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THE GRASSES OF HAWAII

BY

A. S. HITCHCOCK

Systematic Agrostologist, United States Department of Agriculture

Memoirs of the Bernice Pauahi Bishop Museum
Volume VIII, Number 3

WITH PLATES XXXI-XXXV

HONOLULU, HAWAII
BISHOP MUSEUM PRESS
1922

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THE GRASSES OF HAWAII

By A. S. Hitchcock.

INTRODUCTION.

In 1906 I made a trip to the Hawaiian islands for the purpose of studying the grasses. All the main islands of the group were visited except Niihau and barren, windswept Kahoolawe, now uninhabited. This paper is an account of the grass flora, based upon the collections made at that time and on a study of all other accessible collections from the Hawaiian islands, including those made by Professor J. F. Rock of the College of Hawaii, Mr. C. N. Forbes of the Bishop Museum, Abbé Faurie, A. A. Heller, Mann and Brigham, and the Wilkes Exploring Expedition. Specimens given by Brother Matthias Newell of Hilo and by Mr. G. C. Munro of Lanai were examined; the original set of Mann and Brigham, at the herbarium of the Botanical Department of Cornell University, was consulted and also the set of Wilkes Expedition grasses at the Gray Herbarium. All specimens cited are in the United States National Herbarium, except when otherwise stated.

The text figures in this paper, except sixteen from early bulletins of the United States Department of Agriculture, are from original drawings made by Mrs. Mary Wright Gill. As indicated in the legends several of the figures have already appeared in various Government publications. Acknowledgment is made to the Bureau of Plant Industry and to the Smithsonian Institution for the use of cuts and drawings.

Maps have not been included in the illustrations. For the position of geographic features mentioned in this report the following maps may be consulted: for Oahu and for Kauai, the topographic maps issued by the United States Geological Survey; for Hawaii, Molokai, and Maui, maps issued by the Territorial Survey. The position of the islands and their chief topographic features are well shown on Chart No. 4102 of the United States Coast and Geodetic Survey.

GENERAL DISCUSSION.

ECOLOGICAL AREAS.

The indigenous flora of the Hawaiian islands, though comparatively meager on account of the geographic position of the group in a vast expanse of surrounding ocean, is of great interest because of the isolation. The influence of geographic features and climate on the vegetation of the islands has been considered in the reports[1] that have been already published of the 1916 trip, and the general floral

[1] Hitchcock, A. S., (1) Botanical explorations in the Hawaiian Islands: Smithsonian Misc. Coll. Vol. 66, no. 17, pp. 59–73, figs. 61–77, 1917; (2) A botanical trip to the Hawaiian Islands: Sci. Monthly, Vol. 5, Oct. and Nov., pp. 323-349, 419-432, figs. 1-43, may 1, 1917; (3) Floral aspects of the Hawaiian Islands: Smithsonian Rept. for 1917, pp. 449-462, pls. 1-25, 1919.

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regions are discussed in detail by Hillebrand[2] and Rock,[3] and also by Heller[4] for the islands of Oahu and Kauai. The distribution of the grasses as limited to ecological areas is not so distinct as in many other families of plants, but the characteristic habitats of the more common species of Hawaiian grasses are given below.

The only species that is strictly a strand plant is *Sporobolus virginicus* found on sandy shores such as the vicinity of Kahuku on Oahu. This is a low perennial with extensively creeping rhizomes, short, sharp, distichous leaves and spikelike panicles. It is found from Virginia to Brazil and also in the tropics of the Old World from Africa to India and Australia. *Lepturus repens* is also a strand plant of the South Pacific islands but does not reach the main group of the Hawaiian islands, having been collected only on Palmyra and Midway islands.

The grasslike vegetation of marshland is made up chiefly of sedges (Cyperaceae). An introduced grass, *Echinochloa crusgalli crus-pavonis*, is found in taro patches, rice fields, and along ditches. An allied species, *E. colonum*, is found in wet places but is scarcely a marsh grass. In moist cultivated soil it is a weed.

The commoner species of weeds in cultivated soil are *Syntherisma sanguinalis* (crab grass) and a more delicate allied species, *S. chinensis*. In sandy fields *Cenchrus hillebrandianus* (sandbur) is abundant.

Characteristic pasture land is found in the interior of Oahu in the vicinity of Schofield Barracks. The most abundant species of grasses at Schofield is *Rhaphis aciculata*, called by the Hawaiians pilipiliula (Pl. XXXI C. and fig. 107). It is a creeping pestiferous little grass whose sharp-pointed fruits penetrate the clothing and cause annoyance. Other species found in pasture land are *Sporobolus elongatus*, *Agrostis retrofracta*, and *Chaetochloa geniculata*. All these species are aggressive weeds which, with the possible exception of *Agrostis retrofracta*, have been introduced.

The weeds of streets are often found in fields and those of fields are found along streets, but certain species are characteristic of the streets and waste places about Honolulu and the larger towns. *Capriola dactylon*, Bermuda grass, manienie of the Hawaiians, is abundant in dry open ground. It is also found in pasture land, generally where the soil is not too wet or the rainfall too great. Bermuda is a common lawn grass. *Eleusine indica*, goose grass, and two species of Chloris, *C. paraguayensis* and *C. radiata*, are not uncommon.

There are two species of grass dominant on open or partially wooded slopes below the forest in the wet parts of the islands. These are *Paspalum orbiculare* and *P. conjugatum*. Both are introduced and neither is of value as a forage grass. *Paspalum conjugatum* is locally known as Hilo Grass; in the West Indies it is called sour grass.

Practically all the species mentioned thus far are introduced. The native species appear in the more remote regions.

---

[2] Hillebrand, William, (1) The flora of the Hawaiian Islands, New York and Heidelberg, 1888; (2) Die Vegetationsformationen der Hawaiischen Inseln: Engler Bot. Jahrb. Vol. 9, pp. 305-314, 1887.

[3] Rock, Joseph F., Indigenous trees of the Hawaiian Islands, Honolulu, 1913.

[4] Heller, A. A., Plants of the Hawaiian Islands: Minnesota Geol. and Nat. Hist. Survey Bull. 9 (Minn. Botanical Studies Vol. 1), pp. 765-777, 1894-1898.

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The most characteristic species of lee side slopes and plains here are several annual sorts of Panicum, such as *P. torridum, P. beecheyi, P. nubigenum,* and *P. lanaicnse.* These are all annuals that spring up abundantly after the winter rains. The Hawaiian name for these is kakonakona.

On dry rocky slopes such as the sides of Punch Bowl in Honolulu is found *Heteropogon contortus,* a common useful native perennial. The Hawaiian name is pili grass. It was used by the natives to thatch their huts (Pl. XXXI, A.) and is, furthermore, a good forage grass. It extends over much of the drier region of the Hawaiian islands and formerly occupied much of the land now in cultivation.

Grasses are practically absent from the deep forest. *Oplismenus hirtellus* is a shade grass found in the mountains where the shade is not too deep. It is a creeping grass with lanceolate thin blades conspicuously different from the ordinary long, narrow leaves of most grasses. The native name is honohono, which is also applied to a common species of Commelina. *Isachne distichophylla* (fig. 92) is found in somewhat open woods. It is frequent in the vicinity of the Crater Hotel near Kilauea. The other species, *I. pallens,* is found on wet rocks, as in the vicinity of waterfalls. *Panicum kaalaense* (fig. 80), a robust species, is found on the forested slopes of Mt. Kaala and in similar situations. A characteristic grass of dry woods is *Eragrostis grandis,* a robust species in large bunches, 1 to 1.5 meters tall. It is found, for example, on the wooded slopes of the mountains west of Schofield Barracks. *Panicum nephelophilum, P. tenuifolium,* and *P. xerophilum* are also found in dry open woods.

The dominant grass on many of the ridges of the foothills behind Honolulu is *Eragrostis variabilis.* This species is common on the grassy slopes at the Nuuanu Pali (Pl. XXXI, *B*).

An extensive plain lies between Mauna Kea, Mauna Loa, and the Hualalai Mountains on the island of Hawaii. The dominant grasses are *Eragrostis atropioides* and *E. leptophylla.* They form erect tufts over large areas.

Toward the upper limit of vegetation on the high mountains of Hawaii, above timber line and extending down into the upper open forest, are three common species of grasses, *Trisetum glomeratum, Agrostis sandwicensis,* and *Aira nubigena* (Pl. XXXII).

The open bogs are peculiar and interesting formations found at or near the summits of mountains that rise to the height of approximately 5000 feet. These bogs are described by Professor Rock in his admirable book, "The Indigenous Trees of the Hawaiian Islands." They are found on Kauai, Molokai, and West Maui, and also on the Kohala Mountains of Hawaii, but are absent from the higher mountains of that island.

The bogs are devoid of trees, and also of shrubs of any considerable height, though there may be islands or intrusions of woody plants. Many of the species are tussock-forming, a conspicuous one being *Oreobolus furcatus,* a sedge. There are two common tussock-forming grasses, *Panicum imbricatum* and *P. isachnoides.* Other grasses found in these bogs are *Agrostis fallax, Calamagrostis hillebrandiana, C. expansa, Panicum hillebrandianum,* and *Aira nubigena.* The last men-

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tioned is a variable species, which is found in other forms, under various conditions, from the moist spray of Rainbow Falls to the upper slopes of Mauna Kea.

AGRICULTURAL GRASSES.

The most important grass grown in the Hawaiian islands is the sugar cane, *Saccharum officinarum*. Corn, *Zea mays,* is grown in considerable quantity on the Parker Ranch, Hawaii. Rice, *Oryza sativa,* is a commercial product of importance. The small grains, wheat, oats, barley, and rye, have been grown by the United States Agricultural Experiment Station but are not commercially established.

Next to sugar, the most important industry on the Hawaiian Islands is stock-raising. This is carried on chiefly on the islands of Hawaii, Molokai (see Pl. XXXIII, B), Maui, and Lanai, and more particularly on the dry lee side of the islands. The growing of forage grasses has interested the planters here in recent years, for the native forage has become depleted to such an extent that it is necessary to consider supplementary cultivated forage.

Several of the meadow grasses of Europe and the United States have been tried on the ranches, and at medium altitudes give promise of success. Specimens of the following were found growing at altitudes of 3000 to 6000 feet on the Kukaiau Ranch and Parker Ranch on Hawaii, the Molokai Ranch on Molokai, the Haleakala Ranch on East Maui, and the Lanai Ranch: orchard grass (*Dactylis glomerata*); rescue grass (*Bromus unioloides*); blue grass (*Poa pratensis*); Italian rye grass (*Lolium multiflorum*); velvet grass (*Notholcus lanatus*); tall oat grass (*Arrhenatherum elatius*); redtop (*Agrostis stolonifera*); sweet vernal grass (*Anthoxanthum odoratum*).

Of these the orchard grass, rescue grass, and the rye grass are most likely to prove satisfactory.

Paspalum dilatatum is becoming established in the same region. Mr. G. C. Munro, manager of the Lanai Ranch, states that this is the most satisfactory pasture grass he has tried. He takes pains to scatter the seed from mature plants whenever he has the opportunity. There was a fine field of this at the United States Agricultural Substation at Haiku, Maui (Plate XXXIV, *A*).

Two tropical forage grasses may give satisfactory results at the lower altitudes. These are Pará grass (*Panicum barbinode*) and Guinea grass (*P. maximum*). They would not thrive at the higher altitudes, as they are strictly tropical and will not withstand frost. Pará grass requires plenty of moisture and would not thrive in the dry areas.

The two grasses that have proved satisfactory for hay in the dry regions are Rhodes grass (*Chloris gayana*) and Natal grass, or Natal redtop (*Tricholaena rosea*). There is a fine field of the first on the ranch of Mr. Robert Hind at Puu Waawaa, and of the second on the Molokai Ranch at Mr. George Cooke's place.

Bermuda grass is common throughout the Islands in dry open ground. It is an excellent pasture grass and also the best lawn grass for the region.

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Several grasses have been tried at the United States Agricultural Experiment Station, Honolulu. *Andropogon nodosus, A. sericeus,* and *A. saccharoides* are promising. In the vicinity of the station these grasses have shown their adaptability by escaping from cultivation.

Sudan grass, a kind of sorghum, has been tried and has shown its adaptability. An excellent field of Sudan grass grown for hay was seen at the United States Agricultural Substation at Haiku (Pl. XXXIII, *A*).

INTRODUCED SPECIES OF GRASSES.

A large proportion of the grasses of the Islands have been introduced from other countries, mostly from Europe, a few from Australia and the East Indies. The native species are of special interest because of the unusual isolation of the islands. Many species are endemic, and most of the others have extended northward to Hawaii from the East Indies and the southern Polynesian islands.

The following species appear to be introduced, some being well established, others being recent escapes from cultivation or mere waifs. Those with an asterisk [*] were probably introduced for trial as forage or lawn grasses and have escaped from cultivation. Perennial species are followed by P.

SPECIES NATIVE IN EUROPE.

Bromus hordeaceus
molliformis
racemosus
rigidus gussonei
Festuca bromoides
Panicularia fluitans P
Poa annua
compressa P
pratensis* P
Briza minor
Eragrostis cilianensis
Dactylis glomerata* P
Hordeum murinum
Lolium temulentum
multiflorum* P
Avena sativa*
fatua
barbata
Arrhenatherum elatius* P
Aspris caryophyllea
Notholcus lanatus* P
Agrostis verticillata P
stolonifera* P
canina* P
Polypogon monspeliensis
lutosus P
Gastridium ventricosum
Capriola dactylon P
Anthoxanthum odoratum* P
Phalaris paradoxa
minor
Syntherisma sanguinalis
Echinochloa colonum
Panicum repens P
Chaetochloa verticillata
lutescens
Holcus halepensis P
sorghum*

SPECIES NATIVE IN THE UNITED STATES.

Festuca megalura
Eragrostis caroliniana
Agrostis exarata microphylla
Bouteloua curtipendula* P
Phalaris californica P

SPECIES NATIVE IN THE WEST INDIES AND SOUTH AMERICA.

Bromus unioloides*
Chloris paraguayensis
radiata
Valota insularis P
Paspalum fimbriatum
Paspalum distichum P
conjugatum P
dilatatum* P
Paspalum larrañagai P
Panicum barbinode* P
Oplismenus hirtellus P
Echinochloa crusgalli crus-pavonis
Chaetochloa geniculata P
Cenchrus echinatus
Andropogon saccharoides* P

SPECIES NATIVE IN AFRICA.

Chloris gayana* P
Eragrostis abyssinica*
Panicum maximum* P
Tricholaena rosea* P

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SPECIES NATIVE IN AUSTRALIA, EAST INDIES, AND SOUTHERN ASIA.

Schizostachyum glaucifolium P
Eragrostis amabilis
falcata
brownei P
Sporobolus elongatus P
diander P
Eleusine indica
Dactyloctenium aegyptium
Chloris truncata P
Syntherisma longiflora
chinensis
debilis
microbachne
Paspalum orbiculare P
Sacciolepis contracta
Chaetochloa palmifolia P
Andropogon intermedius* P
sericeus* P
nodosus* P
Rhaphis aciculata P
Coix lachryma-jobi* P

SPECIES NATIVE IN HAWAII.

Festuca hawaiiensis P
Poa mannii P
siphonoglossa P
sandwicensis P
Eragrostis atropioides P
mauiensis P
deflexa P
grandis P
monticola P
leptophylla P
variabilis P
Trisetum glomeratum P
Aira nubigena P
Calamagrostis hillebrandiana P
expansa P
Agrostis fallax P
sandwicensis P
Garnotia sandwicensis P
Panicum fauriei
beecheyi
torridum
nubigenum
kauaiense
pellitum
lanaiense
nephelophilum P
kaalaense P
Panicum xerophilum P
tenuifolium P
isachnoides P
imbricatum P
hillebrandianum P
forbesii P
cynodon P
Isachne pallens P
distichophylla P
Dissochondrus biflorus P
(genus endemic)
Cenchrus agrimonioides P
Ischaemum byrone P

SPECIES PROBABLY NATIVE BUT FOUND ALSO IN REGIONS TO THE SOUTHWEST.

Lepturus repens P, a strand grass.
Agrostis retrofracta P, may be introduced.
Sporobolus virginicus P, a strand grass.
Microlaena stipoides P
Syntherisma pruriens, possibly introduced.
Stenotaphrum secundatum, also in American tropics.
Cenchrus hillebrandianus, possibly introduced.
Heteropogon contortus P, also in American tropics.

SUMMARY.

Native species		
Endemic	39	
Not endemic	8	47
Introduced		
From Europe	38	
From United States	5	
From West Indies and So. America	15	
From Africa	4	
From Australasia	21	83

Of the 83 introduced species 39 are perennial and 20 are probably escapes from cultivation.

Of the 47 native species 9 are annuals and of the 39 endemic species 7 are annuals, all belonging to the genus Panicum.

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KEYS.

KEY TO THE TRIBES.

Subfamily Poatae. Spikelets 1 to many-flowered, the reduced florets, if any, above the perfect florets (except in Phalarideae); articulation usually above the glumes; spikelets usually more or less laterally compressed.

Plants woody, the culms perennial; spikelets several-flowered..... **BAMBOSEAE.**

Plants herbaceous, the culms annual.

Spikelets with 2 staminate, neuter, or rudimentary lemmas unlike and below the fertile lemma; no sterile or rudimentary florets above..... **PHALARIDEAE.**

Spikelets without sterile lemmas below the perfect floret.

Spikelets sessile on a usually continuous rachis.

Spikelets on opposite sides of the rachis; spike terminal, single..... **HORDEAE.**

Spikelets on one side of the rachis; spikes usually more than 1, digitate or racemose ..... **CHLORIDEAE.**

Spikelets pedicellate in open or contracted, sometimes spikelike, panicles.

Spikelets 1-flowered..... **AGROSTIDEAE.**

Spikelets 2- to many-flowered.

Glumes as long as the lowest floret, usually as long as the spikelet; lemmas awned from the back (spikelets sometimes awnless in Trisetum) ..... **AVENEAE.**

Glumes shorter than the first floret; lemmas awnless or awned from the tip or from a bifid apex..... **FESTUCEAE.**

Subfamily Panicatae. Spikelets with one perfect terminal floret (disregarding those of the few monoecious genera and the staminate and neuter spikelets) and a sterile or staminate floret below (perfect in Isachne and Dissochondrus), commonly represented by a sterile lemma only, one glume sometimes wanting; articulation below the spikelets, either in the pedicel, in the rachis, or at the base of a cluster of spikelets, the spikelets falling entire, singly, in groups, or together with joints of the rachis; spikelets, or at least the fruits, more or less dorsally compressed.

Glumes membranaceous, the sterile lemma like the glumes in texture; fertile lemma and palea indurate or at least firmer than the glumes..... **PANICEAE.**

Glumes indurate; fertile lemma and palea hyaline or membranaceous, the sterile lemma like the fertile one in texture.

Spikelets unisexual, the pistillate below, the staminate above, on the same inflorescence; the pistillate (in our species) enclosed in a bony ovoid involucre or head..... **TRIPSACEAE.**

Spikelets in pairs, one sessile and perfect, the other pedicellate and usually staminate or neuter (perfect in Ischaemum)..... **ANDROPOGONEAE.**

KEY TO THE GENERA.

BAMBOSEAE.

A single genus in the Hawaiian Islands.....1. SCHIZOSTACHYUM (p. 110)

FESTUCEAE.

Lemmas 3-nerved .....7. ERAGROSTIS (p. 123)

Lemmas 5 to many-nerved.

Lemmas as broad as long, the margins outspread; florets closely imbricate, horizontally spreading .....6. BRIZA (p. 123)

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Lemmas longer than broad, the margins clasping the palea; florets not horizontally spreading.
Lemmas keeled on the back.
Spikelets strongly compressed, crowded in one-sided clusters at the ends of the stiff, naked panicle branches....8. DACTYLIS (p. 137)
Spikelets not strongly compressed, not crowded in one-sided clusters.
Lemmas awned from a minutely bifid apex (awnless or nearly so in *Bromus unioloides*); spikelets large....2. BROMUS (p. 111)
Lemmas awnless; spikelets small....5. POA (p. 117)
Lemmas rounded on the back, sometimes slightly keeled toward the summit.
Nerves of the lemma parallel, not converging at the summit or but slightly so; lemmas awnless, mostly obtuse....4. PANICULARIA (p. 116)
Nerves of the lemma converging at the summit; lemmas awned or pointed.
Lemmas entire, awned from the tip or pointed....3. FESTUCA (p. 115)
Lemmas awned or awn-tipped from a minutely bifid apex..2. BROMUS (p. 111)

HORDEAE.

Spikelets more than 1 at each node of the rachis....9. HORDEUM (p. 139)
Spikelets solitary at each node of the rachis.
Spikelets several-flowered in flat spikes....10. LOLIUM (p. 139)
Spikelets 1-flowered in cylindric spikes....11. LEPTURUS (p. 141)

AVENEAE.

Florets 2, one perfect, the other staminate.
Lower floret staminate, the awn twisted, geniculate, exserted..14. ARRHENATHERUM (p. 143)
Lower floret perfect, awnless; awn of upper floret hooked....17. NOTHOLCUS (p. 147)
Florets 2 or more, all alike except the reduced upper ones.
Spikelets large, the glumes over 1 cm. long....13. AVENA (p. 142)
Spikelets less than 1 cm. long.
Lemmas keeled, bidentate; awn arising from above the middle (sometimes wanting.) ....12. TRISETUM (p. 141)
Lemmas convex; awn from below the middle.
Rachilla prolonged behind the upper floret; lemmas truncate and erose-dentate at summit; plants perennial....15. AIRA (p. 143)
Rachilla not prolonged; lemmas tapering into 2 slender teeth; plants annual.... ....16. ASPRIS (p. 145)

AGROSTIDEAE.

Rachilla articulate below the glumes, these falling with the spikelet; glumes awned; lemmas awned from the tip.
Spikelets pilose at base, in narrow loose simple panicles....20. GARNOTIA (p. 155)
Spikelets not pilose at base, in dense spikelike panicles....21. POLYPOGON (p. 155)
Rachilla articulate above the glumes.
Glumes not longer than the lemma, unequal; spikelets awnless....23. SPOROBOLUS (p. 157)
Glumes longer than the lemma, about equal.
Glumes saccate at base; lemma long-awned; inflorescence contracted, shining.... ....22. GASTRIDIUM (p. 157)
Glumes not saccate at base.
Florets bearing at base a tuft of hairs....18. CALAMAGROSTIS (p. 147)
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CHLORIDEAE.

Spikelets with more than 1 perfect floret.
Rachis not prolonged....24. ELEUSINE (p. 159)
Rachis of spike extending beyond the spikelets....25. DACTYLOCTENIUM (p. 161)

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Spikelets with only 1 perfect floret, often with additional imperfect florets above.
Rachilla prolonged but with no imperfect florets....26. CAPRIOLA (p. 161)
Rachilla bearing 1 or more modified florets above the perfect one.
Spikes digitate or nearly so....27. CHLORIS (p. 163)
Spikes racemose along the main axis....28. BOUTELOUA (p. 165)

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Lateral florets consisting of awned hairy sterile lemmas exceeding the fertile floret; spikelet terete....30. ANTHOXANTHUM (p. 167)
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Spikelets sunken in the cavities of the flattened corky rachis....34. STENOTAPHRUM (p. 177)
Spikelets not sunken in the rachis.
Spikelets subtended or surrounded by 1 to many distinct or more or less connate bristles, forming an involucre.
Bristles united into a burlike involucre, the bur falling entire....44. CENCHRUS (p. 209)
Bristles not united, persistent, the spikelets deciduous.
Lower floret sterile....42. CHAETOCHLOA (p. 205)
Lower floret fertile....43. DISSOCHONDRUS (p. 209)
Spikelets not subtended by bristles.
Glumes or sterile lemma awned (awn short and concealed in the silky hairs of the spikelet in Tricholaena, awn reduced to a point in *Echinochloa colonum*).
Inflorescence paniculate; spikelets silky....41. TRICHOLAENA (p. 204)
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Blades lanceolate, broad and thin; glumes 2-lobed, awned from between the lobes....39. OPLISMENUS (p. 201)
Blades long and narrow; glumes awned from the tip....40. ECHINOCHLOA (p. 202)
Glumes and sterile lemma awnless.
Fruit cartilaginous-indurate, flexible, usually dark colored, the lemma with more or less prominent white hyaline margins, these not inrolled.
Spikelets covered with long silky hairs, arranged in racemes, these panicled....32. VALOTA (p. 170)
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Fertile florets 2 in each spikelet....38. ISACHNE (p. 201)
Fertile floret 1 in each spikelet.
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First glume present; spikelets usually in panicles.
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ANDROPOGONEAE.

Spikelets all perfect; inflorescence of 2 straight digitate racemes....45. ISCHAEMUM (p. 213)
Spikelets not all perfect, the sessile perfect, the pediceled staminate or rudimentary.
Fertile spikelet with a hairy-pointed callus, formed of the attached supporting rachis joint or pedicel.

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Racemes reduced to a single joint, long-peduncled in a simple contracted panicle.....48. RHAPHIS (p. 219)
Racemes of several to many joints, solitary.....49. HETEROPOGON (p. 221)
Fertile spikelet without a callus, the rachis disarticulating immediately below the spikelet: awns slender.
Racemes of several to many joints, solitary, digitate, or aggregate.....46. ANDROPOGON (p. 215)
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TRIPSACEAE.

A single genus (besides the cultivated corn) in the Hawaiian islands.....50. COIX (p. 222)

DESCRIPTION OF THE GENERA AND SPECIES.

1. **SCHIZOSTACHYUM** Nees.

Spikelets slender, cylindric; glumes narrow, usually mucronate; lemmas 2 to 3, the lower 1 or 2 sterile and like the glumes in appearance, the fertile 1 or 2, much imbricate and convolute; palea similar to the lemma, convolute, not keeled; rachilla prolonged and bearing a rudimentary floret; lodicules usually 3, narrow, lanceolate, ciliolate; stamens 6; ovary narrow, with a long style and 3 stigmas; caryopsis ovoid, beaked, inclosed in a crustaceous separate pericarp. Arborescent or shrubby usually erect bamboos with panicles of spicate branches, bearing heads of spikelets, in some species reduced to a spike of heads.

1. **Schizostachyum glaucifolium** (Rupr.) Munro, Trans. Linn. Soc. 26:137. 1868.

Bambusa glaucifolia Rupr. Mém. Acad. St. Pétersb. VI. Sci. Nat. 3[1]:147. 1839.

Culms erect, as much as 6 cm. thick at base, the culm-sheaths 10 cm. broad; foliage-blades linear-oblong, as much as 30 cm. long and 3.5 cm. wide, rather abruptly contracted at the base into a petiole about 5 mm. long, narrowed at apex to a fine involute point, glabrous, or scaberulous on the upper surface near the apex, the margin glabrous or scabrous, the midrib whitish and rather prominent below, the primary veins about 10 pairs; sheaths glabrous, the throat glabrous; ligule a short firm ridge less than 1 mm. long, slightly ciliate; inflorescence on clusters of slender branches from the nodes; spikelets in heads, spicate or paniculate along the branches, the heads about 2 cm. in diameter, in many specimens contiguous, the whole branch 30 to 40 cm. long; spikelets fusiform-cylindric, about 1 cm. long, pale, tawny or stramineous, 2 or 3 in the axils of bracts, the bracts similar to the glumes but longer.

The three specimens cited are floriferous but the spikelets are all sterile and show no stamens or pistils. They may not be correctly referred to *S. glaucifolium* but are the same as Munro's specimen. Munro[5] remarks that the specimen examined by him, this or a duplicate being in the Gray Herbarium (Tahiti, Wilkes Exped.), was in the same condition. The spikelets are sessile, 2 or 3 together, bearing 4 bracts, each successively longer, the first 3 similar, convolute, nerved, mucronate, the fourth very slender, tightly rolled and much convolute. There appears to be no prolongation of the rachilla.

