiculatum var. bispicatum**
18a. Blades up to 9 mm wide. Racemes 1 or 2, up to 7 cm long
**7a. P. scrobiculatum var. scrobiculatum**
b. Blades 10–19 mm wide. Racemes 3–8, 8–15.5 cm long
**7b. P. scrobiculatum var. auriculatum**

## 1. Paspalum conjugatum Berg. – Fig. 1.

*P. conjugatum* Berg., Acta Helv. Phys.-Math. 7 (1762) 129, t. 8; Lamk., Tabl. Encycl. 1 (1791) 175; Kunth, Enum. Pl. 1 (1833) 51; Camus, Fl. Gén. I.-C. 7 (1922) 393; Ridley, Fl. Mal. Pen. 5 (1925) 218; Backer, Handb. Fl. Java 2 (1928) 120; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 162, f. 105; Burk., Dict. Econ. Prod. 2 (1935) 1673; Reeder, J. Arn. Arbor. 29 (1948) 297; Backer in Heyne, Nutt. Pl. Indon. ed. 3, 1 (1950) 200; Schmid, l'Agron. Trop. 13 (1958) 304, f. 47-1; Metcalfe, Anat. Monoc. 1, Gram. (1960) 364; Bor, Grasses (1960) 336; Vickery, Contr. N.S.W. Nat. Herb., Fl. Ser. 19, 1 (1961) 117; Larsen, Dansk Bot. Ark. 20 (1963) 227; Deshaprabhu, Wealt of India 7 (1966) 269; Hsu, Taiwania 13 (1967) 128; Monod de Froid. in Backer & Bakh. f., Fl. Java 3 (1968) 570; Henty, Bot. Bull., Lae 1 (1969) 145; Gill., Rev. Fl. Mal. 3 (1971) 180, pl. 24d, f. 37; Gould & Soderstrom, Canad. J. Bot. 52 (1974) 1084; Beetle, J. Range Managem. 27 (1947) 347, f. 1 & 2; Powell in Paymans, New Guinea Veget. (1976) 136, 167; Holm et al., World's Worst Weeds (1977) 134, f. 49 & 50; Hsu, Fl. Taiwan 5 (1978) 581, pl. 1439; J.W. Parham in A.C. Smith, Fl. Vit. Nov. 1 (1979) 336. – *P. tenue* Gaertn., Fruct. Sem. Pl. 2 (1791) 2, pl. 80, nom. superfl. – Lectotype: *Rolander s.n. in Herb. Berg. 36* (SBT, holo, n.v.; xerox in L, see note), Surinam.
For further synonyms see Chase (1929).

Perennials, not tufted, stoloniferous. Stolons leafy, rooting at the nodes, glabrous, smooth. *Culms* ascending to erect, 40–80(–100) cm long, branching. Nodes of the stolons usually pubescent, the others glabrous. Sheaths slightly keeled, ciliate on the margins, pubescent on the outside collar; basal sheaths often pubescent, purplish, not reticulate, the higher ones otherwise glabrous, green. Ligule collar-shaped, 0.7–1.6 mm long. *Blades* flat, linear, narrowed at base, (2–)8–20(–23) cm by (2–)5–12(–

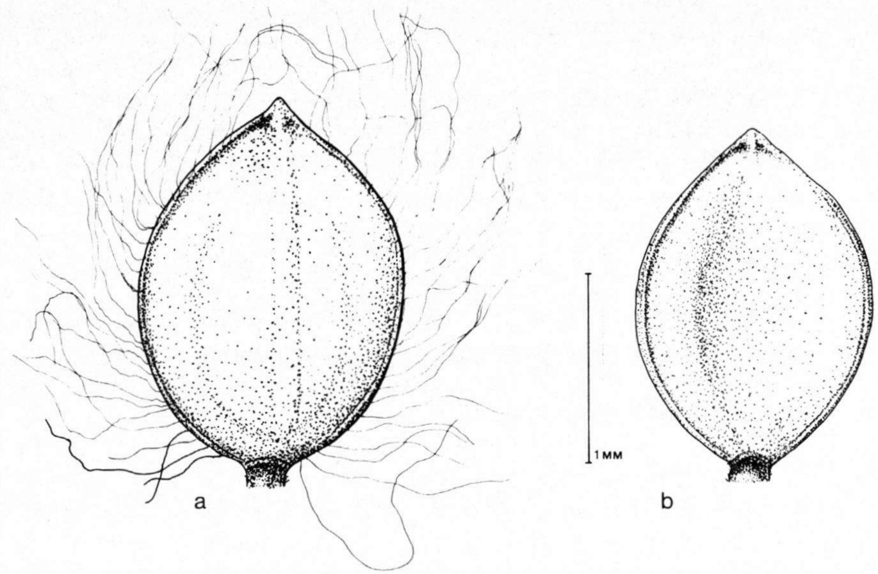


Fig. 1. *Paspalum conjugatum* Berg. a. Upper glume; b. sterile lemma (*Darbyshire & Hoogland 7864*).

15) mm, with some c. 3 mm long white hairs at the immediate base of the ligule, sparsely pubescent on both sides, usually less so beneath, to glabrous. Peduncle 0.7–1 mm diam., glabrous. Stalk up to 2 mm long, pubescent (hairs up to 4 mm long), dark. *Racemes* 2, subopposite, rarely with a third below them, (5–)8–16 cm long. Rachis with an adaxial, longitudinal groove, usually slightly curved down, 0.6–1.2 mm wide, spikeled from the base, margins smooth to scabrous. Pedicel terete, geniculate, up to 4 mm long, smooth. *Spikelets* solitary, imbricate, ovate (the lower ones often oblong), (1.5–)1.7–1.8(–2.1) by (1.1–)1.2–1.4(–1.6) mm, pale green, apex acutish. Lower glume absent. *Upper glume* slightly convex, as long as the spikelet, bearing a fringe of relatively long (c. 1 mm) hairs along the margins, framing the spikelet, otherwise glabrous, nerves 2 (or 4), concolorous, midnerve suppressed. *Sterile lemma* flat to slightly concave, glabrous, not wrinkled, otherwise similar to the upper glume. *Fertile lemma* slightly convex, as long as the spikelet, 0- or 3-nerved, pergamentaceous, glabrous, smooth, pale green. *Palea* flat to slightly concave, 2-nerved, otherwise as the lemma. Anthers slender, c. 0.7 mm long. Stigmas light brown to whitish (i. s.). Caryopsis broadly ovate, plano-convex, c. 1.1 mm long.

Distribution. A weed of American origin, introduced in the last half of the 19th century (not yet collected by e.g. Junghuhn), now common throughout Malesia.

Ecology. Not restricted to particular situations, though a preference for poor, shaded habitats has been reported. Often vegetation-forming. Present on a variety of soils, up to 1500 m alt.

Vernacular names. English: buffalo grass (Malaya), carabao grass (Philippines), sour paspalum; Sumatra: gujung tembagu, ujung abung, paitan burung, rumput kuda, r. paitan; Java: genjoran, jampang tjangah, jukut pait, kelemaran; Lesser Sunda Islands: jampang pait; Borneo: blenna (Iban), rumput blanda; Philippines: bantotan (Manobo), kauad-kauaran, kulape (Tagalog), lacatan (Cebuano), sacate (Bisayan); New Guinea: amdumaning (Eipo), sybsyby (Jali). For more names see also Backer (1950), who remarked that although some of the names indicate a bitter ('pait') taste, this was to his own experience incorrect.

Collector's notes. Plants strongly branching and stooling, bright green, base purple, stems sometimes purple pink, nodes white, bearded. Leaves dark green. Rachis dark green. Inflorescence dull green. Spikelets yellow to yellow green. Anthers and stigmas white or yellow. Fruits white to dark brown. Flowering at 11.00 h. a.m. (*de Vogel 997*).

Anatomy. See Metcalfe (1960).

Chromosome numbers. 2n = 20 (e.g. Hsu, 1967), 40 (e.g. Larsen, 1963), 80 (e.g. Gould & Soderstrom, 1974).

Phytochemistry. Deshaprabhu (1966) reported the presence of a haemostatic glucoside which reduces the time for the clotting of the blood by 50%.

Uses. A very important weed in crops, e.g. in sawahs, and plantations of bananas, cocoa, coffee, papayas, pineapples, rubber, tea, etc. throughout Malesia (Holm et al., 1977). Different opinions about the importance of this grass as a fodder exist. Generally it has a poor reputation, but Backer (1950) stated that it is highly productive under good circumstances. Beetle (1974) reported that it is probably useful as fodder in areas of poor soil fertility, though suitable for grazing only when young since the fruits tend to stick in the throats of live-stock and choke them. Gianno (*187*, L) noted the same for ducks, geese, goats and other animals. Burkill (1935) noted that monkeys readily eat the grains. It is a valuable lawn grass due to its ability to form closed swards and its resistance to trampling.

When wet, the fruit stick to one's legs and other clothing and so may become very irritating (*Gianno 187*, L; Veldkamp, pers. comm.).

The Iban of Borneo use leaf concoctions for wound healing, while in the Sepik area (Papua New Guinea) crushed spikelets are used in the treatment of cuts, wounds and sores (Powel, 1976: 136). This is due to a haemostatic glucoside (see above).

The leaves are used by the Chimbu of Papua New Guinea for the lining of cooking ovens and for wrapping food (Powell, 1976: 167).

Notes. This species is reasonably variable especially in its vegetative characters probably due to ecological circumstances. No infraspecific taxa can be recognized. The variety or forma '*tristachya*' (Vanderyst, Bull. Agric. Congo Belge 9, 1918, 245; Beetle, 1974: 349, respectively) with three instead of two racemes in the inflorescence occurs mixed with the normal form with two racemes in several collections, e.g. in the syntype of *P. conjugatum*.

The type material of this name was not actually seen as the Bergius Herbarium (SBT) does not send such specimens out on loan. Its Director, Dr. L.E. Kers, kindly sent us photocopies of the relevant material. There are two collections which can easily be identified with the present species, both annotated by Bergius. One was collected by Swartz, presumably in the Caribbean, the other by Rolander in Surinam. The latter has a diagnosis written on it by Bergius and as only this provenance was cited in the protologue, it seems the obvious lectotype.

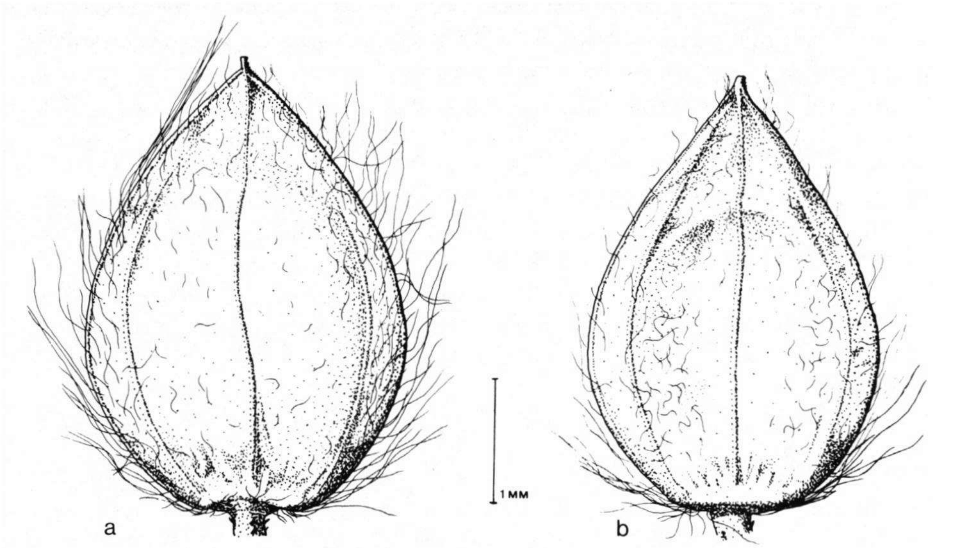


Fig. 2. *Paspalum dilatatum* Poir. a. Upper glume; b. sterile lemma (*Santos 5061*).

## 2. Paspalum dilatatum Poir. – Fig. 2.

*P. dilatatum* Poir., Tabl. Encycl. 5 (1804) 35; Camus, Fl. Gén. I.-C. 7 (1922) 393; Backer, Handb. Fl. Java 2 (1928) 120; Blatter & McCann, J. Bomb. Nat. Hist. Soc. 32 (1928) 640; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 169; Burk., Dict. Econ. Prod. 2 (1935) 1674; Backer in Heyne, Nutt. Pl. Indon. ed. 3, 1 (1950) 201; Gardner, Fl. W. Austr. 1, 1 (1952) 242, pl. 71; Schmid, l'Agron. Trop. 13 (1958) 653; Bor, Grasses (1960) 338; Vickery, Contr. N.S.W. Nat. Herb., Fl. Ser. 19, 1 (1961) 119; Deshaprabhu, Wealth of India 7 (1966) 269; Monod de Froid. in Backer & Bakh. f., Fl. Java 3 (1968) 570; Henty, Bot. Bull., Lae 1 (1969) 146; B.C. Stone, Micronesica 6 (1970) 216; Gill., Rev. Fl. Mal. 3 (1971) 183; Pohl & Davidse, Brittonia 23 (1971) 302; Gould & Soderstrom, Canad. J. Bot. 52 (1974) 1084; Kerguélen, Lejeunia n.s. 75 (1975) 222; Tsvelev, Grasses Soviet Union (1976) 668; Mehra & Chaudhary, Taxon 25 (1976) 633; Holm et al., World's Worst Weeds (1977) 358, f. 151 & 152; Hsu, Fl. Taiwan 5 (1978) 583, pl. 1440; J.W. Parham in A.C. Smith, Fl. Vit. Nov. 1 (1979) 3377. – *Digitaria dilatata* Coste, Fl. Fr. 3 (1906) 553. – Type: *Commerson s.n.* (Herb. Lamarck, P, n.v.; photo in L), Argentine, Buenos Aires.
For further synonyms see Chase (1929).

