OCCASIONAL PAPERS
OF
BERNICE P. BISHOP MUSEUM
HONOLULU, HAWAII

Volume XV | May 10, 1939 | Number 3

# Notes on Polynesian Grasses

By F. R. FOSBERG
UNIVERSITY OF PENNSYLVANIA

## ERAGROSTIS

Several references have been made in literature to *Eragrostis falcata* from central and northern Polynesia. Hillebrand (Fl. Haw. Is., 532, 1888) placed in this species Mann and Brigham's collection no. 44 from Oahu, considering it a recent introduction from Australia. Hitchcock (B. P. Bishop Mus., Mem. 8:127, 1922) accepted their view without apparent question. He also determined plants collected on Ocean (Kure) Island by E. L. Caum as *E. falcata*. Christophersen (B. P. Bishop Mus., Bull. 44:22, 35, 70, 73, 1927) referred to *E. falcata* plants collected on several Pacific equatorial islands. Christophersen and Caum (B. P. Bishop Mus., Bull. 81:21, 1931) accepted Hitchcock's determination and reported *E. falcata* from the leeward Hawaiian islands.

In 1924 Jedwabnik (Bot. Arch., 5:214, 1924) published *E. paupera*, a new species, based on the above mentioned collection (Mann and Brigham 44) with no indication of its relationships in the genus. In determinations of the grasses collected by the Mangarevan Expedition, J. R. Swallen referred to *E. paupera* a collection from Christmas Island (St. John and Fosberg 17489).

Through the kindness of Captain William G. Anderson, I was able to visit Christmas Island in 1936 and to collect rather extensively. Among the results were several collections of the same diminutive *Eragrostis* collected by the Mangarevan Expedition and referred to by Christophersen. A comparison with the specimen of Mann and Brigham (no. 44) showed that the Christmas Island plants differ in several features, though they are undoubtedly closely related.

erect, sharply scabrous, rather slender, almost covered by the leaf sheaths, up to 20 cm. tall; sheaths glabrous, auricles prominent, bristly, ligule a band of stiff bristles, blade slightly scabrous outside, hispid inside, strongly involute when dry, up to 5 cm. long, usually much less; panicle strict, little branched, racemose, sharply scabrous; spikelets few to about 40, straight to somewhat falcate, up to 3 cm. long, flattened, 1.5-2 mm. wide, 0.6-0.7 mm. thick; glumes membranous, strongly keeled, rounded or slightly emarginate at apex, outer 1.5 mm. long, inner 2 mm. long; lemmas appressed, spreading slightly in age, hyaline margined, strongly keeled, tri-nerved, apex emarginate, 1.8 mm. long, overlapping next above on same side about 1 mm., keel sharply scabrous above, otherwise glabrous; palea 1.5 mm. long, oblong, truncate, bent outward, persistent, hyaline with thickened, hispid-ciliate margins; fruit golden brown, somewhat flattened, sub-rotund in outline, 0.5 mm. long, 0.4-0.5 mm. wide, adaxial surface with a small brown tubercle at base, abaxial surface convex with a somewhat divided depression in lower half.

Pacific equatorial and leeward Hawaiian islands.

Differs from *E. paupera,* its closest relative, in the densely caespitose habit, stiff, much more scabrous culms, more pubescent upper surface of the leaves, more prominent auricles, much wider spikelets, relatively much shorter and thicker fruit, and in other minor characters. Includes two well-defined varieties.

Dedicated to my friend, the late Leo D. Whitney, of Honolulu, with whom I had planned to collaborate in writing this paper, and whose work on Hawaiian grasses was cut short by his untimely death.

**Eragrostis Whitneyi** Fosberg var. **typica** Fosberg, n. var. (figs. 1, *b*; 2, *a, b*).

Spicula linearis ad 3 cm. longa, fructus 0.5 mm. longus 0.4 mm. latus supra convexus.

Spikelets up to 3 cm. long, sides somewhat grooved, linear with sides parallel except near apex; fruit slightly longer than broad, rounded at base and apex, obscurely reticulate, adaxial surface convex. (Fruit of one plant of Fosberg 13266 slightly ovate.)

Known only from the Pacific equatorial islands.