Munro's reference to locality is ambiguous: "Hab. in insulis Oceani Pacifici, Tahiti, Hawaii! Wilkes (florif.), no. 130, Guillemin, ('Ovhe', incolis) Bertero, Moehroch; Fiji ('Bitu' incolis), 694! Seemann; Samoa, Fiji, Wilkes; Nukahiva, Kyber." He further states that he has "seen only one flowering specimen of this

[5] Munro, Colonel, Monograph of the Bambusaceae: Linn. Soc., London, Trans. Vol. 26, p. 137, 1868.

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plant, which was collected at Tahiti in Wilkes's Expedition." From this it is not clear who collected the Hawaiian specimen. In the United States National Herbarium is a specimen (leaves only) collected by the Wilkes Expedition at Sandalwood Bay, Fiji Islands. Hillebrand mentions a small bamboo, without flowers, which he refers to this species. The species was originally described from Nukuhiwa, an island of the Marquesas group.
Oahu: Kahauiki Valley, Forbes 1191.
Maui: Nahiku, Rock in 1911.
Hawaii: Hilo, Newell in 1917—"the wild-growing kind."

Bambos vulgaris Schrad.; Wendl. Coll. Pl. 2:26. pl. 47. 1810, the common bamboo, is frequently cultivated and may become established.

2. **BROMUS** L.

Spikelets several to many-flowered, the rachilla disarticulating above the glumes and between the florets; glumes unequal, acute, the first 1 to 3 nerved, the second commonly 3 to 5-nerved; lemmas convex on the back or keeled, 5 to 9-nerved, 2-toothed at the apex, awnless or usually awned from between the teeth; palea usually shorter than the lemma. Annual or perennial, low or rather tall grasses, with closed sheaths, flat blades, and open or contracted panicles of large spikelets.

The species in the Hawaiian islands are all introduced annual weeds, at present not common, but may in the future spread rapidly in the drier parts of the islands.

Spikelets strongly flattened; lemmas acuminate or short-awned..... 1. **B. unioloides.**
Spikelets not strongly flattened; lemmas long-awned.
  Panicle contracted, erect, oblong; lemmas pubescent.
    Awns straight; hairs of lemma straight and appressed..... 2. **B. hordeaceus.**
    Awns bent; hairs of lemma spreading and more or less flexuous..... 3. **B. molliformis.**
  Panicle open; lemmas glabrous or scabrous.
    Awns less than 1 cm. long..... 4. **B. racemosus.**
    Awns more than 2 cm. long..... 5. **B. rigidus gussonei.**

1. **Bromus unioloides** H. B. K. Nov. Gen. & Sp. 1:151. 1816.

Culms 50 to 100 cm. tall; sheaths pilose; blades narrow, scabrous or pilose; panicle open, 20 to 40 cm. long; spikelets compressed, 2 to 3 cm. long, 5 to 9 mm. wide; glumes glabrous, the first 5-nerved, 7 to 10 mm. long, the second 7-nerved, 10 to 12 mm. long; lemmas subcoriaceous, glabrous or scabrous, compressed and keeled, several-nerved, 12 to 15 mm. long, gradually acuminate or extending into an awn as much as 2 mm. long.

A weed in pastures and open ground; introduced. Native country not certainly known, but probably the Andes. Now distributed from Chile to southern United States. Originally described from Ecuador. This species is cultivated occasionally in the southern United States as a forage plant under the name of rescue grass or Schrader's brome grass. It was probably introduced in the Hawaiian islands for trial as a pasture grass on the ranches of the drier parts of the islands.
Molokai: Central part, 3000 feet, Hitchcock 15156.

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FIGURE 1.—Bromus hordeaceus. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 585.



FIGURE 2.—Bromus racemosus. From U. S. Dept. Agr. Div. Agrost. Bull. 23, fig. 2.



FIGURE 3.—Festuca bromoides. From Palmer 2041 in 1892, California.

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Hawaii: Puu Waawaa, Hitchcock 14464. Parker Ranch, Makahalau, Rock 8407. Kukaiau Ranch, 3600 feet, Hitchcock 14211.

2. **Bromus hordeaceus** L. Sp. Pl. 77. 1753.

Culms 20 to 60 cm. tall; sheaths retrorsely softly pilose-pubescent; blades usually pubescent; panicle contracted, erect, 5 to 10 cm. long or in depauperate plants reduced to a few spikelets; glumes broad, obtuse, coarsely pilose or scabrous-pubescent, the first 3 to 5-nerved, 4 to 6 mm. long, the second 5 to 7-nerved, 7 to 8 mm. long; lemmas broad, obtuse, 7-nerved, coarsely appressed-pilose or scabrous-pubescent, rather deeply bidentate, 8 to 9 mm. long, the margin and apex hyaline; awn rather stout, 6 to 9 mm. long (fig. 1).

A weed in pastures and waste places at upper elevations; introduced. Originally described from Europe.
Kauai: Without locality, Rock 5128.
Hawaii: Humuula Sheep Station, 6000 feet, Hitchcock 14434.

3. **Bromus molliformis** Lloyd, Fl. Loire Inf. 315. 1844.

A low branching grass, the culms 10 to 30 cm. tall; sheaths pubescent; blades narrow, pubescent; panicle short and dense, mostly not over 5 cm. long; spikelets 1.5 to 2.5 cm. long; glumes 10 to 12 mm. long, pubescent; lemmas about 1 cm. long, the pubescence more or less spreading and flexuous; awns of the lower florets short, of the upper 5 to 10 mm. long and at maturity or in dried specimens, spreading.

A weed in fields and waste places; introduced. Originally described from Spain.
Oahu: Schofield Barracks, Hitchcock 13914, 13975. Honolulu, weed along car line, Fort Shafter, Hitchcock 13844.

4. **Bromus racemosus** L. Sp. Pl. ed. 2. 1:114. 1762.

Resembles *B. hordeaceus,* but the panicle more open and the spikelets scabrous only, not pubescent (fig. 2).

A weed in pasture land; introduced. Originally described from Europe.
Hawaii: Kukaiau Ranch, 4000 feet, Hitchcock 14266.

5. **Bromus rigidus gussonei** (Parl.) Coss. & Dur. Expl. Sci. Alger, 2:159. 1867.

Bromus maximus gussonei Parl. Fl. Ital. 1:407. 1848.

Bromus villosus gussonei Aschers. & Graebn. Syn. Mittleur. Fl. 2:595. 1901.

Bromus villosus Forsk. 1775 is invalidated by *B. villosus* Scop. 1772.

Bromus maximus Desf. 1798 is invalidated by *B. maximus* Gilib. 1792.

Culms 40 to 60 cm. tall; sheaths and blades pilose; panicle open, rather few-flowered, 8 to 15 cm. long, the lower branches 4 to 5 cm. long; spikelets usually 5 to 7-flowered, 3 to 5 cm. long; glumes smooth, narrow, acuminate, the first 15 to 20 mm. long, 1-nerved, the second 25-30 mm. long, 3-nerved; lemmas 5-nerved, 25 to 30 mm. long, scabrous or puberulent, 2-toothed, the teeth 3 to 4 mm. long; awns stout, straight, 3 to 5 cm. long.

A weed in fields; introduced. Originally described from Italy.
Oahu: Schofield Barracks, Hitchcock 13922.
Hawaii: Kukaiau Ranch, 3600 feet, Hitchcock 14219. Slopes of Mauna Kea, 5000 feet, Rock 8403.
Without locality: Hillebrand.

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FIGURE 4.—Festuca hawaiiensis. From the type specimen.



FIGURE 5.—Poa compressa. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 544.

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Bromus squarrosus L. Sp. Pl. 76. 1753. var. *villosus* Gmel.; Reichenb. Agrost. Germ. 32. pl. 75. f. 1599. 1834. Hillebrand[6] includes this from Ulupalakua, Maui. Introduced from Europe.

Bromus tectorum L. Sp. Pl. 77. 1753. Hillebrand[7] includes this from Makawao and Kula, Maui. Introduced from Europe.

3. **FESTUCA** L.

Spikelets few to several-flowered, the rachilla disarticulating above the glumes and between the florets; glumes narrow, acute, unequal, the first very small in some species; lemmas rounded on the back, membranaceous or somewhat indurate, 5-nerved, the nerves obscure in some species, acute or rarely obtuse, awned from the tip or rarely from a minutely bifid apex. Annual or perennial low or rather tall grasses of varied habit, the spikelets in narrow or open panicles.

Plants perennial; panicle open, the branches spreading..... 1. **F. hawaiiensis.**
Plants annual; panicles narrow, the branches appressed.
Lemmas ciliate toward the apex..... 2. **F. megalura.**
Lemmas not ciliate..... 3. **F. bromoides.**

1. **Festuca hawaiiensis** sp. nov.

Plants perennial; culms tufted, erect, glabrous, about 1.5 meters tall, rather stout; sheaths glabrous, shorter than the internodes; ligule membranaceous, 1 to 2 mm. long, the margin lacerate; blades narrow, 20 to 30 cm. long, 3 to 5 mm. wide, tapering to a slender involute point and more or less involute at the base, smooth on the lower surface, scabrous on the upper; panicle open, 30 to 40 cm. long, erect, the branches in distant fascicles, the axis terete and smooth below, angled and scabrous above; branches spreading or drooping, slender, scabrous, about 5 in the lower fascicle, 8 to 15 cm. long, branching above the middle, bearing 3 to 5 spikelets on slender pedicels 5 to 10 mm. long, the upper fascicles of about 3 successively shorter branches; spikelets several-flowered, the rachilla appressed-hispidulous; glumes narrow, glabrous, scabrous on the keels near the apex, the first 1-nerved, 3 to 5 mm. long, the second 3-nerved, 6 to 7 mm. long; lemmas narrow, 7 to 9 mm. long, 1 to 1.5 mm. wide, rounded on the back, faintly 5-nerved, scabrous, acuminate or extended into an awn about 1 mm. long; palea scabrous, as long as the lemma and closely fitting to its edges (fig. 4).

Type in the U. S. National Herbarium, no. 836317, collected in rich soil on a moist wooded hill (Puu Huluhulu), Humuula Sheep Station, Hawaii, at about 2000 meters elevation, August 27, 1916, by A. S. Hitchcock (no. 14446).

The species was abundant here, growing in bunches 0.5 to 2 meters tall, apparently indigenous.

What appears to be the same species was collected in an over-ripe condition on the Hualalai Mountains, in woods at 1000 meters elevation (Hitchcock 14536).

This is the species described as *Festuca drymeia* Mert. & Koch by Hillebrand[8] who says, "without label; probably collected in Ulupalakua, Maui." Hillebrand's specimen, kindly submitted to me by Dr. Diels, is labeled from "Maui et Hawaii." It differs from *F. drymeia* of Europe in the larger scabrous spikelets and the absence of rhizomes.

2. **Festuca megalura** Nutt. Journ. Acad. Nat. Sci. Phila., II. 1:188. 1848.

Plants annual; culms 20 to 50 cm. tall, tufted; sheaths and blades glabrous; panicle narrow, 7 to 20 cm. long, the branches appressed; spikelets 4 or 5-flowered; glumes glabrous, very unequal, the first mostly less than 2 mm. long, the second 4 to 5 mm. long; lemmas linear-

[6] Op. cit., p. 535.
[7] Op. cit., p. 535.
[8] Op. cit., p. 534.

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lanceolate, scabrous above, ciliate on the upper half, attenuate into an awn about twice their length.

A weed in open ground and grassland, mostly at upper altitudes; introduced. Originally described from California.

Oahu: Summit of Mt. Tantalus, Hitchcock 13868. Palehua, Waianae Range, Forbes 1686.

Hawaii: Kukaiau Ranch, 3600 feet, in pasture, Hitchcock 14210. Summit of Hualalai Mountains, Hitchcock 14530; Forbes 205. Hilo, along river near Rainbow Falls, Hitchcock 14197.

Without locality: Hillebrand.

3. **Festuca bromoides** L. Sp. Pl. 75. 1753.

Similar to *F. megalura* in aspect; panicle dense, 5 to 10 cm. long; glumes unequal, the first 4 mm. long, the second 6 to 7 mm. long; lemma not ciliate, 7 to 8 mm. long, the awn 10 to 12 mm. long (fig. 3).

A weed in pastures and waste places; introduced. Originally described from Europe.

Kauai: Kumuweia Ridge, west side Waimea drainage basin, Forbes 990.

Oahu: Along cliff, Nuuanu Pali, Hitchcock 13747, 13779. Schofield Barracks, Hitchcock 13939. Honolulu, Newell in 1917.

Lanai: Mountains near Koele, Forbes 102.

Maui: Wet forest along Olinda pipe line, Hitchcock 14935. Wet meadow, Haleakala crater, Hitchcock 14975.

Hawaii: Summit of Hualalai Mountains, Forbes 211. In woods, Hualalai Mountains, 5000 feet, Hitchcock 14511. Pasture, Kukaiau Ranch, 3600 feet, Hitchcock 14215. Pasture, Humuula Sheep Station, 6000 feet, Hitchcock 14435, 14436. Paauhau, Parker Ranch, Rock 3155, 3322, 3467. Mauna Kea, Moano Crater, 8000 feet, Rock 3298.

4. **PANICULARIA** Heister.

Spikelets few to many-flowered, subterete or slightly compressed, the rachilla disarticulating above the glumes and between the florets; glumes unequal, short, obtuse or acute, usually scarious, mostly 1-nerved; lemmas broad, convex on the back, firm, usually obtuse, awnless, scarious at the apex, 5 to 9-nerved, the nerves parallel, commonly prominent. Aquatic or marsh grasses, for the most part tall with flat blades, closed or partly closed sheaths, and open or contracted panicles.

1. **Panicularia fluitans** (L.) Kuntze, Rev. Gen. Pl. 2:782. 1891.

Festuca fluitans L. Sp. Pl. 75. 1753.

Plants perennial; culms ascending from a decumbent rooting base, rather thick and succulent, 1 to 1.5 meters tall; sheaths smooth; blades flat, 3 to 10 mm. wide, scabrous above; panicle long and narrow, 20 to 30 cm. long; spikelets single and rather distantly arranged along the upper part of the axis, 2 or 3 together on the lower short appressed branches, linear, 1.5 to 2 cm. long, 2 to 3 mm. wide, short-pediceled, many-flowered; glumes very unequal, obtuse, the second about 3 mm. long; lemmas broad, obtuse, 5 mm. long, 7-nerved, scaberulous, scarious at the apex.

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Swampy ground; introduced. Originally described from Europe. Probably introduced with grass seed; other European meadow grasses are nearby.
Maui: Haleakala crater, west side, about 6000 feet, Hitchcock 14996.

5. **POA** L.

Spikelets 2 to several-flowered, the rachilla disarticulating above the glumes and between the florets, the uppermost floret reduced or rudimentary; glumes acute, keeled, somewhat unequal, the first 1-nerved, the second commonly 3-nerved; lemmas somewhat keeled, acute or acutish, awnless, membranaceous, many somewhat scarious at the tip, 5-nerved, the nerves pubescent in some species. Annual, or usually perennial, species of low or rather tall grasses, with spikelets in open or contracted panicles, the narrow blades flat or folded, ending in a navicular point.

Plants annual; nerves of lemma villous..... 1. **P. annua.**
Plants perennial; nerves pubescent or glabrous.
  Creeping rhizomes present; sheaths open.
    Culms much flattened; lemmas obscurely nerved..... 2. **P. compressa.**
    Culms scarcely flattened; lemmas rather strongly 5-nerved..... 3. **P. pratensis.**
  Creeping rhizomes absent; sheaths closed.
    Ligule deeply fimbriate..... 4. **P. mannii.**
    Ligule entire or dentate, not deeply fimbriate.
      Old culms as much as 3 or 4 meters long, rushlike, bearing bladeless sheaths..... 5. **P. siphonoglossa.**
      Old culms not becoming elongate, leafless, and rushlike..... 6. **P. sandvicensis.**

1. **Poa annua** L. Sp. Pl. 68. 1753. ANNUAL BLUE GRASS.

Plants annual; culms flattened, decumbent at base, some rooting at the lower nodes, 10 to 30 cm. tall; sheaths loose; blades soft and lax; panicle pyramidal, open, 2 to 6 cm. long; spikelets crowded, 3 to 6-flowered, about 4 mm. long; lemma not webbed at base, distinctly 5-nerved, the nerves villous on the lower half (fig. 6).

A weed in open ground, mostly at upper elevations; introduced. Originally described from Europe.
Oahu: Nuuanu Pali, Hitchcock 13750, 13782.
Maui: Olinda pipe line, Hitchcock 14922. Ulupalakua, East Maui, Mann & Brigham 459.
Hawaii: Puu Oo, Forbes 863. Kukaiau Ranch, Hitchcock 14223, 14269. Mauna Kea, near lake, Hitchcock 14455. Without locality, Wilkes Expl. Exped.
Without locality: Hillebrand.

2. **Poa compressa** L. Sp. Pl. 69. 1753. CANADA BLUE GRASS.

Plants perennial, with creeping rhizomes; culms scattered, not tufted, geniculate-ascending, flattened, wiry, bluish green, 15 to 40 cm. tall; panicle narrow, 2 to 7 cm. long, the commonly short branches in pairs, spikelet-bearing to the base; spikelets crowded, subsessile, 3 to 6-flowered, 4 to 6 mm. long; glumes about 2 mm. long, 3-nerved; lemmas firm, obscurely nerved, 2 to 2.5 mm. long, sparingly webbed at base, short-pubescent below on the keel and marginal nerves (fig. 5).

Moist places; introduced. Originally described from Europe and North America.
Hawaii: Around water tank on way to Humuula Sheep Station, Hitchcock 14442.

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3. **Poa pratensis** L. Sp. Pl. 67. 1753. KENTUCKY BLUE GRASS.

Perennial from creeping rhizomes; culms tufted, 30 to 60 cm. tall, terete or slightly flattened; sheaths smooth, compressed; ligule about 2 mm. long; blades soft, flat or folded, the basal often elongate; panicle pyramidal, open, mostly 5 to 10 cm. long, the slender branches in somewhat remote fascicles of 3 to 5, ascending or spreading, naked at base, some of them short; spikelets crowded, 3 to 5-flowered, 4 to 5 mm. long; lemmas 3 mm. long, copiously webbed at base, silky pubescent on keel and marginal nerves, the intermediate nerves prominent (fig. 7).

Grassland; introduced. Originally described from Europe.

Hawaii: Kanehaka, Kona, Forbes 263. Humuula Sheep Station, Hitchcock 14450. Kilauea, Hapeman 7.

An allied but unidentified species was collected by Rock near the lake on Mauna Kea at about 12,500 feet (no. 12737). The species is probably introduced as it has not been observed elsewhere. The locality is a stopping place on the way to the summit of Mauna Kea.

Plant appearing to produce rhizomes; sheaths retrorsely scabrous as in *Poa trivialis;* ligule short and broad, about 1 mm. long; blades flat and broad, some of them 8 mm. wide;

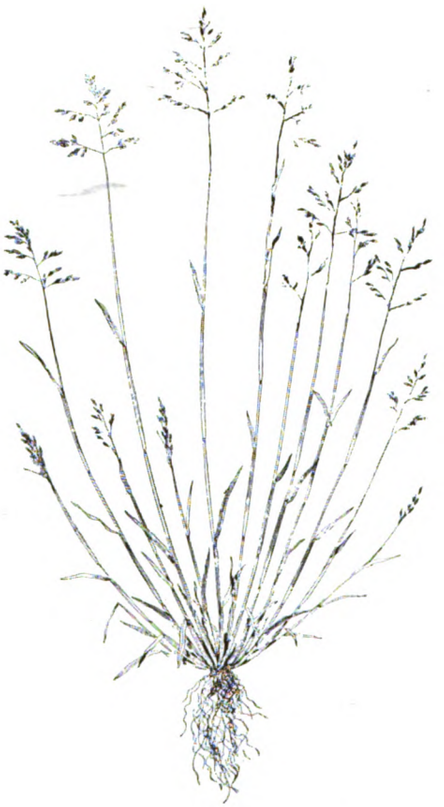


FIGURE 6.—Poa annua. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 533.

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panicle immature; spikelets few-flowered, the glumes acuminate, almost bristle-pointed, a little unequal, the second about 4 mm. long; lemmas copiously webbed at base, the keel and marginal nerves villous, the intermediate nerves rather obscure.

Siphonocoleus sect. nov.

Sheaths closed; ligule united at the edges forming a tube, a somewhat thickened auricle or tooth extending upwards into the ligule from the sinus of the sheath; culms flattened, solid. Type *Poa siphonoglossa* Hack. Includes three species from the Hawaiian islands. (*Siphon,* tube, *coleus,* sheath.)

4. **Poa mannii** Munro; Hillebr. Fl. Haw. Isl. 526. 1888.

Plants perennial without rhizomes; culms tufted, flattened, wiry, glabrous, striate, somewhat glaucous, the internodes solid; sheaths glabrous, striate, mostly shorter than the internodes, closed nearly or quite to the mouth, an auricle continued upward from the sinus for 2 to 3 mm.; ligule membranaceous, about 0.5 mm. long, the margin fimbriate, the divisions 1 to 3 mm. long; blades flat, lax, as much as 15 cm. long, mostly shorter, 2 to 4 mm. wide, acuminate, glabrous beneath, scabrous on the upper surface, somewhat clasping at the base, the lower finally deciduous from the sheaths; panicle ovate, mostly less than 5 cm. long, the lower branches about 3, ascending, bearing above the middle a cluster of spikelets; spikelets mostly 4 or 5-flowered, flattened, about 5 mm. long, pale, greenish or tawny, the rachilla nearly glabrous; glumes glabrous, narrow, acuminate, slightly unequal, about 3 mm. long, 3-nerved, the first in some spikelets faintly nerved; lemmas 3 to 4 mm. long, acute, more or less webbed at base, the keel and lateral nerves villous on the lower part, the intermediate nerves not very prominent (fig. 8).

Wet cliffs. Originally described from "Kauai, Waimea (M. & B. 274)." Kauai: Olokele Gulch, Hitchcock 15229; Faurie 1306. Waimea, 2000-3000 feet, Mann & Brigham 274 (the type collection of *Poa mannii* Munro).

The indigenous species of Poa are not sufficiently known. One of the specimens cited (Faurie 1306) has a few hairs in the axils of some of the branches of the inflorescence.

5. **Poa siphonoglossa** Hack. Repert. Nov. Sp. Fedde 11:24. 1912.

Plants perennial without creeping rhizomes; culms solid, flattened, smooth, striate, tufted, the tufts often large, depending from banks in long masses as much as 4 meters long, the old culms naked and rushlike, bearing bladeless sheaths, the internodes much elongate, as much as 65 cm. long; sheaths glabrous, closed to the mouth, shorter than the internodes, on the older culms much shorter; ligule membranaceous, more or less dentate, 2 to 3 mm. long, continuous across the mouth except where ruptured by the splitting of the sheath; blades flat, lax, mostly less than 10 cm. long, 2 to 3 mm. wide, smooth beneath, scabrous on upper surface, deciduous from the sheaths on the old culms; panicle ovate, mostly less than 5 cm. long, the lower branches about 5, ascending, the whole panicle rather few-flowered; spikelets flat, 2 to 5-flowered, 4 to 7 mm. long, the rachilla pubescent; glumes narrow, acuminate, glabrous, 3-nerved, a little unequal, the second about 4 mm. long; lemmas narrow, acute, 4 to 5 mm. long, not webby at base, scabrous on the keel and marginal nerves, or scabrous-pubescent toward the base, the intermediate nerves rather prominent; palea scabrous-ciliate on the keels, nearly as long as the lemma, 2-toothed (fig. 9).

Shady banks along a ridge. Originally described from Kauai "prope Waimea, 1000 m. s. m. et prope Holokele, Mart. 1910, leg. U. Faurie (no. 1305 et 1306)." No. 1305 may be taken as the type.

Kauai: Maulili, near Kaholuamano, Hitchcock 15536, Rock 9018.

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FIGURE 7.—Poa pratensis. From U. S. Dept. Agr. Bull. 772, fig. 13.



FIGURE 8.—Poa mannii. From Hitchcock 15229, Kauai.

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This species is remarkable in its vegetative characters, and its life history needs investigation. Apparently the shoots come into flower when 30 or 40 cm. tall. At this stage the plant presents no unusual habit. The culms are leafy, the upper sheaths overlapping, the panicle rather small. Later the lower internodes elongate greatly and the lower blades fall away. But the upper part of the shoot retains its juvenile appearance. The blades are soft and lax, the uppermost sheaths are overlapping, and the panicle is somewhat larger. Finally the panicle withers and falls off, the blades drop, and the hard rushlike culm hangs down for as much as 4 meters.

Hackel bases his description of *Poa siphonoglossa* upon two specimens, Faurie 1305 and 1306. The second I have referred to *Poa mannii,* because of the fimbriate ligule and the webby callus hairs at the base of the lemmas. Hackel describes the ligule as "acute dentata haud raro ex parte in fimbria soluta". The latter part of the statement refers to Faurie 1306. The description of the lemma appears also to have been taken from this specimen, insofar as concerns the statement "callo pilis crispis mollibus 1/3-1/2 glumae aequantibus parce lanato."

Faurie's two specimens are said to come from "prope Waimea, 1000 m. s. m. et prope Holokele" [*sic*]. My number 15229 (*Poa mannii*) came from Olokele gulch near Waimea which is probably the same as the locality given by Faurie. The specimens of *Poa siphonoglossa* collected by Professor Rock came from higher up on the mountain near Kaholuamano. A specimen from this collection was submitted to Professor Hackel who identified it as *Poa siphonoglossa.* I collected my specimens (no. 15536), in company with Professor Rock, from the same locality. I here had opportunity to observe the remarkable aftergrowth of the culms. A single bunch or tuft would contain scores of culms forming a pendent mass 3 to 4 meters long. Some of the stems are as much as 5 meters long. They are mostly leafless and rushlike. (Pl. XXXV.)

The portion of Olokele Gulch traversed by the carriage road rises to only about 500 meters. It is probable that Faurie collected his *Poa mannii* (no. 1306) along this road and at the same locality that I obtained my specimens (no. 15229). The locality for our specimens of *Poa siphonoglossa* is at about 1000 to 1200 meters. It would appear from this that one specimen (no. 1305) may have come from near Kaholuamano and the other (no. 1306) from Olokele Gulch, thus agreeing with the distribution of my own specimens.

6. **Poa sandvicensis** (Reichart).

Festuca sandvicensis Reichardt, Sitzungsb. Akad. Wiss. Math. Naturw. (Wien) 76[1]:726. 1878.

Poa longeradiata Hillebr. Fl. Haw. Isl. 526. 1888.

Plants perennial, without rhizomes; culms erect or decumbent, 30 to 100 cm. tall, compressed, smooth, solid; sheaths striate, keeled, retrorsely scabrous or the upper smooth, closed to the mouth or splitting with age; ligule short, firm, dentate, less than 1 mm. long, a hard tooth continued upward from the sinus of the mouth of the sheath; blades 10 to 20 cm. long, as much as 6 mm. wide, glabrous, or scabrous on the upper surface; panicle ovate, 3 to 5 cm. long, becoming later as much as 15 cm. long, the branches slender, spreading or reflexed, the lower as much as 10 cm. long, branching toward the end, bearing a few spikelets; spikelets compressed, 5 to 8 mm. long, 4 to 6-flowered, the rachilla scabrous-pubescent, glumes narrow, acuminate,

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FIGURE 9.—Poa siphonoglossa. From Hitchcock 15536 (fertile plant), and Rock 9018 (sterile plant), Kauai.



FIGURE 10.—Poa sandvicensis. From Hitchcock 15309, Kauai.

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scabrous on the keel, about 3 mm. long; lemmas 4 to 5 mm. long, acute, sparingly webby at base especially in the lower florets, scabrous on the keel, scabrous-pubescent on the lower part of the lateral nerves, the intermediate nerves faint; palea nearly as long as the lemma, scabrous-ciliate on the keels, 2-toothed (fig. 10).

Moist shady cliffs. Originally described from "Kauai; um Halemanu an offenen, humusreichen Stellen der Thäler nr. 2124, 2143." *Poa longeradiata* was described from "Kauai. Waimea (Kn. and M. & B. 368); Maui? gulch of Waihee."