Perennials, tufted, not stoloniferous. *Culms* ascending to erect, 40–120 cm long, rarely branching. Nodes glabrous or with some hairs. Sheaths slightly keeled; basal sheaths often pilose, purplish, not reticulate, the upper ones glabrous. Ligule bluntly triangular, up to 6 mm long. *Blades* flat, linear, narrowed at base, (5–)12–26(–39) cm by (3–)4–13 mm, usually with some up to 6 mm long hairs at the immediate base of the ligule, otherwise glabrous. Peduncle 0.8–1.3 mm diam., glabrous. Stalk 2.5(–7) mm long, appressed hirsute mixed with up to 9 mm long white hairs, brown. *Racemes* 3–5(–9), alternate, the lowest 5–13 cm long, the others gradually shorter upwards. Internodes of main axis 0.3–0.7 times as long as the subtending raceme. Rachis flat, winged, straight, frequently zigzag at the upper end, 1–1.3 mm wide, margins scabrous, spikeled to the base. Pedicels flattened, the inner ones 1.5–2.6 mm long, the outer ones shorter, edges ciliate. *Spikelets* paired, usually imbricate, ovate, (2.8–)3–4 by 1.8–2.5(–3.1) mm, pale green to purplish, apex acute. Lower glume absent. *Upper glume* slightly convex, as long as the spikelet, faintly pilose and with a fringe of white, c. 2 mm long hairs along the margin framing the spikelet, nerves 5–7(–9), concolorous with to slightly darker than the intervenium, midnerve prominent. *Sterile lemma* flat, nerves 3–7, faintly pilose to glabrous, not wrinkled, otherwise as the upper glume. *Fertile lemma* slightly convex, weakly 3-nerved, thickly cartilaginous, glabrous, minutely papillose-striate, pale. *Palea* flat to slightly concave, 2-nerved, otherwise as its lemma. Anthers slender, 1.2–1.5 mm long. Stigmas black to purplish (i. s.). Caryopsis suborbicular, plano-convex, up to about 2 mm long.

Distribution. Weed of American (sub)tropical origin, introduced in Malesia probably from Australia around 1900 (Singapore: 1902) as a cultigen, sometimes escaping: Java (Bogor, Jakarta, Priangan, Kedu, Malang, Besuki), Lesser Sunda Islands (Flores, Timor), Borneo (Sabah), Philippines (Luzon), New Guinea (Central Prov.).

Ecology. Roadsides, dry, damp or even water-logged sunny places, ash-grounds, wastegrounds, 50–2600 m alt.

Vernacular names. English: dallis grass (U.S., Philippines); Indonesian: rumput australi.

Collector's notes. Stigmas purplish black.

Chromosome numbers. 2n = 40, 60 (Gould & Soderstrom, 1974), 50 (Pohl & Davidse, 1971), 54 (Mehra & Chaudhary, 1976).

Phytochemistry. See Deshaprabhu (1966) for an analysis.

Uses. A troublesome weed in banana and papaya plantations in the Philippines (Holm et al., 1977).

In some regions important as a highly productive fodder grass though it requires careful management due to its minor competitive ability, especially on poor soil. Suitable for grasslands at moderate height, therefore cultivated in Java above 1000 m, sometimes escaping, but setting seed badly and primarily propagated by cuttings (Backer, 1950).

Due to its strong rooting habit it has been recommended as a suitable grass for the control of soil erosion (Deshaprabhu, 1966).

May cause diarrhoea in livestock possibly due to infections of an ergot, *Claviceps paspali*.

### 3. Paspalum distichum L. – Fig. 3.

*P. distichum* L., Syst. ed. 10, 2 (1759) 855; Benth., Fl. Austr. 7 (1878) 460; Ridley, Fl. Mal. Pen. 5 (1925) 218; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 46; Gardner, Fl. W. Austr. 1 (1951) 241, 321; Metcalfe, Anat. Monoc. 1, Gram. (1960) 365; Bor, Grasses (1960) 338; Vickery, Contr. N.S.W. Nat. Herb., Fl. Ser. 19, 1 (1961) 119; Türpe, Lilloa 32 (1967) 50; B.C. Stone, Micronesica 6 (1970) 216; Jovet & Guédès, Taxon 21 (1972) 546; Fosberg, Taxon 26 (1977) 201; Guédès, Taxon 27 (1978) 128; Hsu, Fl. Taiwan 5 (1978) 583, f. 1441; J.W. Parham in A.C. Smith, Fl. Vit. Nov. 1 (1979) 336; Renvoize & Clayton, Taxon 29 (1980) 339; Guédès, Taxon 30 (1981) 301; Brummitt, Taxon 32 (1983) 281. – *P. vaginatum* Sw. var. β Flüggé, Gram. Monogr., Paspalum (1810) 109. – *Milium distichum* Muhl., Descr. Gram. (1817) 78. – *Digitaria disticha* Fiori & Paoletti, Icon. Fl. Ital. Ill. 1 (1895) 16, f. 136. – Lectotype: *P. Browne in Herb. Linné 79-9*, second fertile culm from the left (LINN, n.v.; microfiche IDC), Jamaica. (See note on the confused typification.)

*Digitaria paspalodes* Michx., Fl. Bor. Am. 1 (1803) 46. – *Milium paspalodes* Elliott, Sketch Bot. S. Carolina 1 (1816) 104. – *P. michauxianum* Kunth, Rév. Gram. 1 (1829) 25, nom. superfl. – *P. elliottii* S. Warson in A. Gray, Man. Bot. ed. 6 (1890) 629, nom. superfl. – *P. paspalodes* Scribner, Mem. Torrey Club 5 (1894) 29; Bor in Rechinger, Fl. Iran. 70 (1970) 494; Kerguélen, Lejeunia n.s. 75 (1975) 222; Vickery, Fl. N.S.W. Nat. Herb. 19, 2 (1975) 135; Tsvelev, Grasses Soviet Union (1976) 669; Srivastava, Acta Bot. Indica 10 (1982) 111, f. 1–7. – *Anastrophus paspalodes* Nash in Britton, Man. (1901) 75. – *P. distichum* L. subsp. *paspalodes* Thell., Mem. Soc. Nat. Cherbourg 38 (1912) 77. – Type: *Herb. Michaux* (P, n.v.), U.S.A., South Carolina.

*P. distichum* L. var. *longirepens* Domin, Bibl. Bot. 85 (1915) 289. – Type: *Wools ex Herb. F. von Mueller, anno 1877* (K), Australia, Sydney, Manley Beach.

*P. distichum* L. var. *microstachyum* Domin, Bibl. Bot. 85 (1915) 289. – Type: *Domin s.n., anno 1910* (PR, holo, n.v.), Australia, Queensland.

For further synonyms see Chase (1929).

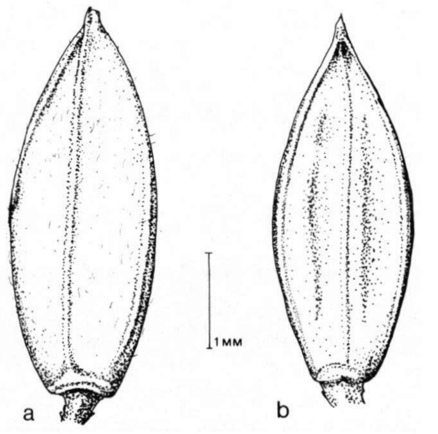


Fig. 3. *Paspalum distichum* L. a. Upper glume; b. sterile lemma (*PNH 33167*).

Perennials stoloniferous, sometimes tufted. Stolons leafy, rooting at the nodes, glabrous, smooth. *Culms* ascending to erect, 9–60(–100) cm long, rarely branching. Nodes often with some c. 3 mm long, white hairs. Sheaths slightly keeled, with some c. 2.5 mm long, white hairs along the margins, at least at the apex, usually in the upper third, otherwise glabrous, the basal ones not reticulate. Ligule collar-shaped, 0.4–0.8 mm long. *Blades* flat, linear, narrowed at base, (1–)6–10(–20) cm by (1.5–)3–5(–9) mm, usually with some c. 2.5 mm long, white hairs at the immediate base of the ligule, otherwise glabrous, rarely pubescent. Peduncle 0.7–0.8 mm diam., glabrous or with a few, white hairs. Stalk up to 1 mm long, green-brown, with some c. 2.5 mm long, white hairs. *Racemes* 2, subopposite, rarely with a third one below them, (2–)3–5(–8) cm long. Rachis flattened, straight, not winged, 1.2–2 mm wide, spikeled from the base, margins scabrous. Pedicels flattened, straight, 0.2–0.5 mm long, ciliate. *Spikelets* solitary, the upper ones usually imbricate, oblong, 2.9–3.4(–4) by 1.3–1.6(–1.8) mm, pale green, apex acute. *Lower glume* at least in some spikelets present, reduced to a minute scale, rarely more developed, then flat, oblong, up to 2 by 1 mm, acute, 1- or 3-nerved. *Upper glume* slightly convex, as long as the spikelet, pubescent, sometimes obscurely so, nerves (3 or) 5 or 7, concolorous with the intervenium, midnerve prominent. *Sterile lemma* flat, glabrous, not wrinkled, as the upper glume. *Fertile lemma* convex, 0- or weakly 3-nerved, pergamentaceous, smooth, apex with some short, stiff cilia, pale green. *Palea* flat, 0- or weakly 2-nerved, as the lemma. Anthers slender, c. 1.5 mm long. Stigmas dark brown to purple (i.s.). Caryopsis ovate, plano-convex, c. 1.5 mm long.

Distribution. A pantropical weed, probably introduced in Malesia: Malaya (Penang), Java (Priangan), Philippines (Luzon), Moluccas (Buru).

Ecology. Wet marshlands, swamps, in polluted, shallow water, along irrigation ditches, etc., up to 1725 m alt.

Vernacular names. English: ginger grass, knot grass, victoria grass, water couch; Indonesia: rumput italia; Philippines: gagayut (Wfumo).

Collector's notes. Glaucous, greenish with black anthers and styles.

Anatomy. See Metcalfe (1960).

Chromosome numbers. 2n = 40, 48, 60 (e.g. Türpe, 1967).

Cytology. Srivastava (1982, as *P. paspalodes*) reported obligate apomixis for Indian representatives.

Uses. Considered to be a valuable pasture grass on alluvial flats and useful as a soilbinder on stream banks. Sometimes found as a weed in sawahs (Bor, 1960).

Notes. When Linné described *P. distichum* he mentioned material sent to him by P. Browne. Bor (Fl. Iraq 9, 1968, 494) without any explanation indicated that the name had been misapplied and that the correct name would be *P. paspalodes* (Michx.) Scribner (*'paspaloides'*). In 1970 he explained that the specimen on sheet 79.9 in the Linnean herbarium (LINN) which most closely agreed with the Linnean description was a grass which until then had been known as *P. vaginatum* Sw. This name ought therefore to be reduced into the synonymy of *P. distichum*, while the species commonly called by that name needed a new one.

The sheet 79.9 in the Linnean herbarium bears one sterile and three fertile culms. Linné had marked them with 'Br.' indicating that they represent P. Browne collections. Unfortunately the sheet contains a mixture as was observed by Jovet & Guédès (1972): the culm on the *right-hand* side is indeed *P. vaginatum*, but the two others, however, are something quite different.

From Linné's original description ('spicibus duabus, altera subsessili', i.e., only one of the two spikes subsessile) Jovet & Guédès argued that that referred to the two *left-hand* culms since the right-hand one has both racemes equally subsessile. The latter author therefore retypified *P. distichum* choosing the fertile culm second from the left whereby both names were restored to their classical usage. Fosberg (1977) disagreed with this, remarking that 'Br.' had been written closest to the right-hand culm which in his opinion indicated that Linné had thus wanted to indicate that this was the 'true' specimen of P. Browne, whereby Bor's original lectotypification ought to be followed. Guédès (1978), in his turn, countered this view and argued that the relative position of a mark should not be given so much weight, while it would be impossible to prove anymore that all specimens were not already part of the same Brownean collection originally received by Linné. In our opinion he correctly pointed out that types should be selected conform the original descriptions and preferably in accordance with established use ('so we choose a specimen of everybody's *P. distichum*').

To put an end to all this confusion Renvoize & Clayton (1980) then proposed that the combination *P. distichum* should be rejected, whereby *P. vaginatum* would be restored and *P. distichum* would become *P. paspalodes*. Guédès (1981) retorted to this new viewpoint that 'such a very classical name should not be dismissed.'

A vote of the Committee on nomenclature (Brummitt, 1983) put an end to all these squabbles and resulted in a vindication of Guédès' typification. So we have *P. distichum* L. being typified by the second specimen from the left on Herb. Linné sheet 79-9 and *P. vaginatum* Sw. typified by a specimen in the Swartz herbarium.

### 4. Paspalum longifolium Roxb. – Fig. 4.

*P. longifolium* Roxb. [Hort. Beng. (1814) 7, nomen] Fl. Ind. 1 (1820) 283; Trin., Diss. Bot. Alt. (1826) 109; Sp. Gram. Icon. 2 (1829) t. 138; Buse in Miq., Pl. Jungh. 3 (1854) 383; Miq., Fl. Ind. Bat. 3 (1857) 432; Camus, Fl. Gén. I.-C. 7 (1922) 392; Ridley, Fl. Mal. Pen. 5 (1925) 217; Bor, Fl. Assam 5 (1940) 253; Jansen, Reinwardtia 2 (1953) 321; Schmid, l'Agron. Trop. 13 (1958) 302, f. 47-2; Bor, Grasses (1960) 339; Henty, Bot. Bull., Lae 1 (1969) 246; Gill., Rev. Fl. Mal. 3 (1971) 182, pl. 24a, f. 14; Hsu, Taiwania 16 (1971) 292; Malik & Tripathy, Broteria 41 (1972) 55; Koyama in Walker, Fl. Okinawa (1976) 216. – Type: *Roxburgh s.n.* (BM, holo, photo in K), India, cult.

*P. scrobiculatum* L. var. β Fluggé, Gram. Monogr., Paspalum (1810) 88. – Type: *Herb. Klein* (ubi?), isotype of *P. flexuosum* Presl?

*P. sumatrense* Roth ex R. & S., Syst. Veg. 2 (1817) 316; Roth, Nov. Pl. Spec. (1821) 35. – Type: *Heyne s.n.* (B, holo, lost; K, p.p.), East Indies.

