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THE JUGLANDACEAE OF GUATEMALA

LOUIS O. WILLIAMS

AND

ANTONIO MOLINA R.

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AN OVERLOOKED GENUS OF THE  
SCROPHULARIACEAE

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A SYNOPSIS OF THE PALM GENUS  
*SYAGRUS* MART.

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A NEW HYBRID IN THE PALM GENUS  
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A Synopsis of the Palm Genus *Syagrus* Mart.<sup>1-2</sup>

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*Syagrus* as a genus was originally described by Martius in 1824, and in subsequent papers he established a number of species under this name (1826, 1844, 1845). Other species of *Syagrus* were described by Barbosa Rodrigues (1875, 1879, 1888), Beccari (1916), Burret (1932, 1933, 1937, 1940), Wessels Boer (1964), and Glassman (1967, 1968a, 1968c). Burret (1937) divided the genus into two sections, *Glaziova* (containing *S. weddelliana*, *S. insignis*, and *S. hoehnei*), and *Orthosyagrus*, which included all the other species of *Syagrus* known to him at the time. Apparently, no one else has attempted to further subdivide the genus into sections or subgenera. Section *Glaziova* was later taken out of *Syagrus* and transformed into the new genus *Lytocaryum* by Toledo (1944). Subsequently, Burret and Potztl (1956) described *Microcoelum* as a segregate genus of *Lytocaryum*.

Drude (1881) included *Syagrus* as one of five sections of the genus *Cocos*. Except for *Eucocos*, consisting of *C. nucifera*, the other sections (*Syagrus*, *Langsdorffia*, *Arecastrum*, and *Diplothemiopsis*) contain species which I presently consider as part of the genus *Syagrus*. In a later paper, Drude (1887) elevated the section names to subgeneric status; but combined the latter two names under subgenus *Arecastrum*, incorporated *Langsdorffia* into subgenus *Syagrus*, and reduced *Glaziova* from a separate genus to a subgenus of *Cocos*. Beccari (1887, 1888) divided *Cocos* into four genera, *Barbosa*, *Rhyticocos*, *Syagrus*, and *Cocos*. *Syagrus* included only *S. cocoides*, and under the genus *Cocos*, he considered four subgenera: *Eucocos*, *Glaziova*, *Arecastrum*, and *Butia*. In 1916, Beccari elevated *Arecastrum* and *Butia*

<sup>1</sup> Since this paper has gone to press, a number of changes have been made in the text and the phylogenetic tree. These changes will appear as parts of future articles in this journal.

<sup>2</sup> This research has been supported by N. S. F. grant no. GB 6899.

to generic status, and retained the previous generic separation of *Barbosa*, *Rhyticocos*, and *Arikury* (= *Arikuryroba* Barbosa Rodrigues, 1891) from *Cocos*. The remaining species of *Cocos*, except *C. nucifera*, were transferred to the genus *Syagrus*. Others who considered *Syagrus* to be part of the genus *Cocos* are Barbosa Rodrigues (1899, 1900, 1901, 1903, 1907) and Bondar (1939, 1941, 1942, 1964). In the latter article, Bondar subdivided the genus *Cocos* in Brazil into five groups: *Butia*, *Barbosa*, *Arikury*, *Arecastrum*, and *Syagrus*.

In previous articles pertaining to *Syagrus*, I discussed the limits of the genus (1965), described several new taxa (1967, 1968a, 1968c), made some new combinations and reduced a number of species to synonymy (1963, 1968b, 1969, 1970), and transferred several closely related genera to *Syagrus* (1968b, 1970).

The purpose of the present paper is to show probable phylogenetic relationships of the various species of *Syagrus* by dividing the genus into subgenera, sections, and groups. Due to lack of fossil material and meager evidence from other fields of study, this information is based primarily on gross morphology. Results of this work are depicted in the form of a key, a phylogenetic tree, and descriptions of various subdivisions of the genus (subgenera, sections, and groups) with a discussion and a list of species under each. A complete revision of *Syagrus*, including descriptions of the genus and all of its species, will appear at a future date.

The genus *Syagrus* is essentially South American in distribution, with only one species (*S. amara*) occurring in the West Indies. Of the South American taxa (45 species, two varieties, and four hybrids), 39 of these (including all four hybrids) occur in Brazil, eight in Paraguay, three in Colombia, three in Argentina, two in Peru, two in Bolivia, two in Surinam, two in Uruguay, one in Ecuador, one in British Guiana, and one is known only from cultivation.

In contrast to the artificial key to species of *Syagrus* proposed by me in 1965, the following key is constructed along phylogenetic lines. Closely related species are placed in the same section or group and are keyed out together. The order of appearance in the key, however, is not intended to show a hierarchy of primitive and advanced species.

#### KEY TO THE GENUS *SYAGRUS*

1. Middle pinnae mostly in tight or loose cluster of 2-4 along rachis of leaf.  
Subgenus A. *Syagrus*.
2. Middle pinnae mostly in loose clusters of 2-4, occasionally single.

3. Stem largely subterranean, upright portion very short or absent, middle pinnae up to 1 cm. wide, branched part of spadix 8-25 cm. long.

## Section I. CAMPYLOSPATHA.

4. Pinnae up to 43 cm. long, mostly with acuminate tips. . . . . Group a.

5. Expanded part of spathe up to 18 cm. long and 8 cm. wide, branched part of spadix up to 9 cm. long, individual branches gnarled and twisted, 1.0-3.5 cm. long. . . . . 1. *S. pleioclada*.

5. Expanded part of spathe up to 30 cm. long and 3.2 cm. wide, branched part of spadix up to 21 cm. long, individual branches straight, up to 16 cm. long. . . . . 2. *S. mendanhensis*.

4. Pinnae up to 24 cm. long, mostly with oblique tips. . . . . Group b.

6. Expanded part of spathe 11-18 cm. long and 2-4 cm. wide, branched part of spadix 8-13 cm. long, branches 4-6 in number, each up to 8 cm. long; female flowers 10-14 mm. long. . . . . 3. *S. loefgrenii*.

6. Expanded part of spathe up to 35 cm. long and 4-6 cm. wide, branched part of spadix up to 25 cm. long, branches up to 20 in number, each up to 15 cm. long, female flowers 6-8 mm. long.

4. *S. campylospatha*.

3. Stem upright, slender, up to 20 m. tall, middle pinnae 0.75-4.2 cm. wide, branched part of spadix 27-70 cm. long. . . . . Section II. SYAGRUS.

7. Flowering spadix branches relatively few, 9-15 in number.

## Group c.

8. Female flowers 12-22 mm. long, fruit subglobose, exocarp striated. . . . . 5. *S. stratinicola*.

8. Female flowers 7-11 mm. long, fruit ovate, exocarp not striated.

9. Middle pinnae up to 2.8 cm. wide, male flowers 10-19 mm. long, fruit up to 5 cm. long. . . . . 6. *S. cocoides*.

9. Middle pinnae up to 0.75 cm. wide, male flowers 5-9 mm. long, fruit up to 2.2 cm. long. . . . . 7. *S. cardenasii*.

7. Flowering spadix branches numerous, 25-50 or more in number.

10. Pinnae up to 117 cm. long, expanded part of spathe up to 104 cm. long and 21 cm. wide, endosperm of seed ruminate, female flowers 10-13 mm. long.

Group d. 8. *S. amara*.

10. Pinnae up to 56 cm. long, expanded part of spathe up to 62 cm. long and 9 cm. wide, endosperm of seed homogeneous, female flowers 6-9 mm. long. . . . . Group e.