Kauai: Kaholuamano, Hitchcock 15309; Rock 12639. Waimea, 2000-3000 feet, Mann & Brigham 368. West side ridge, west side of Kauaikinana, Forbes 796. West side Waimea drainage basin, trail down ridge to Kauaikinana, Forbes 992.

The specimens here cited differ somewhat from one another. Hitchcock's no. 15309 is a tall rather stout plant over 1 meter tall with a large panicle as much as 15 cm. long with long slender branches. The spikelets are past maturity and are mostly wanting. Forbes's no. 992 is a cluster of rather slender culms 40 cm. tall with narrow blades scarcely 2 mm. wide, and small panicles 4 to 5 cm. long. Rock's no. 12639 and Forbes no. 796 are intermediate. They all agree in the scabrous sheaths, short ligule, and the spikelet characters. The slender shoots with small panicles may be the juvenile phase.

6. **BRIZA** L.

Spikelets several-flowered, broad, often cordate, the florets crowded and spreading horizontally, the rachilla glabrous, disarticulating above the glumes and between the florets, the uppermost floret reduced; glumes about equal, broad, papery-chartaceous, with scarious margins; lemmas papery, broad, with scarious spreading margins, cordate at base, several-nerved, the nerves often obscure, the apex in our species obtuse or acutish; palea much shorter than the lemma. Annual or perennial, low grasses, with erect culms, flat blades, and for the most part open, showy panicles, the pedicels in our species capillary, allowing the spikelets to vibrate in the wind.

1. **Briza minor** L. Sp. Pl. 70. 1753. QUAKING GRASS.

An annual with erect culms 10 to 30 cm. tall; panicle erect, pyramidal, many-flowered, the main branches stiffly ascending, the capillary branchlets spreading; spikelets triangular-ovate, 3 mm. long (fig. 11).

A weed along roads and trails; introduced. Originally described from Europe.

Kauai: Olokele Gulch, Hitchcock 15210.

Oahu: Nuuanu Pali, Hitchcock 13799; Forbes 1526.

Molokai: Central part, Hitchcock 15164.

Maui: Olinda pipe line, Hitchcock 14931.

Hawaii: Paauhau, Rock 3457. Kukaiau Ranch, 3600 feet, Hitchcock 14209. Without locality, Wilkes Expl. Exped.

7. **ERAGROSTIS** Host.

Spikelets few to many-flowered, the florets usually closely imbricate, the rachilla disarticulating above the glumes and between the florets, or continuous, the lemmas deciduous, the paleas

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FIGURE 11.—Briza minor. From Howell in 1884, Oregon.



FIGURE 12.—Eragrostis amabilis. From U. S. Dept. Agr. Div. Agrost. Bull. 7, fig. 249.

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commonly persistent; glumes somewhat unequal, shorter than the first lemma, acute or acuminate, 1-nerved, or the second rarely 3-nerved; lemmas acute or acuminate, keeled or rounded on the back, 3-nerved, the nerves as a rule prominent; palea 2-nerved, the keels in some species ciliate. Annual or perennial grasses of various habit, the inflorescence an open or contracted panicle.

Plants annual; introduced species.
- Palea prominently ciliate on the keels, the hairs about 0.3 mm. long ..... 1. **E. amabilis.**
- Palea not prominently ciliate on the keels.
  - Lemmas glandular on the keel ..... 2. **E. cilianensis.**
  - Lemmas not glandular.
    - Spikelets as much as 2 cm. long, densely many-flowered ..... 3. **E. falcata.**
    - Spikelets less than 1 cm. long, loosely few to 12-flowered.
      - Palea remaining on the rachilla after the fall of the lemma; spikelets appressed on the branchlets ..... 4. **E. caroliniana.**
      - Palea and lemma deciduous from the rachilla; spikelets on long ascending pedicels ..... 5. **E. abyssinica.**

Plants perennial.
- Creeping rhizomes short and stout, the culms in loose tufts ..... 6. **E. atropioides.**
- Creeping rhizomes wanting, the culms in compact tufts.
  - Pedicels slender, straight, stiffly ascending, mostly longer than the spikelets ..... 7. **E. mauiensis.**
  - Pedicels mostly shorter than the spikelets, if longer then flexuous.
    - Lower branch of the open panicle solitary; spikelets about 2 mm. wide ..... 8. **E. brownei.**
    - Lower branches of panicle several in a fascicle, or the panicles narrow and spikelike, obscuring the fascicles.
      - Branches of the open panicle deflexed at maturity; blades mostly less than 4 mm. wide ..... 9. **E. deflexa.**
      - Branches of panicle not deflexed; panicle usually contracted, if open the blades mostly more than 5 mm. wide.
        - Plants tall and stout, usually over 1 meter tall; panicles oblong, rather open; blades flat, usually more than 5 mm. wide, in some specimens as much as 1 cm. wide ..... 10. **E. grandis.**
        - Plants mostly less than 1 meter tall, many low or slender; panicles contracted, or even spikelike.
          - Culms low, slender, tufted, mostly less than 30 cm. tall; blades slender, involute, mostly basal; panicles narrow but not very dense, mostly 5 to 15 cm. long ..... 11. **E. monticola.**
          - Culms tall, slender or stout, commonly as much as 1 meter tall, some lower but stout.
            - Culms tall and slender; blades slender, involute, about 1 mm. wide when rolled; panicles slender and spikelike, 15 to 30 cm. long ..... 12. **E. leptophylla.**
            - Culms stout; blades mostly more than 5 mm. wide, flat or becoming involute at the tips; panicle stout, compact or somewhat open, as much as 40 cm. long ..... 13. **E. variabilis.**

1. **Eragrostis amabilis** (L.) Wight & Arn.; Hook. & Arn. Bot. Beechey Voy. 251. 1841.

Poa amabilis L. Sp. Pl. 68. 1753.

Eragrostis plumosa Link, Hort. Berol. 1:192. 1827.

Plants annual; culms erect or spreading and geniculate at base, slender, 10 to 30 cm. tall, glabrous; sheaths glabrous, pilose at the throat; blades flat, lax, striate, mostly less than 10 cm. long, 2 to 4 mm. wide; panicle oblong, or elliptic, 5 to 15 cm. long, 3 to 6 cm. wide, open, the branches ascending or spreading, pilose in the axils, slender, the pedicels finally spreading, mostly as long as the spikelet or longer; spikelets 1.5 to 2 mm. long, mostly 4 to 6-flowered, the rachilla joints finally disarticulating; glumes broad, nearly equal, about 1 mm. long; lemmas obtuse, about 1 mm. long; palea as long as the lemma, prominently ciliate, the hairs straight, rather distant, about 0.3 mm. long (fig. 12).

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FIGURE 13.—Eragrostis cilianensis. From U. S. Dept. Agr. Bull. 772, fig. 15.



FIGURE 14.—Eragrostis caroliniana. From U. S. Dept. Agr. Div. Agrost. Bull. 7, fig. 241.

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A weed in open ground; introduced. Originally described from India. Oahu: Honolulu, Faurie in 1909; Hitchcock 13723, 14074, 13720; Newell in 1917. Waikiki, Heller 1962.

2. **Eragrostis cilianensis** (All.) Link, Vign. Lut. Malpighia 18:386. 1904.

Poa cilianensis All. Fl. Pedem. 2:246. 1785.
Eragrostis major Host, Gram. Austr. 4:14, pl. 24. 1809.
Eragrostis megastachya Link, Hort. Berol. 1:187. 1827.

Plants annual, strong-scented when fresh; culms erect or ascending from a decumbent base, rather flaccid, freely branching, 20 to 40 cm. tall; blades 5 to 15 cm. long, 3 to 6 mm. wide; panicles greenish or lead-colored, 5 to 15 cm. long, rather densely flowered; spikelets 5 to 15 mm. long, 3 mm. wide, 10 to 40-flowered, the florets closely imbricate; the pedicels and keels of the acute glumes and lemmas sparingly glandular; lemmas thin, the lateral nerves prominent (fig. 13).

A weed in waste ground; introduced. Originally described from Italy. Oahu: Honolulu, Newell in 1917. Waikiki, Hitchcock 13802; Heller 2288. Without locality, Mann & Brigham 71.

3. **Eragrostis falcata** (Gaud.) Gaud.; Steud. Nom. Bot. ed. 2. 1:563. 1840.

Poa falcata Gaud. in Freyc. Voy. Uran. Bot. 408. pl. 25. 1830. [Title page dated 1826.]

Plants annual; culms tufted, wiry, 5 to 15 cm. tall, glabrous; sheaths glabrous; blades short, firm, glabrous, involute; inflorescence a raceme or simple panicle; spikelets nearly terete, 1 to 2 cm. long, 1 to 1.5 mm. wide, falcate, many-flowered, short-pediceled, the florets closely imbricate, glabrous; lemmas about 2 mm. long, strongly 3-nerved, tawny, obtuse.

Represented only by Mann & Brigham 44 from Oahu. Originally described from Australia.

4. **Eragrostis caroliniana** (Spreng.) Scribn. Mem. Torrey Club 5:49. 1894.

Poa caroliniana Spreng. Mant. Fl. Hal. 33. 1807.

Plants annual; culms erect, decumbent at base, or prostrate-spreading, 15 to 40 cm. tall, diffusely branched at base; sheaths sparingly pilose at the summit; blades 2 to 10 cm. long, 2 to 3 mm. wide; panicle diffuse, 7 to 20 cm. long, the lower axils sparingly bearded; spikelets 5 to 18-flowered, becoming linear, 4 to 8 mm. long, 1 to 1.5 mm. wide, equaling or shorter than the pedicels, appressed along the main branches; glumes 1-nerved, smooth except the keels, the first 1 mm., the second 1.5 mm. long; lemmas smooth, slightly scabrous on the keel, the lower about 1.5 mm. long, 0.5 mm. wide, the lateral nerves distinct but not prominent (fig. 14).

A weed along road; introduced. Originally described from North Carolina. Oahu: Honolulu, Fort Shafter, Hitchcock 13843.
Hawaii: Hilo, Newell in 1917.

5. **Eragrostis abyssinica** (Jacq.) Link, Hort. Berol. 1:192. 1827.

Poa abyssinica Jacq. Misc. 2:364. 1781. (Link spells the name *abessinica*.)

Plants annual; culms erect, slender, glabrous, 50 to 80 cm. tall; sheaths glabrous, pilose at the throat; blades slender, 10 to 15 cm. long, 1 to 2 mm. wide, acuminate into a slender point; panicle oblong, open, 15 to 20 cm. long, the lower branches fascicled, pilose in the axils, as much as 10 cm. long, the axis, branches and pedicels scabrous; spikelets few-flowered, 3 to 6 mm. long, the pedicels slender; glumes acuminate, a little unequal, the lower 2 mm. long; lemmas about 2 mm. long, minutely scaberulous on the keel above, as also on the keels of the palea; caryopsis brown, turgid, oblong, about 1 mm. long, a little over 0.5 mm. wide, spreading the palea and lemma apart at maturity.

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FIGURE 15.—Eragrostis atropioides. From Hitchcock 14459, Hawaii.



FIGURE 16.—Eragrostis mauiensis. From the type specimen.

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Escaped from the United States Agricultural Experiment Station grounds; introduced from Africa. In the original description no locality is cited.
Oahu: Honolulu, Hitchcock 14123.

6. **Eragrostis atropioides** Hillebr. Fl. Haw. Isl. 531. 1888.

Plants perennial, in loose tufts with short hard scaly creeping rhizomes as much as 7 cm. long; culms erect, hard, glabrous, slightly scabrous below the panicle, 1 to 1.5 meters tall; sheaths glabrous, pilose on the margins especially in the sterile shoots, pilose at the throat; ligule a pilose ridge, the hairs 5 mm. long; blades elongate, 30 to 40 cm. long, 4 to 6 mm. wide, glabrous beneath, scabrous on the upper surface; panicle erect, narrow, contracted but scarcely spikelike, 25 to 50 cm. long, 2 to 4 cm. wide, the branches appressed, several at a node, some short or the spikelets sessile, others as much as 10 cm. long and naked at the base. Spikelets linear, many-flowered, as much as 2.5 cm. long, the rachilla glabrous; glumes a little unequal, 3 to 4 mm. long, acuminate, more or less scabrous on the keel; lemmas glabrous, obtuse and erose at the summit, about 2 mm. long, pale or purplish, rather closely imbricate; palea persistent, about as long as the lemma, obtuse, minutely ciliate on the keels (fig. 15).

Sandy plain between Mauna Kea and Mauna Loa, about 4000 feet. Originally described from "East Maui? (label lost), probably growing in wet places". Hillebrand also describes two varieties β and γ), one from "Hawaii or Maui," the other from "Oahu."

Hawaii: West of Humuula Sheep Station on road to Waimea, Hitchcock 14445, 14459. Puu Waawaa, Hitchcock 14493, 14495. Mauna Kea, above Waikii, Rock 8405. Parker's Ranch, Smith in 1902. Mauna Loa, Wilkes Expl. Exped.

Without locality: Hillebrand.

A specimen in the Gray Herbarium collected in the "Mts. East Maui" by the Wilkes Expedition appears to be this species.

7. **Eragrostis mauiensis** sp. nov.

Plants perennial; culms erect, cespitose, glabrous, 30 to 40 cm. tall; sheaths glabrous, slightly villous at the throat; ligule a ciliate membrane less than 0.5 mm. long; blades mostly involute, 10 to 15 cm. long, 1 to 2 mm. wide, glabrous on the lower surface, slightly villous on the upper surface near the base, tapering to a fine point; panicle oblong, open, about 30 cm. long and 5 to 7 cm. wide, the branches slender, stiffly ascending, as much as 10 cm. long, scabrous, villous in the axils, the ultimate branchlets or pedicels stiffly ascending, mostly longer than the spikelets; spikelets 7 to 10 mm. long, mostly 8 to 10-flowered, brownish yellow; glumes nearly equal, acuminate, scabrous on the keel, 1-nerved, the first a little shorter and narrower, about 2 mm. long, about as long as the lower lemma, almost awn-pointed; lemmas tapering to an obtuse point, 2 to 2.5 mm. long, obscurely scabrous on the keel near the apex, rounded on the back or keeled toward summit, faintly 3-nerved, imbricate and hiding the rachis, glabrous; palea a little shorter than the lemma, closely and minutely ciliate; grain oblong, dark brown, finely alveolate, 1.2 mm. long (fig. 16).

Type in the Gray Herbarium of Harvard University, collected on sandhills at Wailuku, Maui, Hawaiian islands, by the Wilkes Exploring Expedition.

This species resembles *Eragrostis elliottii* S. Wats. in the slender, stiffly ascending branches and pedicels, but differs in the shape of the panicle.

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This appears to be the species described by Hillebrand[9] under the name *E. mexicana* Link, the chief cited specimen of which, from Lanai, has been kindly lent to me by Dr. Diels, Director of the Botanic Garden at Berlin. The panicle is much smaller and less developed than that of the specimen in the Gray Herbarium. Hillebrand cites also a second specimen "Collected also by the U. S. E. Exped." which evidently is the same collection as the one here made the type of *E. mauiensis*. The Gray Herbarium specimen was examined by Munro and is labeled by him "*Eragrostis mexicana?* Link. *E. caerulea* Hillebrand mss." "*E. coerulescens*, Hbd. in herb." is given by Hillebrand as a synonym of *E. mexicana*. This specimen is not referable to the annual *E. mexicana*.

8. **Eragrostis brownei** (Kunth) Nees; Steud. Nom. Bot. ed. 2, 1:562. 1840.

Poa polymorpha R. Br. Prod. Nov. Holl. 180. 1810. Not *Poa polymorpha* Koen. 1803.
Poa brownei Kunth, Rév. Gram. 1:112. 1829.

Plants perennial; culms tufted, mostly prostrate-spreading, slender, uppermost node mostly not over 5 cm. from base, the peduncle and panicle about 15 cm. long but soon elongate and somewhat flexuous, becoming at maturity as much as 35 cm. long; sheaths glabrous, slightly pilose at the mouth; blades short, the basal forming a rosette, the uppermost culm blade about 5 cm. long, 1 to 3 mm. wide, glabrous; panicle at maturity 5 to 10 cm. long, with a few distant branches, single at the nodes, the lowermost 3 to 5 cm. long, spikelet-bearing to the base, glabrous in the axils, the main axis and the branches scabrous; spikelets compressed, 5 to 7 mm. long, 2 mm. wide, 10 to 15-flowered, short-pediceled, somewhat appressed along the branches; glumes nearly equal, acute, 1 to 1.5 mm. long; lemmas closely imbricate, acute, 2 mm. long, about 0.7 mm. wide, glabrous; palea persistent but the rachilla soon disarticulating, scaberulous on the keel (fig. 17).

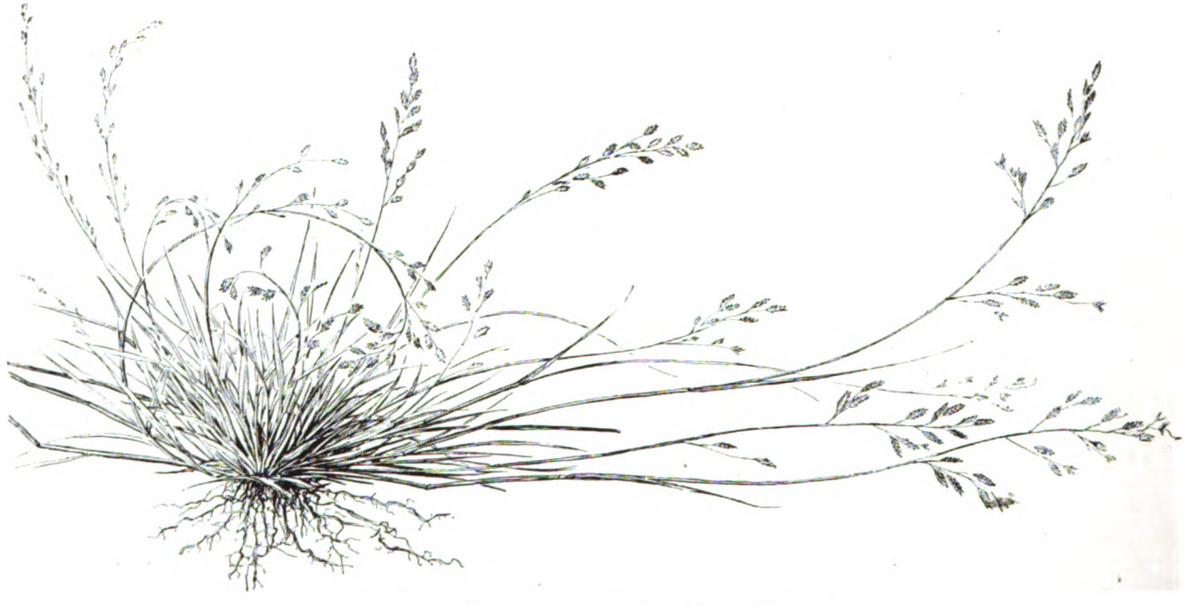


FIGURE 17.—Eragrostis brownei. From Hitchcock 14519, Hawaii.

[9] Op. cit., p. 530.

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Open places along the trail just below timber line in Hualalai Mts. Prostrate bunches, the culms mostly prostrate; at maturity the flowering culms elongate and become flexuous. Originally described from Australia.
Hawaii: Hualalai Mountains, Hitchcock 14519.

9. **Eragrostis deflexa** sp. nov.

Plants perennial; culms tufted, erect or a little decumbent at base, glabrous, firm, 40 to 100 cm. tall; sheaths glabrous, pilose at the throat and more or less on the collar; blades 10 to 30 cm. long, as much as 4 mm. wide, mostly narrower, flat or involute, tapering to a firm point, glabrous beneath, scabrous on the upper surface and pilose near the base; panicle oblong, erect, 20 to 40 cm. long, 6 to 15 cm. wide, open, the branches in rather distant fascicles, finally spreading or deflexed, scabrous, densely pilose in the lower axils; spikelets somewhat compressed, 4 to 7-flowered, 5 to 8 mm. long, the rachilla flexuous, glabrous, the florets loosely imbricate, disclosing the rachilla, the pedicels somewhat flexuous, the lateral 2 to 4 mm. long; glumes nearly equal, acuminate, 2.5 to 3 mm. long, the slender point of the first usually somewhat longer than the first lemma and narrower than the second glume, scaberulous on the keel; lemmas acute, about 2.5 mm. long and 0.7 mm. wide, rather turgid, the lateral nerves faint, finely scaberulous on the upper part of keel and on the sides near the apex; palea nearly as long as the lemma, finely scaberulous on the keels (fig. 18).

Near *E. lugens* but the panicle longer and more oblong, the branches finally deflexed.

Type in the U. S. National Herbarium, no. 836465, collected in open woods on hillside, Puu Waawaa, Hawaii, Hawaiian islands, August 30, 1916, by A. S. Hitchcock (no. 14476).

Lanai: West side, Hitchcock 14715.

Hawaii: Puu Waawaa, Hitchcock 14476, 14494. South side of island on road to Kilauea, Hitchcock 14593. Hanehane, Kona, Forbes 191.

10. **Eragrostis grandis** Hillebr. Fl. Haw. Isl. 528. 1888.

Plants perennial; culms in large tufts, erect, stout and tall, as much as 1 cm. thick at base and 2 meters tall, glabrous; sheaths glabrous, pilose or glabrous at the throat; ligule a dense row of short hairs with long hairs as much as 7 mm. long intermixed, these deciduous; blades elongate, usually 5 to 10 mm. wide, sometimes narrower, flat, usually involute toward the slender tip, glabrous beneath, scabrous on the upper surface; panicle large and open, oblong, as much as 50 cm. long, the branches in more or less distant fascicles, ascending, mostly spikelet-bearing to near the base, pilose in the axils, the axis smooth below, scabrous above as are the branches; spikelets compressed, 5 to 9 mm. long, 5 to 10-flowered, the rachilla joints about 0.8 mm. long, scabrous, the lateral pedicels short, about 1 mm. long; glumes acuminate, 2.5 to 3 mm. long; lemmas acuminate or acute, 3 mm. long, loosely imbricate, disclosing the rachilla, glabrous, scaberulous on the keel, the lateral nerves faint but made somewhat prominent by the shrinkage of the inter-nerves; palea a little shorter than the lemma, scabrous-ciliate on the keel (fig. 19).

Slopes, ravines, and open forest, mostly in partial shade. Originally described from "High mountains of Molokai! E. and W. Maui!" Two varieties are described, β var. *oligantha* from "Molokai! pali of Waikolu, and (doubtfully) top of Mount Kaala, Oahu!" and γ var. *polyantha* from Molokai.

Kauai: West side Waimea drainage basin, Forbes 1013, 1063. Kaholuamano, 3600 feet, Rock 5129.

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FIGURE 18.—Eragrostis deflexa. From the type specimen.



FIGURE 19.—Eragrostis grandis. From Hitchcock 14220, Hawaii.

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Oahu: Mountains to west of Schofield Barracks, Hitchcock 13928, 13950, 13951. Makaleha Valley (in Mokuleia), Rock 17087. Without locality, Mann & Brigham 279.

Molokai: Mountains above Puu Kolekole, Forbes 182. Central part, Hitchcock 15154. Kalae, Rock 16005.

Lanai: Upper part of mountains, Hitchcock 14692. Ravine at foot of mountains, Hitchcock 14691, 14688. Mountains near Koele, Forbes 70. Without locality, Forbes 320.

Maui: Near summit of Mt. Eeka, Forbes 367; Rock 16002. Puu Kukui, Hitchcock 14810. Waikapu, Rock. Nahiku, Rock 12733. Haleakala Crater, Hitchcock 14963, 14946. Isthmus, Rock 17072.

Hawaii: Kukaiau Ranch, Hitchcock 14220. Kohala Mountains, Forbes 487; Rock 4179. Popola, Kau, Forbes 413.

Without locality: Wilkes Expl. Exped.; Hillebrand; Faurie 1329.

11. **Eragrostis monticola** (Gaud.) Hillebr. Fl. Haw. Isl. 531. 1888.

Poa monticola Gaud. in Freyc. Voy. Uran. Bot. 408. 1830.

Plants perennial; culms in dense tufts, slender, erect or spreading, 10 to 30 cm. tall; sheaths glabrous, pilose at the throat; blades mostly clustered at the base of the plants, 5 to 15 cm. long, 1 to 2 mm. wide but mostly narrowly involute, tapering to a slender point, glabrous beneath, scabrous on the upper surface; panicle erect, narrow and more or less spikelike, often somewhat interrupted, 5 to 15 cm. long, mostly less than 1 cm. wide, the branches short and appressed, the lower 1 to 2 cm. long; spikelets mostly 6 to 8-flowered, about 5 mm. long, the florets scarcely disclosing the glabrous rachilla; glumes acuminate, 2 to 3 mm. long, the first often longer than the first lemma; lemmas about 2 mm. long, rather obtuse, glabrous; palea nearly as long as the glume, scabrous on the keels (fig. 20).

Open dry ground. Originally described from "insulis Sandwicensibus."

Molokai: Central part, Hitchcock 15155. Mapulehu, 3000 feet, Rock 6148. Puu Kolekole, Forbes 217.

Lanai: Open plains, Hitchcock 14693.

Hawaii: District of Puna, Wilkes Expl. Exped. (Gray Herbarium).

Without locality: Hillebrand.

12. **Eragrostis leptophylla** sp. nov.

Plants perennial, with numerous erect innovations; culms densely cespitose, erect, slender, glabrous, mostly about 1 meter tall; sheaths ciliate on the margin, villous at the throat, somewhat pubescent on the collar, otherwise glabrous; ligule a ciliate membrane less than 0.5 mm. long; blades slender, erect, involute, 1 to 2 mm. wide, glabrous on lower surface, villous on upper surface near base, scaberulous near the slender sharp tip; panicle slender, spikelike, mostly rather dense, 15 to 30 cm. long, about 5 to 8 mm. thick, the axis and pedicels scabrous or puberulent; spikelets about 1 cm. long, mostly 8 to 10-flowered, longer than the pedicels; glumes about equal, about 5 mm. long, as long as or longer than the first floret, attenuate-pointed, scaberulous on the keel toward the tip, the first 1-nerved, the second 3-nerved, lemmas acute, rather faintly 3-nerved, about 3 mm. long, faintly scaberulous on the keel toward the tip, imbricate, hiding the rachilla; palea shorter than the lemma, scaberulous on the keels (fig. 21).

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FIGURE 20.—Eragrostis monticola. From Hitchcock 15155, Molokai.



FIGURE 21.—Eragrostis leptophylla. From the type specimen.

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Type in the U. S. National Herbarium, no. 836477, collected on the sandy plain west of the Humuula Sheep Station on the flank of Mauna Kea, island of Hawaii, August 29, 1916, by A. S. Hitchcock (no. 14458).

This species is distinguished by the slender, erect culms and blades and the slender, spikelike panicle. It appears to be confined to the western side of Hawaii. Hawaii: West of Humuula Sheep Station, Hitchcock 14440, 14458. Hill south of Humuula Sheep Station, Hitchcock 14447, 14448. Kanehaha, Kona, Forbes 258. Puu Waawaa, Forbes 43. Without locality, Wilkes Expl. Exped.; Remy 92 (Gray Herbarium).

13. **Eragrostis variabilis** (Gaud.) Steud. Nom. Bot. ed. 2. 1:564. 1840, as synonym of *E. wahowensis* Trin.; [as species] Hillebr. Fl. Haw. Isl. 528. 1888.

Poa variabilis Gaud. in Freyc. Voy. Uran. Bot. 408. 1830.
Eragrostis wahowensis Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1:412. 1830.
Eragrostis equitans Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 1:413. 1830.
Eragrostis variabilis var. *β ciliata* Hillebr. Fl. Haw. Isl. 529. 1888.
Eragrostis thyrsoidea Hillebr. Fl. Haw. Isl. 529. 1888.
Eragrostis hawaiiensis Hillebr. Fl. Haw. Isl. 530. 1888.
Eragrostis phleoides Hillebr. Fl. Haw. Isl. 530. 1888.