*P. flexuosum* Klein ex Presl, Rel. Haenk. 1 (1820) 216; Miq., Fl. Ind. Bat. 3 (1855) 433. – Type: *Klein in Herb. Willdenow no. 1574*, p.p. (B, holo, n.v.; microfiche IDC!: first sheet from left; isotype of *P. scrobiculatum* var. β Fluggé?), India.

*P. cognatum* Steudel, Syn. 1 (1853) 28. – *P. zollingeri* Steudel var. β *gracilior* Miq., Fl. Ind. Bat. 3 (1857) 431. – Type: *Zollinger 192* (P, holo, n.v.; B, BM, K, L), Java.

*P. houttuynii* Van Hall ex De Vriese, Pl. Ind. Bat. Or. 2 (1857) 113. – Type: *Kleinhoff in Herb. Reinwardt* (?L, holo, but not found), Java.

*P. longifolium* Roxb. var. *hirsutum* Boerl., Ann. Jard. Bot. Btzg. 8 (1890) 49. – Type: *Boerlage s.n.* (BO, holo), Java, Bogor, Botanic Garden, 6 October 1896.

*P. scrobiculatum* L. var. *philippinense* Merr., Philip. J. Sc. 1 (1906) Suppl. 345. – Lectotype: *BS 1449 (Ramos)* (PNH, holo; BO), Philippines, Luzon, Rizal Prov., Morong, August 1906.

*P. longifolium* Roxb. var. *trichocoleum* Hackel, Philip. J. Sc. 3 (1908) Bot. 167. – Type: *Merrill 5455* (W, holo, PNH, lost, n.v.; BO, L), Philippines, Mindanao, Surigao Prov., Caraga, 6 October 1906.

*P. platycoleum* Ridley, Fl. Mal. Pen. 5 (1925) 217. – Type: *SF 4509 (Nur)* (SING, holo; K), Selangor, Port Swettenham, 13 February 1919.

*P. orbiculare* Forst. f. var. *otobedii* Fosb. & Sachet, Micronesica 18 (1984) 83. – Type: *Otobed PW-10090* (US, holo), Carolines, Palau I., Koror I., 22 August 1977.

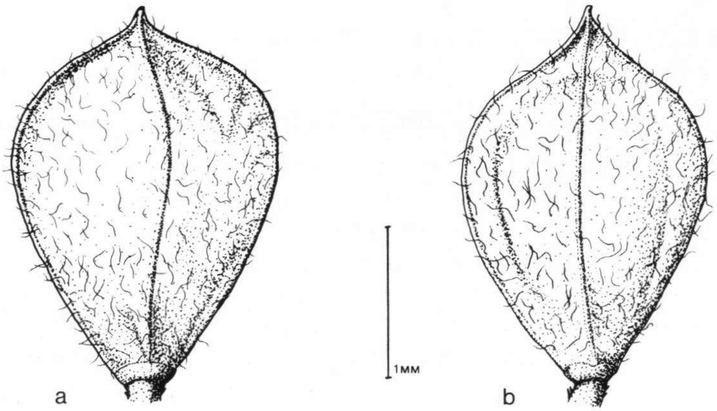


Fig. 4. *Paspalum longifolium* Roxb. a. Upper glume; b. sterile lemma (*Ramos 1956*).

Perennials, tufted, not stoloniferous. *Culms* erect to ascending, (20–)50–125 (–150) cm long, rarely branching. Nodes glabrous or stiffly hairy. Sheaths slightly keeled, the basal ones hirsute at base or glabrous, purplish, rarely somewhat reticulate, the higher ones smooth or with a pilose margin, otherwise glabrous. Ligule collar-shaped, 1–3 mm long. *Blades* usually once folded lengthwise, linear, narrowed towards the base, (2–)20–40(–56) cm by (2–)4–9(–9.5) mm, appressed hirsute at least behind the ligule or at base. Peduncle (0.6–)0.7–1.5 mm diam., glabrous or with a few hairs. Stalk 0.8–3 mm long, appressed hirsute, mixed with some white, up to 11 mm long hairs to scabrous, black. *Racemes* (3–)5–12(–16), alternate, 1.5–8 cm long. Internodes of the main axis 0.15–0.8 times as long as the subtending raceme. Rachis flat, straight, winged, (1.5–)2–3.5(–5) mm wide, spikeled to the base, margins scabrous. Pedicels terete to slightly quadrangular or 2-edged, 0.5–1.5 mm long, scabrous all over or only along the edges, the inner one usually shorter than the outer one. *Spikelets* paired (the inner spikelet sometimes reduced to minute glumes, but usually well-developed at least in the middle part of the raceme), imbricate, broadly ovate to broadly obovate, 2.1–2.5(–2.8) by 1.2–2(–2.2) mm, yellow-green to light brown, sometimes purplish, apex acuminate. Lower glume absent. *Upper glume* convex, as long as the spikelet, sparsely pubescent all over or only along the margins, very rarely entirely glabrous, nerves 3, darker than the intervenium, midnerve prominent. *Sterile lemma* flat to slightly convex, not wrinkled, as the upper glume. *Fertile lemma* convex, 0–5-nerved, thickly cartilaginous, usually glabrous, very rarely sparsely pubescent, or the margins with a few hairs, papillose-striate, pale brown. *Palea* slightly convex, 0- or 2-nerved, as the lemma. Anthers slender, 0.7–1.1 mm long. Stigmas brown to purplish black (i.s.). Caryopsis broadly obovate, unequally biconvex, c. 1.5 mm long.

Distribution. India (Assam), Nepal, Sri Lanka to Vietnam, to the Pacific (Ryukyu I., Samoa) and N. Australia (Queensland), common throughout Malesia.

Ecology. Solitary or in groups in moist places, e.g. along riverbanks, in swamps, bogs and pools, in floating grass communities, growing in up to 60 cm deep water. A common invader in wet and open, disturbed places. Weed in sawahs, associated with e.g. *Bothriochloa glabra, Echinochloa, Eriocaulon, Hymenachne, Miscanthus, Oryza*. On sandy, loamy, clayey, alluvial soils, up to 1700 m alt.

Vernacular names. Malaya: paha belalang, rumput patah siku; Riouw: siak[2]; Sumatra: gereman badah (Ulunese); Java: jukut cariang, rumput jilurang, wawaderan; Borneo: cakan belangkas; Celebes: bulibuliba merah; New Guinea: wabiwabita (Minufia, Kabubu), waiofana (Onjob, Naukwata).

Collector's notes. Erect to ascending, occasionally rooting from the lower nodes, no rhizomes or stolons, whole plant green or occasionally purplish, leaves reddish green to green. Inflorescence green. Rachis purple. Racemes green, greenish brown, reddish. Spikelets purplish when flowering, dark brown. Anthers yellow, orange, black. Stigmas purple, black. Fruit greenish, brown.

Chromosome numbers. 2n = 40 (e.g. Hsu, 1971), 50 (e.g. Malik & Tripathy, 1972).

Uses. Some value as a fodder grass for water buffaloes (Bor, 1960).

Notes. *Paspalum scrobiculatum* L. var. *philippinense* Merr. has here been lectotypified with *BS 1449 (Ramos)*, as this was the only collection of the three cited by Merrill which we have seen.

Plants with a hirsute sheath have been described as var. *hirsutum* by Boerlage (1890), but the pubescence is too variable to base distinct taxa upon.

Bor (1940, 1960) mentioned a var. *lorirachis* Bor, a robust form with the rachis up to 8 mm wide. No such plants have been seen and the status must remain in doubt.

### 5. Paspalum orbiculare Forst. f. – Fig. 5.

*P. orbiculare* Forst. f., Fl. Ins. Austr. Prodr. (1786) 7; Camus, Fl. Gén. I.-C. 7 (1922) 391; Ridley, Fl. Mal. Pen. 5 (1925) 217; Burk., Dict. Econ. Prod. 2 (1935) 1674; Schmid, l'Agron. Trop. 13 (1958) 302; Bor, Grasses (1960) 340; Vickery, Contr. N.S.W. Nat. Herb., Fl. Ser. 19, 1 (1960) 118; Henty, Bot. Bull., Lae 1 (1969) 146; Nath et al., Cytologia 35 (1970) 111; Gill., Rev. Fl. Mal. 3 (1971) 184, pl. 24b, f. 15; Hsu, Taiwania 16 (1971) 292; Khosla & Mehra, Taxon 22 (1973) 560; J.W. Parham in A.C. Smith, Fl. Vit. Nov. 1 (1979) 338; Dujardin, Canad. J. Bot. 57 (1979) 867. – *P. scrobiculatum* var. $\gamma$ Fluggé, Gram. Monogr., Paspalum (1810) 88. – *P. scrobiculatum* L. var. *orbiculare* Hackel, Bot. Jahrb. 6 (1885) 233. – Type: *Forster s.n.* (GOET, holo, n.v.; K), Society Islands.

*P. longifolium* Roxb. var. *pseudo-orbiculare* Jansen, Reinwardtia 2 (1953) 321. – Type: *Santos 5* (MICH, holo), Philippines, Luzon, Mountain Prov., Baguio, 28 March 1940.

Perennials, tufted, not stoloniferous. *Culms* erect, (10–)30–70(–100) cm long, rarely branching. Nodes glabrous, rarely with a few hairs. Sheaths not keeled, glabrous, the basal ones sometimes hirsute in the lower half, not reticulate. Ligule collar-shaped, 0.3–1(–2) mm long. *Blades* flat or once folded lengthwise, linear, narrowed towards the base, (2–)8–25(–40) cm by (1.5–)4–7(–8.5) mm, hirsute at base at least behind the ligule. Peduncle 0.5–0.7(–0.8) mm diam., glabrous. Internodes of the main axis 0.25–1 times as long as the subtending raceme. Stalk 0.5–1.5 mm

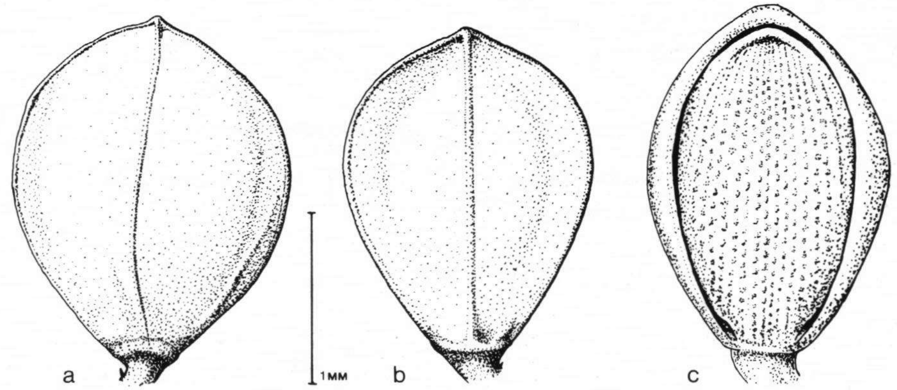


Fig. 5. *Paspalum orbiculare* Forst. f. a. Upper glume; b. sterile lemma; c. fertile lemma and its palea (*Koorders 42216*).

long, appressed hirsute usually mixed with one or more up to 7 mm long, white hairs, black. *Racemes* 2–4(–6), alternate, 1–6.5 cm long. Rachis flat, winged, straight to slightly zigzag, 1–1.5(–1.9) mm wide, spikeled from the base, margins scabrous. Pedicels oval in diam. or 2-edged, 0.3–0.8 mm long, edges scabrous. *Spikelets* paired or solitary, the inner one sometimes developed, usually reduced in the middle of the raceme, sometimes absent at its ends, imbricate, usually broadly obovate, less often suborbicular to broadly obovate, (1.7–)1.9–2.3(–2.7) by (1.2–)1.5–1.8(–2) mm, yellow-brown to brown, apex acute to rounded. Lower glume absent. *Upper glume* convex, as long as the spikelet, glabrous, nerves 3 or 5, darker than the intervenium, midrib prominent. *Sterile lemma* slightly convex, not wrinkled, as the upper glume. *Fertile lemma* convex, 0-, or 3-, or 5-nerved, coriaceous, glabrous, papillose-striate, yellow-brown to brown. *Palea* slightly convex, 0- or 2-nerved, as its lemma. Anthers slender, 0.5–0.9 mm long. Stigmas dark purple to black (i.s.). Caryopsis broadly ovate to broadly obovate, unequally biconvex, c. 1.3 mm long.

Distribution. India (Assam), Sri Lanka, Nepal, to Taiwan, Hongkong to Polynesia (to Hawaii, New Caledonia) and N. Australia (Queensland, New South Wales), throughout Malesia.

Ecology. Generally in moist places, e.g. marshes, swamp grasslands, ponds, also in sunny grassy places near the sea, on sandy soils, clay, or peat, in up to 25 cm deep water. Associated with *Cyperus, Eleocharis, Ophiuros, Themeda, Xyris.* Up to 2200 m altitude.

Vernacular names. None recorded on the sheets, often confused with *P. scrobiculatum* s.l., q.v.

Collector's notes. Culms coarse, erect, ascending with an angle, tufted, thick and soft at base, grey-green, branching horizontally. Leaves milky green, dull green. Spike pinkish, green, brown. Spikelets pale green, green-brown. Anthers black. Stigmas purple. Fruit green.

Chromosome numbers. 2n = 20 (Dujardin, 1979), 40 (e.g. Khosla & Mehra, 1973), 54 (Nath et al., 1970), 60 (Hsu, 1971).

Uses. None recorded, but cf. *P. scrobiculatum*.

Notes. This species may cause difficulties in the identification when the inner spikelets are all reduced whereby the outer ones may appear to be solitary. Especially *P. scrobiculatum* var. *bispicatum* is then very similar. The spikelets in *P. orbiculare* are usually broadly obovate with 3 or 5 discolorous nerves in the upper glumes and sterile lemmas, while in var. *bispicatum* the spikelets are usually suborbicular and the nerves are 5 or 7, concolorous.

The forma *depauperata* Chase mistakenly included by her in *P. longifolium* represents a depauperate form of the present species and needs no taxonomical distinction.

A peculiar collection is *Hosokawa 5959* (L) from Leval, Ponape. It has tumid spikelets with the fertile lemmas nearly completely enveloping the palea, a situation not encountered elsewhere.