Christmas Island: Motu Tapu, alt. 0.5 m., Aug. 16, 1936, *Fosberg 13195* (type of variety and species, type sheet in Bishop Museum); London, alt. 2 m., Aug. 22, 1936, *Fosberg 13230*; Paris, alt. 2 m., Aug. 28, 1936, *Fosberg 13266*; Manulu Lagoon, Oct. 21, 1934, *St. John and Fosberg 17489*; without locality, Aug. 1, 1924, *Bergman 14* (culms scarcely scabrous).

Jarvis Island: Aug. 9, 1924, *Bergman 54.*

Baker Island: alt. 7 m., Sept. 23, 1924, *Christophersen 30.*

Malden Island: Nov. 22, 1924, *Wilder.*

Growing on coral atolls, on coral sand, gravel, and saline flats.

This is the *Eragrostis falcata* of earlier records from these islands, not of Gaudichaud.

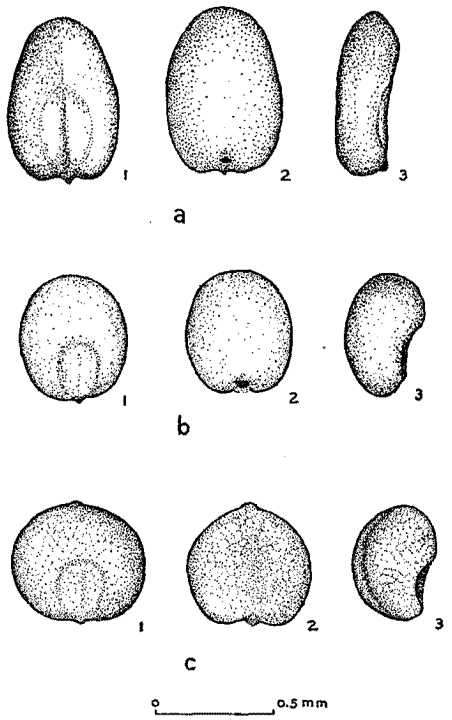


FIGURE 1.—Fruits of *Eragrostis*, (1) abaxial, (2) adaxial, and (3) side views: *a*, *E. paupera*; *b*, *E. Whitneyi* var. *typica*; *c*, *E. Whitneyi* var. *Caumii* (drawings by Violet O. Fosberg after pencil sketches by author).

**Eragrostis Whitneyi** Fosberg var. **Caumii** Fosberg, n. var. (figs. 1, *c*; 2, *c*).

Culmus robustior nodosus, spicula lanceolati-linearis, fructus supra leviter concavus.

Differs from var. *typica* in the thicker culms, more prominent nodes; spikelets usually shorter, 2 mm. wide at base, tapering toward apex, thus appearing lanceolate rather than linear, lateral groove almost absent; lateral nerves of lemmas more prominent, appearing doubled; fruit slightly broader, very slightly umbonate at apex, subcordate at base, adaxial surface transversally slightly concave, lightly, but more prominently reticulate.

Found only in the westernmost leeward Hawaiian islands.

Ocean (Kure) Island: north side, alt. 4 m., April 17, 1923, *Caum 7* (type).

Midway Island: Sand Island, west end, Aug. 21, 1902, *W. A. Bryan*; Eastern Island, Aug. 22, 1902, *W. A. Bryan*.

Dedicated to my friend, E. L. Caum, of Honolulu, collector of the type specimen. This is the *Eragrostis falcata* of previous records from these islands, not of Gaudichaud.

**DIGITARIA** Heister sect. **SOLITARIA** (Hackel) Henrard

Members of the Mangarevan Expedition of Bishop Museum in 1934 collected and observed *Digitaria pacifica* and *D. stenotaphrodes* on several islands. The specimens collected were determined as to species by Dr. Swallen. On the visit to Christmas Island in 1936 I collected *D. pacifica*. The question of the identity of Dr. F. B. H. Brown's *Syntherisma pelagica* then arose, for we had visited many of the islands where it was supposed to occur and had not found it.

Examination of the types of *Syntherisma pelagica* and its varieties in the herbarium of Bishop Museum showed that they did not differ significantly from the two species of *Digitaria* mentioned above. The section *Solitaria,* as characterized by Henrard, contains five species: *D. stenotaphrodes* and *D. pacifica* of Polynesia, *D. Gaudichaudii* and *D. platycarpha* of Micronesia, and *D. pectinata* of Malaysia, all little known and poorly understood. They are characterized by a broad rhachis with the flat spikelets sunk into it in notches, presenting, but for the somewhat elongate spikelets, very much the appearance of a *Paspalum*. These species, with the exception of *D. platycarpha* (and possibly *D. pectinata,* whose habitat is unknown) are strand plants, inhabiting coral sand and limestone.