Plants perennial, cespitose; culms erect, mostly 40 to 80 cm. tall or taller, glabrous or scaberulous, especially below the panicle; sheaths glabrous, or puberulous at the summit and on the collar, in some plants villous at the throat; ligule a very short ciliate membrane less than 0.5 mm. long; blades mostly flat near the base, involute above and ending in a fine point, as much as 50 cm. long and 1 cm. wide, scabrous-puberulent on the upper surface, in some plants villous near the base, glabrous on the lower surface; panicle narrow, as much as 40 cm. long, somewhat open with ascending branches or dense and spikelike, the main axis scabrous or pubescent, in some plants smooth below, the axils of some pilose; spikelets 5 to 10 mm. long, mostly 8 to 12-flowered, the pedicels smooth or scabrous, the rachilla smooth or puberulous; glumes acuminate or attenuate-pointed, commonly strongly scaberulous on the keels, about equal, 2 to 3 mm. long, the first 1-nerved, the second 3-nerved; lemmas acuminate, 2.5 to 3 mm. long, scabrous on the keel, and even also on the back, especially toward the tip, the 2 lateral nerves often prominent because of the sunken tissue on each side; palea nearly as long as the lemma, scabrous-ciliate on the keels (fig. 22).

A very variable species especially as to the density of the panicle. I have been unable to coördinate the characters so as to segregate distinct species.

Through the courtesy of Dr. Diels, Director of the Botanic Garden at Berlin, I have had the privilege of examining the type specimens of *Eragrostis hawaiiensis, E. phleoides,* and *E. thyrsoidea.* The three types look rather distinct but they all fall within the range of specimens cited below. The type of *E. phleoides,* from "Haleakala", has a dense spikelike panicle, 5 to 12 cm. long. In *E. thyrsoidea* from "Oahu! Maui!" (there are two specimens on the sheet), the panicle is contracted but scarcely spikelike, 20 cm. long on one specimen, lobed or interrupted. The panicle of *E. hawaiiensis,* from "Kohala", is about 35 cm. long, the upper part spikelike, the lower part looser, the branches crowded but ascending, as much as 7 cm. long. The plants of the three specimens are similar, all being rather tall with broad blades mostly convolute above.

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FIGURE 22.—Eragrostis variabilis. From Hitchcock 15274, Kauai, and (the dense panicle) a specimen named by Hillebrand E. phleoides.



FIGURE 23.—Dactylis glomerata. From U. S. Dept. Agr. Bull. 772, fig. 28.

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Grassy slopes and ridges. Originally described from "insulis Sandwicensibus (Alt. 450-500 hexap.)"; *E. wahowensis* described from "Ins. Wahu"; *E. equitans* from "Ins. Wahu."

Kauai: Olokele Gulch, Hitchcock 15274. Haupu Range near Nawiliwili Bay, Forbes 714. West side Waimea drainage basin, Halemanu, Forbes 855, 949; Rock 2180. Kaholuamano, Rock 5131, 12741; Hitchcock 15543; Heller 2830. Cliffs at Haena, Rock 17260. Waimea, Mann & Brigham 251.

Niihau: Kalua Keale (from Forbes) in 1912.

Oahu: Nuuanu Pali, Heller 1992; Hitchcock 13790, 13791; Forbes 1086, 1087. Palolo Valley, Forbes 2403; Hitchcock 14139, 14141, 14142. Kalihi Pali, Forbes 2294. Without locality, Wilkes Expl. Exped.; Mann & Brigham 15, 218; Remy 89 (Gray Herbarium).

Molokai: Mauna Loa, Forbes 16. Kalae, Forbes 47. Kaunakakai Gulch, Forbes 624. East Molokai, Rock 12736. Wailau, Faurie 1332. Ka Lae o ka Laau, Forbes 58.

Maui: Sand hills of Wailuku, Wilkes Expl. Exped. (Gray Herbarium).

Hawaii: Kilauea Crater, Hitchcock 14611. Road to volcano from south, Hitchcock 14591. Mauna Loa, Wilkes Expl. Exped. (Gray Herbarium). Without locality, Mann & Brigham.

Laysan: Fullaway in 1911; Bryan 8730, 8731. Snyder in 1902 (Albatross Haw. Expl.)

Without locality: Hillebrand; Rock 12740.

Arundo donax L. Sp. Pl. 81, 1753, the giant reed, is cultivated for ornament and probably will become established. This is a large herbaceous grass as much as 7 meters tall, with thick knotty rhizomes, flat blades 5 to 7 cm. wide on the main culms, smaller on the branches, and a handsome feathery panicle 30 to 60 cm. long. The conspicuously distichous leaves are distributed rather evenly along the culm.

8. **DACTYLIS** L.

Spikelets few-flowered, compressed, finally disarticulating between the florets, nearly sessile in dense one-sided fascicles, borne at the ends of the few branches of a panicle; glumes unequal, carinate, acute, hispid-ciliate on the keel; lemmas compressed-keeled, mucronate, 5-nerved, ciliate on the keel. Perennials, with flat blades and fascicled spikelets.

1. **Dactylis glomerata** L. Sp. Pl. 71. 1753. ORCHARD GRASS.

Culms erect, 6 to 120 cm. tall; blades broadly linear; panicle 7 to 15 cm. long, the few stiff branches naked below, contracted after flowering; spikelets crowded in dense 1-sided clusters at the ends of the branches (fig. 23).

Escaped from cultivation in pastures and grassland at upper elevations; introduced. Originally described from Europe.

Kauai: West side Waimea drainage basin, Forbes 1074.

Molokai: Central part, Hitchcock 15159. Papaaloa, Forbes 95.

Hawaii: Paauhau, Rock 3212. Kukaiau Ranch, Hitchcock 14213. Papaaloa, Kona, Forbes 324.

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FIGURE 24.—Hordeum murinum. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 605.



FIGURE 25.—Lolium temulentum. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 587.



FIGURE 26—Lolium multiflorum. From U. S. Dept. Agr. Bull. 772, fig. 52.

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Wheat (*Triticum aestivum* L.; *T. vulgare* Vill.; *T. sativum* Lam.) was found as a waif in the experimental fields at Schofield Barracks (Hitchcock 13964, 13965, 13966) and may be found in waste places. Spikelets 2 to 5-flowered, solitary, sessile, placed flatwise at each joint of a continuous rachis, forming a dense spike; glumes rigid, broad, the apex abruptly mucronate or toothed; lemmas keeled, ending in a short point or a long awn; plants annual; a pair of appendages or small auricles at the junction of the sheath and blade.

Rye (*Secale cereale* L.) was also found as a waif at Schofield Barracks (Hitchcock 13962). Plants taller than wheat, the spike nodding; spikelets 2-flowered, solitary and sessile, placed flatwise against the continuous rachis; glumes narrow, rigid, acuminate or subulate-pointed; lemmas broader, sharply keeled, 5-nerved, ciliate on the keel and exposed margins, tapering into a long awn.

9. **HORDEUM** L.

Spikelets 1-flowered, 3 (sometimes 2) together at each node of the articulate rachis (continuous in *Hordeum vulgare*), the back of the lemma turned from the rachis, the middle one sessile or subsessile, the lateral ones pediceled; rachilla disarticulating above the glumes and, in the central spikelet, prolonged behind the palea as a bristle and in some spikelets bearing a rudimentary floret; lateral spikelets commonly imperfect, in some species reduced to bristles; glumes narrow, often subulate and awned, rigid, standing in front of the spikelet; lemmas rounded on the back, 5-nerved, as a rule obscurely so, tapering into a usually long awn. Annual or perennial low or rather tall grasses, with flat blades and dense terminal spikes.

1. **Hordeum murinum** L. Sp. Pl. 85. 1753. WILD BARLEY.

Plants annual; culms bushy-branched, spreading; sheaths and blades smooth; spike 5 to 7 cm. long, often partially enclosed in the uppermost inflated sheath; glumes of the central spikelet narrowly spindle-form, 3-nerved, long-ciliate on both margins, the nerves scabrous, the awn about 2.5 cm. long; glumes of lateral spikelets unlike, the inner similar to the central, the outer setaceous, not ciliate; lemmas all broad, 8 to 10 mm. long, the awns somewhat exceeding those of the glumes (fig. 24).

Weed in pastures; introduced. Originally described from Europe.
Oahu: Schofield Barracks, Hitchcock 13920.
Hawaii: Makahalau, Rock 3198. Waimea, Hitchcock 14348.

Barley (*Hordeum vulgare* L.) as a waif in the experimental fields was found at Schofield Barracks (Hitchcock 13963). Plants annual with flat blades and dense terminal spikes resembling those of bearded wheat but with longer awns; auricles at base of blade larger than in wheat or rye; spikelets in groups of three, all three fertile in 4 and 6-rowed barley, the kind usually grown; grain (except in naked barley) permanently enclosed in the spikelet.

10. **LOLIUM** L.

Spikelets several-flowered, solitary and sessile, placed edgewise to the continuous rachis, one edge fitting to the alternate concavities, the rachilla disarticulating above the glumes and between the florets; first glume wanting (except on the terminal spikelet), the second outward, strongly 3 to 5-nerved, equaling or exceeding the second floret; lemmas rounded on the back, 5 to 7-nerved, obtuse, acute, or awned. Annuals or perennials, with flat blades and simple terminal flat spikes.

Plants annual; glume as long as or longer than the spikelet..... 1. **L. temulentum.**
Plants perennial; glume shorter than the spikelet..... 2. **L. multiflorum.**

1. **Lolium temulentum** L. Sp. Pl. 83. 1753.

Plants annual; culms 60 to 80 cm. tall; spike stout and strict, 15 to 20 cm. long; glume about 2.5 cm. long, as long as or longer than the 5 to 7-flowered spikelet, firm, pointed; lemmas as much as 8 mm. long, obtuse, the awn wanting or as much as 8 mm. long (fig. 25).

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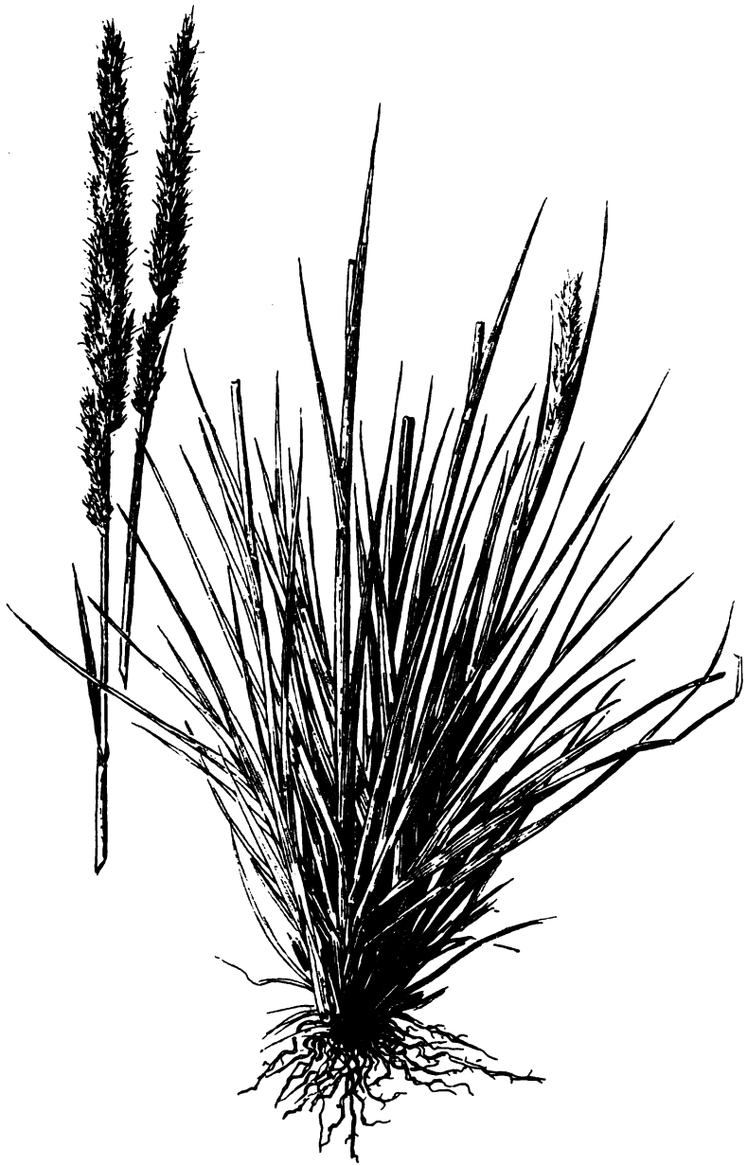


FIGURE 27.—Trisetum glomeratum. From Hitchcock 14284, Hawaii.



FIGURE 28.—Avena fatua. From U. S. Dept. Agr. Bull. 772, fig. 58.

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Weed along road; introduced. Originally described from Europe.
Oahu: Nuuanu Pali, Hitchcock 13778.
Hawaii: Hilo, Newell in 1917.

2. **Lolium multiflorum** Lam. Fl. Franç. 3:621. 1778. ITALIAN RYE GRASS.

Short-lived perennials; culms 30 to 60 cm. tall, erect or often decumbent at base, often rough below the spike and on the convex portion of the rachis; spike as much as 30 cm. long; spikelets as much as 2.5 cm. long, twice as long as the glumes, 10 to 20-flowered; lemmas 5 to 6 mm. long, at least the upper awned, the awn as much as 5 mm. long (fig. 26).

Grassland at medium altitudes; introduced. Originally described from Europe.
Oahu: Honolulu, Hitchcock 13859. Schofield Barracks, Hitchcock 13917, 13923.
Molokai: Papaaloa, Forbes 99. Central part, Hitchcock 15152.
Hawaii: Paauhau, Rock 3461.

11. **LEPTURUS** R. Br.

Spikelets 1-flowered, embedded in the hard, cylindric, articulate rachis, placed edgewise thereto, the first glume wanting except on the terminal spikelet, the second glume closing the cavity of the rachis and flush with the surface, indurate, nerved, acuminate, longer than the joint of the rachis; lemma lying next the rachis, hyaline, shorter than the glume, 3-nerved; palea hyaline, 2-nerved, a little shorter than the lemma; rachilla not disjointing, the spikelet falling entire, attached to its rachis joint. Low annuals or perennials, with hard cylindric spikes.

1. **Lepturus repens** (Forst.) R. Br. Prodr. Fl. Nov. Holl. 207. 1810.

Rottboellia repens Forst. Prodr. 9. 1786.
Monerma repens Beauv. Ess. Agrost. 117, 168, 177. 1812.

Plants perennial, widely creeping, diffusely branching, the fertile culms ascending or erect, as much as 1 meter tall, commonly shorter; sheaths glabrous; ligule membranaceous, about 1 mm. long, ciliolate; blades flat, 10 to 20 or even 30 cm. long, as much as 1 cm. wide, glabrous on the surface, scabrous on the margins, long-acuminate; spikes 5 to 15 cm. long, erect, strict, the margins of the oblong hollows membranaceous, the internodes about 5 mm. long; second glume twice as long as the internode, coriaceous, ovate-lanceolate, acuminate, greenish; lemma about 4 mm. long, pale, oblong-lanceolate, the margins incurved; palea about as long as the lemma.

This has not been observed on the main group of islands but is a common shore grass on the islands to the south and extends to Australia and Ceylon. Originally described from "Insulae intra tropicas," South Pacific.
Midway Island: Bryan in 1902; Bartsch 92.
Palmyra: Rock 10 in 1913.

12. **TRISETUM** Pers.

Spikelets usually 2-flowered, sometimes 3 to 5-flowered, the rachilla prolonged behind the upper floret, usually villous; glumes somewhat unequal, acute, awnless, the second usually longer than the first floret; lemmas usually short-bearded at the base, 2-toothed at the apex, the teeth often awned, bearing from the back below the cleft apex a straight and included, or usually bent and exserted, awn. Tufted perennials with flat blades and open or usually contracted or spikelike panicles.

1. **Trisetum glomeratum** (Kunth) Trin.; Steud. Syn. Pl. Glum. 1:229. 1854.

Koeleria glomerata Kunth, Rév. Gram. 2:611. pl. 219. 1834.

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Culms densely tufted, erect, glabrous or pubescent, 30 to 100 cm. tall; sheaths usually loose, glabrous or softly pubescent; ligule membranaceous, about 5 mm. long, lacerate at apex; blades rather thick, 10 to 20 cm. long, 2 to 4 or sometimes as much as 6 mm. wide, glabrous or pubescent, flat or more or less involute, especially toward the apex, tapering to a hard subulate point; panicle erect, close and spikelike, more or less interrupted at base, or sometimes interrupted throughout, or even rather loose, 10 to 20 cm. long, usually about 1 cm. thick; spikelets in close clusters, 1 to 3-flowered, compressed; glumes acuminate, about equal in length, about 5 mm. long, scabrous on the keels, scabrous or soft-pubescent on the surface, the first narrow, the second nearly twice as wide as the first; lemmas rather firm, scarcely keeled, obscurely 5-nerved, the lower about 5 mm. long, more or less scabrous, awned on the back below the entire or slightly bifid tip, the awn variable, reduced or wanting, or as much as 2 to 3 mm. long; straight or spreading, commonly shorter on the upper florets, the rachilla joints villous or glabrous (fig. 27).

This species is fairly uniform in habit but varies greatly in the amount of pubescence and in the length of the awns. Plants with 1-flowered spikelets might be referred technically to Calamagrostis. The species is intermediate between Trisetum and Koeleria.

Open ground, sandy or gravelly slopes or plains, 5000 feet and upwards, common near timber line. (Pl. XXXII, *A*.) Originally described from "Insula Owhyhee, ad montem Kaah," collected by Macrae in 1825. The type is described as being pubescent and as having awns short and erect, or absent from the upper floret.

Lanai: Kalama, Munro 317.

Maui: Haleakala Crater, Faurie 1359, Hitchcock 14959, 14993, 14998, 14953, Rock 8512, 16005. Mountains, East Maui, Wilkes Expl. Exped. (Gray Herbarium).

Hawaii: Hanehane, Kona, Forbes, 168; Mauna Kea, Forbes 853, 854, 855; Hitchcock 14299, 14453, 14457; Rock 8404, 8709, Faurie 1358; region of Sophora, Wilkes Expl. Exped.; Humuula Sheep Station, Hitchcock 14419, 14431; Kukaiau Ranch, Hitchcock 14235, 14244; Aina Hou, Forbes 830; Hualalai Mountains, Rock 3628; Hitchcock 14510, 14520, 14527; Mann & Brigham 326; Luamakani Crater, Rock 3260; Mauna Loa, Hitchcock 14621; north slope Mauna Kea, Hitchcock 14284; Bullock Plains, Wilkes Expl. Exped.; Waimea, Wilkes Expl. Exped. Without locality, Remy 82[10] (Gray Herbarium).

13. **AVENA** L.

Spikelets 2 to several-flowered, the rachilla bearded, disarticulating above the glumes and between the florets; glumes about equal, membranaceous or papery, several-nerved, longer than the lower floret, usually exceeding the upper floret; lemmas indurate, except toward the summit, 5 to 9-nerved, bidentate at the apex, bearing a dorsal bent and twisted awn (this straight and reduced in *Avena sativa*). Annual or perennial, low or moderately tall grasses, with narrow or open commonly few-flowered panicles and large spikelets.

Lemmas glabrous or nearly so ..... 1. **A. sativa.**

Lemmas pubescent with long hairs, commonly brown.

Teeth of lemma acute, not awned ..... 2. **A. fatua.**

Teeth of lemma awned ..... 3. **A. barbata.**

[10] The Remy collection in the Gray Herbarium has two sheets numbered 82. See *Capriola dactylon*.

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1. **Avena sativa** L. Sp. Pl. 79. 1753. CULTIVATED OAT.

Similar to *A. fatua;* florets not readily separating from the glumes, spikelets commonly 2-flowered; lemma glabrous; awn straight, or wanting.

Occasional in waste places, mostly as a waif. Originally described from cultivated plants in Europe.
Oahu: Schofield Barracks, Hitchcock 13972.

2. **Avena fatua** L. Sp. Pl. 80. 1753. WILD OAT.

Plants annual; culms 30 to 90 cm. tall, erect, stout; panicle loose and open, the slender branches as a rule horizontally spreading; spikelets commonly 3-flowered; glumes about 2.5 cm. long; rachilla and lower part of shining lemma clothed with long stiff brownish hairs; florets readily falling from the glumes; lemma nerved above, about 2 cm. long, the teeth acuminate but not awned; awn stout, geniculate, red-brown, twisted below, about 3 cm. long (fig. 28).

Weed along roadside; introduced. Originally described from Europe.
Oahu: Nuuanu Pali, Hitchcock 13749.

3. **Avena barbata** Brot. Fl. Lusit. 1:108. 1804.

Differs from *A. fatua* in having somewhat smaller, 2-flowered spikelets, with curved and capillary pedicels: teeth of lemma ending in fine awns 2 mm. long.

Weed along road; introduced. Originally described from Europe.
Oahu: Schofield Barracks, Hitchcock 13934.

14. ARRHENATHERUM Beauv.

Spikelets 2-flowered, the lower floret staminate, the upper perfect, the rachilla disarticulating above the glumes, produced beyond the florets as a slender bristle: glumes rather broad and papery, the first 1-nerved, the second a little longer than the first and about as long as the spikelet, 3-nerved; lemmas 5-nerved, hairy on the callus, the lower bearing near the base a twisted, geniculate, exserted awn, the upper bearing a short straight, slender awn just below the tip. Perennial, rather tall grasses, with flat blades and rather dense panicles.

1. **Arrhenatherum elatius** (L.) Beauv.; Mert. & Koch in Röhl, Deutsch. Fl. 1:546. 1823. TALL MEADOW OAT GRASS.

Avena elatior L. Sp. Pl. 79. 1753.
Arrhenatherum avenaceum Beauv. Ess. Agrost. 152, pl. 11, f. 5. 1812.

Culms a meter or more tall; blades as much as 1 cm. wide, scabrous on both surfaces; panicle pale or purplish, shining, 15 to 30 cm. long, narrow, the short branches verticillate, usually spikelet-bearing from the base; spikelets 7 to 8 mm. long; glumes minutely scabrous, the second about equaling the florets; lemmas scabrous, the awn of the staminate floret about twice the length of its lemma; palea as long as the lemma (fig. 29).

Pasture land at medium altitudes. Cultivated as a pasture grass and established here and there. Originally described from Europe.
Hawaii: Kukaiau Ranch, Hitchcock 14267.

15. AIRA L.

Spikelets 2-flowered, disarticulating above the glumes, the hairy rachilla prolonged behind the upper floret as a stipe, this in some plants bearing a reduced floret; glumes about equal, acute or acutish, membranaceous; lemmas thin, truncate and 2 to 4-toothed at the summit, bearing a slender awn from or below the middle, the awn straight, bent or twisted. Low or moderately tall annual or commonly perennial grasses, with shining pale or purplish spikelets in narrow or open panicles.

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FIGURE 29.—Arrhenatherum elatius. From U. S. Dept. Agr. Bull. 772, fig. 59.



FIGURE 30.—Aira nubigena. From Hitchcock 14728, Maui.



FIGURE 31.—Calamagrostis hillebrandi. From Hitchcock 14730, Maui.

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1. **Aira nubigena** (Hillebr.).

Aira australis Nees; Steud. Syn. Pl. Glum. 1:220. 1854. Not *Aira australis* Raoul, 1846.
Deschampsia australis Nees; Hillebr. Fl. Haw. Isl. 520. 1888.
Deschampsia pallens Hillebr. Fl. Haw. Isl. 520. 1888. Not *Aira pallens* Spreng. 1807.
Deschampsia nubigena Hillebr. Fl. Haw. Isl. 521. 1888.

Plants perennial, often in dense tufts; culms 30 to 100 cm. tall, stiff, glabrous; sheaths glabrous; ligule firm, 3 to 4 mm. long; blades firm or coriaceous, folded or involute, glabrous or scabrous, 0.5 to 1.5 mm. wide as folded, sometimes in a short basal cluster 5 to 10 cm. long, sometimes elongate; panicle ovate to oblong, 5 to 30 cm. long, open or somewhat contracted, usually bronze-tinted, the capillary branches in fascicles, some naked at base, some spikelet-bearing near the base; spikelets shining; glumes acuminate, nearly equal, about 5 mm. long, mostly bronzed in the middle, hyaline at margin and yellowish at the tip, scabrous on the keels; lemmas glabrous, about 4 mm. long, the callus hairs about 1 mm. long; awn from near the base, variable in length, nearly straight and included, or bent and exserted as much as 5 mm. (fig. 30).

The three species given by Hillebrand (*Deschampsia pallens, D. australis, D. nubigena*) seem to be all forms of *A. nubigena*. It grows on the dry plains of the upper elevations in company with *Trisetum glomeratum*. It also grows in the open bogs at the summits of the mountains, where it is often more dwarfed with short basal tufts of leaves, and in the wet forest where the whole plant is more lax.

Dry slopes and plains and also swamps, at upper altitudes. *Aira australis* was described from "Ins. Owyhee"; *Deschampsia nubigena* was described from "top of Mt. Eeka, Maui."

Kauai: Kaholuamano, Rock 4176; Hitchcock 15340. Alakai Swamp, Forbes 875. Waialeale, Hitchcock 15506. Waimea, 2000 to 3000 feet, Mann & Brigham 306.

Molokai: Wailau, Faurie 1284. Kamalo Bog, Hitchcock 15104.

Maui: Puu Kukui, Hitchcock 14728, 14825; Rock 8139. "Mt. Eeke" Forbes 368. Olinda, wet forest, Hitchcock 14899, 14907. Haleakala Crater, Rock 8511; Hitchcock 14942, 14965, 14969; Forbes 294.

Hawaii: Mauna Loa near Rest House, Hitchcock 14622; at 8000 feet, Wilkes Expl. Exped. Kilauea, Faurie 1363. Hualalai Mountains, Hitchcock 14521; Forbes 199. Hanehane, Kona, Forbes 170. Holualoa, Forbes 805. Luamakani, Rock 3114, 3219. Kukaiau Ranch, Hitchcock 14225, 14250. Hilo, Rainbow Falls, Hitchcock 14198; Newell in 1917. Waikii, Rock 8408. Humuula Sheep Station, Hitchcock 14437; Forbes 852. Mauna Kea, Faurie 1366.

Without locality: Wilkes Expl. Exped.; Hillebrand.

16. **ASPRIS** Adans.

Spikelets 2-flowered, the rachilla disarticulating above the glumes, not prolonged; glumes about equal, acute, membranaceous or subscarious; lemmas firm, rounded on the back, tapering into two slender teeth, the callus with a very short tuft of hairs, bearing on the back below the middle a slender, geniculate, twisted awn commonly exserted. Low, delicate annuals (apparently perennial in the Hawaiian islands) having small open or contracted panicles.

1. **Aspris caryophyllea** (L.) Nash in Britt. & Brown, Illustr. Fl. ed. 2. 1:214. 1913.

Aira caryophyllea L. Sp. Pl. 66. 1753.

Culms solitary or few or in the Hawaiian plant, numerous in apparently perennial tufts, with a dense basal tuft of leaves, erect, 10 to 30 cm. tall; blades short, setaceous; panicle open,

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FIGURE 32.—Notholcus lanatus. From U. S. Dept. Agr. Bull. 772, fig. 62.



FIGURE 33.—Aspris caryophyllea. From U. S. Dept. Agr. Bull. 772, fig. 61.

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the silvery shining spikelets 3 mm. long, clustered toward the ends of the spreading capillary branches; lemma of both florets with a geniculate awn 4 mm. long, the teeth setaceous (fig. 33).

A weed along trail, 4000 to 6000 feet; introduced. Originally described from Europe.

Maui: Haleakala Crater, Hitchcock 14973. Along Olinda pipe line in very wet forest, Hitchcock 14938.

17. **NOTHOLCUS** Nash.