11. Fruit obovate, non-beaked, up to 2.5 cm. long and 2.2 cm. in diameter. . . . . 9. *S. allenii*.

11. Fruit ovate, short beaked, up to 4.0 cm. long and 2.2 cm. in diameter. . . . . 10. *S. orinocensis*.

2. Middle pinnae mostly in tight clusters of 2-4.

12. Petiole margins with long, spine-like projections

## Section III. CORONATA.

13. Female flowers 9-13 mm. long, pinnae 3-4 cm. wide. . . . . 11. *S. coronata*.

13. Female flowers 6-7 mm. long, pinnae 2-3 cm. wide. . . . . 12. *S. treubiana*.

12. Petioles with fibrous or smooth margins.

14. Endocarp cavity more or less triangular in cross-section, seeds 3-lobed with truncate ends.  
Section IV. INAJAI.
15. Endosperm ruminant, female flowers 12 mm. long, 9-10 mm. wide. . . . . Group f. 13. *S. smithii*.
15. Endosperm homogeneous, female flowers 5-7 mm. long, 5-7 mm. wide. . . . . Group g. 14. *S. inajai*.
14. Endocarp cavity rounded or irregular in cross-section, but not triangular, seeds round or irregular in cross-section, but not 3-lobed.
16. Female flowers 5-9 mm. long.
17. Female flowers mostly strongly nerved, with obtuse tips.  
Section V. SANCONA.
18. Female flowers 5-6 mm. long.  
15. *S. ecuadorensis*.
18. Female flowers 7-9 mm. long.  
16. *S. sancona*.
17. Female flowers mostly smooth, with acute tips.  
Section VI. ARECASTRUM.
19. Endocarp cavity very irregular in shape, seed gibbous-uncinate, pinnae mostly with acuminate tips.  
Group h. 17. *S. romanzoffiana*.
19. Endocarp cavity mostly regular in shape, seed not gibbous-uncinate, pinnae mostly with oblique tips.  
Group i. 18. *S. comosa*.
16. Female flowers 12-35 mm. long.
20. Endosperm of seed ruminant, female flowers with obtuse, keeled tips. . . . . Section VII.  
BARBOSA 19. *S. pseudococos*.
20. Endosperm of seed homogeneous, female flowers with acuminate or acute tips.  
Section VIII. OLERACEA.
21. Acaulescent or small trees up to 4.5 m. tall, middle pinnae 13-36 cm. long, 0.5-2.5 cm. wide, mostly with oblique tips.  
Group j.
22. Middle pinnae 0.5-1.6 cm. wide.
23. Acaulescent, pinnae up to 13 cm. long, female flowers up to 13 mm. long.  
20. *S. rachidii*.
23. Small trees up to 4.5 m. tall, pinnae up to 36 cm. long, female flowers up to 22 mm. long.  
21. *S. flexuosa*.

22. Middle pinnae 2.0-2.5 cm. wide.
24. Acaulescent, spadix branches 5-8 in number, up to 22 cm. long, fruit turbinate, endocarp 6-8 mm. thick.  
22. *S. duartei*.
24. Small trees up to 3 m. tall, spadix branches 12-17 in number, up to 12 cm. long, fruit ovoid, endocarp 2-4 mm. thick along sides.  
23. *S. glaucescens*.
21. Taller trees 10-36 m. tall, middle pinnae 42-80 cm. long, 2.4-4.0 cm. wide, mostly with acuminate tips. . . . . Group k.
25. Female flowers 25-35 mm. long, scars inflated, up to 10 mm. in diameter.  
24. *S. macrocarpa*.
25. Female flowers 12-22 mm. long, scars not inflated, up to 6 mm. in diameter.
26. Tree up to 36 m. tall, leaf rachis up to 120 cm. long, pinnae up to 100 pairs per leaf, each up to 42 cm. long.  
25. *S. gomesii*.
26. Tree 10-20 m. tall, leaf rachis 175-263 cm. long, pinnae 134-152 pairs, each up to 80 cm. long.  
6. *S. oleracea*.
1. Middle pinnae unclustered for the most part, rarely in loose clusters of 2.  
Subgenus *B. Syagropsis*.
27. Spadices simple, unbranched. . . . . Section IX. DIPLOTHEMIOPSIS.
28. Spadices extending beyond tips of spathes for several cm., fruits 1-2 chambered, 1-2 seeded. . . . . Group 1.
29. Spathes more or less woody in texture, expanded part up to 19 cm. long, flowering part of spadix 10-12 cm. long, male flowers 5-7 and 8-10 mm. long, fruit ovate, up to 2 cm. long. . . . . 27. *S. campicola*.
29. Spathes papery in texture, expanded part 4-5 cm. long, flowering part of spadix 3.0-5.5 cm. long, male flowers 3-5 mm. long, fruit rounded, 1.0-1.4 cm. long. . . . . 28. *S. leptospatha*.
28. Spadices completely enclosed by spathes, fruits 1-chambered and 1-seeded.  
Group m.
30. Flowering part of spadix up to 18 cm. long, female flowers 6-7 mm. long, with broad, acute or obtuse tips. . . . . 29. *S. acaulis*.

30. Flowering part of spadix up to 12 cm. long, female flowers 7–14 mm. long, with acute or acuminate tips.
31. Female flowers 10–14 mm. long.
32. Pinnae up to 7 mm. wide, with acuminate or oblique tips, unclustered throughout, female flowers 4–5 mm. wide, mostly nerved, tips acuminate. . . . . 30. *S. petraea*.
32. Pinnae up to 12 mm. wide, mostly with oblique tips, usually single, but in occasional clusters of 2, female flowers 5–8 mm. wide, mostly smooth, tips acute. . . . . 31. *S. glazioviana*.
31. Female flowers 7–10 mm. long. . . . . 32. *S. glazioviana* var. *alpina*.
27. Spadices with 2–many branches.
33. Petiole margins spiny, pinnae mostly with oblique tips.  
Section X. BUTIA.
34. Spathes deeply plicate-sulcate for the most part, fruits 1-chambered and 1-seeded. . . . . Group n.
35. Acaulescent, middle pinnae in loose clusters of 2 or single, 2.0–2.5 cm. wide, endosperm of seed homogeneous.  
33. *S. vagans*.
35. Trees up to 4 m. tall, middle pinnae unclustered throughout, 3.0–3.5 cm. wide, endosperm of seed ruminant.  
34. *S. schizophylla*.
34. Spathes shallowly plicate-sulcate, appearing smooth, fruits 1–3-chambered and 1–3-seeded. . . . . Group o.
36. Female flowers 10–16 mm. long, 6–10 mm. wide, mature fruit 3.0–4.2 cm. long.
37. Acaulescent or with trunk 1–2 m. tall, 10–20 cm. in diameter, middle pinnae 0.8–1.3 cm. wide, up to 50 cm. long, rachis of leaf up to 76 cm. long, up to 42 pairs of pinnae, spathe up to 43 cm. long and 5 cm. wide. . . . . 35. *S. paraguayensis*.
37. Trees 8–10 m. tall, up to 40 cm. in diameter, middle pinnae 2.0–2.4 cm. wide, up to 81 cm. long, rachis of leaf up to 170 cm. long, up to 72 pairs of pinnae, spathe up to 125 cm. long and 12 cm. wide.  
36. *S. yatay*.
36. Female flowers 3–8 mm. long, 3.5–5.0 mm. wide, mature fruit 1.8–2.6 cm. long.
38. Acaulescent or with very short trunk, middle pinnae 0.7–1.1 cm. wide, up to 40 cm. long, spathe up to 33 cm. long and 3 cm. wide, spadix with up to 22 branches, petiolar spines short, usually not exceeding 2 mm. in length. . . . . 37. *S. arenicola*.
38. Trees 3–6 m. tall, middle pinnae 1.8–2.7 mm. wide, 60–70 cm. long, spathe up to 135 cm. long, 4–16 cm. wide, spadix with 40–60 branches, petiolar spines frequently only a few mm. long, but in older specimens up to 11 cm. long.
39. Spathe up to 16 cm. wide, densely brownish tomentose on outside, female flowers 3–5 (6) mm. long. . . . . 38. *S. eriospatha*.
39. Spathe up to 8.5 cm. wide, glaucous on outside, female flowers 4–8 mm. long. . . . . 39. *S. capitata*.
33. Petiole margins fibrous or becoming smooth with age, pinnae with oblique or acuminate tips.