## 6. Paspalum paniculatum L. – Fig. 6.

*P. paniculatum* L., Syst. Nat. ed. 10, 2 (1759) 855; Stapf in Prain, Fl. Trop. Afr. 9 (1920) 577; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 122, f. 72; Metcalfe, Anat. Monoc. 1, Gram. (1960) 366; Vickery, Contr. N.S.W. Nat. Herb., Fl. Ser. 19, 1 (1961) 121; Henty, Bot. Bull., Lae 1 (1969) 146; Bosser, Mém. Orstom 35 (1969) 399, f. 149e & f; Davidse & Pohl, Canad. J. Bot. 50 (1972) 275; J.W. Parham in A.C. Smith, Fl. Vit. Nov. 1 (1979) 335. – *Panicum paniculatum* O. Kuntze, Rev. Gen. Pl. 3 (1898) 363. – Type: *P. Browne in Herb. Linné 79-11* (LINN, holo, n.v.; microfiche IDC!), Jamaica.
For further synonyms see Chase (1929).

Perennials, tufted, not stoloniferous. *Culms* ascending to erect, 35–100(–120) cm long, often branching. Nodes pilose with up to 5 mm long, white or brown hairs. Sheaths slightly keeled, hirsute, rarely glabrous, the basal ones not reticulate. Ligule collar-shaped, c. 3 mm long. *Blades* flat, linear, rounded at base, (4–)20–35 cm by (5–)10–25 mm, hirsute, rarely glabrous, with a tuft of long, white hairs at the immediate base of the ligule. Peduncle 0.9–1.3 mm diam., with scattered hairs. Stalk up to 2 mm long, hirsute, mixed with some up to c. 5 mm long, white, sometimes flattened hairs, dark brown. *Racemes* 10–40(–60), alternate, the lowermost 5.5–8 cm long, the others distally becoming shorter. Internodes of the main axis 0.1–0.3 times as long as the subtending. Rachis flat, winged, straight to slightly zigzag at the upper end, 0.3–0.5 mm wide, spikeled from the base, margins scabrous and often with some hairs. Pedicels terete to 2-edged, the outer ones 0.6–1.2 mm

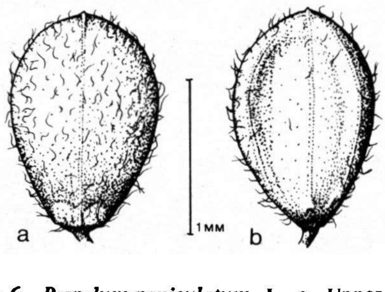

Fig. 6. *Paspalum paniculatum* L. a. Upper glume; b. sterile lemma (*Brass 28208*).

long, the inner ones shorter, edges scabrous. *Spikelets* paired, sometimes a few solitary or rarely ternate within a single raceme, at least the upper ones imbricate, obovate, 1.2– 1.4 by 0.9–1 mm, yellow-brown or purplish with brown dots, apex rounded. Lower glume absent. *Upper glume* convex, slightly shorter than, sometimes as long as the spikelet, shortly appressed hirsute, nerves 5, concolorous with to slightly darker than the intervenium, midnerve prominent. *Sterile lemma* flat, hirsute along the margins, 3- or 5-nerved, not wrinkled, as the upper glume. *Fertile lemma* convex, 0- or 3nerved, thickly coriaceous, glabrous, smooth, yellow. *Palea* flat to slightly convex, 2-nerved, as the lemma. Anthers slender, c. 1 mm long. Stigmas dark brown to dark purple (i.s.). Caryopsis ovoid, unequally biconvex, c. 1.2 mm long.

Distribution. Tropical South America and West Africa, introduced elsewhere in the tropics, e.g. in Malesia: New Guinea (Vogelkop, Jayapura, West Sepik, East Sepik, Eastern Highlands, Southern Highlands, Central, Northern, Morobe, Milne Bay, New Britain).

Ecology. Locally common along roadsides, wastegrounds, in regrowth of *Albizzia*, coconut plantations, rocky stream banks, etc. on loamy clay or volcanic sands, up to 1400 m alt.

Vernacular names. English: galmarra grass, Russell river grass; New Guinea: hanu (Kutubu), samara (Orokaiva, Mumuni), wolo (Miwaute, Wapi).

Collector's notes. Culms erect. Sheaths slightly viscid, the lower with irritant hairs, hairs very sharp. Leaves dull green above, lighter below. Spikelets purplish. Fruit brownish, grey, tending to adhere to animals and man during rain and thus transported (Bosser, 1969).

Anatomy. See Metcalfe (1960).

Chromosome numbers. 2n = 20, 40 (e.g. Davidse & Pohl, 1972).

Uses. A weed of cultivated land. Introduced as a pasture grass, but apparently not palatable to cattle (Parham, 1979).

Notes. *Schodde 2153* (K, L) from Papua, S. Highlands, Lake Kutubu, has ternate spikelets, the third ones much reduced.

## 7. Paspalum scrobiculatum L. – Diagram 1 a–c (see p. 285).

For the references see under the varieties.

### a. var. scrobiculatum

*P. scrobiculatum* L., Mant. 1 (1767); R. & S., Syst. Veg. 2 (1817) 382; Buse in Miq., Pl. Jungh. (1854) 382; Miq., Fl. Ind. Bat. 3 (1857) 430; Camus, Fl. Gén. I.-C. 7 (1922) 391, t. 39, f. 5 & 6; Burk., Dict. Econ. Prod. 2 (1935) 1675; Henr., Blumea 3 (1940) 440; Bor, Grasses (1960) 340; Deshaprabhu, Wealth of India 7 (1966) 270; Henty, Bot. Bull., Lae 1 (1969) 145; Gill., Rev. Fl. Mal. 3 (1971) 185, f. 38; Hsu, Taiwania 16 (1971) 292; Clayton, Kew Bull. 30 (1975) 101. – *P. scrobiculatum* L. var. *frumentaceum* Stapf in Prain, Fl. Trop. Afr. 9 (1920) 575, nom. superfl. – Lectotype: *Herb. Linné no. 79-4* (LINN, holo, n.v.; microfiche IDC!), India orientalis.

[*P. frumentaceum* Rottl. ex Beauv., Agrost. (1812) 10, 171, nom. inval., 'India orientalis', 'Rottb.']

*P. scrobiculatum* L. var. *turgidum* Buse in De Vriese, Pl. Ind. Bat. Or. 2 (1857) 113. – *P. commersonii* Lamk. var. *turgidum* Jansen, Reinwardtia 2 (1953) 320. – Type: *Reinwardt 66* (L, holo), Java.

Plants perennial (annual?), tufted, not stoloniferous. *Culms* ascending to erect, 8–20(–55) cm long, sometimes branching. Nodes glabrous, rarely setose. Sheaths not keeled, the basal ones usually glabrous, sometimes hirsute all over, not reticulate, the cauline ones usually hairy along the margins or only in the upper part, rarely glabrous. Ligule collar-shaped, 0.3–1.8 mm long. *Blades* flat or once folded lengthwise, linear, narrowed towards the base, (4–)7–20(–30) cm by (3–)5–7(–9) mm, hirsute at base along the margins and above or at least behind the ligule, rarely hirsute all over. Peduncle 0.5–1 mm diam., glabrous. Stalk 0.8–2 mm long, appressed hirsute, sometimes mixed with white, up to 5 mm long hairs, black. *Racemes* solitary, terminal, or paired, subopposite or alternate, 1.5–7 cm long. Internodes of the main axis up to 0.25 times as long as the subtending raceme. Rachis flat, straight to slightly zigzag, winged, (0.8–)1.3–2.2(–3) mm wide, spikeled from the base, margins scabrous. Pedicels straight, terete to 2-edged, 0.4–1.3 mm long, edges scabrous. *Spikelets* solitary, imbricate or not, usually suborbicular, less often broadly ovate to obovate, 2.55–3.25 by 2.1–2.6 mm, brown to dark brown, apex rounded to broadly, shortly, bluntly acuminate. *Lower glume* absent, rarely more or less developed. *Upper glume* strongly convex, as long as the spikelet, glabrous, nerves 7, 9, 11, or 13, concolorous with the intervenium, midnerve prominent. *Sterile lemma* flat to slightly convex, 7- or 9-nerved, usually wrinkled along the margins, occasionally cartilaginous or partly so. *Fertile lemma* strongly convex, 0-, 3-, or 5-nerved, coriaceous, glabrous, papillose-striate, dark brown at maturity. *Palea* slightly convex, 0- or 2-nerved, as the lemma. Anthers slender, 0.8–1.2 mm long. Stigmas white or purple (i.s.). Caryopsis broadly ovate to obovate, usually biconvex, c. 2 mm long.

Distribution. World distribution uncertain due to doubtful identifications in the literature, seen from India (throughout), Sri Lanka to the Pacific (New Hebrides), Malesia: Java (Bantam, Jakarta, Ceribon, Pekalongan, Banyumas, Kedu, Semarang, Japara-Rembang, Madiun, Kediri, Surabaya, Malang, Madura, Kangean I.), Lesser Sunda Islands (Sumba, Flores, Timor), New Guinea (see note). Not seen from Africa.

Ecology. Roadsides, sawahs, teak plantations, usually in moist places on clayey soils, loam or volcanic sands, up to 650 m altitude. Exact data are difficult to verify because of the confusion with the other varieties.

Vernacular names. English: kodo millet, kodra millet; Java: rebu bawang, rumput kinangan; Madura: rebbha ghung² mloko; suket krisik (Tayu).

Chromosome numbers. None recorded, but see the introduction and var. *bispicatum*.

Uses. Cultivated for the grains, but reported to be poisonous possibly due to infections of the outer husks by *Sorosporium paspali* and *Uredo paspali-scrobiculari*. 'Eaten with caution, except when the eaters deliberately set themselves to get intoxicated' (Burkill, 1935). Bor (1960) mentioned that elephants which had raided the crop died as a result of their depredations. Storage of more than six months seems to remove the poisonous principle (Deshaprabhu, 1966).

Notes. This variety has been described as an annual. The specimens we have seen, however, when they had a root system, were invariably perennial. As the roots were often absent we cannot exclude the possibility of an annual cycle, but it seems unlikely.

Beauvois (1812) mentioned a *Paspalum frumentaceum* 'Rottb.' (no doubt a mistake for 'Rottler' because of the provenance from India), a name probably found on a label. Although the name appears in various reports, e.g. Roemer & Schultes (1817) ('Rottler'), the combination was never validly published as it was generally cited as a synonym of *P. scrobiculatum*. Stapf (1920) used the epithet at the varietal level under that name without citing a source. As he stated that this form represents the typical variety his combination is still invalid, as the autonym must now be used. His specimens (incl. *Rottler s.n.*, K) indeed belong to var. *scrobiculatum.*

The variety *turgidum* Buse (1854) was proposed for small perennials with few racemes and large spikelets. Again the autonym is required.

According to Henty (1969) several introductions have been tried in Papua New Guinea, but none seem to have persisted.

**b. var. auriculatum (Presl) Merr.**

*P. scrobiculatum* L. var. *auriculatum* (Presl) Merr., Philip. J. Sc. 1 (1906) Suppl. 345. – *P. auriculatum* Presl, Rel. Haenk. 1 (1830) 217; Miq., Fl. Ind. Bat. 3 (1857) 432; Henr., Blumea 3 (1940) 440. – Lectotype: *Haenke s.n.* (PR, holo; K), Philippines, Luzon, Sorzogon (see note).

*P. zollingeri* Steudel, Syn. 1 (1853) 28; Miq., Fl. Ind. Bat. 3 (1857) 431; Camus, Fl. Gén. I.-C. 7 (1922) 391; Schmid, l'Agron. Trop. 13 (1958) 302. – Type: *Zollinger 48* (P, holo, n.v.; B, K, L), Java.

Differs from the typical variety by:

Culms up to 135 cm long. Cauline sheaths glabrous. Blades 20–40(–53) cm by 10–16(–19) mm. Peduncle 1–1.9 mm diam. Racemes 3–8, alternate, 8–15.5 cm long. Upper glume 7-nerved. Sterile lemma 7- or 9-nerved, usually more or less smooth.

Distribution. General distribution uncertain because of the confusions in identity. Cultivated and escaping in at least India, Sri Lanka, Thailand and Malesia: Java (Bantam, Kedu), Lesser Sunda Islands (Flores, Alor, Timor), Philippines (Palawan, Paragua, Leyte), Moluccas (Sula).

Ecology. Wet monsoon forests, grassplains, along roads on damp open soil on loam, yellow mecamie soil, up to 650 m altitude.

Collector's notes. None recorded.

Chromosome numbers. Not known with certainty.

Uses. A cereal in India, sown in June, harvested in November (*Panigrahi 20846*, L).

Notes. The type collection in PR is a mixture of three culms mounted on the righthand side belonging to the present variety and one culm on the left side belonging to var. *bispicatum* (with indurated sterile lemmas). Presl's description agrees with the first three which must therefore be regarded as type material.

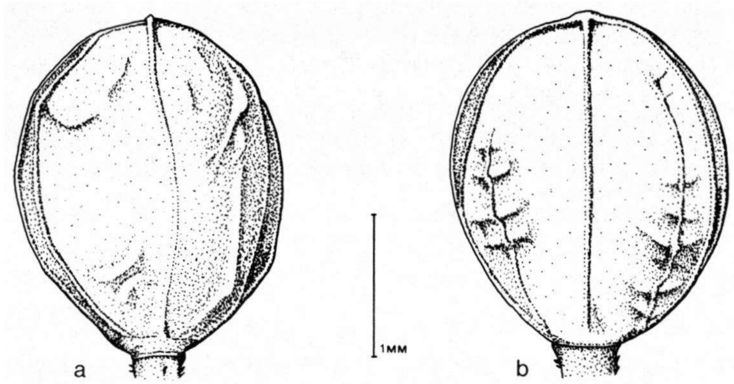


Fig. 7A. *Paspalum scrobiculatum* L. var. *bispicatum* Hackel. a. Upper glume; b. sterile lemma (*Hoogerwerf 227*).