Spikelets 2-flowered, the pedicel disarticulating below the glumes, the rachilla curved and somewhat elongate below the first floret, not prolonged above the second floret; glumes about equal, longer than the two florets; first floret perfect, its lemma awnless; second floret staminate, its lemma awned on the back. Perennial grasses, with flat blades and contracted panicles.

1. **Notholcus lanatus** (L.) Nash; Hitchc. in Jepson, Fl. Calif. 1:126. 1912. VELVET GRASS.

Holcus lanatus L. Sp. Pl. 1048. 1753.

Plants grayish, velvety-pubescent; culms erect, 30 to 60 cm. tall; panicle 5 to 10 cm. long, narrow, contracted, sometimes almost spikelike, purple-tinged; spikelets 4 mm. long; glumes villous, hirsute on the nerves, the second broader than the first, 3-nerved; lemmas ciliate at the apex; awn of the second floret hooklike (fig. 32).

Pasture land at medium altitudes; introduced. Originally described from Europe.

Hawaii: Kukaiau Ranch, Hitchcock 14204, 14252. Paauhau, Rock 3437.

18. **CALAMAGROSTIS** Adans.

Spikelets 1-flowered, the rachilla disarticulating above the glumes, generally prolonged behind the palea as a short, commonly hairy bristle; glumes about equal, acute or acuminate; lemma shorter and as a rule more delicate than the glumes, the callus bearing a tuft of hairs, these in many species copious and as long as the lemma, awned from the back, usually below the middle, the awn being delicate and straight, or stouter and exserted, bent and sometimes twisted; palea shorter than the lemma. Perennial, usually moderately tall or robust grasses, with small spikelets in open or usually narrow, sometimes spikelike panicles.

Callus hairs very short..... 1. **C. hillebrandi.**
Callus hairs longer than the floret..... 2. **C. expansa.**

1. **Calamagrostis hillebrandi** (Munro).

Deyeuxia hillebrandi Munro; Hillebr. Fl. Haw. Isl. 519. 1888.

Culms tufted, apparently with slender rhizomes, erect, glabrous, 30 to 50 cm. tall; sheaths glabrous, longer than the internodes; ligule a membrane about 1 mm. long, erose; blades flat or more or less involute, those of the midculm 10 to 15 cm. long, 2 to 4 mm. wide when flat, the uppermost near the panicle, 2 to 4 cm. long, all very scabrous on the upper surface, glabrous or nearly so beneath, firm and stiff; panicle ovate, 5 to 10 cm. long, 3 to 7 cm. wide, rather loose, the branches ascending, glabrous, commonly pubescent about the base, the lower in fascicles, naked below, branching below the middle; glumes nearly equal, acuminate, 4 to 6 mm. long, glabrous including the keel; lemma 4 to 5 mm. long, firm, faintly 5-nerved, short-pilose at base, the hyaline apex 4-toothed, the teeth extending into slender awns as much as 1 mm. long; awn dorsal, arising above the middle, scabrous, curved-spreading, 5 to 10 mm. long; palea nearly as long as the lemma, sharply 2-toothed, scaberulous on the keels; rachilla prolongation more than half as long as the lemma, silky-villous, the hairs extending as far as the tip of the lemma (fig. 31).

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FIGURE 34.—Calamagrostis expansa. From Hitchcock 14830, Maui.



FIGURE 35.—Agrostis retrofracta. From Hitchcock 14531, Hawaii.

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Open bogs, summit of mountains. Originally described from "top of Mt. Eeka, Maui."

Molokai: Central part, Hitchcock 15186.

Maui: Puu Kukui, Hitchcock 14730; Rock 8190, 16003; "Mt. Eeka", Forbes 369.

2. **Calamagrostis expansa** (Munro).

Deyeuxia expansa Munro; Hillebr. Fl. Haw. Isl. 519. 1888.

Culms 50 to 60 cm. tall, erect, decumbent and naked below; sheaths minutely retorse-scaberulous, overlapping rather closely along the middle of the culm; ligule membranaceous, 1 to 2 mm. long; blades flat or more or less involute, firm, 15 to 20 cm. long, as much as 1 cm. wide, the uppermost near the panicle, 2 to 4 cm. long, ending in a hard sharp point, glabrous beneath, scabrous on the upper surface; panicle oblong, contracted, 8 to 15 cm. long, the axis and branches scabrous; glumes acuminate, about 7 mm. long, the keels scabrous; lemma thin, 3 to 4 mm. long, 4-toothed at apex, the teeth slender, the callus hairs abundant and a little longer than the lemma; awn from near the middle, scabrous, spreading, about 5 mm. long; palea a little shorter than the lemma, 2-toothed, scabrous on the keels; rachilla prolongation about 0.5 to 2 mm. long with silky hairs similar to the callus hairs (fig. 34).

The lemma is glabrous in Hitchcock's no. 14830 and scabrous in Forbes's no. 371. Hillebrand, who had only a fragment, states that the lemma is glabrous. The duplicate type in the Gray Herbarium is larger than the specimens cited below. The panicle is 20 cm. long, and the blades as much as 1.5 cm. wide.

Boggy places at upper altitudes. Originally described from "north bank of the crater of Haleakala (U. S. E. Exp.)."

Maui: Edge of woods near bog, summit of Puu Kukui, Hitchcock 14830, "Mt. Eeke", Forbes 371. North bank of crater, East Maui, Wilkes Expl. Exped. (Gray Herbarium).

19. **AGROSTIS** L.

Spikelets 1-flowered, disarticulating above the glumes, the rachilla in most species not prolonged; glumes equal or nearly so, acute, acuminate, or even awn-pointed, carinate, usually scabrous on the keel and in some species also on the back; lemma obtuse, usually shorter and thinner in texture than the glumes, awnless or dorsally awned, often hairy on the callus; palea usually shorter than the lemma, 2-nerved in only a few species, in most species small and nerveless or obsolete. Annual or usually perennial, delicate or moderately tall grasses, with glabrous culms, mostly flat scabrous blades, and open or contracted panicles of small spikelets.

Lemma pubescent; panicle finally diffuse ..... 1. **A. retrofracta.**

Lemma glabrous; panicle more or less open but not diffuse.

Spikelets awnless; plants spreading or decumbent.

Panicle contracted and lobed or verticillate; glumes scabrous on keel and back ..... 2. **A. verticillata.**

Panicle more open; glumes scabrous on keel, smooth on back ..... 3. **A. stolonifera.**

Spikelets awned (some awnless in *A. sandwicensis*).

Panicle small but open ..... 4. **A. canina.**

Panicle contracted and spikelike.

Plants solitary or few together in bogs ..... 5. **A. fallax.**

Plants strongly tufted.

Blades involute ..... 6. **A. sandwicensis.**

Blades flat ..... 7. **A. exarata microphylla.**

1. **Agrostis retrofracta** Willd. Enum. Pl. 94. 1809.

Avena filiformis Forst. Prodr. 9. 1786. Not *Agrostis filiformis* Vill. 1787.

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Deyeuxia retrosracta Kunth, Rév. Gram. 1:77. 1829.
Deyeuxia forsteri Kunth, Rév. Gram. 1:77. 1829.
Calamagrostis retrofracta Link; Steud. Nom. Bot. ed. 2. 1:251. 1840.

Plants tufted, soft and lax; culms erect or decumbent at base, 20 to 60 cm. tall; sheaths glabrous or scabrous; ligule conspicuous, membranaceous, as much as 8 mm. long; blades flat, 10 to 20 cm. long, 0.5 to 3 mm. wide, scabrous on the upper surface, glabrous beneath; panicle 10 to 30 cm. long, becoming very diffuse, with long capillary, fascicled, scabrous branches, spikelet-bearing toward the ends; spikelets pale; glumes 2 to 3 mm. long, acuminate, scabrous on the keel; lemmas 1.5 mm. long, silky pubescent, obtuse, dentate; awn from about the middle, 3 mm. long; prolongation of rachilla about 0.3 mm. long, the silky hairs extending to 1 mm. (fig. 35).

This species is intermediate between Agrostis and Calamagrostis. The habit is that of the former genus, the silky prolongation of the rachilla is that of Calamagrostis.

Wet cliffs and grassy slopes up to 8000 feet. Originally described from Australia.

Kauai: Olokele Gulch, Hitchcock 15199, 15223, 15253. Kaholuamano, Heller 2779.
Oahu: Schofield Barracks, Hitchcock 13947, 13959. Palehua, Waianae Range, Forbes 1692. Mt. Tantalus, Hitchcock 13870.
Molokai: Kamalo, Hitchcock 15103.
Lanai: Upper part of mountain, Hitchcock 14640.



FIGURE 36.—Agrostis verticillata. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 484.



FIGURE 37.—Agrostis fallax. From Hitchcock 14729, Maui.

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Maui: Lahaina, Hitchcock 14885. Puu Kukui, Hitchcock 14764. West Maui, Rock.
Hawaii: Summit of Hualalai Mountains, Hitchcock 14531. Hilo, Hitchcock 14195. Kukaiau Ranch, Hitchcock 14205, 14232. Paauhau, Rock 3462, 5124. Waimea, Hitchcock 14376.
Without locality: Hillebrand.

2. **Agrostis verticillata** Vill. Prosp. 16. 1779.

Agrostis kauaiensis Hillebr. Fl. Haw. Isl. 516. 1888.

Culms commonly decumbent at base, sometimes with long creeping and rooting stolons, the flowering branches 20 to 40 cm. tall; blades flat, mostly less than 10 cm. long, 2 to 4 mm. wide, scabrous; panicle contracted, lobed or verticillate, especially at base, 3 to 10 cm. long, light green, the branches flower-bearing from the base; glumes equal, obtuse or barely acute, scabrous on back and keel, 2 mm. long; lemma half as long as glumes, awnless, truncate and toothed at apex; palea nearly as long as the lemma (fig. 36).

Moist places, banks of streams; introduced. Originally described from Europe. *Agrostis kauaiensis* was described from "Kauai! Waimea (Kn., and M. & B. no. 273)." These specimens probably came from the same general region as the Kauai specimens listed below.
Kauai: Kaholuamano, Hitchcock 15301. Waimea drainage basin, Kokee stream, Forbes 774. Waimea, 2000 to 3000 feet, Mann & Brigham 273 (type collection of *A. kauaiensis*). Without locality, Rock 5120.
Hawaii: Kukaiau Ranch, Hitchcock 14221. Puu Waawaa, Hitchcock 14474.

3. **Agrostis stolonifera** L. Sp. Pl. 62. 1753. Redtop.

Culms decumbent at base, with long creeping stolons, 30 to 60 cm. tall; sheaths smooth; ligule membranaceous, 2 to 4 mm. long; blades flat, scabrous, 10 to 15 cm. long, 3 to 4 mm. wide; panicle ovate or oblong, 10 to 20 cm. long, moderately contracted or somewhat open; glumes acuminate, about 2.5 mm. long, scabrous on the keel, glabrous on the back; lemma a little shorter than the glumes, awnless; palea about half as long as the lemma.

Pasture land in the mountains; introduced. Originally described from Europe.
Kauai: Waimea drainage basin, Waineke paddock, Forbes 1018.
'Oahu: Mt. Tantalus, Hitchcock 13869.
Molokai: Poholua, Forbes 98.
Hawaii: Kukaiau Ranch, Hitchcock 14216, 14231.

4. **Agrostis canina** L. Sp. Pl. 62. 1753.

Culms erect or, in the Hawaiian specimens, often creeping at base, 10 to 30 cm. tall; leaves in a firm basal tuft, and a few on the culm, less than 5 cm. long, the basal ones capillary; panicle oblong, open, but the branches ascending or appressed; glumes 2 mm. long or a little shorter, acuminate; lemma a little shorter than the glumes, the awn from about the middle, longer than the glumes, bent (fig. 38).

Grassland; introduced. Originally described from Europe.
Hawaii: Glenwood, Rock 12738, July 1912.

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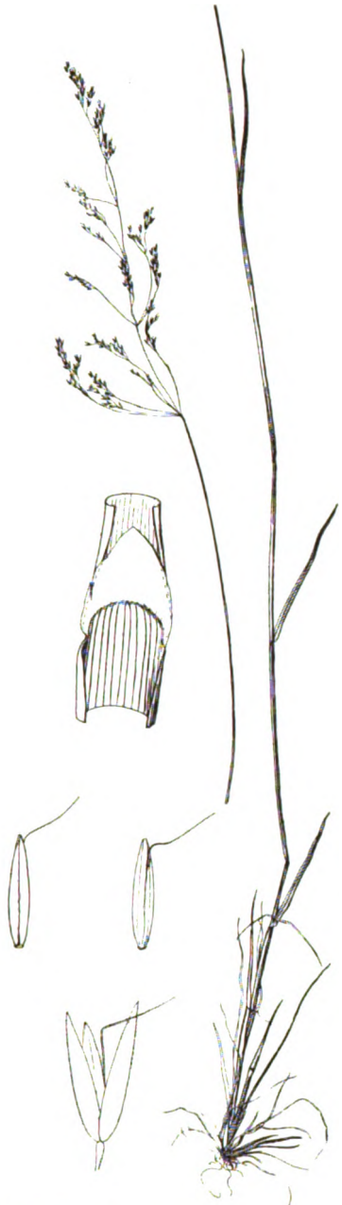


FIGURE 38.—Agrostis canina. From U. S. Dept. Agr. Bur. Pl. Ind. Bull. 68, pl. 9, fig. 2.



FIGURE 39.—Agrostis sandwicensis. From Hitchcock 14631, Hawaii.



FIGURE 40.—Agrostis exarata microphylla. From U. S. Dept. Agr. Bur. Pl. Ind. 68, pl. 19, fig. 1.

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5. **Agrostis fallax** Hillebr. Fl. Haw. Isl. 516. 1888.

Culms solitary or few together, with creeping rhizomes, erect, 15 to 30 cm. tall; sheaths glabrous; ligule membranaceous, 3 mm. long; blades of innovations capillary, of the culm 1 to 2 mm. wide, all less than 10 cm. long; panicle narrow, spikelike, 5 to 10 cm. long; glumes broad at base, acute, 4 mm. long, scabrous on the keel; lemma rather broad, about 2 mm. long, obtuse, the summit divided into 4 fine short teeth, the awn from below the middle, nearly straight or somewhat bent, 3 mm. long, extending about to the tip of the glumes or a little beyond; palea none (fig. 37).

Open bogs on summit of mountain. Originally described from "Plateau of Mt. Eeka, Maui!"

Maui: Puu Kukui, Hitchcock 14729. Mt. Eeka, in summit swamp, 5000 feet, Rock 16001.

6. **Agrostis sandwicensis** Hillebr. Fl. Haw. Isl. 515. 1888.

Agrostis rockii Hack. Repert. Nov. Sp. Fedde, 10:167. 1911.

Plants densely tufted, the culms and blades generally stiffly upright; culms 30 to 50 cm. tall, scabrous; sheaths scabrous; ligule acute, 3 mm. long; blades firm, scabrous, involute or sometimes flat, 1 to 2 mm. wide when flat, sharp-pointed; panicle spikelike, 5 to 10 cm. long, the branches and pedicels very scabrous; glumes narrow, acuminate, 3 to 4 mm. long, scabrous on keel and back; lemma thin, 2 mm. long, the faint nerves extending into minute teeth, the awn from about the middle, bent and twisted below, about as long as the glumes, or reduced, or almost wanting; palea wanting (fig. 39).

Sandy or gravelly plains and slopes at upper altitudes, mostly from 8000 to 11000 feet. Originally described from "E. Maui! Oahu!"

Maui: Haleakala Crater, Hitchcock 14976; Rock 8508 (type collection of *A. rockii*), 16004.

Hawaii: Kau Desert, Rock 12580. Hualalai Mountains, Hitchcock 14529. Mauna Kea, Hitchcock 14285, 14298, 14452; Forbes 474. Bullock Plains, Wilkes Expl. Exped. Kukaiau Ranch, Hitchcock 14243. Kilauea Crater, Hitchcock 14604. Mauna Loa, Hitchcock 14631. Na Puu o Pele, Wilkes Expl. Exped. Road from Kona to Volcano, Hitchcock 14592. Humuula Sheep Station, Hitchcock 14418. Without locality, Mann & Brigham; Remy 75 (Gray Herbarium).

7. **Agrostis exarata microphylla** (Steud.) Hitchc. Amer. Journ. Bot. 2:303. 1915.

Agrostis microphylla Steud. Syn. Pl. Glum. 1:164. 1854.

Culms tufted, 60 cm. tall, scabrous below the panicle; sheaths scabrous; ligule 3 mm. long; blades flat, rather lax, scabrous, 10 to 15 cm. long, 2 to 4 mm. wide; panicle contracted, interrupted, 10 to 20 cm. long, branches and pedicels scabrous; spikelets in clusters, short-pediceled, pale; glumes acute or acuminate, about 3 mm. long, scabrous on the keel and more or less on the back; lemma thin, 1.5 mm. long, the awn from near the middle, twisted below, geniculate or straight, extending about 2 mm. beyond the glumes; palea none (fig. 40).

Moist places; introduced. Originally described from western North America.

Hawaii: Kukaiau Ranch, 6000 feet, in a gulch, Hitchcock 14245.

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FIGURE 41.—Garnotia sandwicensis. From Hitchcock 14193, Hawaii.



FIGURE 42.—Polypogon monspeliensis. From U. S. Dept. Agr. Bull. 772, fig. 75.



FIGURE 43.—Gastridium ventricosum. From U. S. Dept. Agr. Bull 772, fig. 78.

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20. **GARNOTIA** Brongn.

Spikelets 1-flowered, the pedicel disarticulating below the glumes, in unequally pediceled pairs, scarcely compressed; glumes narrow, about equal, rather rigid, often awned, the first 1-nerved, the second 3-nerved; lemma usually awned at the apex; palea as long as the body of the lemma. Annual or perennial grasses with flat blades and narrow panicles.

1. **Garnotia sandwicensis** Hillebr. Fl. Haw. Isl. 513. 1888.

Plants perennial, tufted; culms erect or decumbent, glabrous, 30 to 50 cm. tall; sheaths glabrous, villous on the margin and somewhat so at the throat and on the collar; ligule a short ciliolate membrane less than 1 mm. long; blades flat but more or less involute toward the end in drying, glabrous beneath, slightly scabrous on the upper surface, 5 to 15 cm. long, less than 5 mm. wide, narrowed at the base, long-acuminate at the apex; panicle narrow, rather closely flowered, 7 to 15 cm. long, the branches appressed; spikelets nearly terete, in pairs appressed along the branches, the shorter pedicel 1 to 2 mm. long, the other twice as long, both angled and scabrous, thickened upward, the base of the spikelet stiffly pilose with hairs about 0.5 mm. long; glumes firm, about 4 mm. long, scaberulous on the nerves and somewhat so on the back, 3-nerved, the first with an awn about 5 mm. long, the second depressed or flat on the back, the awn about 2 mm. long; lemma firm, glabrous, rounded on the back, somewhat depressed, very faintly nerved, a little shorter than the glumes, sparsely pilose near margins at base, extending into a scabrous awn about 1 cm. long; palea about as long as the lemma, bearing a minute tuft of hairs at apex (fig. 41).

This species is closely allied to *G. stricta* Brongn.[11] originally described from Tahiti and extending to the Philippines. In the latter species the hairs at the base of the spikelet are shorter and fewer, the glumes are acuminate or the first slightly awned. The awns are directly from the tips of the glumes while in *G. sandwicensis* there is a slight notch or shoulder at the tip of the glume.

Moist cliffs or slopes. Originally described from "Molokai on grassy slopes of the northern shore (Waikolu)," and a variety with shorter awns from Hawaii.
Molokai: Mapulehu Valley, near Pukoo, Forbes 306. Without locality, Hillebrand.
Maui: Nahiku, East Maui, Forbes 253.
Hawaii: Hilo, Faurie 1340; Rainbow Falls, Hilo, Hitchcock 14193; Newell in 1917. Na Puu o Pele, Wilkes Expl. Exped.

21. **POLYPOGON** Desf.

Spikelets 1-flowered, the pedicel disarticulating a short distance below the glumes, leaving a short-pointed callus attached; glumes equal, entire or 2-lobed, awned from the tip or from between the lobes, the awn slender, straight; lemma much shorter than the glumes, hyaline, usually bearing a slender straight awn shorter than the awns of the glumes. Annual or perennial, usually decumbent grasses, with flat blades and dense, bristly, spikelike panicles.

Plants annual; panicle compact, very silky; awns 7 to 10 mm. long..... 1. **P. monspeliensis.**
Plants perennial; panicle somewhat lobed; awns 2 to 3 mm. long..... 2. **P. lutosus.**

1. **Polypogon monspeliensis** (L.) Desf. Fl. Atlant. 1:67. 1798.

Alopecurus monspeliensis L. Sp. Pl. 61. 1753.

Plants annual; culms erect or decumbent at base, scabrous below the panicle, depauperate or as much as 80 cm. tall; sheaths smooth; ligule large; panicle dense and spikelike, 2 to 15 cm. long, 1 to 2.5 cm. thick, green or tawny; glumes hispidulous, 2 mm. long, bearing a slender awn 7 to 10 mm. long from a minutely 2-lobed apex; lemma smooth and shining, 1 mm. long, minutely toothed at the truncate apex, and bearing an awn about 1 mm. long (fig. 42).

[11] Duperrey, L. I., Voyage de la Coquille: Botanique, Vol. 2, p. 133, pl. 21, 1830.

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A weed in moist places along roads in the mountains; introduced. Originally described from Europe.
Oahu: Nuuanu Pali, Hitchcock 13751. Honolulu, Newell in 1917.
Hawaii: Kilauea Crater, Hitchcock 14605. Alakalei Gorge, Rock 4189.

2. **Polypogon lutosus** (Poir.) Hitchc. U. S. Dept. Agr. Bull. 772:138. 1920.

Agrostis littoralis With. Arr. Brit. Pl. ed. 3. 2:129. 1796. Not *Agrostis littoralis* Lam. 1791.
Polypogon littoralis Smith, Comp. Fl. Brit. 13. 1800.
Agrostis lutosa Poir. in Lam. Encycl. Suppl. 1:249. 1810.

Plants perennial; culms geniculate at base, 30 to 70 cm. tall; sheaths scabrous; ligule 2 to 4 mm. long, or the uppermost longer; panicles oblong, 5 to 15 cm. long, more or less interrupted or lobed; glumes equal, scabrous on back and keel, 2 to 3 mm. long, acute, with a terminal awn as long as the body or longer; lemma as in *P. monspeliensis* (fig. 44).

Moist rocks and banks of streams; introduced. Originally described from Europe.
Oahu: Nuuanu Pali, Hitchcock 13789. Honolulu, Heller 2210.
Maui: Haleakala, above Ukulele, Forbes 171. Lahaina, Hitchcock 14871.
Hawaii: Kanehaha, Kona, Forbes 261.
Without locality: Hillebrand.



FIGURE 44.—Polypogon lutosus. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 472.

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22. **GASTRIDIUM** Beauv.

Spikelets 1-flowered, the rachilla disarticulating above the glumes, prolonged behind the palea as a minute bristle; glumes unequal, somewhat enlarged or swollen at the base; lemma much shorter than the glumes, hyaline, broad, truncate, awned or awnless; palea about as long as the lemma. Annual grasses, with flat blades and pale, shining, spikelike panicles.

1. **Gastridium ventricosum** (Gouan) Schinz & Thell. Mitt. Bot. Mus. Univ. Zurich 58:39. 1913.

Agrostis ventricosa Gouan, Hort. Monsp. 39. pl. 1. f. 2. 1762.
Milium lendigerum L. Sp. Pl. ed. 2. 91. 1762.
Gastridium australe Beauv. Ess. Agrost. 164. 1812.
Gastridium lendigerum Desv. Obs. Angers 48. 1818.

Culms about 30 cm. tall, smooth; panicle 5 to 8 cm. long, dense and spikelike; spikelets 5 to 6 mm. long, the glumes subulate-acuminate, the second shorter; lemma much shorter than the glumes, subglobose, pubescent at apex, the awn 5 mm. long (fig. 43).

A weed in pastures; introduced. Originally described from Europe.
Oahu: Schofield Barracks, Hitchcock 14048.
Maui: Haleakala, Rock 8558; collector unknown [Faurie?] 1356.

23. **SPOROBOLUS** R. Br.

Spikelets 1-flowered, the rachilla disarticulating above the glumes; glumes awnless, usually unequal, the second often as long as the spikelet; lemma membranaceous, 1-nerved, awnless; palea usually prominent and as long as the lemma or longer; seed free from the pericarp. Annual or perennial grasses, with small spikelets in open or contracted panicles.

Plants with strong creeping rhizomes..... 1. **S. virginicus.**
Plants tufted, without rhizomes.
Inflorescence spikelike..... 2. **S. elongatus.**
Inflorescence narrow but not spikelike..... 3. **S. diander.**

1. **Sporobolus virginicus** (L.) Kunth, Rév. Gram. 1:67. 1829.

Agrostis virginica L. Sp. Pl. 63. 1753.

Plants perennial, with strong scaly creeping rhizomes; culms 10 to 30 cm. tall, glabrous, pilose at the throat but the hairs sometimes deciduous; sheaths glabrous, mostly overlapping, the blades conspicuously distichous, ascending or spreading, mostly 2 to 4 cm. long, sometimes longer, 2 to 3 mm. wide, flat or involute, firm, glabrous beneath, sometimes pilose on the upper surface; panicle spikelike, tapering above and often also below, 2 to 5 cm. long; spikelets 2 to 2.5 mm. long, pale; glumes unequal, scarcely nerved, acute, the first about two-thirds as long as the floret, the second as long as the floret; lemma and palea acutish, the lemma smooth, faintly keeled and scarcely nerved (fig. 45).

Sandy beaches, tropics of both hemispheres. Originally described from Virginia.
Oahu: Kahuku, Hitchcock 13884. Without locality, Mann & Brigham 245.
Molokai: West end, Hitchcock 15130.
Maui: Sand hills, Wilkes Expl. Exped.
Without locality: Hillebrand; "Insulis Sandwich", Faurie 1320.

2. **Sporobolus elongatus** R. Br. Prodr. Fl. Nov. Holl. 170. 1810.

Plants perennial, tufted; culms erect, glabrous, somewhat compressed, 50 to 80 cm. tall; sheaths glabrous, sparingly pilose at the throat, shorter than the internodes, exposing one, 2, or rarely 3, nodes of the culm; blades flat or usually involute, the lower elongate, 2 to 4 mm. wide, ending in a fine point, glabrous beneath; panicle spikelike, 10 to 20 cm. long, 5 mm.

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FIGURE 45.—Sporobolus virginicus. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 470.



FIGURE 46.—Sporobolus elongatus. From Hitchcock 13949, Oahu.

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thick, mostly plumbeous, interrupted below, the lower branches appressed, somewhat distant, 1 to 2 cm. long, the upper part dense; lateral panicles produced in the axils of the leaves; spikelets about 2 mm. long; glumes unequal, the first one-fourth as long as the floret, obtuse or truncate, broad, the second about half as long as the floret, acute; lemma and palea equal, nerveless; caryopsis red-brown, oblong, 1.2 mm. long (fig. 46).

This species is allied to *S. berteroanus* of the West Indies. The habit is somewhat different, because of the flattened falcate internodes and the narrow and denser panicles. As in that species the reddish fruits at maturity remain attached to the panicle by their mucilaginous coating. Our species is rarely attacked by the black fungus which gives to the allied *S. berteroanus* its name of smut grass.

Grassy slopes and savannas; apparently introduced but abundant in places. Originally described from Australia.

Oahu: Schofield Barracks, Hitchcock 13940, 13949.

Molokai: Central part, Hitchcock 15162.

Maui: Olinda, East Maui, Hitchcock 14934. Haleakala above Ukulele, East Maui, Forbes 170.

Hawaii: Kukaiau Ranch, Hitchcock 14203. Kukuihaele, Rock 4508.

3. **Sporobolus diander** (Retz.) Beauv. Ess. Agrost. 26, 147. 1812.

Agrostis diandra Retz. Obs. Bot. 5:19. 1789.