40. Fruit splitting in 3 sections at maturity, endocarp thin and papery, pinnae silvery-glaucous or brownish pubescent. -

## Section XI. GLAZIOVA.

41. Middle pinnae up to 40 cm. long and 2.0 cm. wide, usually brownish pubescent, male and female flowers 6-8 mm. long, endosperm of seed ruminant. . . . 40. *S. hochnei*.
41. Middle pinnae up to 23 cm. long and 1.5 cm. wide, usually silvery glaucous, male and female flowers 2.5-5.0 mm. long, endosperm of seed homogeneous.
42. Middle pinnae 1.0-1.5 cm. wide, exterior of spathe usually covered with long blackish-brown hairs, spadix branches up to 20 cm. long. . . . . 41. *S. insignis*.
42. Middle pinnae 0.5-0.8 (1.2) cm. wide, exterior of spathe usually covered with short chestnut-brown hairs, spadix branches up to 13 cm. long.  
42. *S. weddelliana*.
40. Fruit not splitting into 3 sections at maturity, endocarp woody or bony, pinnae neither pubescent nor silvery-glaucous, for most part.
43. Trees up to 18 m. tall, leaf rachis up to 160 cm. long, 50-80 pairs of pinnae, each up to 3.5 cm. wide, mostly with oblique tips, spathes 65-110 cm. long, female flowers 4-7 mm. long.

## Section XII. SYAGROPSIS.

44. Middle pinnae up to 2.7 cm. wide, spathe up to 20 cm. wide, male flowers 7-13 mm. long, mature fruit mostly ovate, up to 4.5 cm. long.  
43. *S. botryophora*.
44. Middle pinnae up to 3.5 cm. wide, spathe up to 6 cm. wide, male flowers 3-6 mm. long, mature fruit mostly rounded, up to 2.5 cm. long.  
44. *S. ruschiana*.
43. Acaulescent, leaf rachis 25-70 cm. long, 10-30 pairs of pinnae, each up to 1.0 cm. wide, mostly with acuminate tips, spathes 7-40 cm. long, female flowers 4-13 mm. long.

## Section XIII. GRAMINIFOLIA.

45. Expanded part of spathe 6-12 cm. long, brownish tomentose, branched part of spadix 4-13 cm. long, fruits 1-chambered.  
Group p.
46. Branched part of spadix up to 4 cm. long, up to 3 branches in number, each branch up to 3 cm. long. . . 45. *S. lilliputiana*.
46. Branched part of spadix 10-13 cm. long, 13-15 branches in

- number, each branch 6–11 cm.  
long . . . . . 46. *S. hatschbachii*.
45. Expanded part of spathe 24–39  
cm. long, glaucous or brownish  
pilose, branched part of spadix  
20–30 cm. long, fruits 1–2-cham-  
bered . . . . . Group q.
47. Spadix branches 19–31 in  
number, spathes mostly glau-  
cous, female flowers 5–7 mm.  
long, mostly with obtuse tips.  
47. *S. archeri*.
47. Spadix branches 2–7 in num-  
ber, spathes brownish pilose,  
becoming glabrous with age,  
female flowers 7–13 mm. long,  
with acute tips
48. Female flowers 10–13 mm.  
long, spathes 1–2 cm. wide,  
spadix branches 4–7 in  
number.  
48. *S. graminifolia*.
48. Female flowers 7–10 mm.  
long, spathes 0.8–1.2 cm.  
wide, spadix branches 2–4  
in number . . . 49. *S. gra-  
minifolia* var. *nana*.

The genus *Syagrus* seems to fall into two natural divisions, subgenus *Syagrus*, with clustered pinnae, and subgenus *Syagropsis* with unclustered pinnae. In the phylogenetic tree (fig. 1), I have shown these as two major lines of development.

Subgenus *Syagrus* is divided into two branches, one with tightly clustered pinnae and the other with loosely clustered pinnae. I have not given formal names to these subdivisions because the latter branch (including sections *Syagrus* and *Campylospatha*) appears to represent a transitional stage of development between clustered and unclustered pinnae, and hence may not be a natural grouping. Section *Syagrus* is separated from *Campylospatha* chiefly on its larger dimensions and by being arborescent rather than acaulescent. It is split into three groups based on whether the spadix branches are few or many, size of female flowers and pinnae, and the nature of the endosperm. Some people may wonder why *S. amara*, previously included under genus *Rhyticocos*, is placed in section *Syagrus*. If one disregards the ruminant endosperm, which I believe evolved independently in several different sections of the genus *Syagrus*, e.g., *Syagrus*, *Barbosa*, *Inajai*, *Butia*, and *Glaziova*, then the relationships with section *Syagrus* become apparent. The loosely clustered

pinnae, the numerous spadix branches, the triangular, acute-tipped female flowers, and the ovoid, short-beaked fruits would warrant placing *S. amara* in this section, probably near *S. orinocensis* and *S. allenii*.

Section *Campylospatha* is split into two groups based on the length of the pinnae and whether their apices are oblique or acuminate. The first group of *S. pleioclada* and *S. mendanhensis* especially seems to be a natural one because of the remarkable resemblance of the two species in the vegetative stage. The other group (*S. campylospatha* and *S. loefgrenii*) does not show such a close relationship.

Concerning the sections with tightly clustered pinnae, *Oleracea* is probably ancestral to all of the others in this grouping because it is the least specialized. This section appears to be a natural unit because the female flowers are relatively large and usually have acuminate or acute tips. In general, other sections in this grouping (except *Barbosa*) have smaller female flowers with acute or obtuse tips. Section *Oleracea* is differentiated into two groups, one comprising acaulescent plants or small trees mostly with oblique-tipped pinnae, and another group of taller trees having pinnae with acuminate tips. *Syagrus flexuosa* may be intermediate between the two groups because it has pinnae with both oblique and acuminate tips. Apparently, each group represents a reduction series, with a decrease in size of the stem in *S. duartei* and *S. rachidii* and a decrease in the size of female flowers and width of middle pinnae in *S. rachidii*, on the one hand; and the reduction in size of female flowers in *S. oleracea* and *S. gomesii*, and reduction in the size of the leaf rachis, and number and length of pinnae in *S. gomesii*, on the other hand.

Among the more specialized sections of subgenus *Syagrus*, section *Coronata* is the only one with spiny petioles. This character seems to have arisen independently because it is also found in section *Butia* of subgenus *Syagropsis*. The broad, spine-like projections on the petiole of *S. coronata* shows a strong similarity to those of *S. capitata*, *S. eriospatha*, and *S. yatay*, but the resemblance is probably only superficial.