### c. var. bispicatum Hackel – Fig. 7A.

*P. scrobiculatum* L. var. *bispicatum* Hackel in Kneucker, Allg. Bot. Zeitschr. 20 (1914) 146. – Type: *Kneucker Exsicc. 803 (Merrill & McGregor)* (W, holo, n.v.; BM, K, L, UPS), Philippines, Luzon, Rizal Prov., San Petro Macati, 10 m alt., July 1910.

*P. commersonii* Lamk., Tabl. Encycl. 1 (1791) 175, t. 43; Ridley, Fl. Mal. Pen. 5 (1925) 218; Jansen, Reinwardtia 2 (1953) 319; Metcalfe, Anat. Monoc. 1, Gram. (1960) 362; Bor, Grasses (1960) 335; Tateoka, Amer. J. Bot. 52 (1965) 167; Henty, Bot. Bull., Lae 1 (1969) 145; B.C. Stone, Micronesica 6 (1970) 218. – *P. scrobiculatum* L. var. *commersonii* Stapf in Prain, Fl. Trop. Afr. 9 (1920) 573; Camus, Fl. Gén. I.-C. 7 (1922) 391. – Type: *Commerson s.n.* (P, holo; L), Mauritius.

*P. kora* Willd., Sp. Pl. ed. 4, 1 (1797) 332; Roxb., Fl. Ind. ed. Carey 1 (1832) 279. – *P. scrobiculatum* L. var. β Fluggé, Gram. Monogr., Paspalum (1810) 87. – Type: *Herb. Willdenow 1574 p.p.* (B, holo, n.v.; microfiche IDC!: third from left), India.

*P. polystachyum* R. Br., Prod. 1 (1810) 188; R. & S., Syst. Veg. 2 (1817) 297. – *P. scrobiculatum* L. var. *polystachyum* Stapf in Prain, Fl. Trop. Afr. 9 (1920) 576. – Lectotype: *R. Brown 6088* (K, holo), Australia, Bay of Carpentaria, 1802–1803.

*P. firmum* Trin., Gram. Pan. (1826) 105; Steudel, Syn. 1 (1853) 28. – *P. mauritanicum* Nees ex Steudel, Syn. 1 (1853) 25, nom. superfl. (see note). – Type: *Sieber Fl. Maur. 44* (LE, holo; P, n.v.; L), Mauritius.

*P. cartilagineum* Presl, Rel. Haenk. 1 (1830) 216; Miq., Fl. Ind. Bat. 3 (1855) 432; Jansen, Reinwardtia 2 (1953) 320; Bor, Grasses (1960) 335; Henty, Bot. Bull., Lae 1 (1969) 145; Gill., Rev. Fl. Mal. 3 (1971) 184. – *P. orbiculare* Forst. f. var. *cartilagineum* Summerh. & Hubb., Kew Bull. (1930) 257. – *P. cartilagineum* Presl var. *cartilagineum:* Fosb. & Sachet, Micronesica 18 (1984) 81. – Lectotype: *Haenke s.n.* (PR, holo), Philippines, Luzon, Sorzogon, 1792.

*P. adelogaeum* Steudel, Syn. 1 (1853) 27. – Type: *Goering II, 168* (P, holo), probably from Java.

*P. metzii* Steud., Syn. 1 (1853) 21. – Type: *Hohenacker 923* (P, holo, n.v.; L, UPS, W), India, Nilgirris, 1851.

*P. polo* F.M. Bailey, Queensl. Agric. J. 1 (1897) 234, f. 1; Queensl. Fl. 6 (1902) 1813. – Type *Bailey 51* (BRI, holo), Australia, Queensland, Somerset, Polo Creek, June 1897.

*P. scrobiculatum* L. var. *gracillimum* Domin, Bibl. Bot. 85 (1915) 288. – Type: not indicated (?PR, holo, n.v.), Australia, Queensland, Townsville, anno 1910.

*P. commersonii* Lamk. var. *hirsutum* Jansen, Reinwardtia 2 (1953) 319. – Type: *SF 4787 (Nur)* (SING, holo; K), Malaya, Selangor, Kuala Lumpur, 22 Feb. 1919.

*P. scrobiculatum* auct. non L., p.p.: Trin., Diss. Bot. Alt. (1826) 122; Sp. Gram. Icon. 2 (1829) t. 143 (!); Buse in Miq., Pl. Jungh. 3 (1854) 382; Miq., Fl. Ind. Bat. 3 (1857) 430; Merr., Philip. J. Sc. 1 (1906) Suppl. 344, p.p.; Gill., Rev. Fl. Mal. 3 (1971) 185, f. 38 (!); Hsu, Taiwania 16 (1971) 292.

*P. cartilagineum* Presl var. *biglumaceum* Fosb. & Sachet, Micronesica 18 (1984) 81. – Type: *Necker RS-292* (US, holo), Marianas, Rota I., Sabana, 1 Nov. 1945.

Differs from the typical variety by:

Culms 8–70(–130) cm long. Cauline sheaths glabrous or hairy along the margins at the top, rarely hirsute all over. Blades 10–25(–42) cm by 4–9(–15) mm. Peduncle 0.5–1.4 mm diam. Racemes (1 or) 2–6(–14), alternate or rarely subopposite, 1.5–9(–11) cm long. Spikelets 1.8–2.6 by 1.45–2.15 mm. Upper glume 5- or 7-nerved. Sterile lemma 5- or 7-nerved, usually more or less smooth. Fertile lemma 1.6–2.3 mm long. Anthers 0.5–1.1 mm long.

Distribution. Tropical Africa (not in Mauretania, see note!), Madagascar, Mauritius, Asia, to the Pacific (Mariannes, Bougainville, New Caledonia), Australia (N. Territory, Queensland, New South Wales), throughout Malesia.

Ecology. In many habitats, on many types of soil, from dry to damp, sunny to shaded, in rural areas, on beaches and along roads. A weed in sawahs and plantations. A sand binder on gravel banks. Associated with e.g. *Fimbristylis miliacea, Imperata, Melaleuca.* Up to 1900 m altitude.

Vernacular names. Malaya: pala belang, rumput tulo santadok; Sumatra: lulangan, rumput manis (Gajas), r. paitan, r. tumbag (Gajas), siansak; Bangka: gegit lalang; Java: blembeman, genjoran, jampang merak (Sund.), jampang ping²-basit, jukut jajampangan, tatamagan, tuton gilig; Lesser Sunda Islands: amila (Alor), semanki (Flores); Borneo: kumpai batu (illapatan), k. sikubalang, rumput klambu rusak, r. moto kaki; Moluccas: njelo² (Ternate), o hoye (Halmaheira), rumput piso (Buru); Celebes: cani², kaleta; New Guinea: fatana (Minafia, Utukap), tambuka (Kulomo), wakerakampa (Waskuk).

Collector's notes. Plants pale, glaucous, leaves and sheaths midgreen, flushed purple at base. Inflorescence light to dark green-brown. Flowers green to dark brown, odourless. Anthers yellow to dark purple. Stigmas white or purplish black. Fruit green. Host of *Cerebella paspali.*

Anatomy. Metcalfe (1960) gave an extensive description of the leaf anatomy of two specimens identified for him as *P. commersonii.* He observed some curious differences between them, it might therefore just be possible that he had two different varities in hand, e.g. var. *bispicatum* and var. *lanceolatum.*

Chromosome numbers. 2n = 20 (Tateoka, 1965).

Notes. *Paspalum polystachyum* was described by R.Brown (1810) in living material seen in 'T', i.e. from the tropical coasts of Queensland and the Bay of Carpentaria. In K there is material named by him from the Prince of Wales Island from the first area and from Sydney. The first has the number *'6088'* and is selected as the type.

Steudel (1853) took up a *Paspalum* described by Nees on two Sieber exsiccates, *Fl. Maur. 44* and *Fl. Mixta 145*, without realizing that the first was also the type of *P. firmum* Trin. (1826) also recognized by him. He erroneously wrote '*mauritanicum*' thereby suggesting that the species would occur in Northwest Africa, although Nees actually, and correctly, had written '*mauritianum*' for Mauritius on the other side of the continent.

The type of *P. cartilagineum* falls within the circumscription of this variety. As explained in the introduction a taxon distinguished by an indurated fertile lemma cannot be upheld.

Fosberg & Sachet (1984) have described *P. cartilagineum* var. *biglumaceum* because of the presence of a lower glume. They noted that this may also occur in the typical variety. We have also noted the occurrence of an occasional lower glume, but have not found it to correlate with an indurated fertile lemma, while it occurs in at least two of the varieties distinguished here: var. *bispicatum* (e.g. *Monod de Froideville 978*) and var. *scrobiculatum* (e.g. *Monod de Froideville 1566*). It must be admitted that lower glumes occur more frequently in the Pacific than elsewhere, but we think this is insufficient to distinguish a variety on this rather haphazardly occurring feature.

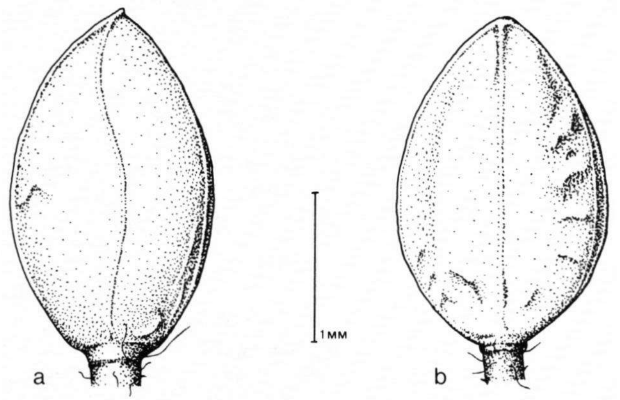


Fig. 7B. *Paspalum scrobiculatum* L. var. *horneri* (Henr.) Koning & Sosef. a. Upper glume; b. sterile lemma (*NGF 47924*).

**d. var. horneri** (Henr.) Koning & Sosef, *stat. & comb. nov.* – **Fig. 7B.**

*P. horneri* Henr., Blumea 1 (1935) 306, f. 2. – Type: *Horner s.n.* (L, holo), Sumatra, Padang.

Differs from the typical variety by:

Culms 15–80 cm long. Nodes glabrous or appressed hirsute to pilose. Sheaths shortly hirsute, sometimes minutely so, rarely glabrous. Blades 3–6 mm wide, usually hirsute at least above, sometimes minutely so, or only along the margins, rarely glabrous. Peduncle usually sparsely hairy. Racemes 1–4, alternate or sub-opposite when paired. Pedicels 0.2–1 mm long, usually hairy all over. Spikelets broadly elliptic to ovate, 1.7–2.5 by 1.2–1.85 mm, orange- to dark-brown, the margins usually paler. Upper glume 5-nerved. Sterile lemma 5- or 7-nerved. Fertile lemma brown. Anthers c. 0.8 mm long.

Distribution. Very disjunct: Assam and Malesia: Sumatra (Padang), Philippines (Luzon), New Guinea (East Sepik, Western and Eastern Highlands, Gulf, Central, Morobe, Milne Bay).

Ecology. On ridges, hills, in savannah depressions and bogs, occasionally common where the natural grasslands have been cut, associated with e.g. *Arundinella, Dianella, Gleichenia, Themeda*. On sand, silt, peat, 25–4000 m altitude.

Vernacular name. New Guinea: kuk (Melpa).

Collector's notes. Erect, forming strongly rooted tussocks in bogs. Leaves green, grey. Inflorescence brown, sticky. Fruit grey.

Note. The very disjunct distribution and the few collections (mainly from Papua New Guinea) would suggest a polytopic origin and hence an unacceptable taxon. We cannot show one or disprove another opinion, but in view of the clear differences with the other varieties, which are better than the differences between these (!), we thought it advisable to retain the former species at present.

## 8. Paspalum urvillei Steudel – Fig. 8.

*P. urvillei* Steudel, Syn. 1 (1853) 24; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 173, f. 108; Gardner, Fl. W. Austr. 1, 1 (1952) 242; Bor, Grasses (1960) 341; Vickery, Contr. Nat. Herb. N.S.W., Fl. Ser. 19, 1 (1961) 120; Türpe, Lilloa 32 (1967) 50; B.C. Stone, Micronesica 6 (1970) 217; J.W. Parham in A.C. Smith, Fl. Vit. Nov. 1 (1979) 339. – Type: *Dumont-d'Urville s.n.* (P, holo), Brazil.

For further synonyms see Chase (1929).

Perennials, tufted, not stoloniferous. *Culms* erect, (65–)90–200(–300) cm long, sometimes branching. Nodes glabrous, rarely with some hairs. Sheaths slightly keeled in the upper part, the basal usually densely pilose, not reticulate, the cauline glabrous. Ligule triangular, up to 6 mm long. *Blades* flat, linear, narrowed at base, (25–)30–45(–50) cm by 5–15 mm, usually with some up to 6 mm long, white hairs at the immediate base of the ligule, otherwise glabrous. Peduncle c. 1.3 mm diam., glabrous. Internodes of the main axis 0.3–0.5 times as long as the subtending raceme. Stalk c. 2.2(–4) mm long, appressed hirsute, mixed with up to 9 mm long, flattened hairs, brown. *Racemes* (5–)10–20, alternate, the lowest (5–)8–13 cm long, the others gradually shorter. Rachis flat, winged, straight, frequently distally zigzag, 0.7–0.9(–1.1) mm wide, spikeled from the base, margins scabrous. Pedicels slightly flattened, edges ciliate, the outer ones up to 2.5(–4) mm long, the inner ones shorter. *Spikelets* paired, imbricate, narrowly ovate to oval, 2–2.8(–3) by 1.2–1.5 mm,

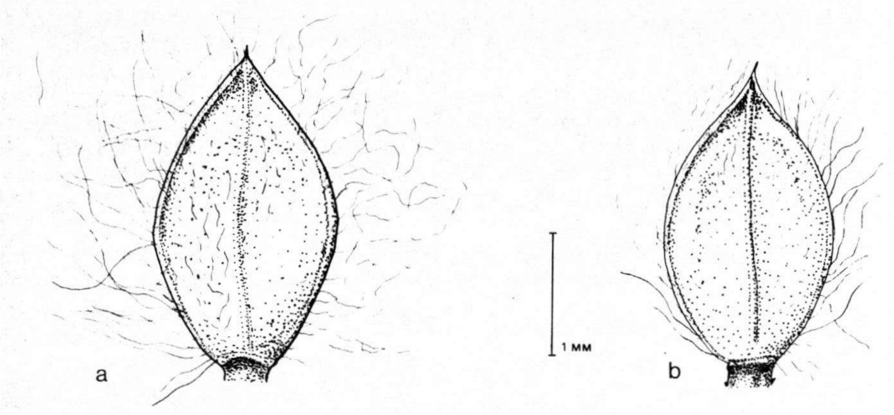


Fig. 8. *Paspalum urvillei* Steudel. a. Upper glume; b. sterile lemma (*Dissing 2527*).

green-brown to brown or purplish, apex acute. Lower glume absent. *Upper glume* slightly convex, as long as the spikelet, obscurely pilose, with a fringe of relatively long, c. 1.5 mm long, white hairs on the marginal nerves framing the spikelet, 3- or 5-nerved, concolorous with to slightly darker than the intervenium, midnerve prominent. *Sterile lemma* flat, not wrinkled, as the upper glume. *Fertile lemma* slightly convex, 3-nerved, thickly cartilaginous, glabrous, minutely papillose-striate, pale green. *Palea* flat to slightly convex, 2-nerved, as the lemma. Anthers slender, 0.8–1 mm long. Stigmas brown to dark purple (i.s.). Caryopsis round to round-elliptic, plano-convex, c. 1.5 mm long.