Plants perennial; culms tufted, erect from a geniculate base, slender, glabrous, 30 to 60 cm. tall; sheaths glabrous, sometimes sparsely pilose at the throat; blades flat, 1 to 2 mm. wide; panicle narrow, but loose, as much as 30 cm. long, the branches ascending or somewhat spreading, the lower 2 to 3 cm. long, the spikelets short-pediceled and clustered along these main branches; spikelets 1.5 mm. long, scarcely compressed, glabrous; glumes unequal, obtuse, or the second acutish, the first about one-fourth as long as the floret, the second about one-half as long; lemma and palea equal, obtuse or acutish; caryopsis brown, about 0.8 mm. long (fig. 47).

Allied to *S. indicus* of South America, the panicle looser and more delicate.

Grassland along streets; introduced. Originally described from India.

Oahu: Honolulu, Hitchcock 14070; Forbes 1715.

Osterdamia matrella (L.) Kuntze. Rev. Gen. Pl. 2:781. 1891. (*Agrostis matrella* L. Mant. Pl. 2:185. 1771) has been introduced as a lawn grass and was collected at Wailuku, Maui, by Faurie (no. 1329). This is a creeping grass with strong rhizomes, the flowering culms spreading or prostrate, 10 to 15 cm. long, with short distichous blades, and a narrow rather few-flowered panicle, the subsessile spikelets about 3 mm. long, these disarticulating from the pedicel, the first glume wanting, the second glume infolding the thin lemma and palea. Originally described from India.

Leptochloa virgata (L.) Beauv. Ess. Agrost. 166. 1812. (*Cynosurus virgatus* L. Syst. Nat. ed. 10. 2:87. 1759.) This was growing in Mr. Von Tempsky's garden on the Haleakala Ranch, Maui, under the name of Judd grass. An erect smooth perennial with several slender spikes along the upper part of the culm.

24. **ELEUSINE** Gaertn.

Spikelets few to several-flowered, compressed, sessile and closely imbricate, in two rows along one side of a rather broad rachis, the latter not prolonged beyond the spikelets; rachilla disarticulating above the glumes and between the florets, glumes unequal, rather broad, acute, 1-nerved, shorter than the first lemma; lemmas acute with 3 strong green nerves close together forming a keel, the uppermost somewhat reduced; seed dark brown, roughened by fine ridges,

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FIGURE 47.—Sporobolus diander. From Hitchcock 14070, Oahu.



FIGURE 48.—Eleusine indica. From U. S. Dept. Agr. Bull. 772, fig. 103.

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loosely inclosed in the thin pericarp. Annual grasses with two to several rather stout spikes, digitate at the summit of the culms, some plants with one or two spikes a short distance below, or rarely with a single terminal spike (fig. 48).

1. **Eleusine indica** (L.) Gaertn. Fruct. & Sem. 1:8. 1788. GOOSE GRASS.

Cynosurus indicus L. Sp. Pl. 72. 1753.

Plants very smooth; culms flattened, decumbent at base or prostrate-spreading; sheaths loose, overlapping, compressed; spikes 2 to 10, 3 to 7 cm. long; spikelets appressed, 3 to 5-flowered, about 5 mm. long (fig. 48).

Weed along streets; introduced. Originally described from India.
Kauai: Lihue, Forbes 735.
Oahu: Honolulu, Hitchcock 13710. Waikiki, Heller 2290.
Hawaii: Hilo, Newell in 1917. Without locality, Wilkes Expl. Exped.

25. **DACTYLOCTENIUM** Willd.

Spikelets 3 to 5-flowered, compressed, sessile and closely imbricate, in two rows along one side of the rather narrow flat rachis, the end projecting in a point beyond the spikelets; rachilla disarticulating above the first glume and between the florets; glumes somewhat unequal, broad, 1-nerved, the first persistent upon the rachis, the second mucronate or short-awned below the tip, deciduous; lemmas firm, broad, keeled, acuminate or short-awned, 3-nerved, the lateral nerves indistinct, the upper floret reduced; palea about as long as the lemma; seed subglobose, ridged or wrinkled, inclosed in a thin, early-disappearing pericarp. Annual or perennial grasses, with flat blades and two to several short thick spikes, digitate and widely spreading at the summit of the culms.

1. **Dactyloctenium aegyptium** (L.) Richt. Pl. Eur. 1:68. 1890.

Cynosurus aegyptius L. Sp. Pl. 72. 1753.

Culms ascending or prostrate, 10 to 30 cm. long; blades flat, mostly less than 10 cm. long and 4 mm. wide, more or less ciliate at base; spikes 2 to 5, 1 to 3 cm. long, rather thick, densely flowered; spikelets pectinate, 3 mm. long; palea winged on the keels (fig. 49).

A weed along streets; introduced. Originally described from "Africa, Asia, America."
Oahu: Honolulu, Hitchcock 13682. Diamond Head, Forbes 1074.

26. **CAPRIOLA** Adans.

Spikelets 1-flowered, awnless, sessile in two rows along one side of a slender continuous rachis, the rachilla disarticulating above the glumes and prolonged behind the palea as a slender naked bristle, this sometimes bearing a rudimentary lemma; glumes narrow, acuminate, 1-nerved, about equal, shorter than the floret; lemma strongly compressed, pubescent on the keel, firm in texture, 3-nerved, the lateral nerves close to the margins. Perennial, usually low, grasses, with creeping stolons or rhizomes, short blades, and several slender spikes digitate at the summit of the upright flowering culms.

1. **Capriola dactylon** (L.) Kuntze, Rev. Gen. Pl. 2:764. 1891. BERMUDA GRASS.

Panicum dactylon L. Sp. Pl. 58. 1753.

Cynodon dactylon Pers. Syn. Pl. 1:85. 1805.

Culms flattened, wiry, glabrous; ligule a conspicuous ring of white hairs; spikes 4 or 5, 3 to 6 cm. long; spikelets imbricate, 2 mm. long, the lemma longer than the glumes (fig. 50).

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FIGURE 49.—Dactyloctenium aegyptium. From U. S. Dept. Agr. Bull. 772, fig. 104.



FIGURE 50.—Capriola dactylon. From U. S. Dept. Agr. Bull. 772, fig. 105.

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Open grassland at low altitudes, a weed along streets and in lawns and gardens; introduced. Originally described from southern Europe. Native name manienie.

Kauai: Lihue, Forbes 465.

Oahu: Honolulu, Hitchcock 13708; Didrichsen 3444. Hauula, Farmer 12. Waikiki, Heller 1960. Without locality, Remy 82 (Gray Herbarium).

Hawaii: Hilo, Newell in 1917.

Without locality: Hillebrand.

27. **CHLORIS** Swartz.

Spikelets with 1 perfect floret, sessile, in two rows along one side of a continuous rachis, the rachilla disarticulating above the glumes, produced beyond the perfect floret and bearing 1 to several reduced florets consisting of empty lemmas, in some species truncate, and, if more than one, the smaller ones inclosed in the lower, forming generally a club-shaped rudiment; glumes somewhat unequal, the first shorter, narrow, acute; lemma keeled, usually broad, 1 to 5-nerved, often villous on the callus and villous or long-ciliate on the keel or marginal nerves, awned from between the short teeth of a bifid apex, the awn slender or sometimes reduced to a mucro, the sterile lemmas awned or awnless. Perennial or sometimes annual, tufted grasses, with flat blades and few to several often showy and feathery spikes aggregate at the summit of the culms.

Plants annual
- Rudiment broad and truncate ..... 1. **C. paraguayensis.**
- Rudiment narrow, acute ..... 2. **C. radiata.**

Plants perennial.
- Awn less than 2 mm. long; plants abundantly stoloniferous ..... 3. **C. gayana.**
- Awn more than 5 mm. long; plants not stoloniferous ..... 4. **C. truncata.**

1. **Chloris paraguayensis** Steud. Syn. Pl. Glum. 1:204. 1854.

Andropogon barbatum L. Mant. Pl. 2:302. 1771. Not *Andropogon barbatum* L. Syst. Nat. ed. 10. 2:305. 1759, which is *Chloris polydactyla* Swartz.

Chloris barbata Swartz, Fl. Ind. Occ. 1:200. 1797.

Plants annual; culms 30 to 60 cm. tall, glabrous; sheaths glabrous, shorter than the internodes; blades flat, mostly less than 10 cm. long; spikes few to several, 2 to 5 cm. long, erect or ascending, often a little flexuous, purplish; spikelets closely imbricate; glumes narrow, acute, the first 1.5 mm., the second 2 mm. long; fertile lemma broad, obovate, rounded at the summit, 2 mm. long, a little pilose along the keel, the callus appressed-pilose, the marginal nerves long-silky on the upper half, the slender awn about 1 cm. long; palea of fertile lemma as long and nearly as broad as the lemma, the keels marginal; rudiment about 1 mm. long, of two triangular-truncate thin sterile lemmas, one within the other on a slender stipe, lifted to about the height of the fertile lemma, the awns about 5 mm. long (fig. 51).

A weed along streets; introduced. Originally described from Paraguay.

Oahu: Honolulu, Hitchcock 13711, 14066; Faurie 1282; Newell in 1917.

2. **Chloris radiata** (L.) Swartz, Prodr. Veg. Ind. Occ. 26. 1788.

Agrostis radiata L. Syst. Nat. ed. 10. 2:873. 1759.

Plants annual; culms decumbent at base, 30 to 60 cm. long; sheaths glabrous, compressed; blades flat or folded, 5 to 15 cm. long, 2 to 4 mm. wide, scabrous; spikes ascending, slender, numerous, 4 to 8 cm. long, pubescent at the base, the rachis puberulent; glumes narrow, awn-pointed, the second 2.5 mm. long; fertile lemma firm, compressed, narrow, acute, 3 mm. long, short-pilose at base, the margins incurved, the marginal nerves short-pilose toward the tip, the awn delicate, 5 to 10 mm. long; sterile lemma narrow, acute, inclosed by the fertile lemma, the awn 3 to 5 mm. long (fig. 52).

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FIGURE 51.—Chloris paraguayensis. From Rose, Fitch & Russell 3534, St. Croix, W. Ind.



FIGURE 52.—Chloris radiata. From Sintenis 28, Porto Rico.

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A weed along streets; introduced. Originally described from Jamaica.
Kauai: Olokele Gulch, Hitchcock 15250.
Oahu: Honolulu, Hitchcock 13681, 14121. Waikiki, Heller 1963. Without locality, Remy 76 (Gray Herbarium).
Lanai: Mr. Gay's place, Hitchcock 14722.
Hawaii: Halawa, Faurie 1283.
Without locality: Hillebrand.

3. **Chloris gayana** Kunth, Rév. Gram. 1:89. 1829. RHODES GRASS.

Plants perennial, producing strong creeping stolons; culms stout, 60 to 120 cm. tall, compressed; blades elongate, scabrous, as much as 7 mm. wide; spikes ascending, rather thick, several to many, 6 to 9 cm. long; glumes unequal, rather broad, the first acute, 1.5 mm. long, the second mucronate, 2 mm. long; fertile lemma oblong, acute, 3 mm. long, the marginal nerves short-pilose below, longer-pilose above, the awn below the tip, about 2 mm. long; first sterile lemma oblong, similar in shape to the fertile lemma, 2.5 mm. long, glabrous, the awn about 1.5 mm. long, the palea as long as the lemma; second sterile lemma an oblong truncate rudiment about 1 mm. long on a slender stipe, awnless (fig. 53).

Introduced as a meadow grass and cultivated in the drier parts. Tending to become established. Originally described from Africa.
Oahu: Schofield Barracks, open grassland, becoming well established, Hitchcock 13946. Honolulu, Kalihi Valley, Hitchcock 14088.
Lanai: Upper part of mountain, Hitchcock 14641.
Maui: Without locality, Curran 18.
Hawaii: Puu Waawaa, hay field on Mr. Hind's ranch, Hitchcock 14492. Pasture on north side of Mauna Kea, Hitchcock 14296.

4. **Chloris truncata** R. Br. Prodr. Fl. Nov. Holl. 186. 1810.

Plants perennial; culms tufted, erect, or decumbent at base, 10 to 30 cm. tall; sheaths compressed; blades flat or folded, short, 1 to 2 mm. wide; spikes several in 1 or 2 whorls, finally spreading, slender, 5 to 10 cm. long, pubescent at base; spikelets 3 mm. long, narrowly wedge-shaped, appressed along the rachis; first glume narrow, acuminate, a little over 1 mm. long; second glume nearly as long as spikelet, apiculate, hyaline; fertile lemma black, oblong-cuneate, truncate at apex, short-pilose at base and appressed-ciliolate on the marginal nerves above, the awn about 1 cm. long; rudiment black, truncate-cuneate, about half as long as the spikelet and raised on a stipe of about its own length (fig. 54).

Open grassland; introduced. Originally described from Australia.
Oahu: Fort Shafter, Honolulu, Hitchcock 13849.
Also grown at United States Agricultural Experiment Station, Westgate, Oct. 9, 1915.

28. **BOUTELOUA** Lag.

Spikelets 1-flowered, with the rudiments of one or more florets above, sessile, in two rows along one side of the rachis; glumes unequal, 1-nerved, acuminate or awn-tipped, the first shorter and narrower; lemma as long as the second glume or a little longer, 3-nerved, the nerves extending into awns, the internerves usually extending into teeth; palea 2-nerved, sometimes 2-awned; rudiment various, commonly 3-awned, a second rudimentary floret present, in some species. Perennial or a few species annual, low or rather tall grasses, with two to several or many spikes racemose on a common axis, or in some species solitary, the spikelets few

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FIGURE 53.—Chloris gayana. From Hitchcock 13667, Arizona.

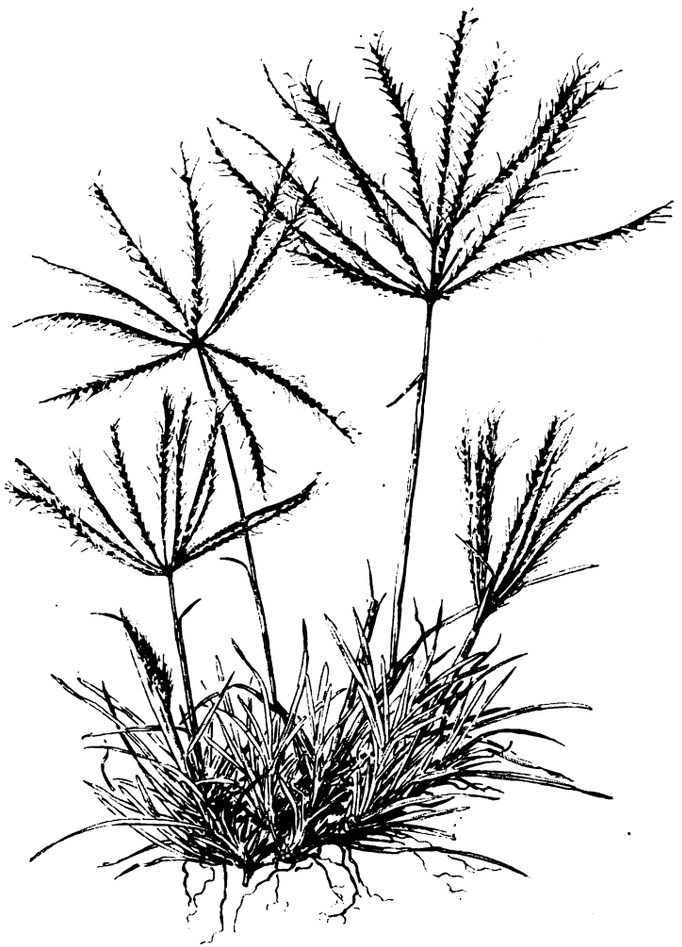


FIGURE 54.—Chloris truncata. From Hitchcock 13849, Oahu.

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to many in each spike, pectinate or more loosely arranged and appressed, the rachis of the spike usually produced beyond the insertion of the spikelets.

1. **Bouteloua curtipendula** (Michx.) Torr. in Emory, Notes Mil. Recon. 154. 1848.
Chloris curtipendula Michx. Fl. Bor. Amer. 59. 1803.

Plants perennial, tufted; culms erect, slender, 30 to 60 cm. tall; blades elongate, 2 to 3 mm. wide, scabrous; inflorescence a 1-sided raceme 10 to 20 cm. long of short deflexed spikes; spikes 8 to 10 mm. long, with few spikelets; lemma scabrous, ending in 3 short slender awns; sterile lemma with 2 acute lobes and 3 straight awns, the lateral ones much shorter than the middle awn (fig. 55).

On United States Agricultural Experiment Station grounds (substation) halfway up Mt. Tantalus. Introduced but apparently established away from original planting. Originally described from Illinois.
Oahu: Hitchcock 14075, 14064.

29. **MICROLAENA** R. Br.

Spikelets with 1 perfect terminal floret and 2 sterile lemmas below, disarticulating above the minute glumes; sterile lemmas narrow, firm, awned from the tip; fertile lemma hyaline, compressed, shorter than the sterile lemmas; palea narrow, compressed, nerveless, shorter than the lemma; lodicules 2, large, hyaline, broad. Perennial, rather low or lax grasses, with mostly flat rather short blades and narrow loose panicles, the spikelets short-pediceled and appressed along the axis or the main branches.

1. **Microlaena stipoides** (Labill.) R. Br. Prodr. Fl. Nov. Holl. 210. 1810.
Ehrhartia stipoides Labill. Nov. Holl. Pl. 1:91. pl. 118. 1804.

Culms more or less decumbent at base, glabrous; sheaths glabrous or retrorsely scabrous, shorter than the internodes; ligule a very short membrane; blades flat, spreading, mostly less than 10 cm. long, 2 to 3 mm. wide, scabrous on the margins and upper surface; panicle narrow, about 10 cm. long, mostly simple, the rather distant spikelets appressed along the slender main axis, a few short branches below with 2 or 3 spikelets; spikelets narrow, about 1 cm. long, the pedicels 1 to 2 mm. long, the rachilla somewhat elongate above the glumes and between the sterile lemmas; glumes very short, nerveless, unequal, less than 1 mm. long; sterile lemmas rather firm, narrow, 5-nerved, scaberulous on the keels, the rather prominent callus pilose with appressed hairs about 1 mm. long, the apex narrowed into a slender awn 1 to 1.5 cm. long, the first shorter; fertile lemma compressed, faintly 7-nerved, about as long as the sterile lemma and inclosed in its margins, scabrous on the keel, apiculate; palea similar to the lemma, a little shorter, nerveless; lodicules 2, prominent, broad and hyaline, irregularly triangular, about 1 mm. long; stamens 4; stigmas long and plumose (fig. 56).

Open dry forest. Originally described from Tasmania. Also in Australia, New Zealand, and the Philippines.
Hawaii: Puu Waawaa on summit of hill, Hitchcock 14465.

30. **ANTHOXANTHUM** L.

Spikelets with 1 terminal perfect floret and 2 sterile lemmas, the rachilla disarticulating above the glumes, the sterile lemmas falling attached to the fertile floret; glumes unequal, acute or mucronate; sterile lemmas shorter than the glumes, empty, awned from the back; fertile lemma shorter than the sterile ones, awnless; palea 1-nerved, rounded on the back, inclosed in the lemma. Sweet-smelling annual or perennial grasses, with flat blades and spikelike panicles.

1. **Anthoxanthum odoratum** L. Sp. Pl. 28. 1753. SWEET VERNAL GRASS.

Plants perennial; culms slender, erect, 20 to 60 cm. tall; panicle 3 to 8 cm. long, pointed; spikelets brownish green, 8 to 10 mm. long; glumes sparsely pilose; first sterile lemma short-

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FIGURE 55.—Bouteloua curtipendula. From U. S. Dept. Agr. Bull. 772, fig. 115.



FIGURE 56.—Microlaena stipoides. From Hitchcock 14465, Hawaii.

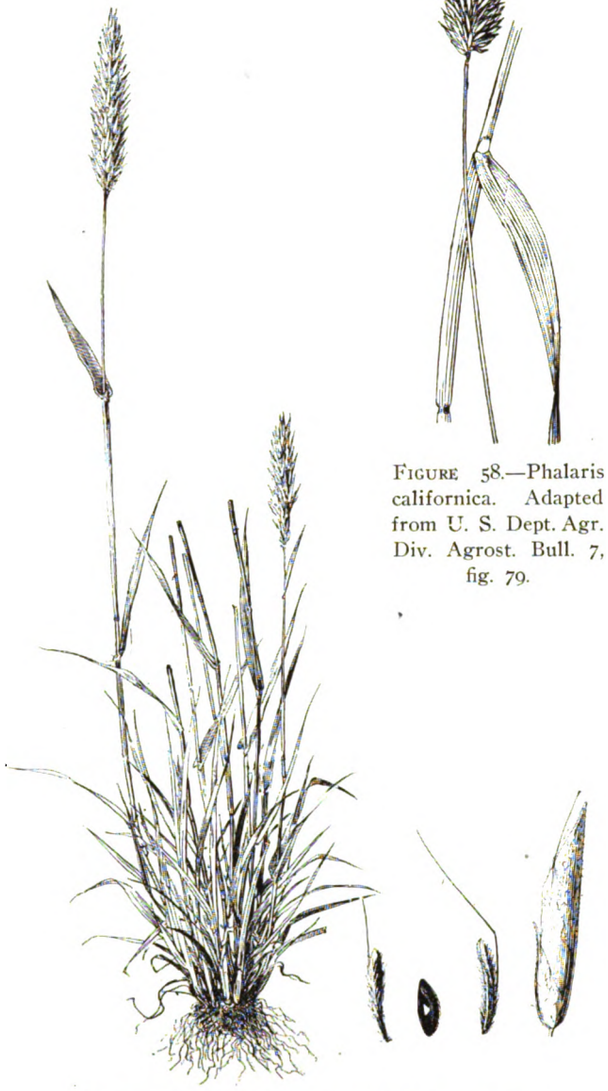


FIGURE 57.—Anthoxanthum odoratum. From U. S. Dept. Agr. Bull. 772, fig. 120.

FIGURE 58.—Phalaris californica. Adapted from U. S. Dept. Agr. Div. Agrost. Bull. 7, fig. 79.

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awned below the apex, the second bearing a strong, bent, scarcely exserted, awn near its base (fig. 57).

Pastures at medium altitudes; introduced. Originally described from Europe.
Molokai: Central part, Hitchcock 15170. Papaaloa, Forbes 96.
Hawaii: Kukaiau Ranch, Hitchcock 14212.

31. **PHALARIS** L.

Spikelets laterally compressed, with 1 terminal perfect floret and 2 sterile lemmas below, disarticulating above the glumes, arranged in usually dense spikelike panicles; glumes equal, boat-shaped, often winged on the keel; sterile lemmas reduced to 2 small scales (rarely only 1); fertile lemma coriaceous, shorter than the glumes, inclosing the faintly 2-nerved palea. Annual or perennial erect grasses, with flat blades.

Plants perennial; about 1 meter tall ..... 1. **P. californica.**
Plants annual, mostly less than 50 cm. tall.
Spikelets in groups of 7, 1 fertile surrounded by 6 sterile ..... 2. **P. paradoxa.**
Spikelets single, all alike ..... 3. **P. minor.**

1. **Phalaris californica** Hook & Arn. Bot. Beechey Voy. 161. 1841.

Plants perennial; culms erect or somewhat geniculate at base, about 1 meter tall; blades flat, rather lax, 6 to 12 mm. wide; panicle ovoid or oblong, 3 to 5 cm. long, 1.5 to 2.5 cm. thick, often purplish tinged; glumes about 6 to 7 mm. long, narrow, gradually narrowed from below the middle to an acute apex, smooth or slightly scabrous on the keel, the lateral nerves somewhat nearer the margin than the keel; fertile lemma ovate-lanceolate, about 4 mm. long, rather sparsely villous, often exposing the palea, the sterile lemmas about 1 mm. long (fig. 58).

Wet places; probably introduced. Originally described from California.
Maui: Haleakala, east part of crater, Hitchcock 14999.

2. **Phalaris paradoxa** L. Sp. Pl. ed. 2. 2:1665. 1763.

Plants annual; culms cespitose, more or less spreading at base, 30 to 50 cm. tall; panicle dense, oblong, narrowed at base, 2 to 5 cm. long, often inclosed in the uppermost enlarged sheath; spikelets finally falling from the axis in groups of 7, the central fertile, nearly sessile, the others sterile, slender-pediceled; glumes of sterile spikelets narrow, with faint lateral nerves, the keel prominently winged above, the wing extending into a more or less well-marked tooth, the apex of the glume narrowed into an acuminate point or awn, the glumes of the 4 outer sterile spikelets in the lower part of the panicle more or less deformed; glumes of the fertile central spikelet lanceolate, 6 to 8 mm. long including the awn, the lateral nerves prominent, the wing on the keel wider and toothed near summit, the apex of the glume narrowed into an awn about 2 mm. long; fertile lemma smooth and shining, 3 mm. long, the sterile lemmas obsolete.

Weed along road; introduced. Originally described from Europe.
Oahu: Nuuanu Pali, Hitchcock 13780.

3. **Phalaris minor** Retz. Obs. Bot. 3:8. 1783.

Plants annual; culms erect, 30 to 50 cm. tall; panicle ovate-oblong, 1.5 to 5 cm. long; glumes oblong, 4 to 6 mm. long, strongly winged on the keel, the green stripes on the glumes rather prominent, the wing scabrous on the margin and more or less toothed; fertile lemma ovate, acute, villous, about 3 mm. long, the sterile lemma solitary, about 1 mm. long.

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Weed in field; introduced. Originally described from Europe.
Oahu: Schofield Barracks, Hitchcock 13915.
Maui: Haleakala, Hitchcock 14988.

Rice (*Oryza sativa* L. Sp. Pl. 333. 1753) is cultivated and is occasionally found growing spontaneously in fields and ditches.

Arundinella agrostoides Trin. is included doubtfully by Hillebrand[12] but should be omitted as the locality "Oahu" is probably an error.

32. **VALOTA** Adans.

Spikelets lanceolate, in pairs, short-pediceled, in two rows along one side of a narrow rachis; first glume minute, glabrous; second glume and sterile lemma about as long as the fruit, 3 to 5 nerved, copiously silky; fertile lemma cartilaginous, lanceolate, acuminate, usually brown, the flat white hyaline margins broad. Perennial grasses, the slender racemes erect or nearly so, aggregate along the upper part of the main axis, forming a pale or brownish woolly panicle.

1. **Valota insularis** (L.) Chase, Proc. Biol. Soc. Washington 19:188. 1906. SOUR GRASS.

Andropogon insularis L. Syst. Nat. ed. 10. 2:1304. 1759.
Panicum leucophaeum H. B. K. Nov. Gen. & Sp. 1:97. 1816.

Culms erect, or decumbent at base, about 1 meter tall, glabrous; sheaths sparsely hirsute or glabrous; blades flat, elongate, 5 to 10 mm. wide; panicle 15 to 20 cm. long, nodding, the numerous racemes about 10 cm. long; spikelets narrow, about 4 mm. long, appressed along the rachis; second glume and sterile lemma obscured by the long silky tawny hairs; fruit acuminate, 3 mm. long (fig. 60).

Along roadsides and in waste places, infrequent; introduced. Originally described from Jamaica.
Oahu: Honolulu, Hitchcock 13841.

33. **SYNTHERISMA** Walt.

(Digitaria Hall.)

Spikelets solitary or in twos or threes, subsessile or short-pediceled, alternate in two rows on one side of a three-angled winged or wingless rachis; spikelets lanceolate or elliptic, plano-convex; first glume minute or wanting; second glume equaling the sterile lemma or shorter; fertile lemma cartilaginous, the hyaline margins pale. Annual or sometimes perennial, erect or prostrate grasses, the slender racemes digitate or somewhat scattered, but aggregate at the summit of the culms. Our species are all annuals.