Section *Inajai* is characterized by a triangular endocarp cavity in cross-section and a three-lobed seed with truncate ends. Such characteristics are so highly specialized that they are found nowhere else in the genus *Syagrus*. Therefore, it seems highly unlikely that these features could have developed independently. *Syagrus smithii* was originally described under the genus *Chrysallidosperma* by Moore (1963); and even though the endosperm is ruminant, the resemblance

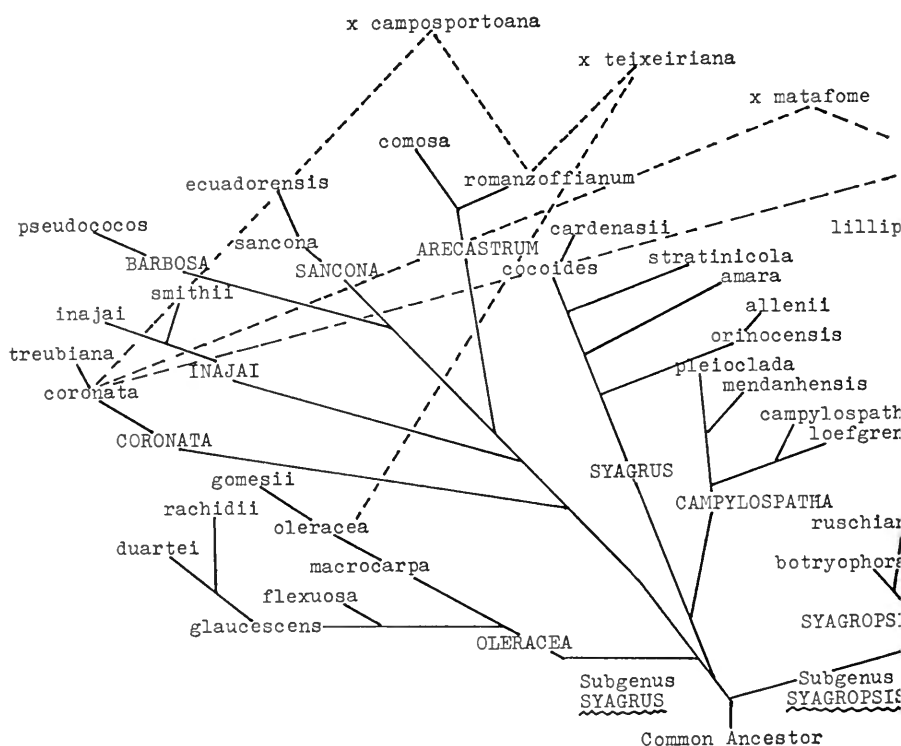
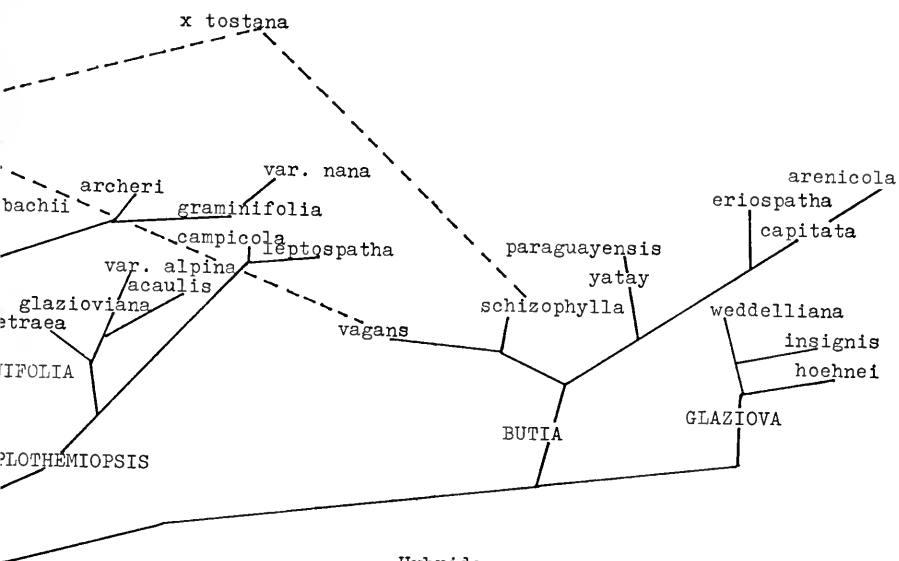


FIG. 1. Phylogenetic tree showing probable relationships of various species of *Syagrus*.



#### Hybrids

- |   |  |
|---|--|
| x camposportoana (Bondar) Glassman<br>. <u>coronata</u> x <u>S. romanzoffiana</u> | 3. S. x teixeiriana Glassman<br>( <u>S. oleracea</u> x <u>S. romanzoffiana</u> )     |
| x matafome (Bondar) Glassman<br>. <u>coronata</u> x <u>S. vagans</u>              | 4. S. x tostana (Bondar) Glassman<br>( <u>S. coronata</u> x <u>S. schizophylla</u> ) |

of the fruit and seed of this species and *S. inajai* is so strong that it could not logically be considered coincidental. In my 1965 paper, I keyed out *S. inajai* with other species having spiny petiole margins but this is incorrect because the margins are actually fibrous.

The strongly nerved female flowers with obtuse tips of section Sancona are apparently a unique combination of characters within *Syagrus*. Section Barbosa also has blunt-tipped female flowers and may be remotely related to Sancona; but its female flowers are smooth and unusually large (up to 32 mm. long), the fruit is prominently beaked and the endosperm is ruminant. *Syagrus pseudococos* was formerly treated under the genus *Barbosa*, and although it has no very close relatives within *Syagrus*, it appears to have the general characteristics of the genus as a whole.

The final section in the subgenus *Syagrus* is *Arecastrum*, characterized by having small female flowers (about 5–7 mm. long and 4–7 mm. wide) with acute tips and small, ovate fruits, 2–3 cm. long and 1.2–1.7 in diameter. It consists of two groups, differentiated by the nature of the endocarp and seed, and tips of the pinnae. For a long time *S. romanzoffianum* was treated under the separate genus *Arecastrum* because of the irregular endocarp cavity and gibbous-uncinate seed, but its affinities with the genus *Syagrus* are now unmistakable. Besides the close similarity to *S. comosa*, it is known to hybridize with at least two different species of *Syagrus* and is also thought to cross with several others (Glassman, 1968b).

As previously mentioned, the other major division of *Syagrus* is the subgenus *Syagropsis*, characterized by having unclustered pinnae. Section *Syagropsis* seems to be the least specialized section in this grouping. It differs from section *Graminifolia*, to which it is most closely related, in its larger dimensions, i.e., tall trees rather than acaulescent, much longer leaf rachis, wider and more numerous pinnae, and much longer spathes. *Graminifolia* is divided into two specialized groups, one with 1–2-chambered fruits and 1–2 seeds (*S. archeri* and *S. graminifolia*) which is also characteristic of parts of the sections *Diplothemopsis* and *Butia*. Evidently, multiple-chambered fruits with more than one seed arose independently in the three sections mentioned above because members having these features are not closely related. The other group in the section *Graminifolia*, which includes *S. hatschbachii* and *S. lilliputiana*, is characterized by having both its vegetative and reproductive structures extremely reduced in size. *Syagrus lilliputiana* is perhaps the smallest species in

the genus with a leaf rachis measuring only 25 cm. long and a spadix up to 5 cm. in length.

Section *Diplothemiosis* is apparently derived from *Graminifolia* by the complete loss of spadix branches. Of the two groups in this section, the one with *S. campicola* and *S. leptospatha* is more specialized because its spathes are shorter than the spadices and the fruits are 1-2-chambered with 1-2 seeds. *Syagrus leptospatha*, particularly, shows extreme specialization in the spathe texture which is papery rather than woody, and, in addition to this, the spathes, spadices, and male flowers are considerably reduced in size. The other group in *Diplothemiosis* is less specialized, but it seems to show a trend toward reduction in size of the female flowers (from 10-14 mm. long to 6-7 mm. long) and change in their shape from acute or acuminate to broadly acute or obtuse tips.