Distribution. Native to northern South America, introduced in many (sub)tropical areas, escaping here and there in Malesia: Malaya, Java, Philippines (Luzon), New Guinea (Biak, Bismarck Archipelago).

Ecology. Along ditches and roadsides, in waste areas, usually on rather moist soil, up to 2600 m altitude in Luzon.

Vernacular name. English: vasey grass.

Chromosome number. 2n = 40 (e.g. Türpe, 1967).

Uses. Cultivated as a fodder grass, readily eaten when young, but becoming tough and unpalatable with age (Bor, 1960). Sometimes cut for hay (Chase, 1929).

Note. The above description is based on Malesian material, usually cultivated; South American material was compared where necessary.

*Van Leeuwen BIAK 6* is somewhat aberrant by the presence of only 5 racemes.

**9. Paspalum vaginatum Sw. – Fig. 9.**

*P. vaginatum* Sw., Prod. (1788) 21; Miq., Fl. Ind. Bat. 3 (1857) 433; Camus, Fl. Gén. I.-C. 7 (1922) 394; Blatter & McCann, J. Bombay Nat. Hist. Soc. 32 (1928) 640; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 41, f. 19; Burk., Dict. Econ. Prod. 2 (1935) 1675; Backer in Heyne, Nutt. Pl. Indon. ed. 3, 1 (1950) 202; Gardner, Fl. W. Austr. 1, 1 (1952) 241; Schmid, l'Agron. Trop. 13 (1958) 304, f. 48-2; Bor, Grasses (1960) 341; Vickery, Contr. Nat. Herb. N.S.W., Fl. Ser. 19, 1 (1961) 117; Monod de Froid. in Backer & Bakh.f., Fl. Java 3 (1968) 569; Debray, Bull. Centre Etud. Rech. Sc., Biarritz 7 (1969) 585; Henty, Bot. Bull., Lae 1 (1969) 146; Gill., Rev. Fl. Mal. 3 (1971) 182, pl. 24c; Hsu, Taiwania 16 (1971) 294; Kerguélen, Lejeunia n.s. 75 (1975) 223; Sindhe, Taxon 24 (1975) 368; Taxon 26 (1977) 268; Hsu, Fl. Taiwan 5 (1978) 588. – *P. distichum* L. var. *vaginatum* Sw. ex Griseb., Fl. Brit. W. Ind. (1864) 541. – *Digitaria vaginata* Magnier, Scrinia 6 (1887) 120. – *Sanguinaria vaginata* Bubani, Fl. Pyr. 4 (1901) 258. – Type: *Swartz s.n.* (S, holo), Jamaica.

*P. littorale* R. Br., Prod. 1 (1810) 188; R. & S., Syst. Veg. 2 (1817) 316; Trin., Sp. Gram. Icon. 1 (1828) t. 112. – *P. vaginatum* Sw. var. *β* Trin., Diss. Bot. Alt. (1826) 95. – *P. vaginatum* Sw. var. *littorale* Trin. ex Buse in Miq., Pl. Jungh. 3 (1854) 383; Miq., Fl. Ind. Bat. 3 (1857) 433. – *P. distichum* L. var. *littorale* F.M.Bailey, Queensl. Gr. (1888) 23. – Lectotype: *R. Brown 6091* (BM, holo; K), Australia, Queensland, Cumberland Islands, Prince of Wales I., 1802.

*P. boryanum* Presl, Rel. Haenk. 1 (1830) 209; Miq., Fl. Ind. Bat. 3 (1857) 432. – Type: *Haenke s.n.* (PR, holo), Philippines, Luzon, Sorzogon, 1792.

*Rottboellia ? uniflora* Cunningh. in Hook., Comp. Bot. Mag. 2 (1837) 371. – Type: *Cunningham s.n.* (K, holo, n.v.), New Zealand, North Island, 1834.

*P. distichum* auct. non L.: Bor in Rechinger, Fl. Iran. 70 (1970) 494; Vickery, Fl. New South Wales no. 19 (1975) 135; Simon, Techn. Bull. Bot. Br., Brisbane 4 (1980) 72; Wheeler et al., Grasses New South Wales (1982) 229.

For further synonyms see Chase (1929) (some non-Malesian synonyms not listed by her have here been included).

Perennials, not tufted, stoloniferous. Stolons leafy, rooting at the nodes. *Culms* ascending to erect, (15–)25–50(–100) cm long, rarely branching. Nodes glabrous. Sheaths not keeled, glabrous, the basal ones not reticulate. Ligule collar-shaped, 0.5–1.1 mm long. *Blades* strongly distichous, flat or involute, linear, narrowed to the base, (2–)8–18 cm by (1–)1.5–4(–6) mm, usually with some c. 0.5 mm long, white hairs at the immediate base of the ligule, otherwise glabrous. Peduncle c. 1.1 mm diam., glabrous. Stalk up to 1.5 mm long, frequently with some c. 1 mm long, white hairs, pale to brown. *Racemes* 2, opposite, rarely up to 5, then the upper 2 opposite, the lower ones alternate, 2–5 (–8) cm long. Rachis flat, sometimes more or less grooved, straight to slightly zigzag, 1–2 mm wide, without spikelets immediately above the stalk, naked for the lower c. 5 mm, margins smooth. Pedicels 2-edged, 0.3–0.8 mm long, edges finely ciliate, sometimes obscurely so. *Spikelets* solitary, at least the upper ones imbricate, oblong, 3–4.5 by 1.3–1.6 mm, glabrous, pale green, apex acute. *Lower glume* rarely developed (e.g. in the type of *P. vaginatum*), then a minute, oblong

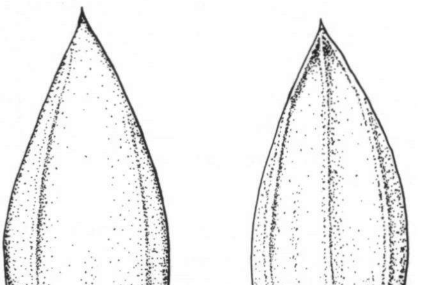


Fig. 9. *Paspalum vaginatum* Sw. a. Upper glume; b. sterile lemma (*Backer 20700*).

scale. *Upper glume* slightly convex, as long as the spikelet, glabrous, nerves 3–7, concolorous with the intervenium midnerve often obscure. *Sterile lemma* flat, often weakly, transversally undulate in the lower half, 3-, or 5-, or 7-nerved, midnerve prominent, as the upper glume. *Fertile lemma* convex, (0- or) 3- or 5-nerved, pergamentaceous, smooth, pale green, the apex with some short, stiff cilia, otherwise glabrous. *Palea* flat, 0- or 2-nerved, as the lemma. Anthers slender, 1.2–1.5 mm long. Stigmas dark brown (i.s.). Caryopsis ovate, plano-convex, c. 2.5 mm long.

Distribution. Sea coasts of (sub)tropical areas, in Malesia: Malaya (Pinang, Perak, Pahang, Selangor, Johore), Singapore, Sumatra (East Coast), Riau (P. Bintan), Java (throughout, also in lowland, inland saline areas, fide Backer, 1950; see note), Kangean Islands, Lesser Sunda Islands (Bali, Sumbawa), Borneo (Sarawak, Brunei, Sabah), Philippines (Luzon), Celebes (Kendari), Moluccas (Halmaheira, Ceram, Tenimbar), Aru Islands (Dobo), New Guinea (Vogelkop, Adi I., Gulf, Morobe, Mussau I.).

Ecology. Halophilous, favouring exposed places, rarely in the shadow, locally vegetation forming: on beaches, along tidal pools, at river mouths, mangrove margins, salt swamps, can withstand flooding, also on quays, in plantations of coconuts and low altitude sawahs and inland saline areas at least in Java. Associated with *Casuarina*, Cyperaceae, *Ipomoea pes-caprae, Ischaemum* spp., *Spinifex*. Usually at sea level, rarely up to 50 m altitude in salt ponds.

Vernacular names. English: salt water paspalum; Malaya: rumput dawai; Java: asianan.

Collector's notes. Mat-forming with long runners, main stem and bases of secondary ones red, leaves slightly fleshy. Spikelets light green. Anthers dark purple, black. Stigmas black.

Chromosome numbers. 2n = 20 (e.g. Hsu, 1971), 40 (e.g. Sindhe, 1977), 60 (e.g. Sindhe, 1975).

Uses. Readily eaten by cattle and possibly of some nutritional value as a fodder on swampy, saline soils. Not very useful for hay as it tends to dry slowly. An important soil binder (Burkill, 1935; Backer, 1950).

Notes. For the nomenclatural problems that have involved the name accepted here see under *P. distichum*.

One culm of a collection from Adi I., New Guinea (*BW 6336, Kalkman*, L) has two racemes each with a secondary branch, a very rare abnormality.

The species has been mentioned by Backer (1950) for inland saline areas in Java. A few inland collections were available, but they were always from areas only a few kilometres from the coast, e.g. *Backer 23434* (BO) ('W. of Batavia, moist grassland, not salt, very unusual habitat for the species'), *24533* (BO) ('Pradjekan, Pasoeroean, sandy bank of kali, abnormal locality, the grass usually grows on silty clay'), several collections from Bangil, which may be from inland stations. *Clason Laarman G-60* (BO) is from 20 m altitude near Pandar, S. of Panarukan, Besuki. *Elmer 18140* (K, L) is from Mt Maquiling, Luzon, but the label carries no further information. The species is not mentioned by Van Steenis in his survey of coastal plants occurring near inland salt wells in Java (in Backer & Bakh.f., Fl. Java 2, 1965, '53').

## APPENDIX

**Paspalum scrobiculatum L. var. lanceolatum Koning & Sosef, *var. nov.***

*P. lamprocaryon* K. Schum. in Engler, Pfl. W. O. Afr. C (1895) 100. – Type: *Stuhlmann 3901* (B, holo, n.v.), Tanzania, Bukoba.
*P. auriculatum* auct. afr. non Presl: see Clayton & Renvoize, Fl. Trop. E. Afr., Gram. 3 (1982) 609 for references.

Taxon cum *Paspalo auriculato* Presl (vero) confusum, verumtamen nodis a vaginis involutis, laminibus linearo-lanceolatis, 7–21 cm longis, 12–27 mm latis, basi rotundatis, racemis 2–4, spiculis 2–2.7 mm longis bene distinctum. – Typus: *Stolz 1413* (L, holo), Malawi, Nyassa Highlands, Kyimbila Station, 1100–1400 m alt., 3 July 1912.

Confused with the true *Paspalum auriculatum* Presl, however different from that by the sheaths enveloping the nodes, blades linear-lanceolate, 7–21 cm by 12–27 mm, rounded at base, racemes 2–4, spikelets 2–2.7 mm long.

Distribution. Tropical Africa, South to Angola, Zimbabwe.

Ecology. Damp places and forest margins, 50–2000 m altitude.

Note. Most of the specimens seen had indurated sterile lemmas, which in the other varieties occur only now and then. It may be more common in this form.

## ALIEN AND EXCLUDED SPECIES

A number of species have been found once or twice apparently escaped from botanical gardens, experimental stations, or have been recently introduced in the area. These have been included in the key, only, as it cannot yet be estimated whether they will really maintain themselves.

The many Malesian species at one time or another placed in *Paspalum*, but included in other genera, at presently have not been taken up here, as that information seemed to be a waste of paper.

**Paspalum decumbens** Sw., Prod. (1788) 22; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 92, f. 48; Jansen, Reinwardtia 2 (1953) 322; Monod de Froid. in Backer & Bakh. f., Fl. Java 3 (1968) 569. – Type: *Herb. Swartz* (S, holo; B, M, P, n.v.), Jamaica.

This South American species has been introduced in West Java and may have escaped from the Botanical Gardens in Bogor, although it was never cultivated there on purpose. It was first found in 1949 (*Monod de Froideville 979*, BO).

**Paspalum notatum** Fluggé, Gram. Monogr., Paspalum (1810) 106; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 64, f. 32; Parodi, Rev. Argent. Agron. 15 (1948) 54; De Castro, Garcia de Orta 12 (1964) 58; Gould, Grasses Texas (1975) 506; Madulid, Acta Manil. A, 14 (1975) 121; L.B. Smith et al., Fl. Il. Catarinense, Gram. (1982)

944, f. 190a-d. – Lectotype: *Ventenat s.n.* (B, KIEL, MO, n.v.), St. Thomas, 1802.

This species has been introduced recently in formerly Portuguese Timor (*Cinatti 111*, LISC, n.v.), Luzon (fide Madulid, 1975), and at least in Flores (*Veldkamp 6998*, BO, L, Herb. Verheijen in Ruteng) as a grass for lawns and pastures. It grows well on low-fertility soils probably due to symbiosis with *Azotobacter paspali*, a nitrogen fixing bacterium (Dobereiner, 1966, cited by Smith et al., 1982). It is very resistant to drought and spreads rapidly and aggressively by its rhizomes and has therefore been used for soil conservation and the prevention of erosion in Uganda and the U.S., where it is known as Bahia- or Pensacola Bahia grass; in Timor it was called 'rumput pencasilan' (sic) and was considered to be a good fodder.