Henrard's key (Medd. Rijks Herb. Leid., **61**:20-21, 1930) to the species of this section shows certain inadequacies that are obviously the result of insufficient material to show the variability of the species. Likewise the characters used by Brown in his key to the varieties of his *Syntherisma pelagica* (Bishop Mus., Bull. **84**: 74, 1931) vary too much, even on the same plant.

Certain specimens of *D. pacifica* might well be placed in *D. Gaudichaudii* with Hendrard's key, because the number of spikes in an inflorescence of *D. pacifica* may be at least 11, while according to the key they should number only 2-3. The number of spikes in this species is ordinarily 5-7. Imbricate versus remote spikelets, a difference separating two of Brown's varieties, means nothing, as both

may occur on the same plant. The spikelets vary considerably in length in plants of the same species. Finally the size, shape, and nervation of the second glume seem valueless as key characters, due to their variability even on the same plant, and particularly between different plants in the same region. The second glumes of *D. stenotaphrodes* are generally larger than those of *D. pacifica,* but the overlapping is considerable. Rudimentary structures such as this are likely to be highly variable. The first glume, very minute when present, is present on some spikelets and absent from others on the same plant,

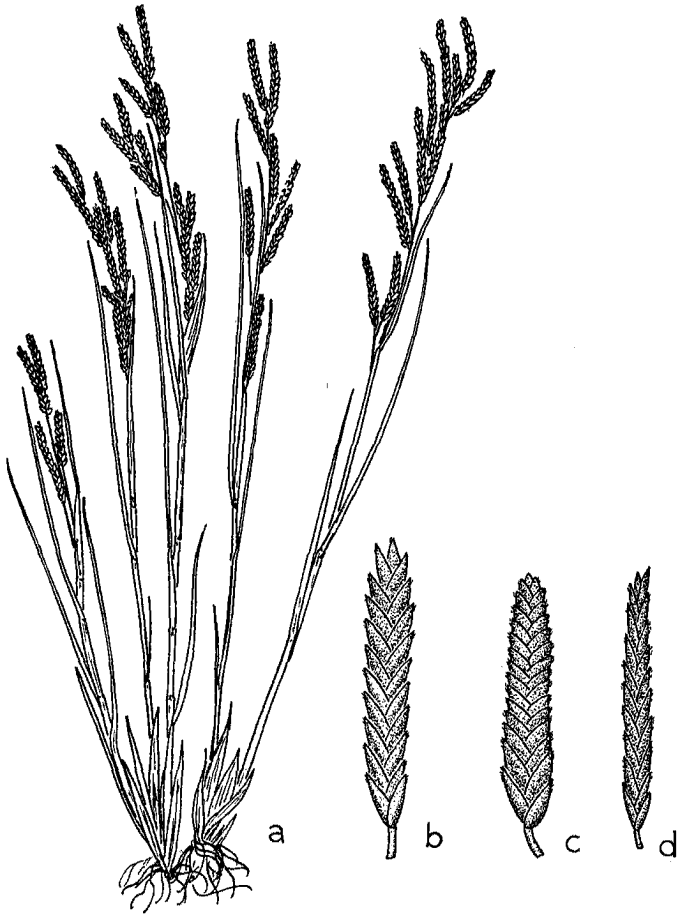


FIGURE 2.—*a, Eragrostis Whitneyi* var. *typica*; *b,* spikelet of var. *typica*; *c.* spikelet of var. *Caumii*; *d,* spikelet of *E. paupera.*

though more often absent. When the second glume is comparatively large, it may show a single faint median nerve, or even traces of lateral ones. The hairiness of the sterile lemma varies considerably, being most marked on certain specimens of *D. stenotaphrodes* (omitting from consideration the three western Pacific species of the section) and least marked on Christmas Island specimens of *D. pacifica.* Spikelets of plants of *D. pacifica* from the Phoenix group are fully as hairy on the sterile lemma as most plants of *D. stenotaphrodes.*

Being unfamiliar with two of the three western Pacific species of section *Solitaria,* I cannot construct a key to the species of the section, but will try to contrast the two central Pacific species sufficiently to make possible the evaluation of their rank. I regard them as weak species, perhaps better considered varieties; but, as species in the genus *Digitaria* and in the Gramineae, they are sufficiently distinct.