The remaining two sections, *Butia* and *Glaziova*, are among the more highly specialized within the subgenus *Syagropsis*. They do not appear to have close relatives in any of the other sections. *Butia* is described here as having spiny petioles and pinnae with oblique tips. It has two well-defined groups which are distinguished chiefly by the depth of grooving in the spathes and the number of chambers and seeds in the fruit. *Syagrus schizophylla* was formerly treated under a separate genus, *Arikuryroba* because its seeds have ruminate endosperm; however, it appears to be closely related to *S. vagans* with homogeneous endosperm (Glassman, 1968b). Both species have male and female flowers which are almost identical in size and shape. An interesting sidelight is that each is known to hybridize with the same species, *S. coronata* (also with spiny petiole margins), of the subgenus *Syagrus*. The other group of species in this section was previously included under the genus *Butia*, but I gave reasons for transferring them to *Syagrus* in a recent paper (Glassman, 1970). These closely related species appear to represent one reduction series of larger female flowers (10-16 mm. long and 6-10 mm. wide) and larger fruits (3.0-4.2 cm. long) in *S. yatay* and *S. paraguayensis*, to smaller, female flowers (3-8 mm. long and 4-5 mm. wide) and smaller fruits (1.5-2.6 cm. long) in *S. capitata*, *S. arenicola*, and *S. eriospatha*; and another series in the attainment of the acaulescent habit in *S. paraguayensis* and *S. arenicola* from arborescent ancestors.

The last section to be discussed here, *Glaziova*, consists of three species. Until recently it was thought to be comprised of two different genera, *Lytocaryum* (*S. hoehnei*) and *Microcoelum* (*S. insignis* and *S. weddelliana*). *Syagrus hoehnei* was split off from the other two

species because of the ruminant endosperm, however, the three species make up a closely knit group characterized by fruits which dehisce into three parts at maturity and by a papery-thin endocarp. The alliances are unmistakably with *Syagrus* because the leaves, spathes, spadices, and male and female flowers fit the general characteristics of the genus. Section Glaziova seems to show a trend toward decrease in length and width of the middle pinnae and a reduction in size of both male and female flowers, and possibly a loss of ruminant endosperm in the seed. Under this interpretation, *S. weddelliana* would be the most highly evolved species in the section.

The following subgenera, sections, groups, and species are listed according to their appearance in the key. Descriptions and synonymy of subgenera and sections are given along with their type species. Each species under the sections is merely listed with its known geographical distribution, and synonyms are given only when a new combination is made. Complete synonymy and descriptions will appear in a subsequent paper.

**SYAGRUS subgenus A. *Syagrus*.** *Cocos*, subgen. *Syagrus* Drude, Engler & Prantl Natur. Pflanzenf. II, 3: 81. 1887; in part.

Acaulescent or trees up to 36 m. tall. Petiole margins mostly fibrous or smooth, seldom spiny, middle pinnae mostly in tight or loose clusters of 2-4, occasionally single, with acuminate or oblique tips; spathes deeply plicate-sulcate; spadices branched, branches 4-many in number; female flowers mostly with acute or acuminate tips, occasionally obtuse, 5-35 mm. long; mature fruit with a single locule and single seed; endocarp cavity more or less circular in cross-section, occasionally triangular or irregularly lobed; seed mostly conforming to shape of endocarp cavity, endosperm usually homogeneous, occasionally ruminant.

Type species: *Syagrus cocoides* Mart. which is also the type species of the genus.

This subgenus contains more than one-half of the described species of *Syagrus*. I consider it to be representative of the genus as a whole because the sections show a closer relationship to each other and seem to be less specialized than the subgenus *Syagropsis*.

### Section I. CAMPYLOSPATHA Glassman, *sect. nov.*

Palma acaulis. Piniis in gregibus laxis dispositis ca. 1 cm. latis; spadix pars ramosa 8-25 cm. longa; endospermium non ruminatum.

Acaulescent. Petiole margins fibrous; middle pinnae mostly in loose clusters of 2-4, occasionally single, 15-43 cm. long, up to 1.0 cm. wide, with oblique or acuminate tips; expanded part of spathe 18-35 cm. long and 2-8 cm. wide; branched part of spadix 8-25 cm. long, branches 4-20 in number, each branch



1–15 cm. long; male flowers 4–10 mm. long; female flowers 6–14 mm. long, 4–8 mm. wide; fruit ovate, 1.7–3.0 cm. long and 1.0–2.0 cm. in diameter; endosperm of seed homogeneous.

Type species: *Syagrus campylospatha* (Barb. Rodr.) Becc.

Section *Campylospatha* consists of two groups distinguished by the length of the pinnae and the nature of its apices.

Group a. Pinnae up to 43 cm. long, mostly with acuminate tips.

1. *S. pleioclada* Burret—Brazil (Minas Gerais).
2. *S. mendanhensis* Glassman—Brazil (Minas Gerais).

Group b. Pinnae up to 24 cm. long, mostly with oblique tips.

3. *S. loefgrenii* Glassman—Brazil (São Paulo).
4. *S. campylospatha* (Barb. Rodr.) Becc.—Paraguay.

Section II. SYAGRUS. *Cocos*, sect. *Syagrus* Drude, Mart. Fl. Bras. 3: 401. 1881, in part. *Rhyticocos* Beccari, Malpighia 1: 353. 1887, in part (as genus). *Syagrus* sect. *Orthosyagrus* Burret, Notizbl. 13: 679. 1937.

Trees up to 20 m. tall. Petiole margins fibrous; middle pinnae mostly in loose clusters of 2–4, occasionally single, 30–117 cm. long, 0.75–4.2 cm. wide, with oblique or acuminate tips; expanded part of spathe 38–104 cm. long and 3.3–21 cm. wide; branched part of spadix 27–70 cm. long, branches 9–50 in number, each branch 22–56 cm. long; male flowers 5–19 mm. long; female flowers 6–18 mm. long, 4–11 mm. wide; fruit subglobose or ovoid, 2.2–5.8 cm. long and 1.6–3.7 cm. in diameter; endosperm of seed homogeneous, sometimes ruminant.

Type species: *Syagrus cocooides* Mart.

Drude (1881) listed the following species under *Cocos*, section *Syagrus*: *S. botryophora*, *S. romanzoffiana* (in part), *S. inajai*, *S. cocooides*, *S. comosa*, *S. graminifolia*, *S. flexuosa*, and *S. macrocarpa*. I have recognized only *S. cocooides* as belonging to section *Syagrus*; the remainder are placed in several other sections of the genus.

This section is divided into three groups based mainly on the number of spadix branches, size of pinnae, spathes and female flowers, and nature of the endosperm.

Group c. Flowering spadix branches 9–15 in number, endosperm homogeneous.

5. *S. stratinicola* Wessels Boer—Surinam.
6. *S. cocooides* Mart.—Brazil (Pará, Amapa, Bahia, Piauí, Ceará, Mato Grosso and Goiás); British Guiana.
7. *S. cardenasii* Glassman—Bolivia.

Group d. Flowering spadix branches up to 50 in number, pinnae up to 117 cm. long, female flowers 10–13 mm. long, endosperm ruminant.

8. *S. amara* (Jacq.) Mart.—Lesser Antilles (Martinique, Dominica, Guadeloupe and St. Lucia).

Group e. Flowering spadix branches up to 40 in number. pinnae up to 56 cm. long, female flowers 6–9 mm. long, endosperm homogeneous.

9. *S. allenii* Glassman—Colombia.

10. *S. orinocensis* (Spruce) Burret—Colombia, Venezuela.

### Section III. CORONATA Glassman, *sect. nov.*

Palma 9 m. alta. Petiolus cum marginibus spinosus; pinnis in gregibus strictis dispositis 2.0–4.2 cm. latis.

Trees up to 9 m. tall. Petiole margins armed with long, spine-like projections for most of its length; middle pinnae in tight clusters of 2–4, 40–72 cm. long, 2.0–4.2 cm. wide, mostly with acuminate tips; expanded part of spathe 54–75 cm. long, 8–17 cm. wide; branched part of spadix 38–54 cm. long, branches 42–48 in number each branch up to 30 cm. long; male flowers 6–16 mm. long; female flowers 6–13 mm. long, 4–7 mm. wide; fruit 2.5–2.7 cm. long, 1.5–2.0 cm. in diameter; endosperm of seed homogeneous.