Generally two varieties have been distinguished next to the typical one, which according to Parodi (1948) would differ by somewhat larger spikelets and longer racemes. The collection from Flores belongs to var. *notatum*.

**Paspalum plicatulum** Michx., Fl. Bor. Amer. 1 (1803) 45; Chase, Contr. U.S. Nat. Herb. 29, 1 (1929) 214, f. 129; Hill, Papua New Guinea Agric. J. 22 (1970) 44; Gallash, Papua New Guinea Agric. J. 22 (1971) 63. – Type: *Herb. Michaux s.n.* (P, holo, n.v.), U.S.A., 'Georgia, Florida'.

Two cultivars have been tried in Papua New Guinea (cv. Rodds Bay and cv. Hartley), which seed freely. They are highly palatable to cattle. As they are good pioneers and grow well in areas of reasonably low fertility, they are bound to escape where introduced (Hill, 1970). Only one collection was seen (*NGF 41935 Henty*; L) from a cultivation plot in Bubia.

Yield tests reported by Gallash (1971) show fairly high production figures, higher even than those of the for grazing purposes more commonly used *P. conjugatum*.

**Paspalum tenellum** Willd., Enum. Pl. (1809) 89; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 112, f. 62. – *P. elegans* Fluggé, Gram. Monogr., Paspalum (1810) 183; F.-Vill., Nov. App. (1882) 310, nom. superfl. – Type: *Herb. Willdenow 1608* (B, holo, n.v.; microfiche IDC!, lefthand specimen), cult. in Berlin.

A number of other species have been mentioned by F.-Villar (1882), some have never been found again and no records exist, so they again may be examples of the unreliability of this work. (See for comment also Merrill, Sp. Blanc., 1918, 16–17.) The species has therefore not been included in the key.

**Paspalum virgatum** L., Syst. Nat. ed. 10, 2 (1759) 855; Hitchc., Contr. U.S. Nat. Herb. 12 (1908) 116; Chase, Contr. U.S. Nat. Herb. 28, 1 (1929) 197, f. 119; Baum, Canad. J. Bot. 45 (1967) 1846. – Type: *P. Browne s.n.* in Herb. Linné no. 80.26 (LINN, n.v., microfiche IDC), Jamaica, see note.
*Paspalum sp.*: Buse in Miq., Pl. Jungh. 3 (1854) 384.

Once collected by Junghuhn in Java, probably, as Buse also suspected, cultivated. It has not been found again.

Contrary to Baum (1967) *P. virgatum* was not based 'on one element only', i.e. the description and plate of Sloane and hence on Sloane's specimen in BM, which Baum has appointed as the type, but which is most unlikely to have been studied or even seen by Linné. The latter gave a diagnosis of his own which had to be based on actual material, e.g. a P. Browne specimen (LINN), which he as usual did not cite, and which he matched with Sloane's work. See Stearn's introduction to the facsimile edition of the Species Plantarum, ed. 1 (1957, p. 108, 113) and for a similar case of a mistaken typification Veldkamp (Taxon 33, 1984, 95). In any case, the name has been lectotypified previously by Hitchcock (1908), which was followed by Chase (1929) and this has to be followed.

**Paspalum wettsteinii** Hackel, Denkschr. Wiss. Math. Naturw. Akad. Wien 79 (1906) 5 (preprint), (1908) 66; L.B. Smith et al., Fl. Il. Catarinense, Gram. (1982) 994, in syn. – Type: *Wettstein & Schiffner s.n.* (?W, holo, n.v.), Brazil, Sao Paulo, Conceicão, Rio Branco, July 1901 (not received from W).

*Paspalum wettsteinii* has been cultivated in Australia, Two collections from Papua New Guinea have been seen, *LAE 72440 Henty* (L) and *Sterly 1658* (L). The first was cultivated in Abunaka, Morobe Dist., the second occurred along a roadside near Noglkanmambuno, Gembogl subdist., Chimbu Dist. Sterly noted that it had been cultivated and recorded the pidgin remark 'namba wan' (= ± 'excellent'), which indicates the enthusiasm with which this cultigen has been received there.

Smith et al. have placed this name in the synonymy of *P. conspersum* Schrad. Unfortunately the type of *P. wettsteinii* was not received from W, so we could not check whether this was correct. Our specimens, however, matched Hackel's description and from these and from material of *P. conspersum* we conclude that the two are distinct taxa. The present species differs clearly from the latter by e.g. the narrower rachis and glabrous spikelets.

## INDEX OF COLLECTORS

Only numbered collections have been included. Specimens cited in literature but not seen have been included with their identities *between brackets* when these seemed acceptable, otherwise they have been omitted. *Paspalum conjugatum* is underrepresented, because it was specifically asked not to include this species in the loans, as it is very common and without any special problems. The numbers correspond with the species as presented above, the letters with the initials of the alien species (which were included in the key and the short survey above).

Backer 54: 4; 197: 7c; 860: 4; 937: 1; 1023: 7c; 1375: 1; 1834: 4; 1919: 1; 2096: 4; 2392: 7c; 2578: 4; 3393: 7c; 4127: 4; 4229: 4; 5137: 9; 5148: 7c; 5154: 9; 5474: 7c; 5537: 5; 5817: 4; 6198: 7c; 6658: 7a; 6857: 7b; 7134: 7c; 7319: 1; 7573: 9; 7670: 1; 7817: 1; 8132: 7a; 8257: 9; 8434: 9; 8746: 5; 8747: 1; 9165: 1; 9969: 4; 10050: 7c; 10052: 1; 10560: 4; 10565: 7c; 10744: 2; 11791: 9; 11887: 1; 11892: 4; 12123: 4/7c; 12941: 9; 13997: 1; 14079: 4; 14276: 7c; 14541: 7c; 14594: 5; 14814: 7c; 14924: 4; 15245: 9; 15419: 1; 15599: 1; 15668: 5; 15881: 7c; 16309: 9; 17109: 7c; 17262: 4; 17421: 1; 17430: 7c; 17651: 9; 18280: 7c; 18477: 7c; 18578: 4; 18999: 1; 19112: 9; 19115: 7a; 19547: 9; 20043: 7c; 20700: 9; 21173: 9; 21389: 9; 22445: 4; 23434: 9; 23532: 1; 23539: 4; 23540: 7c; 23770: 7b; 24093: 7c; 24143: 9; 24507: 9; 24533: 9; 24689: 9; 25077: 2; 26579: 7a; 27105: 7a; 27676: 9; 27730: 7a; 28026: 9; 28602: 9; 29143: 7c; 29251: 9; 29701: 9; 30125: 1; 30327: 7c; 30991: 9; 31073: 9; 31831: 7c; 31835: 4; 31837: 4; 31850: 9; 36053: 9; 37556: 9 – Bakhuizen van den Brink 9: 7c; 44: 1; 70a: 4; 141: 1; 180: 4; 707: 2; 1086: 7c; 1669: 7c; 2018: 9; 2022: 9; 2767: 4; 2768: 7c; 4446: 4; 4546: 4; 7796: 7c; 14446: 4 – Barber 83: 9; 300: 4; 341: 9 – bb 9013 (Ostwald): 7c; 11158 (Japing): 7c – Beccari B-110: 4; B-3528: 9 – Beguin 15: 7c; 48: 1; 60: 2; 67: 7c; 180: 1; 614: 7c; 2050: 7c; 2278: 9 – Beumée 10a: 4; 782: 7a; 855: 7c; 1066: 1; 1115: 7c; 1155: 7c; 1176: 7c; 1555: 7a; 1703: 7c; 1747: 7c; 2208: 7c; 2840: 7c; 2892: 7c; 3172: 4; 3609: 7c; 3717: 7c; 3772: 7a; 4156: 7c; 4811: 4; 4835: 7c; 5559: 7c – Bloembergen 3010: 1; 3516: 4; 4524: 7b – Boerlage 667: 7c – Bor S-14: 5; S-18: 7c; S-30: 4 – Brass 521: 4; 1229: 9; 3935: 1; 5922: 4; 6285: 9; 6297: 7c; 6341: 4; 6948: 7c; 7529: 7c; 8302: 7c; 8325: 1; 13784: 7c; 21674: 1; 22037: 7c; 22080: 9; 23815: 7c; 24420: 6; 25116: 6; 28208: 6 – van Breemen 21: 7c; 31: 2 – Brooke 8268: 5; 9833: 5 – D.A.L.I. Brown 10: 7c; 11: 7c – BS 318a (Shan): 7c; 843 (Foxworthy): (7b); 941 (Mangubat): 4; 1449 (Ramos): 4; 1653 (Robinson): 1; 1956 (Ramos): 4; 2454 (Native coll.): 4; 9323 (Merrill): 5; 10083: (7c); 10979 (Ramos): 4; 10984 (id.): 5; 11621 (Robinson): 4; 11667 (id.): 4; 14512: (4); 16878 (Servinas): 1; 18908 (McGregor): 1; 21684 (Ramos): 4; 24435 (id.): 7c; 26002: (4); 26675 (Fénix): 5; 27378 (Ramos): 7c; 29504 (Ramos & Edaño): 4; 31512 (id.): 7c; 31758 (Santos): 5; 32275: (7c); 35186 (Farinas): 1; 43974 (Ramos & Edaño): 7c; 43975 (id.): 4; 44275 (id.): 4 – Bünnemeijer 144: 7c; 193: 7c; 218: 1; 791: 5; 1060: 1; 1320: 1; 1323: 5; 1386-b: 5; 1394: 1; 1570: 5; 1638: 7c; 1717: 5; 1854: 5; 2158: 7c; 2246: 1; 2807: 1; 2809: 5; 2911: 7c; 3549: 1; 3722: 7c; 4248: 1; 4322: 7c; 4789: 1; 4791: 5; 5597: 1; 5603: 5; 5998: 4; 6005: 1; 6220: 1; 6221: 5/7c; 6258: 5; 6270: 4; 6277: 1; 6333: 7c; 6575: 4; 6617: 5; 6910: 1; 7015: 5; 7216: 4; 7398: 1; 7400: 4; 7403: 7c; 7501: 5; 7618: 5; 8011: 7c; 8171: 1; 8282: 5; 10744: 1; 11022: 5; 11028: 7c; 11142: 7c; 11719: 1 – Burkill & Haniff 464: 9 – Burkill & Shah 945: 7c – Buwalda 2729: 1; 2788: 7c; 3394: 1; 3744: 1; 4532: 7c; 4613: 9; 4851: 9; 4885: 1; 5798: 1; 6047: 9; 7875: 1; 7911: 4; 8160: 7c – Buijsman 119: 2 – BW 723 (Versteegh): 1; 6283 (Kalkman): 1; 6336 (id.): 9; 8366 (Versteegh & Vink): 1.

Carr 11025: 1; 12957: 6; 12972: 6; 13598: 6; 14282: 6 – CF 20384 (Strugnell): 7c – Cheesman 220: 2 – Cinatti 11a: 5; 11b: 2; 51: 7c; 111: n; 116: 7c – Clason A20: 1 – Clason-Laarman G-20: 9 – Clemens 399: (4); 17953: 7c; 17954: 9; 17955: 9; 18235: 7c; 30264: 7c; 32616 = 34124: 1 – Coert 72: 7c; 728: 1; 791: 9; 831: 9; 1728: 7c – Coode 3773: 6; 3782: 7c – Copeland 371: 4; 575: (1) – Craven & Schodde 717: 7c – Cruttwell 169: 7c; 1609: 5; 1616: 7c – Cuming 720: 4/7c; 2410: 4 – Curtis 492: 5; 493: 1; 1957: 9.

van Daalen 304: 1; 419: 4 – Dakat 2: 5 – Dalenberg 155: 7c – Dames 84: 1 – Danser 5386: 7c; 6023: 2; 6453: 7c; 6459: 4; 6795: 7c; 6866: 7c – Darbyshire 185: 6; 827: 5 – Darbyshire & Hoogland 7864: 1 – DeVore & Hover 101: (4); 180: (1) – Dihm 109: 1; 121: 4 – Dilmy 1406: 9 – Dissing 2527: 8 – Djadoek 1113: 7c – Docters van Leeuwen 9252: 1 – Docters van Leeuwen-Reijnvaan 3765: 9; 5552: 5 – Dorgelo 168: 9; 637: 7a; 694: 7c; 3243: 7c.

Elbert 4254: 7b – Elmer 5759: 5; 16494: 1; 16727: 4; 18140: 9; 18184: 1 – Elsener H-213: 5 – Endert 1570: 1; 1679: 1; 1746: 7c; 1895: 7c; 2096: 7c – Enoh 95: 7c; 334: 7c – Everaarts 74: 1.

Fairchild 178: 1 – Farinas 115: 7c; 116: 4; 117: 3 – Feuilletau-de Bruyn 205: 7c; 342: 1 – Fitzgerald 117: 7c – Flenley 61: 7c – FMS 14470 (Symington): 4; 37620 (id.): 4 – Forbes J-1266: 7b; T-3462: 7c; T-3472: 7b – Forster F-10: 5; F-74: 4; F-84: 7c; F-137: 7c; F-144: 4; F-147: 7c – Foxworthy 843: (7b) – Franch 173: 1; 174: 4.

Gezagh. Manggerai 2: 5 – Gianno 110: 7c; 187: 1 – Gibbs 2773: 7c – Gilliland 5179: 7c; 5231: 5 – Gisius 76: 2 – Gjellerup 95: 1 – Goering II-168: 7c – Gouv. Veearts Watampone 13: 7c; 25: 7a – Grimes 1100: 7c – Groot 9: 7c – Guggitz 36: 7c.