The main difference is in the shape of the spikelet, that of *D. pacifica* being elliptic or ovate-elliptic and relatively broad, while that of *D. stenotaphrodes* is lanceolate or ovate-lanceolate and considerably narrower and longer pointed. This is constant over the entire area of the two species. In addition, *D. pacifica* is ordinarily much more robust, with wider leaves than *D. stenotaphrodes.* The former also has, ordinarily, more spikes in an inflorescence.

Brown's varieties of his *Syntherisma pelagica,* not named but designated by Greek letters, show many variations, possibly ecological, but appearing more like genetic segregates in such characters as length of spikelets, length of spikes, number of spikes, width of rhachis, position of spikelets, hairiness of different parts, size and shape of glumes and habit of plants. These characters are frequently used in the taxomony of grasses, and many of them could scarcely be subject to much environmental influence. These variations are only semi-localized and not at all correlated. It would seem that in some way a heterozygous population had been widely disseminated over the Polynesian area, and that selection and the newly formulated "scatter-effect" had not yet had time to "set" this variable population into distinct insular varieties. I have no explanation to offer for this. It is a condition found in a number of other groups of plants in the Pacific, for example *Lepidium bidentatum* and *Pandanus tectorius.* When its true significance is worked out perhaps a number of the phytogeographic problems in the Pacific may be materially nearer solution.

The distribution of *Digitaria pacifica* and *D. stenotaphrodes,* on the basis of the material available in Bishop Museum together with the localities given by Stapf (Kew Bull., 77, 1906) and repeated by Henrard, seemed quite anomalous. All specimens of *D. stenotaphrodes* in Bishop Museum are from the Tuamotu Archipelago, while all material from farther west belongs to *D. pacifica.* Yet Stapf recorded *D. stenotaphrodes* from Canton of the Phoenix group, Uteite of the Gilberts, and Ifaluk of the Carolines. This seems improbable, especially as a specimen in Bishop Museum from Hull Island, of the Phoenix group, is definitely *D. pacifica.*

The Canton Island specimen, collected by Lister in 1891, is certainly *D. pacifica.* The specimen collected by T. Powell of Samoa in 1877 from Uteute (marked in pencil beside the label "Uteite Is?" and so cited by Stapf) in the Gilberts has the spikelets of *D. pacifica* and therefore probably belongs to that species, though it is much more slender than other material seen. I am unable to find any reference to Uteute or Uteite in the Gilberts or any neighboring group.

The specimens collected by the U. S. Exploring Expedition on "Willson's Island" (marked in pencil on the sheet "Ifaluk of the Carolines" and so cited by Stapf) are true *D. stenotaphrodes.* A careful study of Wilkes' "General report of the United States South Pacific Exploring Expedition" shows that at no time did the Expedition visit the Caroline Islands. However, Wilkes' map of the Tuamotu Archipelago gives "Wilson's" as an old name for Manihi, and the report shows that two visits were made to this island, on one of which the naturalists landed and collected numerous botanical specimens (Wilkes' Rept., 1: 336, 1845). There seems little doubt that the specimens in question came from Manihi of the Tuamotus rather than from Ifaluk of the Carolines (also called Wilsons Island), especially as the plant has since been found on Manihi. This gives the species a very natural distribution limited to the Tuamotus. The other specimens cited by Stapf are from Chain (Anaa), Bow (Hao), and Kings (Taiaro) Islands, all in the Tuamotu group.

I wish to thank Sir Arthur Hill, Director of Kew Gardens, for loaning to the Herbarium of the University of Pennsylvania for my examination the specimens of *Digitaria pacifica* and *D. stenotaphrodes,* upon which Stapf based his records.

Following is a statement of the synonomy and known distribution of the two species under consideration. It seems unnecessary to cite specimens.

**Digitaria stenotaphrodes** (Nees) Stapf, Kew Bull., 77, 1906; (fig. 3, *b, d*).

*Panicum stenotaphrodes* Nees, in Steud. Syn. Pl. Glum., 41, 1855.

*Syntherisma pelagica* F. Brown vars. γ, δ, ζ, ξ, η, Bishop Mus., Bull. 84: 74-75, 1931.