Type species: *Syagrus coronata* (Mart.) Becc.

This section consists of two closely related species, therefore no subdivision into groups is necessary.

11. *S. coronata* (Mart.) Becc.—Brazil (Bahia).

12. *S. treubiana* (Becc.) Becc.—Only known from cultivation.

### Section IV. INAJAI Glassman, *sect. nov.* *Chrysallidosperma* H. E. Moore, Principes 7: 109. 1963, in part (as genus).

Palma 12 m. alta. Pinnis in gregibus strictis dispositis 3–4 cm. latis; fructus cavus endocarpus triquetras; semine trilobo cum termini truncati endospermium ruminatum aut non ruminatum.

Trees up to 12 m. tall. Petiole margins fibrous; middle pinnae in tight clusters of 2–4, 66–77 cm. long and 3–4 cm. wide, mostly with acute or acuminate tips; expanded part of spathe 80–85 cm. long, 10–14 cm. wide; branched part of spadix 38–50 cm. long, branches 35–64 in number, each branch 31–40 cm. long; male flowers 5–13 mm. long; female flowers 5–12 mm. long, 5–10 mm. wide; fruit ovoid, with short beak, 4–7 cm. long, 3–4 cm. in diameter, endocarp cavity irregularly triangular in cross-section, trivittate within; seed 2.0–3.5 cm. long, 1.2–1.8 cm. in diameter, three-lobed or three-angled in cross-section, truncate at each end, with sculptured impressed sides, endosperm homogeneous or ruminant.

Type species: *Syagrus inajai* (Spruce) Becc.

I have included *S. inajai* and *S. smithii* in the same section because of the unique characteristics of the fruit and seed, however, I have placed them in separate groups based on the differences in the endosperm and size of the female flowers. Moore (1963) originally described *S. smithii* in another genus, *Chrysallidosperma*, as having affinities with *Barbosa* and *Rhyticocos*. In the present paper, I have included the latter two genera in other sections of the subgenus *SYAGRUS*.

Group f. Endosperm of seed ruminant, female flowers 12 mm. long, 9–10 mm. wide.

13. *S. smithii* (H. E. Moore) Glassman, *comb. nov.*—Peru.  
*Chrysallidosperma smithii* H. E. Moore, *Principes* 7: 110. 1963.

Group g. Endosperm of seed homogeneous, female flowers 5–7 mm. long, 5–7 mm. wide.

14. *S. inajai* (Spruce) Becc.—Brazil (Pará and Amazonas); Surinam, French Guiana.

#### Section V. *SANCONA* Glassman, *sect. nov.*

Palma 20 m. alta. Piniis in gregibus strictis dispositis 3.5–4.7 cm. latis; flores feminei 5–9 mm. alti cum venas firmas et apices obtuses.

Trees up to 20 m. tall. Petiole margins fibrous or smooth; middle pinnae in tight clusters of 2–4, 56–100 cm. long and 3.5–4.7 cm. wide, with acute or acuminate tips; expanded part of spathe up to 100 cm. long and 21 cm. wide; branched part of spadix 76–109 cm. long, branches 100–138 in number, each branch 42–63 cm. long; male flowers 6–12 mm. long; female flowers mostly strongly nerved, with obtuse tips, 5–9 mm. long and 4–7 mm. wide; fruit ovoid, 3.0–3.4 cm. long, 1.5–2.0 cm. in diameter, with short beak.

Type species: *Syagrus sancona* Karsten.

This section contains two closely related species, hence it is not divided into groups. In fact, they may even be conspecific, but due to lack of complete collections of *S. ecuadorensis* I am reluctant to combine the two species.

15. *S. ecuadorensis* Becc.—Ecuador.  
16. *S. sancona* Karsten—Colombia, Peru, and Venezuela.

Section VI. *ARECASTRUM* (Drude) Glassman, *comb. nov.*  
*Cocos*, *sect. Arecastrum* Drude, *Mart. Fl. Bras.* 3: 402. 1881. *Cocos*,

subgen. *Arecastrum* Beccari, *Malpighia* 1: 351. 1887; Drude, Engler & Prantl, *Natur. Pflanzenf.* II, 3: 81. 1887. *Arecastrum* Beccari, *L'Agric. Colon.* 10: 446. 1916 (as genus).

Trees 7–15 m. tall. Petiole margins fibrous or smooth; middle pinnae in tight clusters of 2–4, 41–85 cm. long and 2.0–3.2 cm. wide, with acuminate or oblique tips; expanded part of spathe 72–150 cm. long, 7.5–14 cm. wide; branched part of spadix 32–125 cm. long, branches 19–80 in number, each branch 23–62 cm. long; male flowers 6–16 mm. long; female flowers smooth in texture, with acute tips, 4.5–7.0 mm. long, 4–7 mm. wide; fruit ovoid, 2.0–3.0 cm. long and 1.2–1.7 cm. in diameter, slightly beaked, endocarp cavity regular or very irregular in cross-section; seed ovoid and smooth or gibbous-uncinate.

Type species: *Syagrus romanzoffiana* (Chamisso) Glassman.

Besides *S. romanzoffiana*, Drude (1881) included the following species in section *Arecastrum*: *S. coronata*, *S. oleracea*, *S. eriospatha*, *S. schizophylla*, *S. yatay*, and *S. capitata*. When he elevated *Arecastrum* to subgeneric status in 1887, Drude also added *S. petraea* and *S. acaulis*. In the present paper I have placed the above species in several different sections of the genus *Syagrus*. On the other hand, Beccari (1916) considered only *S. romanzoffianum* under the genus *Arecastrum*.

Section *Arecastrum* is divided into two groups, represented by one species each.

Group h. Endocarp cavity very irregular, seed gibbous-uncinate, pinnae mostly with acuminate tips; length of pinnae, size of spathe, and length and branches of spadices of much larger dimensions than the next group.

17. *S. romanzoffianum* (Chamisso) Glassman.—Brazil (Bahia, Minas Gerais, Goiás, Mato Grosso, São Paulo, Guanabara, Paraná, Santa Catarina and Rio Grande do Sul); Paraguay, Bolivia?, Argentina, and Uruguay?.

Group i. Endocarp cavity mostly regular in shape, seed not gibbous-uncinate, pinnae mostly with oblique tips.

18. *S. comosa* (Mart.) Mart.—Brazil (Minas Gerais, Bahia?, Ceará, Piauí, Maranhão, Goiás and Mato Grosso).

Section VII. BARBOSA (Beccari) Glassman, *comb. nov.* *Barbosa* Beccari, *Malpighia* 1: 349. 1887; *L'Agric. Colon.* 10: 439. 1916 (as genus). *Cocos*, sect. *Langsdorffia* Drude, *Mart. Fl. Bras.* 3: 401. 1881.

Trees 10–15 m. tall. Petiole margins fibrous; middle pinnae in tight clusters of 2–4, up to 85 cm. long and 4 cm. wide, with acuminate or oblique tips; spadix branches up to 34 cm. long; male flowers 14–22 mm. long; female flowers smooth in texture, 20–32 mm. long, 12–13 mm. wide, with obtuse, keeled tips; mature fruit 6.0–6.8 cm. long, 3.8–4.0 cm. in diameter, with distinct beak; endosperm of seed ruminant.

Type species: *Syagrus pseudococos* (Raddi) Glassman.