Hallier f. 103: 7c; 631a: 7c; 632b: 4; 635a: 5; 663: 1; C-156: 7c – Hamel 1100: 4 – Harmsen 6: 7c; 27: 7c – Harreveld-Lako 27: 7c – 't Hart & van Leeuwen K-15: 7c; M-10: 4; M-35: 4; MA-12: 7c; MA-14: 1; MA-18: 7c – Hartley 11609: 7c; 11600: 1 – Hasskarl 647: 7c – Hellwig 407: 7c – Heyligers 1340: 7d – Hiepko & Schultze-Motel 527: 9; 530: 6; 605: 4; 1018: 1 – Hochreutiner 1375: 7c; 2113: 5 – Hollrung 828: 4 – Hommel 051e: 7c; 078d: 9; 223c: 7c – Hoogerwerf 4: 7c; 227: 7c – Hoogland 3289: 6; 3368: 1; 3476: 6; 3681: 1; 4628: 1; 4640: 7d; 4806: 7c; 9012: 1 – Hoogland & Craven 10134: 7c; 10142: 4 – Horner 1: 7c – Horsfield 962: 7c – Hose 4: 7c; 26: 4 – Houtvester Besoeki 14: 1 – Houwing 110: 7c; 192: 7c; 269: 7c; 860: 7a; 1010: 7c – Hullett 482: 5 – Hume 7266: 7c; 7337: 4; 7436: 4; 7477: 7c; 7511: 4.

Iboet 273: 1; 334: 7c – Idjan & Mohtar 58: 7c; 119: 1 – Iwatsuki et al. S-148: 5; S-449: 1.

Jaag 263: 7b; 1164: 7c; 1186: 7c – Jacobs 4985: 4; 5579: 1 – Jacobson 117: 5 – Janaki Ammal 10: 4 – A.H. Jansen 17: 3 – H. Jensen 222: 9 – Jermy 4417: 7c – Jochems 313b: 4; 1680: 7c; 3131: 7c; 3305: 7c – J.K. de Jong 22: 7c.

Kalkman 4171: 1 – Karta 187: 5; 368: 7c – (Kuswata) Kartawinata 289: 9; 1373: 3; 1425: 4 – Kasik 54: 4; 57: 1; 76: 1; 107: 5 – Kasim b. Rajab 544: 2 – Kaudern 114: 7c; 253: 1; 462: 4 – Kelly 25: 1 – Kern 7274: 1 – Kievits 50: 7c; 671: 7c; 1483: 7c; 1628: 7c; 2159: 7c; 2186: 7c; 2190: 7a; 2469: 7c; 2655: 7c; 2807: 7c; 3022: 7a; 3111: 7c; 3318: 7c – Kingston 34: 6 – Kjellberg 377: 9; 1182: 4 – Kleinhoonte 324: 4 – Kneucker 607 (Merrill): 1; 803 (Merrill & McGregor): 7c; 804 (Merrill): 2; 805 (id.): 9 – Køe & Olsen 1728: 9 – Kooper 497: 9 – Koorders 17272: 7c; 17274: 1; 17275: 1; 22308: 1; 23079: 1; 23503: 1; 23881: 1; 26208: 7c; 27171: 1; 27727: 7c; 35284: 7a; 41073: 7c; 41345: 7c; 41408: 1; 42216: 5; 42421: 1; 42514: 7a; 44229: 4 – Kooy 695: 1; 698: 7a; 765: 1; 771: 4 – Kornassi 456: 1; 766: 1 – Kostermans 2849: 1; 18161b: 7c; 21675a: 7c – Kostermans & Anta 357: 5 – Kostermans & Soegeng 130: 6 – Kostermans & Wirawan 428: 4 – Kostermans & van Woerden 23: 1 – Kramer 165: 1 – van Kregten 50: 7c; 56: 1 – Kreulen 29: 1 – Kulescha 18: 7c; 44: 9 – Kurz 120: 7c; 3023: 5 – Kuswata, see Kartawinata.

LAE 50291 (Stevens): 1; 50292 (id.): 7c; 53708 (Stone & Streimann): 1; 57130 (Andrew): 5; 64022 (Howcroft): 7d; 66580 (Barker & Vinas): 7c; 67671 (Barker): 1; 72440 (Henty): w; 72458 (id.): 6 – Lam 2618: 4 – Landbouwconsulent G: 4; J: 7c – Lauterbach 647: 4 – Leefmans 161a: 1; 161b: 1; 161c: 1; 161d: 1 – van Leeuwen 3: 7c; BIAK-6: 8; DII-6: 7c; KAB-3: 7c; KAB-6: 7c; POE-4: 7c – Lobb 131: 7a; 139: 7c – Loenen 10: 7c – Loher 1738: 7c; 1740: 7c; 1741: 7c; 1742: 4; 1743: 4; 1744: 4; 1746: 9; 1747: 9; 1748: 9; 1749: 9; 1750: 7c; 1751: 7c; 5035: 7c – Loogen 7: 7c – Lörzing 120: 7c; 387: 1; 3068: 7c; 3114: 7c; 3226: 9; 3437: 7c; 3450: 4; 3486: 9; 3744: 4; 4963: 7c; 4979: 7c; 6466: 5/7c; 6644: 4; 7280: 9; 7902: 7c; 8562: 5; 8681: 7c; 9090: 9; 9242: 7c; 9789: 7c; 9521: 4; 9631: 4; 11073: 4/7c; 12502: 1; 12673: 7c; 12914: 4; 12992: 1; 13123: 1; 13141: 9; 13249: 4/7c; 13296: 4; 13588: 5/7c; 15464: 5 – Lörzing & Jochems 7560: 7c – Lütjeharms 3828: 7c; 5091: 4; 5238: 1.

McGregor 61: (1); 1250: (4) – McKee 1709: 4 – Main 413: 1; 679: 1; 1741a: 7c; 1741b: 5; 1742: 5; 1988: 7c; 2052: 1; 2073b: 1 – Marche 350: 7c; 416: 5 – Maxwell 81-67: 9 – Mayr 88: 1 – van der Meer 917: 7c; 918: 7c – van der Meer & van den Hoed 2002: 9 – Merrill 8: 7c; 34: (1); 140: (4); 140a: (4); 478: (4); 820: 7b; 1137: (1); 4253: 7c; 4793: 5; 5229: (9); 5361: (7b); 5455: 4; 7116: 9; 7292: 7c; Philip. Pl. 158: (7b); 576: (7c); 1956: (4); Sp. Blanc. 1035: 7c – Meijer 466: 7c; 1853: 4; 2021a: 1; 5875: 7c; 9640: 7c – Meijer-Drees 522: 1 – Mondi 47: 7c – Monod de Froideville 623: 1; 672: 1; 913: 7c; 916: 5; 931: 9; 949: 5; 978:

7c; 979: d; 1054: 4; 1141: 7a; 1190: 4; 1204: 7c; 1210: 7c; 1288: 7c; 1354: 7c; 1432: 7a; 1518: 5; 1566: 7c; 1607: 4; 1761: 4; 1808: 4; 1827: 4; 1831: 7c; 1858: 7c; 1872: 7c; 1881: 4; 1911: 7c; 1919: 7a – Morley et al. 29: 1 – Motley 43: 7c; 83: 9; 127: 7c; 133: 7c; 134: 9; 998: 4 – Mousset 20: 7c; 69: 1; 1047: 2 – Murata et al. B-25: 4; B-30: 1; B-115: 7c; B-121 4; B-312: 7c; B-558: 1; B-579: 1; B-3420: 4: B-4576: 5.

Native coll. 5772: 7c – Nedi: 380: 1; 404: 7c – Nedi & Idjan 125: 7c; 150: 7c – New Guinea Dept. Agric. H-2868: 5 – NGBF 1030 (Argent): 1 – NGF 3162 (no coll.): 6; 3601 (Fryar): 1; 3610 (id.): 7c; 3612 (id.): 7c; 3629 (id.): 7d; 3878 (Womersley): 1; 9874 (Henty): 9; 9875 (id.): 7c; 10427 (Grey & White): 7c; 15700 (van Royen & Millar): 1; 16874 (Henty): 7d; 17410 (Epstein): 1; 22002 (Gillison): 4; 29526 (Coode): 7c; 29631 (Coode et al.): 1; 34699 (Croft & Lelean): 5; 35182 (Millar & Dockrill): 1; 38634 (Henty & Katik): 7c; 38851 (Henty & Streimann): 7d; 40383 (Coode): 1; 41316 (Croft & Islands): 1; 41341 (Croft): 1; 41935 (Henty): p; 43414 (Mann & Vandenberg): 1; 44005 (Kairo & Streimann): 6; 44218 (id.): 6; 47924 (Kairo): 7d; 49125 (Henty & Barlow): 7c – Nooteboom 1190: 1 – Nyman 148: 7c; 160: 7c; 1119: 7c.

Oersipuny 20: 7c – Ohwi 45: 7c – Olsen 795: 7c – van Ooststroom 12512: 4; 12987: 1; 13587: 9; 13625: 1 – Ophof & de Wit 4057: 1 – Ottolander 415: 7c.

Peekel 41: 5 – Pleyte 411: 1; 490: 7c; 909: 5; 1142: 1 – PNH 10300 (Mendoza & Convocar): 7c; 11296 (Edaño): 7c; 16567 (Soriano): 7c; 16864 (Sulit & Conklin): 1; 17062 (Sulit): 4; 18097 (Farinas): 7c; 19086 (Conklin): 4; 20377 (Mendoza): 5; 20457 (id.): 7d; 33167 (id.): 3; 33233 (Steiner): 7c; 33670 (Gachalian): 7c; 34386 (Edaño): 7c; 34767 (Steiner): 1; 35186 (Farinas): 1/4; 35189 (id.): 4; 36242 (Mendoza): 4; 37191 (Edaño): 1; 38537 (Edaño & Gutierrez): 1; 39074 (Edaño): 4; 42137 (Mendoza): 1; 42559 (id.): 7c; 76715 (Conklin et al.): 1; 76793 (Mendoza & Buwaya): 7c; 78165 (Gutierrez): 1; 80661 (Conklin & Buwaya): 3; 97738 (Mendoza): 4; 117291 (Gutierrez): 7c; 117984 (Madulid et al.): 4; 118126 (id.): 4; 118203 (id.): 7c – Polak 286: 5; 721: 5 – Poore 637: 9 – Posthumus 965: 7c; 2028: 7c; 2029: 4; 2362: 7c; 2708: 7c; 3155: 4 – Proppe 18: 4 – Pulle 77: 7c; 166: 4 – Pullen 703: 7d; 979: 1; 1323: 7c; 1325: 4; 1327: 6; 1656: 5; 2726: 4; 2739: 5; 3638: 4; 6428: 7d; 6436: 9; 6709: 7d; 6797: 6; 7176: 7c; 7383: 7c; 7429: 4; 8087: 5 – van der Pijl 909: 4.

Raap 35: 1 – Rahmat si Boeea 1047: 4/7c; 1259: 7c; 4580: 4; 8211: 4 – Rahmat si Toroes, see praec. – Ramlan 051: 7a – Ramos 1700: 1; 1710: 5 – Rant 15: 1; 17: 7c – Rau 40: 4 – Reinwardt 66: 7a – Richards 1104: 1 – Ridley 31: 4; 444: 9; 1111: 4; 1417: 9; 1702: 9; 11525 (Machado): 7c; 11680: 7c; 12340: 7c – Robbins 145: 4; 541: 4; 550: 1 – Robinson 1651: 7c – Roesil 605: 7c; 717: 7c; 778: 4/7c; 824: 7c; 900: 7c – Römer 358: 4; 623: 4 – Roos 6: 7c – Rostados 38: 7c – van Royen 3069: 1; 3109: 9; 3131: 1; 3368: 1; 3485: 1; 4757: 7c; 4757a: 7c; 5076: 1; 5287: 4 – RSNB 1220 (Chew et al.): 1; 1418 (id.): 1 – Rutten-Kooistra 15: 4 – Ruttner 92: 5.

S 17705 (Ashton): 1; 33153 (Chai et al.): 1 – SAN 39356 (Meijer): 7c; 39369 (id.): 7c; 39816 (Madani): 7c; 81304 (Aban & Leopold): 4 – Sands 1881: 7c – Santos 5: 5; 4128: 7c; 4171: 1; 4175: 7c; 4293: 4; 4508: 4; 4509: 5; 4636: 7c; 4673: 9; 4716: 7c; 4747: 7c; 4850: 1; 4874: 5; 4957: 7c; 4979: 1; 4985: 7c; 5011: 4; 5059: 1; 5061: 2; 5110: 2; 5295: 7c; 5521: 5/7c; 5592: 5; 5594: 5/7c; 5799: 2; 5866: 7c; 6004: 7c; 6005: 4; 6015a: 1; 6096: 7c; 6231: 1; 6284: 4; 6287: 7c; 6361: 7c; 6363: 4; 6476: 7c; 6476: 7c; 6513: 1; 6555: 4; 6608: 7c; 6619: 4; 6623: 7c; 6624: 4; 6753: 7c; 6760: 1; 6786: 1; 6814: 7c; 6861: 7c; 6862: 4; 6893: 7c; 6984: 4; 6998: 7c; 7072: 5; 7175: 7c; 7429: 4; 7526: 9; 7589: 7c; 7607: 7c; 7632: 7c; 7633: 7c; 7667: 5; 7668: 1; 7669: 4; 7671: 4/7c; 7732: 4; 7747: 4; 7748: 4; 7760: 2; 7776: 5; 7787: 7c; 7844: 2; 7873: 2; 7984: 4; 7985: 7c; 7992: 8; 8028: 8; 8059: 7c; 8067: 7c; 8092: 4; 8102: 7c; 8115: 4/7c; 8136: 9; 8139: 7c; 8150: 4; 8161: 9; 8198: 7c – Sapiin 2024: 2 – Saunders 99: 4 – Sauveur & Sinke 2518: 6; 2593: 5; 2608: 1 – Savinière 1660: 7c – Schiffner 1508: 7c; 1540: 1 – Schlenker 29: 7c – Schmutz 1527: 1 – 2080a: 4; 2080b: 7c; 3647: 5; 5000: 7a; 5005: 7c; 5013: 4; 5093: 1; 5265: 5; 5270: 2; 5578: 5; 5579: 7c; 5580: 5; 5584: 4; 6008: 1 – Schodde 2153: 6 – Seimund 93: 7c; 110: 7c; 316: 7c – SF 363 (Burkill): 4; 573 (id.): 7c; 1275 (id.): 9; 1849 (Alvins): 5; 4508 (Nur): 9; 4509 (id.): 4; 4515