Spikelets 1.5 mm. long, obtuse.
- Stems creeping, the sterile shoots with short broad blades 1 to 2 cm. long.. 1. **S. longiflora.**
- Stems erect, or decumbent at base; blades all linear..... 2. **S. chinensis.**

Spikelets 3 mm. long, acute.
- Racemes several, erect, remaining close together even at maturity.....3. **S. pruriens**
- Racemes ascending or spreading at maturity.
  - First glume evident, 0.5 mm. long; second glume about two-thirds as long as the spikelet, villous on the margins.....4 **S. sanguinalis.**
  - First glume wanting or only about 0.2 mm. long; second glume usually not over half as long as the spikelet.
    - Second glume acute, about half as long as the spikelet, slightly villous; racemes 2 to 4..... 5. **S. debilis.**
    - Second glume obtuse, less than one-fourth as long as the spikelet; racemes several .....6.. **S. microbachne.**

[12] Op. cit., p. 514.

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1. **Syntherisma longiflora** (Retz.) Skeels, U. S. Dept. Agr. Bur. Pl. Ind. Bull. 261:30. 1912.

Paspalum longiflorum Retz. Obs. Bot. 4:15. 1786.

Stems creeping, as much as 40 cm. long, sending up flowering culms 10 to 20 cm. tall, erect from an ascending base, glabrous, sparingly pilose at the nodes; sheaths glabrous, shorter than the internodes; ligule membranaceous, about 1 mm. long; blades ovate-lanceolate to oblong-lanceolate, 1 to 2 cm. long, 3 to 5 mm. wide, clasping at the sparsely pilose base, glabrous; racemes 2 or 3, digitate, slender, often curved, 2 to 4 cm. long, the rachis narrowly winged, glabrous; spikelets 1.5 mm. long, elliptic, acute, nearly glabrous, the longer pedicel terete, glabrous, about 1 mm. long; first glume wanting; second glume as long as the spikelet, 3-nerved; sterile lemma as long as the spikelet, 5-nerved; fruit pale, acute, as long as the spikelet (fig. 59).

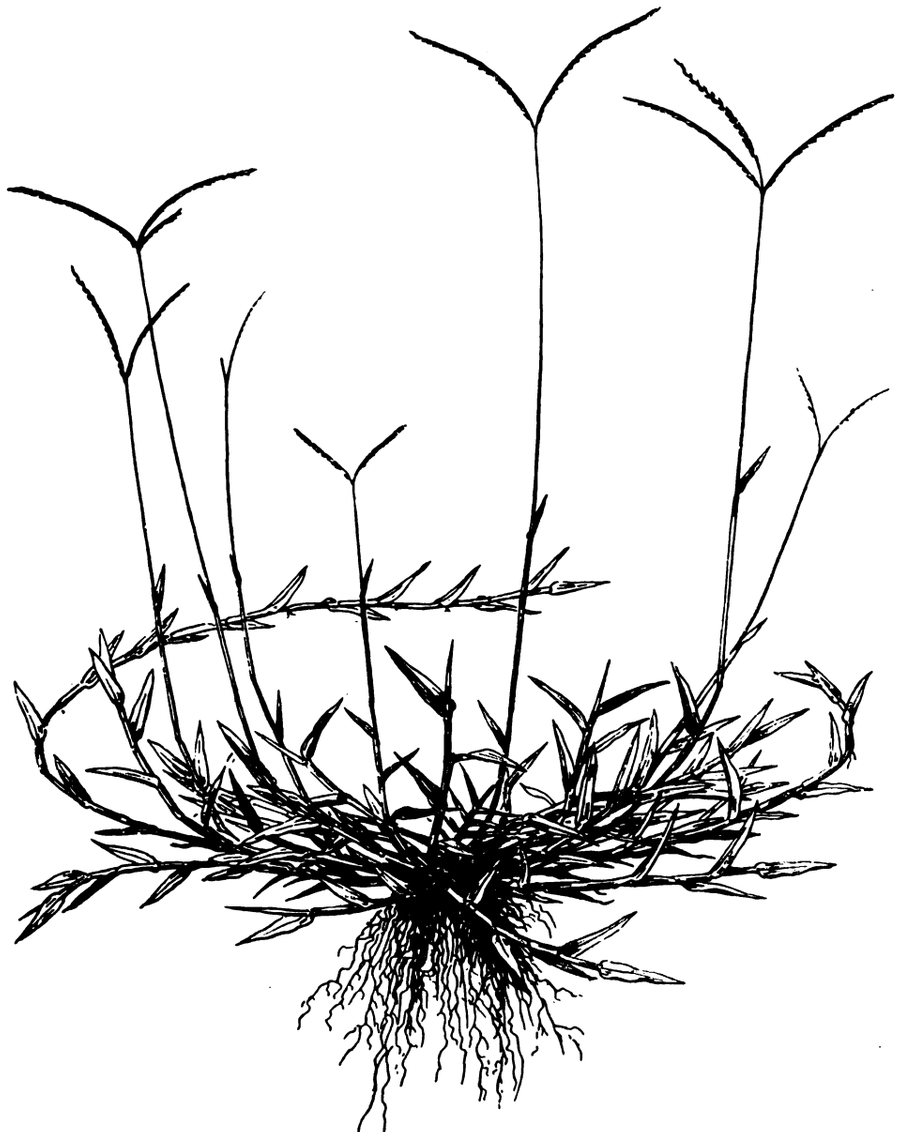


FIGURE 59.—Syntherisma longiflora. From Hitchcock 14186, Hawaii.

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FIGURE 60.—Valota insularis. From U. S. Dept. Agr. Bull. 772, fig. 129.



FIGURE 61.—Syntherisma chinensis. From Hitchcock 10328, Trinidad, W. Ind.

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Along a moist cut; introduced. Originally described from India.
Hawaii: Hilo, Hitchcock 14186.

2. **Syntherisma chinensis** (Nees).

Paspalum chinensis Nees in Hook. & Arn. Bot. Beechey Voy. 231. 1841.
Paspalum minutiflorum Steud. Syn. Pl. Glum. 1:17. 1854. Not *Paspalum minutiflorum* Desv. 1831.
Syntherisma helleri Nash, Minn. Bot. Stud. 1:798. pl. 44. 1897.

Culms erect, or decumbent at base, glabrous, slender, 20 to 60 cm. tall; sheaths glabrous, compressed-keeled; ligule a short membrane less than 1 mm. long; blades linear, 5 to 15 cm. long, 3 to 5 mm. wide, glabrous, scabrous on the margins, sparingly pilose at base; racemes 2 to 6, slender, often curved, 4 to 10 cm. long, approximate at the summit of the culm, the rachis narrowly winged, glabrous, scabrous on the margins; spikelets elliptic, 1.5 mm. long, the longer pedicel terete, scaberulous, less than 1 mm. long; first glume wanting; second glume and sterile lemma about equal, obscurely appressed-silky between the nerves, the glume 3-nerved, the lemma 5-nerved; fruit acute, as long as spikelet, brown (fig. 61).

This species was referred to *S. longiflora* (Retz.) Skeels by Hitchcock and Chase,[13] to *Digitaria violascens* Link by Merrill,[14] and to *Panicum filiforme* L. by Hillebrand[15] as is shown by a specimen in the Gray Herbarium from a "Valley behind Honolulu, Oahu," collected by the Wilkes Expedition and cited by Hillebrand.

A weed in fields, grassland and waste places; introduced. Originally described from China.
Kauai: Olokele Gulch, Hitchcock 15260.
Oahu: Honolulu, Hitchcock 13712; Hauula, Farmer 16. Kalihi Valley, Hitchcock 14107. Mt. Tantalus, Hitchcock 13863. Schofield Barracks, Hitchcock 13941, 13977. Pauoa, Heller 2321 (type collection of *Syntherisma helleri*).
Molokai: Pukoo, Hitchcock 15065. Kahanui, Forbes 261.
Maui: Olinda, Hitchcock 14937.
Hawaii: Kilauea, Faurie 1300. Hilo, Hitchcock 14169, 14188; Newell in 1917.

3. **Syntherisma pruriens** (Trin.) Arthur, Torreya 19:83. 1919.

Panicum pruriens Trin. Gram. Pan. 77. 1826.
Digitaria consanguinea Gaud. in Freyc. Voy. Uran. Bot. 410. 1830.
Digitaria pruriens Busse in Miq. Pl. Jungh. 379. 1854.
Paspalum sanguinale var. *pruriens* Hook. f. Fl. Brit. Ind. 7:15. 1896.
Syntherisma consanguinea Skeels. U. S. Dept. Agr. Bur. Pl. Ind. Bull. 282:33. 1913.

Culms decumbent at base, as much as 1 meter tall, glabrous; sheaths pilose, often densely so; ligule rather prominent, membranaceous, 2 mm. long; blades flat, lax, mostly 10 to 15 cm. long, about 5 to 10 mm. wide, scabrous, hispid or sometimes velvety-pubescent; racemes several at the summit of the culm, erect, scarcely spreading even at maturity, 10 to 15 cm. long; rachis winged, the margins scabrous; spikelets lanceolate, acute, 3 mm. long; first glume wanting, or a mere ridge, sometimes as much as 0.2 mm. long; second glume oblong, obtuse, about 1 mm.

[13] Hitchcock, A. S., and Chase, Agnes, Grasses of the West Indies: Contr. U. S. Nat. Herb. Vol. 18, p. 294, 1917.
[14] Merrill, E. D., An enumeration of Philippine Graminae: Philippine Jour. Sci. Vol. 1, Suppl. 5, p. 347, 1906.
[15] Op. cit., p. 495.

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FIGURE 62.—Syntherisma pruriens. From Hitchcock 14190, Hawaii.



FIGURE 63.—Paspalum fimbriatum. From Small & Carter 8926, Bahamas.

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long, villous on the margins; sterile lemma as long as the spikelet, about 5-nerved, the lateral nerves villous; fertile lemma as long as the spikelet, pale (fig. 62).

This species differs from *S. sanguinalis* in the erect racemes and the shorter glumes.

A weed in shady moist rich soil; introduced. Originally described from Hawaii and the Marquesas Islands ("Inss. Sandw. et Marchion.").

Kauai: Kaloko Reservoir, Forbes 582. Olokele Gulch, Hitchcock 15257.

Oahu: Makiki, Heller 1972. Honolulu, Hitchcock 13735. Mt. Tantalus, Hitchcock 13862.

Hawaii: Hilo, Hitchcock 14190; Newell in 1917. Kukuihaele, Rock 4545. Southeast coast of Puna, Wilkes Expl. Exped. (Gray Herbarium. In this specimen the sheaths are glabrous or very sparsely beset with papillae.)

4. **Syntherisma sanguinalis** (L.) Dulac, Fl. Haut. Pyr. 77. 1867.

Panicum sanguinale L. Sp. Pl. 57. 1753.

Digitaria sanguinalis Scop. Fl. Carn. ed. 2. 1:52. 1772.

Culms usually decumbent-spreading, often rooting at the nodes, as much as 1 meter long, glabrous; sheaths, at least the lower, papillose-hispid; ligule a short membrane; blades flat, lax, 5 to 15 cm. long, 5 to 10 mm. wide, scabrous, more or less pilose at base; racemes several, mostly 3 to 10, rarely 2, digitate or with 1 or 2 fascicles below the summit, 3 to 15 cm. long, more or less spreading at maturity; rachis winged, the green wings about as broad as the whitish center, scabrous on the margins; spikelets 3 mm. long, lanceolate, acute; first glume evident, triangular-acute, about 0.5 mm. long; second glume narrow, 3-nerved, about two-thirds as long as the spikelet, prominently villous on the margins and often also on the internerves; sterile lemma as long as the spikelet, 5 to 7-nerved, usually 3 nerves on the flat face of the spikelet, the marginal nerves more or less silky-villous, the hairs appressed at first, often spreading and prominent at maturity; fertile lemma pale, acute (fig. 64).

A weed in fields and waste places; introduced. Originally described from Europe.

Kauai: Lihue, Forbes 466.

Oahu: Honolulu, Forbes 1714; Hitchcock 13683. Slopes of Kaala, Forbes in 1912. Pauoa, Heller 2320.

Hawaii: Hilo, Hitchcock 14191; Newell in 1917. Without locality, Mann & Brigham.

5. **Syntherisma debilis** (Desf.) Skeels, U. S. Dept. Agr. Bur. Pl. Ind. Bull. 261:30. 1912.

Panicum debile Desf. Fl. Atl. 1:59. 1798.

Digitaria debilis Willd. Enum. Hort. Berol. 91. 1809.

Culms weak and slender, erect or decumbent at base; sheaths glabrous or sparsely pilose; ligule thin, truncate-erose, 2 mm. long; blades flat, lax, scabrous, 5 to 10 cm. long, 2 to 5 mm. wide; racemes mostly 2 to 4, ascending or spreading, 2 to 3 approximate at the summit and sometimes one a short distance below, 3 to 8 cm. long; rachis narrow, 0.5 mm. wide, narrowly winged, scabrous; spikelets lanceolate, acute, 3 mm. long; first glume wanting or only about 0.2 mm. long; second glume about half as long as the spikelet, narrow, acute, slightly villous along the margin; sterile lemma as long as the spikelet, about 7-nerved, glabrous; fertile lemma pale.

A weed in waste places; introduced. Originally described from the Mediterranean region.

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FIGURE 64.—Syntherisma sanguinalis. From U. S. Dept. Agr. Bull. 772, fig. 130.



FIGURE 65. — Paspalum distichum. From U. S. Dept. Agr. Div. Agrost. Bull. 7, fig. 25.



FIGURE 66.—Stenotaphrum secundatum. From U. S. Dept. Agr. Bull. 772, fig. 132.

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Hawaii: Hilo, Newell in 1917.

6. **Syntherisma microbachne** (Presl).

Panicum microbachne Presl, Rel. Haenk. 1:298. 1830.

Culms ascending from a spreading and rooting base, as much as 1 meter long; sheaths papillose-hispid; ligule thin, truncate-erose, prominent, 3 mm. long; blades flat, lax, narrowed at base, 10 to 20 cm. long, more or less pilose; racemes several, 7 to 15 cm. long, ascending or spreading, somewhat scattered, the main axis 3 to 5 cm. long; rachis winged, scabrous; spikelets lanceolate, acute, 3 mm. long; first glume wanting or a mere ridge or a minute bract 0.2 mm. long; second glume oblong, obtuse, about 0.5 mm. long; sterile lemma slightly exceeding the spikelet, 7-nerved, two pairs of nerves close together on the infolding edges, the margins silky-pubescent; fertile lemma pale.

This species has the aspect of *S. sanguinalis* but differs in the short glumes.

A weed in gardens; introduced. Original locality unknown, probably the Philippines.

Hawaii: Hilo, Newell in 1917.

34. **STENOTAPHRUM** Trin.

Spikelets embedded in one side of an enlarged and flattened corky rachis disarticulating at maturity, the spikelets remaining attached; first glume small; second glume and sterile lemma about equal, the latter with a palea or staminate flower; fertile lemma chartaceous. Creeping stoloniferous perennials, with short flowering stems, rather broad and short obtuse blades, and terminal and axillary racemes.

1. **Stenotaphrum secundatum** (Walt.) Kuntze, Rev. Gen. Pl. 2:794. 1891.

Ischaemum secundatum Walt. Fl. Carol. 249. 1788.

Stenotaphrum americanum Schrank, Pl. Rar. Hort. Monac. pl. 98. 1819.

Plants extensively creeping, glabrous, the stolons with long internodes and short leafy branches; sheaths equitant; blades short, obtuse; flowering culms 10 to 30 cm. tall, the blades commonly 10 to 15 cm. long; racemes terminal and axillary, 5 to 10 cm. long (fig. 66).

Grassy slopes; sometimes near the seashore. Tropical shores of both hemispheres.

Oahu: Nuuanu Pali, Heller 2359; Forbes 1522; Hitchcock 13768. Valley behind Honolulu, Wilkes Expl. Exped. Without locality, Mann & Brigham 88.

Molokai: Pukoo, Hitchcock 15048.

Hawaii: Halawa, Faurie 1348; Hilo, Hitchcock 14152; Newell in 1917.

Without locality: Hillebrand 490.

35. **PASPALUM** L.

Spikelets plano-convex, usually obtuse, subsessile, solitary or in pairs, in two rows on one side of a narrow or dilated rachis, the back of the fertile lemma toward it; first glume generally wanting; second glume and sterile lemma commonly about equal, the former rarely wanting; fertile lemma usually obtuse, chartaceous-indurate, the margins inrolled. Mostly perennials, with one to many spikelike racemes, these single or paired at the summit of the culms or racemosely arranged along the main axis.

Plants annual; spikelets with a broad stiff lacerate margin..... 1. **P. fimbriatum.**

Plants perennial; spikelets not lacerate-margined.

Racemes 2, conjugate at the summit of the culm, rarely a third below.

First glume present on at least some of the spikelets; spikelets elliptic..... 2. **P. distichum.**

First glume wanting; spikelets orbicular in outline..... 3. **P. conjugatum.**

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FIGURE 67.—Paspalum conjugatum. From Baker 90, Cuba.



FIGURE 68.—Paspalum orbiculare. From Hitchcock 14192, Hawaii.

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Racemes more than 2, racemosely arranged.
Spikelets glabrous..... 4. **P. orbiculare.**
Spikelets pubescent.
Spikelets 3 to 3.5 mm. long; racemes few to several, more or less spreading..... 5. **P. dilatatum.**
Spikelets 2 mm. long; racemes usually numerous, suberect..... 6. **P. larranagai.**

1. **Paspalum fimbriatum** H. B. K. Nov. Gen. & Sp. 1:93. 1816.

Plants annual; culms erect, rather soft, 30 to 60 cm. tall; sheaths glabrous; blades flat, glabrous, 5 to 20 cm. long, 5 to 10 mm. wide; racemes few, erect or ascending, 3 to 5 cm. long, the rachis nearly 2 mm. wide; spikelets orbicular-ovate, glabrous, 2 mm. long, with a broad, stiff, lacerate margin (fig. 63).

A weed along roadsides; introduced. Originally described from Colombia.
Oahu: Honolulu, Hitchcock 13672, 15561.

2. **Paspalum distichum** L. Syst. Nat. ed. 10. 2:855. 1759.

Culms erect from a decumbent rooting base, with numerous creeping rhizomes, glabrous, or the nodes pubescent, 30 to 60 cm. tall; sheaths glabrous or pubescent; blades flat, glabrous, or rarely pubescent, 5 to 10 cm. long, the upper shorter; racemes commonly 2, one sessile, the other slightly peduncled, in some plants a third below these, all more or less pilose at base, ascending or appressed, 3 to 5 cm. long; spikelets elliptic, 3 mm. long; first glume variable in length, or wanting on the lower spikelets, glabrous; second glume pubescent; sterile lemma glabrous (fig. 65).

Marshes near sea; probably introduced. Tropics of both hemispheres. The source of Linnaeus's specimen is unknown.
Oahu: Waikiki, Hitchcock 13803.

3. **Paspalum conjugatum** Bergius, Act. Helv. Phys. Math. 7:129. 1762. HILO GRASS.

Culms erect from a decumbent base mostly 30 to 60 cm. tall, producing extensively creeping leafy stolons; sheaths glabrous; blades flat, 5 to 15 cm. long, 5 to 10 mm. wide; racemes 2, conjugate, slender and spreading, 5 to 10 cm. long or even longer, villous at the base, the rachis about 0.5 mm. wide; spikelets yellow, orbicular-ovate, about 1.5 mm. long, sparsely silky-villous along the margin (fig. 67).

Roadsides, waste places and moist grassland; introduced. Very abundant in the zone below moist forests. Tropics of both hemispheres. Originally described from Dutch Guiana.
Oahu: Honolulu, Hitchcock 13729, 14067. Nuuanu Valley, Forbes in 1908. Slopes of Makiki, Heller 1975. Hauula, Farmer in 1895.
Hawaii: Paauhau, Rock in 1909. Hilo, Hitchcock 14182; Newell in 1917.
Without locality: Hillebrand 492.

4. **Paspalum orbiculare** Forst. Florul. Ins. Austr. Prodr. 7. 1786.

Plants perennial, glabrous throughout; culms erect, as much as 1 meter tall; blades narrow, erect or ascending, 10 to 25 cm. long, 5 to 8 mm. wide, flat; racemes mostly 4 to 6, spreading, 3 to 5 cm. long, distant on the axis 1 to 3 cm., the rachis 1 mm. wide; spikelets tawny or brownish, closely imbricate, glabrous, broadly elliptic, 2 mm. long; fruit brownish (fig. 68).

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FIGURE 69.—Paspalum dilatatum. From Hitchcock in 1903, Louisiana.



FIGURE 70.—Paspalum larranagai. From Chase 4388, Louisiana.

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Moist grassy slopes, common in the belt below the forest; apparently introduced. Originally described from the Society Islands.

Kauai: Lihue, Forbes 479.

Oahu: Hauula, Farmer 11. Nuuanu Pali, Hitchcock 13792. Makiki, Heller 1971. Schofield Barracks, Hitchcock 13930, 13935, 13978. Mountains east of Schofield Barracks, Hitchcock 14020. Mt. Tantalus, Hitchcock 13879. Manoa Valley, Hitchcock 13730. Honolulu, Forbes 1717. Without locality, Mann & Brigham 59; Remy 103; Seeman 2249 (last two in Gray Herbarium).

Molokai: Pukoo, Hitchcock 15054.

Hawaii: Hilo, Hitchcock 14192; Newell in 1917. Kukuihaele, Rock 4527.

5. **Paspalum dilatatum** Poir. in Lam. Encycl. 5:35. 1804.

Plants perennial; culms erect, 50 to 100 cm. tall; sheaths glabrous, or the lower villous; blades glabrous, flat, 10 to 25 cm. long, mostly 5 to 8 mm. wide, often pilose at base; racemes mostly 4 to 6, 3 to 7 cm. long, rather lax and spreading, pilose at the base, the lower distant 2 to 3 cm., the rachis 1 mm. wide; spikelets ovate, 3 to 3.5 mm. long, silky-villous on the margins (fig. 69).

Along roadsides and in grassland; escaped from cultivation. Originally described from Argentina.

Kauai: Lihue, Forbes 737.

Oahu: Honolulu, near United States Experiment Station, Hitchcock 14072. Schofield Barracks, Hitchcock 13981.

Molokai: Central part, Hitchcock 15153.

Hawaii: Papaaloa, Forbes 325. Kukaiau Ranch, Hitchcock 14214. Hilo, Newell in 1917.

This species is proving of value as a pasture grass in the grazing areas of the southern islands at medium altitudes, 2000 to 6000 feet.

6. **Paspalum larranagai** Arech. Ann. Mus. Nac. Montevideo 1:60. pl. 2. 1894.

Paspalum vaseyanum Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 17:32. fig. 328. 1899.

Plants perennial; culms erect, 1 to 1.5 meters tall; sheaths glabrous, or the lower hispid, pilose around the throat; blades flat, 15 to 30 cm. long, about 1 cm. wide, glabrous; inflorescence narrow, virgate, the racemes several to many, appressed or ascending, 3 to 10 cm. long, the rachis 1 mm. wide; spikelets ovate, 2 mm. long, densely long-silky on the margins (fig. 70).

This species differs from *P. dilatatum* in the more numerous racemes, virgate panicle, and smaller and more silky spikelets. It is found in the United States from North Carolina to Texas. Probably introduced.

Along roadside; introduced or escaped from cultivation. Originally described from Uruguay.

Oahu: Manoa Valley, Hitchcock 13737, 14081.

36. **PANICUM** L.

Spikelets more or less compressed dorsiventrally, arranged in open or compact panicles, rarely in racemes; glumes 2, herbaceous, nerved, commonly very unequal, the first generally minute, the second typically equaling the sterile lemma, the latter of the same texture and simu-

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lating a third glume, bearing in its axil a membranaceous or hyaline palea and sometimes a staminate flower, the palea rarely wanting; fertile lemma chartaceous-indurate, typically obtuse, the nerves obsolete, the margins inrolled over an inclosed palea of the same texture, a lunate line of thinner texture at the back just above the base, the rootlet protruding through this at germination. Annual or perennial grasses, of various habit.

Plants annual.
- Spikelets glabrous ..... 1. **P. fauriei.**
- Spikelets pubescent.
  - Spikelets densely long-villous.
    - Culms and leaves glabrous or puberulent, the nodes bearded ..... 2. **P. beecheyi.**
    - Culms and leaves densely soft-villous ..... 3. **P. torridum.**
  - Spikelets sparsely short-villous or densely long-villous only at the tip.
    - Culms and leaves puberulent or glabrous.
      - Spikelets with a tuft of long hairs at apex; leaves puberulent ..4. **P. nubigenum.**
      - Spikelets sparsely villous all over; leaves glabrous ..... 5. **P. kauaiense.**
    - Culms and leaves villous or hispid.
      - Leaves papillose-hispid; spikelets acuminate, 2.5 mm. long ..... 6. **P. pellitum.**
      - Leaves densely short-villous; spikelets acutish, 1.5 mm. long 7. **P. lanaiense.**

Plants perennial.
- Rhizomes or stout stolons present.
  - Panicle made up of several densely flowered racemes; stems decumbent and rooting at base, sending out stout stolons ..... 9. **P. barbinode.**
  - Panicle open; creeping rhizomes present.
    - Fertile lemma smooth; culms mostly single ..... 8. **P. repens.**
    - Fertile lemma minutely transversely rugose; culms tufted ..... 10. **P. maximum.**
- Rhizomes and stout stolons wanting.
  - First glume as long as the spikelet or a little shorter, acuminate.
    - Blades glabrous, flat, about 1 cm. wide ..... 11. **P. nephelophilum.**
    - Blades pubescent, flat or involute.
      - Blades 1 to 1.5 cm. wide, velvety-pubescent, flat ..... 12. **P. kaalaense.**
      - Blades mostly less than 5 mm. wide, pilose hirsute, flat or involute.
        - Spikelets about 2 mm. long; blades mostly flat, lax ....13. **P. xerophilum.**
        - Spikelets about 3 mm. long; blades often involute, stiff..14. **P. tenuifolium.**
  - First glume short, in one species as much as half or two-thirds as long as the spikelet, obtuse; plants forming low dense tussocks or mats in bogs.
    - Blades conspicuously ciliate, broad, short, closely imbricate ..... 15. **P. isachnoides.**
    - Blades not ciliate.
      - Spikelets 2 mm. long or a little less, the first glume less than half as long; plants in close dense tufts, the blades short and spreading, closely imbricate ..... 16. **P. imbricatum.**
      - Spikelets more than 2 mm. long, the first glume short or as much as two-thirds the length of the spikelet; plants less densely tufted and blades as a rule not closely imbricate.
        - Spikelets about 3 mm. long; first glume short ....17. **P. hillebrandianum.**
        - Spikelets 2.2 to 2.5 mm. long; first glume short or long.
          - First glume about one-fourth the length of the spikelet; fruit nearly as long as the second glume ..... 18 **P. forbesii.**
          - First glume half to two-thirds as long as the spikelet; fruit much shorter than the second glume ..... 19. **P. cynodon.**

1. **Panicum fauriei** sp. nov.

Plants annual, bushy-branched; culms puberulent, branched at all the nodes, 10 to 15 cm. tall; sheaths puberulent; ligule a densely ciliate membrane, the hairs nearly 1 mm. long; blades flat or more or less involute, 2 to 5 cm. long, about 1 mm. wide, appressed-hispidulous beneath, appressed villous on upper surface; panicles numerous, narrow, rather few-flowered, 1 to 3 cm.

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long, yellowish, the axis and appressed pedicels angled, short-villous with ascending hairs; spikelets glabrous, about 2 mm. long; glumes equal, lanceolate, acute, 5-nerved; sterile lemma a little shorter than the glumes, rather thin, 5-nerved, the palea oval, about half as long as the lemma; fertile lemma acute, 1.5 mm. long; palea nearly hidden by the margins of the lemma (fig. 71).

Type in the U. S. National Herbarium, no. 950341, collected at Halawa, Island of Hawaii, June, 1909, by Abbé Faurie (no. 1318).

There are no data on the labels to indicate the habitat of the specimens, except from Hitchcock's no. 15145, which grew on a sandy seabeach.