Although the name *Langsdorffia* has priority over *Barbosa*, I have avoided its use because it was originally applied as a generic name in the family *Balanophoraceae* by Martius in 1818. It was first used in the *Palmae* by Raddi in 1820 as *Langsdorffia pseudococos*, thus becoming a homonym. In 1887, Drude incorporated section *Lansdorffia* into the subgenus *Syagrus*. Beccari (1887, 1916) recognized only one species under the genus *Barbosa* and in the present paper I am transferring this species to the genus *Syagrus* under section *Barbosa*.

19. *Syagrus pseudococos* (Raddi) Glassman, *comb. nov.*—Brazil (Guanabara, São Paulo, Bahia?). *Langsdorffia pseudococos* Raddi, *Mem. Soc. Ital. Sci. Modena* 18: 345. 1820. *Barbosa pseudococos* (Raddi) Beccari, *Malpighia* 1: 349. 1887.

#### Section VIII. OLERACEA Glassman *sect. nov.*

*Palma acaulis* aut 36 m. alta. Pinnis in gregibus strictis dispositis 0.5–4 cm. latis; flores feminei 10–35 mm. alti cum apices acuminates aut acutates; endospermium non ruminatum.

Acaulescent or trees up to 36 m. tall. Petiole margins fibrous or smooth; middle pinnae in tight clusters of 2–4, 13–80 cm. long, 0.5–4 cm. wide, with acuminate or oblique tips; expanded part of spathe 16–100 cm. long, 3.5–14 cm. wide; branched part of spadix 15–68 cm. long, branches 8–50 in number, each branch 8.5–45 cm. long; male flowers 8–22 mm. long; female flowers 10–35 mm. long, 6–19 mm. wide, with acuminate or acute tips; fruit 2–9 cm. long, 1.0–4.5 cm. in diameter; endosperm of seed homogeneous.

Type species: *Syagrus oleracea* (Mart.) Becc.

This section is divided into two groups based chiefly on the size of the plants and size and tips of the pinnae.

Group j. Acaulescent or small trees up to 4.5 m. tall, middle pinnae 13–36 cm. long, 0.5–2.5 cm. wide, mostly with oblique tips.

20. *S. rachidii* Glassman—Brazil (São Paulo).  
 21. *S. flexuosa* (Mart.) Becc.—Brazil (Minas Gerais, São Paulo, Mato Grosso, Goias, and Bahia).

22. *S. duartei* Glassman—Brazil (Minas Gerais).

23. *S. glaucescens* Glaz. ex Becc.—Brazil (Minas Gerais).

Group k. Taller trees 10–36 m. tall, middle pinnae 42–80 cm. long, 2.4–4.0 cm. wide, mostly with acuminate tips.

24. *S. macrocarpa* Barb. Rodr.—Brazil (Guanabara and Minas Gerais).

25. *S. gomesii* Glassman—Brazil (São Paulo).

26. *S. oleracea* (Mart.) Becc.—Brazil (Paraná, São Paulo, Guanabara, Espirito Santo, Minas Gerais, Goiás, Bahia, Pernambuco, Paraíba and Ceará); Paraguay.

### SYAGRUS subgenus B. *Syagropsis* Glassman, *subgenus nov.*

Palma acaulis aut 18 m. alta. Petiolus cum marginis fibrosus aut spinosus; pinnis aequaliter pinnatisecta; fructus loculus 1–3; semine 1–3 endospermium non ruminatum interdum ruminatum.

Acaulescent or trees up to 18 m. tall. Petiole margins fibrous; smooth or spiny; middle pinnae unclustered for the most part, rarely in loose clusters of 2, with oblique or acuminate tips; spathes deeply or less frequently shallowly plicate-sulcate; spadices usually branched, sometimes unbranched, branches 2–many in number; female flowers mostly with acute tips, occasionally acuminate or obtuse, 2.5–16 mm. long; mature fruit with 1–3 locules and 1–3 seeds; endocarp cavity (with single locule) more or less circular in cross-section, seeds conforming to shape of endocarp cavity or locules, endosperm usually homogeneous, occasionally ruminant.

Type species: *Syagrus botryophora* (Mart.) Mart.

Neither the genus *Syagrus* nor *Cocos* was previously divided into subgenera based on clustering of pinnae, hence it became necessary to establish a new name for the grouping with unclustered pinnae. As mentioned before, subgenus *Syagropsis* contains sections which seem to be more specialized than subgenus *Syagrus*. Although sections *Syagropsis*, *Graminifolia* and *Diplothermiopsis* show fairly close affinities, *Butia* and *Glaziova* appear to be more distantly related to the other three sections and to each other.

Section IX. *DIPLOTHEMIOPSIS* (Drude) Glassman, *comb. nov.* *Cocos*, sect. *Diplothermiopsis* Drude, Mart. Fl. Bras. 3: 404. 1881, in part.

Acaulescent. Petiole margins fibrous or smooth; middle pinnae unclustered for the most part, 26–38 cm. long, 0.3–1.3 cm. wide, with acuminate or oblique tips; expanded part of spathe usually woody in texture, occasionally papery, 4–23 cm. long, 0.5–3.0 cm. wide; spadix unbranched, flowering part 3.0–18 cm. long; male

flowers 3–20 mm. long; female flowers with acuminate, acute or obtuse tips, 4.5–14 mm. long, 4–8 mm. wide; fruit 1.0–2.8 cm. long, 0.8–1.7 cm. in diameter, with 1–2 chambers; seeds 1–2, endosperm homogeneous.

Type species: *Syagrus petraea* (Mart.) Becc.

Drude (1881) included only *S. acaulis* and *S. petraea* in this section, but in a later paper (1887) he incorporated these species into the subgenus *Arecastrum*. Beccari (1887) did not think that section *Diplothemiosis* was a natural one, and subsequently (1888) listed *S. acaulis* with subgenus *Arecastrum*. In the present paper, I am recognizing *Diplothemiosis* as a distinct section, probably derived from *Graminifolia* by loss of its spadix branches. The section is differentiated into two apparently well-defined groups.

Group l. Spadices extending beyond tips of spathes for several cm., fruits 1–2-chambered, 1–2-seeded.

27. *S. campicola* (Barb. Rodr.) Becc.—Paraguay.

28. *S. leptospatha* Burret—Brazil (Mato Grosso).

Group m. Spadices completely enclosed by spathes, fruits 1-chambered and 1-seeded.

29. *S. acaulis* (Drude) Becc.—Brazil (Goias).

30. *S. petraea* (Martius) Becc.—Bolivia; Brazil (Mato Grosso and Piauí?).

31. *S. glazioviana* (Dammer) Becc.—Brazil (Goias).

32. *S. glazioviana* var. *alpina* (Drude) Glassman—Brazil (Goias).

Section X. BUTIA (Beccari) Glassman, *comb. nov.* *Cocos*, subgen. *Butia* Becc., *Malpighia* 1: 352. 1887. *Butia* Beccari, *L'Agric. Colon.* 10: 471. 1916 (as genus). *Arikuryroba* Barb. Rodr., *Pl. Nov. Cult.* 1: 5. 1891; *Arikury* Beccari, *l.c.* 445. 1916; in part.

Acaulescent or trees up to 10 m. tall. Petiole margins mostly armed with short spines, occasionally with coarse spines up to 11 cm. long on basal part; middle pinnae unclustered for the most part, 40–81 cm. long, 0.7–3.5 cm. wide, mostly with oblique tips; expanded part of spathe usually shallowly plicate-sulcate, sometimes deeply plicate-sulcate, 30–135 cm. long, branches 22–100 in number, each branch 18–62 cm. long; male flowers 3–11 mm. long; female flowers 3–16 mm. long, 3.5–10 mm. wide; fruit 1.8–4.2 cm. long, 1.0–2.8 cm. in diameter, with 1–3 chambers; seeds 1–3, endosperm mostly homogeneous, sometimes ruminant.

Type species: *Syagrus capitata* (Mart.) Glassman.