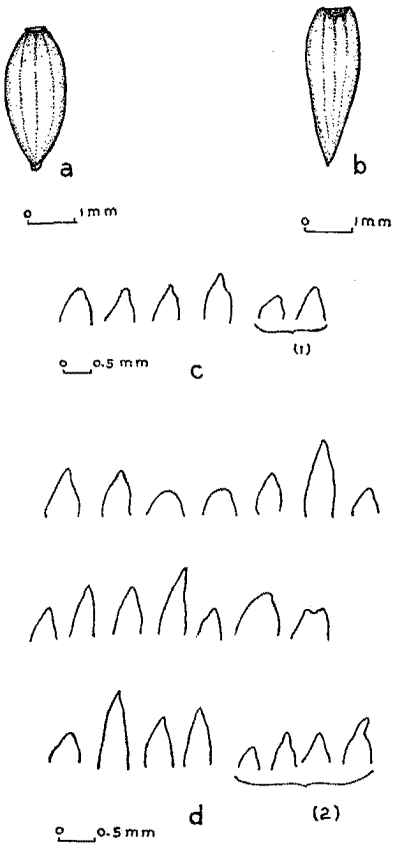


FIGURE 3.—*Digitaria* sect. *Solitaria*: *a*, spikelet of *D. pacifica*; *b*, spikelet of *D. stenotaphrodes*; *c*, second glumes of *D. pacifica*, (1) two from same plant; *d*, second glumes of *D. stenotaphrodes*, (2) four from same plant.

Tuamotu Archipelago: Anaa (Chain) (Cuming's specimen, the type, came from here); Hao (Bow); Taiaro (Tataro, Kings); Manihi (Wilson's); Napuka; Tepoto; Matahiva; Arutua; Fakarava; Katiu; Tenararo; Takapoto; Rangiroa; Takume; Makemo; Raraka; Kauehi; Paraoa; Fangatau; Faaite; Nengonengo; Tureia; Makatea.

Specimens from all these islands, except Taiaro, may be found in the herbarium of Bishop Museum.

**Digitaria pacifica** Stapf, Kew Bull., 77, 1906; (fig. 3, *a, c*).

*Syntherisma pelagica* F. Brown vars, *α*, *β*, Bishop Mus., Bull. **84**: 74, 1931.

Pacific equatorial islands: Christmas; Malden; Baker.

Phoenix Islands: Canton; Hull. [The Hull Island specimen is said by the collector, E. H. Bryan, Jr., to have been introduced from Funafuti (Ellice Is.) by Mr. Shafer.]

Ellice Islands: Funafuti. (Not known from collections, but if the above information is correct it must occur there.)

Gilbert Islands: Uteute. (This island is unknown to me.)

Specimens from Christmas, Malden, Baker, and Hull are in the herbarium of Bishop Museum, the others are in Kew.

## PASPALUM

**Paspalum vaginatum** Swartz, Prodr. Veg. Ind. Occ., 21, 1788.

This wiry perennial species, not previously reported from the Hawaiian islands, though common in other parts of Polynesia, was found in abundance lining the estuary of Kailua Stream, Oahu, in 1936 (Fosberg 13182). A duplicate of this collection was sent to Dr. Swallen, who verified the determination and contributed the information that there was a specimen in Washington of the same species received from Dr. F. G. Krauss in 1930, collected on the Shipman Ranch, Hawaii.

Dr. Swallen also verified Hitchcock's citation [Bishop Mus., Mem. 8(3): 179, 1922] of a specimen (Hitchcock 13803) as *P. distichum,* a species closely related to *P. vaginatum.*

It is difficult to know whether or not *P. vaginatum* is indigenous in the Hawaiian islands. The fact that it has not been collected previously would indicate that it might be a recent introduction (as Hitchcock regarded *P. distichum*), but the fact that it is common

throughout the warmer regions of the world in saline places, including many islands in Polynesia, suggests that it may be indigenous. Common plants are sometimes overlooked by collectors, and this species is usually without fruit and in that condition looks much like many other common grasses.

Specimens collected by the Mangarevan Expedition on a number of islands from which Brown (Bishop Mus. Bull. 84:76, 1931) reported *P. distichum* were all determined by Dr. Swallen as *P. vaginatum.* This species was collected by the Mangarevan Expedition on Mangareva, Rapa, Raivavae, Tubuai, and Rurutu. It has been previously reported from Samoa by Christophersen.