Beccari (1887) included *S. schizophylla* under subgenus *Butia*, but later (1916) he transferred this species to the genus *Arikury* (= *Arikuryroba*) when he elevated *Butia* to generic rank. In the present paper

I am placing both genera plus a few other species of *Syagrus* under section *Butia* which is split into the following groups.

Group n. Spathes deeply plicate-sulcate, fruits 1-chambered and 1-seeded.

33. *S. vagans* (Bondar) Hawkes—Brazil (Bahia).

34. *S. schizophylla* (Mart.) Glassman—Brazil (Bahia).

Group o. Spathes shallowly plicate-sulcate, appearing smooth, fruits 1-3-chambered and 1-3-seeded.

35. *S. paraguayensis* (Barb. Rodr.) Glassman—Paraguay and Argentina.

36. *S. yatay* (Mart.) Glassman—Argentina, Paraguay, Uruguay and Brazil (Rio Grande do Sul).

37. *S. arenicola* (Barb. Rodr.) Frambach ex Dahlgr.—Paraguay and Brazil (Mato Grosso and Minas Gerais)?.

38. *S. eriospatha* (Mart. ex Drude) Glassman—Brazil (Rio Grande do Sul and Santa Catarina).

39. *S. capitata* (Mart.) Glassman—Brazil (Minas Gerais, Goias, São Paulo, Paraná, Santa Catarina and Rio Grande do Sul) and Uruguay.

Section XI. GLAZIOVA (Mart. ex Drude) Burret, Notizbl. 13: 677. 1937. *Glaziova* Mart. ex Drude, Mart. Fl. Bras. 3: 395. 1881 (as genus). *Cocos* subgen. *Glaziova* (Mart. ex Drude) Beccari, Malpighia 1: 443. 1887; Drude, Engler & Prantl Naturl. Pflanzenf. II, 3: 81. 1887. *Lytocaryum* Toledo, Arq. Bot. Est. São Paulo 2: 6. 1944; Burret & Potztal, Willdenowia 1: 387. 1956. *Lytocaryum* sect. *Glaziova* (Mart. ex Drude) Toledo, and sect. *Maxburretia* Toledo, l.c. 7. *Microcoelum* Burret & Potztal, l.c. 387.

Trees up to 5 m. tall. Petiole margins smooth or fibrous; middle pinnae unclustered, silvery-glaucous or brownish pubescent, 21-40 cm. long, 0.5-2.0 cm. wide, mostly with oblique tips; expanded part of spathe brownish or blackish tomentose on outside, 40-56 cm. long, 2.5-7.0 cm. wide; branched part of spadix 36-40 cm. long, branches 38-62 in number, each branch 8-20 cm. long; male flowers 2.5-8.0 mm. long; female flowers 2.5-8.0 mm. long, 2.5-6.0 mm. wide; fruit 1.7-3.3 cm. long, 1.0-2.3 cm. in diameter, usually dehiscent along 2 or 3 seams at maturity, endocarp thin and papery, 0.5-1.0 mm. thick; endosperm of seed homogeneous or ruminant.

Type species: *Syagrus weddelliana* (Wendl.) Becc.

*Glaziova* was originally described as a genus of palms by Drude (1881) in which he included *G. insignis* and *G. martiana* (= *S. weddel-*



*liana*). Beccari (1887) reduced *Glaziova* to a subgenus under *Cocos*, and in 1910 he described a new species, *G. treubiana* (now included in section *Coronata*), under the genus *Glaziova*. Later, Beccari (1916) incorporated the three species listed above into the genus *Syagrus*, chiefly because it was discovered that the name *Glaziova* previously was published as a genus in the family Bignoniaceae in 1868 by Bureau.

Since this section apparently consists of closely related species, I have not chosen to divide it into groups.

40. *S. hoehnei* Burret—Brazil (São Paulo).
41. *S. insignis* (Hort. ex Drude) Becc.—Brazil (Guanabara and Espirito Santo?).
42. *S. weddelliana* (Wendl.) Becc.—Brazil (Guanabara).

## Section XII. SYAGROPSIS

Trees up to 18 m. tall. Petiole margins fibrous or smooth; middle pinnae unclustered, 53–62 cm. long, 2.7–3.5 cm. wide, mostly with oblique tips; expanded part of spathe 65–110 cm. long, 6–20 cm. wide; branched part of spadix 50–98 cm. long, branches 34–100 in number, each branch 34–55 cm. long; male flowers 3–13 mm. long; female flowers 4–7 mm. long, 3–7 mm. wide; fruit 2.5–4.5 cm. long, 2.0–2.5 cm. in diameter; endosperm of seed homogeneous.

Type species: *Syagrus botryophora* (Mart.) Mart.

As previously stated, this section seems to be the least specialized in the subgenus *Syagropsis*, and is probably ancestral to section *Graminifolia*. *Syagrus botryophora* was formerly considered to be a variety of *Arecastrum romanzoffianum* by Beccari (1916), and *S. ruschiana* was included in the genus *Arikuryroba* by Toledo (1944). Both species show a close affinity, therefore this section is not broken down into groups.

43. *S. botryophora* (Mart.) Mart.—Brazil (Bahia).
44. *S. ruschiana* (Bondar) Glassman—Brazil (Espirito Santo).

## Section XIII. GRAMINIFOLIA Glassman, *sect. nov.*

Palma acaulis. Folia rachis 25–70 cm. longa; pinnis utrinque 10–30 aequaliter pinnatisecta 0.4–1.0 cm. latis cum apices acuminates; spatha 7–40 cm. longa; flores feminei 4–13 mm. alti.

Acaulescent or with short trunk up to 1 m. high. Petiole margins fibrous or smooth; middle pinnae unclustered, 26–55 cm. long, 0.4–1.0 cm. wide, mostly with acuminate tips; expanded part of spathe brownish pubescent or glaucous, 6.5–39 cm. long, 1–3 cm. wide; branched part of spadix 5–30 cm. long, branches 2–31 in number, each branch 3–18 cm. long; male flowers 3–10 mm. long; female flowers

4–13 mm. long, 3.5–7.0 mm. wide; fruit 1.2–2.0 cm. long, 0.7–1.4 cm. in diameter, with 1–2 chambers; seeds 1–2, endosperm homogeneous.

Type species: *Syagrus graminifolia* (Drude) Becc.

Section Graminifolia is divided into the following two groups.

Group p. Expanded part of spathe 6–12 cm. long, brownish tomentose, branched part of spadix 4–13 cm. long, fruits 1-chambered.

45. *S. lilliputiana* (Barb. Rodr.) Becc.—Paraguay.

46. *S. hatschbachii* Glassman—Brazil (Paraná).

Group q. Expanded part of spathe 24–39 cm. long, glaucous or brownish pilose, branched part of spadix 20–30 cm. long, fruits 1–2-chambered.

47. *S. archeri* Glassman—Brazil (Minas Gerais, São Paulo, and Goias).

48. *S. graminifolia* (Drude) Becc.—Brazil (Piauí, Goias and Mato Grosso?).

49. *S. graminifolia* var. *nana* (Drude) Becc.—Brazil (Goias).

It should be pointed out here that superficially, *S. archeri* resembles *S. arenicola* of section Butia more closely than *S. graminifolia*. The first two species have shallowly plicate-sulcate spathes which may become deeply grooved with age, middle pinnae about the same length and width, and male and female flowers approximately the same size. *Syagrus archeri*, however, differs from *S. arenicola* primarily in having fibrous rather than spiny petiole margins and pinnae with acuminate rather than oblique tips; hence it would appear to be more closely related to species in section GRAMINIFOLIA. Neither mature fruits nor seeds of *S. arenicola* have been seen by me, therefore, comparisons of these characteristics with *S. archeri* cannot be made.

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