Dr. Stapf has kindly sent me a fragment from a specimen in the Kew Herbarium labeled "Sandhills. Wailuku, Maui, Wilkes Exped." This appears to be the same as the specimen listed below which is without data other than "Sandwich Islands," but the character of the label and the handwriting indicate a collection of the Wilkes Expedition. In the Gray Herbarium is a duplicate of the one in the Kew Herbarium.

Molokai: West end, sandy beach, Hitchcock 15145.
Hawaii: Halawa, Faurie 1318.
Without locality: "Sandwich Islands," U. S. National Herbarium no. 974867.



FIGURE 71.—Panicum fauriei. From the type specimen.



FIGURE 72.—Panicum nubigenum. From Forbes 2447, Oahu.

2. **Panicum beecheyi** Hook. & Arn. Bot. Beechey Voy. 100. 1841.

Plants annual; culms branching and spreading, 20 to 30 cm. tall, glabrous, scaberulous, or puberulent, the nodes villous; sheaths glabrous, shorter than the internodes; ligule a very short membrane with a line of hairs about 1 mm. long; blades glabrous or scaberulous, 4 to 10 cm. long, 2 to 4 mm. wide; panicles numerous, narrow, lanceolate or linear, 5 to 10 cm. long, white or tawny, more or less inclosed in the uppermost sheaths, the axis and branches angled,

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FIGURE 73.—Panicum beecheyi. From Munro in 1917, Lanai.



FIGURE 74.—Panicum torridum. From Munro in 1916, Lanai.



FIGURE 75.—Panicum pellitum. From Rock 8708, Maui.

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scabrous and somewhat villous; spikelets acuminate, 4 mm. long, the lower half hidden by the dense pubescence; glumes equal, 5-nerved, acuminate, the lower two-thirds densely long-villous, the hairs spreading, 1 to 2 mm. long, the upper third pubescent only; sterile lemma a little shorter than the glumes, 7-nerved, pubescent, or appressed-villous toward the apex, the palea wanting; fertile lemma rather thin, oblong-elliptic, 2 mm. long, the palea enclosed only at the margins (fig. 73).

Open dry plains of lee side. Originally described from the "Sandwich Islands."

Molokai: North coast, G. C. Munro in 1903.

Lanai: Kahalepaloa, Munro 6 and 6b in 1917. Maneli, Munro in 1917; May 2, 1918.

3. **Panicum torridum** Gaud. in Freyc. Voy. Uran. Bot. 411. 1830.

Panicum cinereum Hillebr. Fl. Haw. Isl. 500. 1888.

Plants annual; culms erect, or branched and decumbent at base, 20 to 60 cm. tall, or even taller, densely soft-pubescent or villous; sheaths and blades soft-pubescent or villous like the culms; ligule a short ciliate membrane about 1 mm. long; blades 10 to 20 cm. long, as much as 1 cm. wide; panicle green or tawny, oblong-elliptic, rather densely flowered, 3 to 15 cm. long, 1 to 4 cm. wide, the approximate branches ascending, closely flowered; spikelets 3 mm. long, acuminate; glumes nearly equal, acuminate, the first a little shorter, 3 to 5-nerved, the second 5 to 7-nerved, both villous with ascending or spreading hairs 2 to 3 mm. long from papillae, the hairs not dense enough to hide the glumes; sterile lemma acute, as large as the first glume except the acuminate point, 7-nerved, glabrous, or sparsely villous on upper part, the palea triangular-acute, about half as long as the lemma; fertile lemma 1.5 mm. long, the palea inclosed only at the margins (fig. 74).

Hillebrand describes this species as having a hairy sterile lemma. In our specimens the sterile lemma is usually glabrous. In some specimens, *e. g.*, Wilkes Exped., labeled "P. pellitum," and Forbes 2415, which appear to differ in no other respect, the sterile lemma is pilose on the upper part.

We have seen no authentic specimens of *Panicum cinereum,* though a Mann and Brigham specimen has been so labeled (cited below). From the description it appears to be referable to *P. torridum,* except for the peculiar ligule. Hillebrand says, "sheath ending in the blade with a broad beak-like truncate projection of about 6‴ [6 lines or 12 mm.] in length, the ligule forming a thick woolly border to it." This may be an abnormality or his specimen might have included an admixture of something else.

Dry plains, chiefly on lee side of islands. Originally described from "insulis Sandwicensibus." *Panicum cinereum* was described from "Maui! Haleakala (Prof. Alexander)."

Oahu: Koko Head, Mann & Brigham; Forbes 1454, 2415, 2455, 2449. Laie, Mann & Brigham. Waialua Mountains, Mann & Brigham 272.

Molokai: Kauluwai, Rock 8704; Ka Lae o Ka Laau, Rock 2545.

Lanai: G. C. Munro, March 31, 1914; Forbes 150; Miki, G. C. Munro, December, 1916; west end of island, Hitchcock 14719; Nahua, G. C. Munro, December, 1916.

Maui: Sand hills, East Maui. Wilkes Expl. Exped.

Hawaii: Without locality, Mann & Brigham.

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FIGURE 76.—Panicum kauaiense. From the type specimen.



FIGURE 77.—Panicum repens. From Hitchcock 14154, Hawaii.

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4. **Panicum nubigenum** Kunth, Enum. Pl. 1:98. 1833.

Panicum montanum Gaud. Voy. Uran. Bot. 411. 1830 (title page 1826). Not *Panicum montanum* Roxb. 1820.

Neurachne montanum Gaud. Voy. Uran. Bot. Atlas pl. 26. 1830.

Plants annual; culms commonly much branched and spreading, 10 to 30 cm. tall, puberulent, more or less villous at the nodes; sheaths puberulent; ligule a dense line of hairs 1 to 2 mm. long; blades flat or involute, mostly less than 10 cm. long, 1 to 2 mm. wide, puberulent beneath, pilose on the upper surface, subulate-pointed; panicles numerous, greenish or tawny, narrow, 1 to 5 cm. long, usually included at base in the uppermost sheath, the branches appressed, angled, pilose; spikelets about 2.5 mm. long, acuminate; glumes pubescent, the acuminate apex pilose, the erect hairs forming a terminal tuft, the first a little longer, 5-nerved, the second 7-nerved; sterile lemma a little shorter than the glumes, glabrous, 7-nerved, the palea elliptic, one-third as long as the lemma; fertile lemma 1.5 mm. long, 7-nerved, the palea inclosed at the margins (fig. 72).

Dry plains and slopes. Originally described from "Insulis Sandwicensibus."

Oahu: Mokolii Island, Rock 12766; Koko Head, Forbes 2414, 2447.

Molokai: Without locality, Stokes in 1909.

Lanai: Mamali, G. C. Munro, April 23, 1917. Kahalepaloa, G. C. Munro, Mar. 6, 1917.

Hawaii: Without locality, Wilkes Explor. Exped.

5. **Panicum kauaiense** sp. nov.

Plants annual, glabrous except the spikelets; culms branching at base, 30 cm. tall; ligule about 0.5 mm. long, a short membrane dissected into hairs; blades flat, involute at the long and slender point, 10 to 15 cm. long, 1 to 3 mm. wide; panicles tawny, narrow, 5 to 8 cm. long, the axis and branches scabrous, the lower branches as much as 5 cm. long; spikelets narrow, acuminate, 3 mm. long, pubescent, appressed along the branches; glumes acuminate, pilose, the hairs ascending as much as 1 mm. long; first glume a little shorter than the second, about 5-nerved, the second 7-nerved; sterile lemma intermediate in length between the glumes, glabrous, 7-nerved, the palea narrow, about one-fourth as long as the lemma; fertile lemma narrow, acute, 1.7 mm. long (fig. 76).

Type in the U. S. National Herbarium, no. 836228, collected in Haupu Range, near Nawiliwili Bay, Kauai, Hawaiian islands, October 31, 1916, by C. N. Forbes (no. 703).

A collection from East Maui by the Wilkes Expedition appears to be this species but differs in having the leaves minutely hispidulous and the nodes slightly villous.

6. **Panicum pellitum** Trin. Gram. Pan. 198. 1826; Sp. Gram. 2: pl. 237. 1829.

Panicum gossypina Hook. & Arn. Bot. Beechey Voy. 100. 1841.

Plants annual; culms erect or decumbent at base, 30 to 50 cm. tall, glabrous or pubescent, the nodes pilose; sheaths papillose-pilose or glabrescent; ligule a line of hairs 1 mm. long; blades flat, 5 to 15 cm. long, as much as 5 mm. wide, pilose; panicle 10 to 15 cm. long, rather loose, the branches ascending, as much as 10 cm. long; spikelets appressed, acuminate, 2 mm. long or, because of the longer point, 3 mm. long; glumes about equal, pilose on the upper part with a few hairs 1 mm. long from a papillose base, the first 3-nerved, the second 5-nerved; sterile lemma a little shorter than the glumes, glabrous, 7-nerved, the palea oval, one-third as long as the lemma; fertile lemma 1.2 mm. long (fig. 75).

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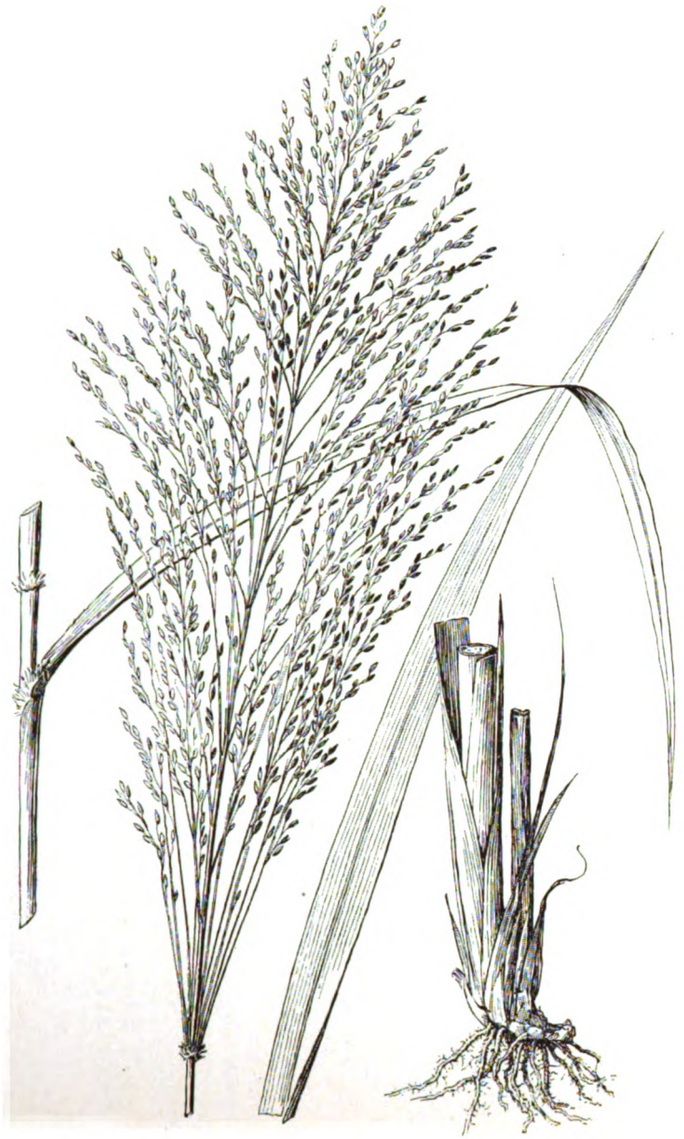


FIGURE 78.—Panicum maximum. From Combs & Baker 1170, Cuba.



FIGURE 79.—Panicum barbinode. From Hitchcock 9693, Jamaica.

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Originally described from "Inss. Sandw. (Chamisso)."
Maui: Haleakala, Rock 8708.

7. **Panicum lanaiense** nom. nov.

Panicum affine Hook. & Arn. Bot. Beechey Voy. 100. 1841. Not *Panicum affine* Poir. 1816, nor Nees 1829.

Plants annual; culms 20 to 40 cm. tall, erect or decumbent at base, sometimes much branched at base, villous; sheaths villous; ligule a short ciliate membrane; blades ascending, flat, villous on both surfaces, 10 to 15 cm. long, 2 to 5 mm. wide; panicles numerous, open, 3 to 10 cm. long, the branches pilose, ascending or spreading; spikelets 1.5 mm. long, acutish, appressed along the branchlets; glumes about equal, pilose, especially toward the upper part, with a few long hairs as much as 1 mm. long, the first 3-nerved, the second 5-nerved; sterile lemma 7-nerved, glabrous, about as long as the glumes, the palea oval, about one-third as long as the lemma; fertile lemma broadly elliptic, 1.2 mm. long, turgid (fig. 86).

Panicum affine Hook. & Arn. was described from "Sandwich Islands."

Open ground in dry places on lee side of the islands. *Panicum affine* Hook & Arn. was described from "Sandwich Islands."
Kauai: Waimea, 2000 to 3000 feet, Mann & Brigham 383.
Lanai: Miki Plain, Munro in 1916.
Maui: Sand hills, Wailuku, Wilkes Expl. Exped.
Without locality: Hance 4926 (Gray Herbarium). In the Gray Herbarium is a specimen with glabrous spikelets bearing a printed label, "Panicum pellitum Trin. cum varr. Ins. Sandwich."

8. **Panicum repens** L. Sp. Pl. ed. 2. 1:87. 1762.

Plants perennial from stout branching creeping rhizomes; culms erect, 30 to 80 cm. tall, clothed at base with bladeless overlapping sheaths; blades flat or folded, 4 to 15 cm. long, 2 to 5 mm. wide, pilose on the upper surface toward the base; panicle 7 to 12 cm. long, the somewhat distant branches stiffly ascending, usually naked at base, bearing short appressed branchlets with short-pediceled approximate spikelets toward the ends; spikelets about 2.5 mm. long, glabrous, ovate, abruptly pointed; first glume about one-fifth as long as the spikelet, truncate; second glume and sterile lemma equal, 5 to 7-nerved; fruit 1.8 mm. long (fig. 77).

Along bank of river in open ground; introduced. Originally described from the Old World.
Hawaii: Hilo, Hitchcock 14145; Newell in 1917.

9. **Panicum barbinode** Trin. Mém. Acad. St. Pétersb. VI. Sci. Nat. 1:256. 1834. PARA' GRASS.

Plants perennial with long stout stolons; culms decumbent and rooting at base, often 2 meters or more long, glabrous, the nodes densely villous; sheaths softly or harshly villous or merely papillose or even glabrous, densely pubescent on the collar; ligule membranaceous, densely ciliate, about 1 mm. long; blades ascending or spreading, 10 to 30 cm. long, 10 to 15 mm. wide, glabrous; panicle 12 to 20 cm. long, about half as wide, the rather distant, subracemose, densely flowered branches ascending or spreading, the main axis and the somewhat flattened branches scabrous on the edges, densely pubescent in the axils; spikelets 3 mm. long, elliptic, glabrous; first glume one-fourth the length of the spikelet, acute, 1-nerved; second glume and sterile lemma subequal; fruit 2.5 mm. long, minutely transversely rugose (fig. 79).

Wet places; introduced. Originally described from Brazil where it was introduced from Africa.
Hawaii: Hilo, Hitchcock 14183; Newell in 1917.

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FIGURE 80.—Panicum kaalaense. From the type specimen.



FIGURE 81.—Panicum nephelophilum. From Forbes 820, Kauai.

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10. **Panicum maximum** Jacq. Coll. Bot. 1:76. 1786. GUINEA GRASS.

Plants perennial, tufted; culms robust, erect, glabrous, 1 to 2 meters tall, the nodes usually densely hirsute; sheaths papillose-hirsute to glabrous, usually pubescent on the collar; ligule 4 to 6 mm. long, stiffly and densely ciliate; blades erect or ascending, flat, 30 to 75 cm. long, 1 to 3.5 cm. wide, scabrous on the margin, glabrous on the surfaces or hirsute above near the base; panicle 20 to 50 cm. long, about one-third as wide, densely flowered, the long, rather stiff branches ascending, naked at base, the lower in whorls, the axils pilose, the branchlets short, appressed, bearing more or less clustered short-pediceled spikelets; spikelets about 3 mm. long, oblong-ellipsoid, glabrous; first glume one-third as long as spikelet, obtuse; second glume and sterile lemma subequal, slightly exceeding the fruit, thin, the lemma with a staminate flower; fruit about 2.5 mm. long, transversely rugose (fig. 78).

Open ground along road; introduced. Originally described from Guadeloupe where it was introduced from Africa.
Oahu: Fort Shafter, Hitchcock 13858.

11. **Panicum nephelophilum** Gaud. in Freyc. Voy. Uran. Bot. 411. 1830.

?Panicum pseudogrostis Trin. Gram. Pan. 197. 1826.

Panicum havaiense Reichardt, Sitzungsb. Akad. Wiss. Math. Naturw. (Wien) 76[1]:723. 1878.

Plants perennial, tufted; culms erect, glabrous, usually 1 to 1.5 meters tall; sheaths papillose-pilose or glabrate; ligule a short membrane about 1 mm. long, densely ciliate with hairs 1 mm. long; blades flat, glabrous, scabrous, in some specimens ciliate on the margin, mostly 15 to 30 cm. long, 8 to 25 mm. wide; panicle open, in well-developed plants very large, as much as 50 cm. long and 30 cm. wide, the branches stiffly ascending, the lower in whorls, the axils often pubescent; spikelets narrow, 2 to 2.5 mm. long, glabrous, appressed along the branchlets on pedicels about their own length; glumes equal, the first acuminate, 5-nerved, the second acute, 7-nerved; sterile lemma a little shorter than the glumes, glabrous, about 9-nerved, the palea ovate, nearly half as long as the lemma; fertile lemma acute, about 1.7 mm. long (fig. 81).

Dr. Stapf has sent me a drawing of the Gaudichaud specimen. The sheaths are pilose.

Panicum pseudogrostis Trin., from "Ins. Sandw. (Chamisso herb.)" may belong to *Panicum nephelophilum* but the description does not agree in all respects. It is described as having a large panicle and leaves a foot long, and one-half inch wide, "hirtula". The pedicels are described as hispidulous, and the fertile lemma as having two appendages at base as in *Panicum* (Ichnanthus) *almadense*. The last statement does not apply to any of our species and may be an error. The pedicels of this species and the next are mostly glabrous, sometimes sparsely scaberulous, but not hispidulous. The blades of *P. nephelophilum* are glabrous and of *P. kaalaense*, velvety pubescent, but not hirtulous. *Panicum pseudogrostis* will be uncertain until the type is examined.

Moist or dry woods, mostly at upper altitudes. Originally described from "Insulis Sandwicensibus."
Kauai: Kaholuamano, Rock 12638; Hitchcock 15284, 15436; Heller 2850; Halemanu, Forbes 820; Waimea, 2000 to 3000 feet, Mann & Brigham 300; Searle in 1900.
Oahu: Mt. Kaala, Hitchcock 14014.
Molokai: Without locality, Forbes 379.
Lanai: Munro 272, 334, 467.

12. **Panicum kaalaense** sp. nov.

Plants perennial, tufted; culms erect, more or less pubescent or villous, 60 to 150 cm. tall, the nodes villous; sheaths villous; ligule membranaceous, 1 mm. long, extending into cilia 1 mm.

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FIGURE 82.—Panicum tenuifolium. From Hitchcock 14208, Hawaii.



FIGURE 83.—Panicum xerophilum. From Munro in 1916, Lanai.

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long; blades flat, velvety-pubescent, 10 to 40 cm. long, 8 to 15 mm. wide, rounded at the base, acuminate at apex, scabrous on the margins; panicle 15 to 35 cm. long, as much as 20 cm. wide, the branches ascending, pubescent in the axils, often purple; spikelets narrow, 2.5 to 3 mm. long, acuminate, glabrous; first glume acuminate, 5-nerved; second glume a little shorter than the first, acute, 7-nerved; sterile lemma slightly shorter than the glumes, 7-nerved, the palea ovate, about one-third as long as the lemma; fertile lemma 2 mm. long (fig. 80).

Type in the U. S. National Herbarium, no. 836474, collected on a wooded hillside on Mount Kaala, at about 1000 meters, July 9, 1916, by A. S. Hitchcock (no. 14013).

This species differs from *P. nephelophilum* in the villous culms and sheaths, the velvety pubescent blades and the slightly larger spikelets and fruit.

Damp woods.

Kauai: Halemanu, Forbes 775.
Oahu: Mt. Kaala, Hitchcock 14013; Hillebrand in 1856. Palehua, Waianae Range, Forbes 1693. Makaleha Ridge, Rock 17082.
Molokai: Slopes of Puu Kolekole, Forbes 218.
Maui: Sand hills, Wailuku, Wilkes Expl. Exped. (Gray Herbarium).
Hawaii: Puu Waawaa, Hitchcock 14475.

13. **Panicum xerophilum** (Hillebr.).

Panicum nephelophilum γ var. *xerophilum* Hillebr. Fl. Haw. Isl. 498. 1888.

Plants perennial; culms slender, erect, more or less pilose, 15 to 30 cm. tall, the nodes villous; sheaths papillose-pilose; ligule pilose, the hairs 2 to 3 mm. long; blades flat, 5 to 15 cm. long, 1.5 to 3 mm. wide, rather lax, pilose, especially on upper surface; panicle open, 5 to 15 cm. long, oblong, the branches ascending; spikelets 2 mm. long, glabrous, appressed along the branchlets; glumes equal, acute, 5-nerved; sterile lemma about as long as the glumes, 7-nerved, the lemma ovate-acuminate, half as long as the lemma; fruit 1.5 mm. long (fig. 83).

Dry plains. Originally described from "dry exposed ridges of Oahu! Lanai! and Maui! Maalaea."
Molokai: Without locality, Rock 8705; Stokes in 1909. Western end, Rock 14005.
Lanai: Miki Plain, Munro 295, Dec. 1916, Jan. 1917.
Maui: Without locality, Faurie 1316.
Without locality: Hillebrand; Mann & Brigham.

14. **Panicum tenuifolium** Hook. & Arn. Bot. Voy. Beechey 101. 1841.

Panicum nephelophilum β var. *tenuifolium* Hillebr. Fl. Haw. Isl. 497. 1888.
Panicum nephelophilum β var. *rhyacophilum* Hillebr. Fl. Haw. Isl. 498, 1888.

Plants perennial; culms erect or sometimes geniculate at base, 30 to 60 cm. tall, sometimes taller, pilose, the nodes villous; sheaths papillose-pilose; ligule a line of hairs 1 to 2 mm. long; blades flat or more or less involute, 10 to 20 cm. long, 2 to 5 mm. wide, pilose; panicle open, oval, 10 to 20 cm. long, 10 to 15 cm. wide, the branches ascending; spikelets 3 mm. long, glabrous, appressed along the branchlets; glumes equal, acute, 5 to 7-nerved; sterile lemma about as long as the glumes, 7-nerved, the palea triangular-acute, half as long as the lemma; fruit 1.7 mm. long (fig. 82).

Dry open ground or open woods. Originally described from "Sandwich Islands." The variety *rhyacophilum* was described from "Hawaii! on lava fields of Laieha, 6000 ft. above the sea (Lydgate), Hualali (M. & B. 327)."[16]

[16] The specimen in the Cornell Herbarium is 327; in the National Herbarium and in the Gray Herbarium the number is 237.

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Lanai: Munro in 1914.
Maui: Without locality, Hillebrand in 1858.
Hawaii: Kanehaha, Forbes 259; Papaalo, Forbes 313, 315a. Kukaiau Ranch, Hitchcock 14208, 14251, 14256, 14264. Hualalai Mountains, Hitchcock 14518; Mann & Brigham 237.[17] Humuula Sheep Station, Hitchcock 14413; Waimea, Na Puu o Pele, Wilkes Expl. Exped.
Without locality: Hillebrand.

Dr. Stapf has kindly sent me a portion of the top of *Panicum tenuifolium* Hook. & Arn. collected at "Oahu Bay". The blades are narrow and involute, glabrous on the under or outer surface, densely pubescent and more or less pilose on the upper surface. The plant is described originally as glabrous, the upper surface of the blades not having been investigated. The general aspect and the character of the pubescence place this with the specimens referred by Hillebrand to his variety *rhyacophilum*.

Hillebrand's variety *tenuifolium* is based upon *Panicum tenuifolium* Hook. & Arn. but Hillebrand mentions two other specimens besides the type, as follows, "Molokai! pali of Makonalua; Maui! Haleakala; Oahu (Lay & Collie). In specimens from E. Maui a slight pubescence becomes visible on the nodes of the stems and on the leaf-sheaths". Among the specimens sent by Dr. Stapf there are three from Maui collected by Hillebrand labeled respectively, "Haleakala 538", "Makawa E. Maui 64", and "Maui 536". The first one is the common form of his variety *rhyacophilum* which I am referring to *Panicum tenuifolium* Hook. & Arn. The second and third appear to be the same form and may be duplicates. Some of the blades are flat, glabrous, and as much as 5 mm. wide, other blades are involute and finely pubescent. The plants are cespitose, 25 to 30 cm. tall. These may be the specimens referred to by Hillebrand as having a slight pubescence. The Haleakala specimen is so evidently pubescent as to appear to be excluded from this reference. Hillebrand's Molokai specimen was kindly sent me from the Berlin Herbarium by Dr. Diels. This has glabrous blades as much as 5 or 6 mm. wide, flat below and involute above. I have referred this to *P. nephelophilum* as a small form. Possibly these intermediate specimens constitute a distinct species. This can be determined only by more material.

A specimen in the herbarium of Cornell University, without data, is labeled *Panicum nephelophilum* Gaud. *P. tenuifolium* Hook. & Arn. and bears the note "[revised 1885 by Dr. W. Hillebrand]." The blades are narrow and velvety with a fine hirsutulous pubescence.

15. **Panicum issachnoides** Munro; Hillebr. Fl. Haw. Isl. 501. 1888.
Panicum conchoideum Hillebr. as synonym under *P. isachnoides*.

Plants perennial, forming dense tussocks as much as 20 or 30 cm. or more in diameter, repeatedly branching, the lower parts of the culms dying and the new shoots appearing at the periphery; culms indefinite in length but the new shoots only a few centimeters long, the leaves closely imbricate; sheaths striate, more or less pubescent, mostly hidden by the imbricate blades; ligule a very short ciliate membrane 0.5 mm. long; blades horizontally spreading 1 to 3 cm. long, 5 to 7 mm. wide, conspicuously papillose-ciliate, flat and firm, oblong-lanceolate, conchoid or spoon-shaped, striate, clasping at base; panicle narrow and few-flowered, 1 to 2 cm. long,

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the few branches appressed; spikelets oblong, 2 mm. long, glabrous; first glume one-fourth to one-third as long as spikelet; second glume and sterile lemma equal or the glume a little shorter, 7 to 9-nerved, the sterile palea about one-third as long as the lemma; fruit 2 mm. long, acute (fig. 85).

Open bogs on mountain summits. Originally described from the "swampy summit of Mt. Eeka, Maui."

Kauai: Summit of Waialeale, Rock; Hitchcock 15504, 15505. Kauluwehi bog near Kaholuamano, Hitchcock 15518.

Molokai: Kawela bog, Forbes 190.

Maui: Puu Kukui, West Maui, Hitchcock 14733. Without locality, Wilkes Expl. Exped.



FIGURE 84.—Panicum imbricatum. From Forbes 879, Kauai.



FIGURE 85.—Panicum isachnoides. From Hitchcock 15518, Kauai.

16. **Panicum imbricatum** Hillebr. Fl. Haw. Isl. 501. 1888.

Plants perennial, forming tussocks 20 to 30 cm. or more in diameter, repeatedly branching, the old stems dying and new shoots forming at the periphery; culms indefinite in length, the new shoots less than 10 cm. long, the leaves closely imbricate; sheaths glabrous or somewhat hispid, striate; ligule less than 1 mm. long, ciliate; blades stiff and firm, spreading, 1 to 1.5 cm. long, 2 to 4 mm. wide, scaberulous on the margin or sometimes ciliate near the base, flat or becoming more or less involute; panicle narrow, few-flowered, 1 to 2 cm. long, the few branches appressed; spikelets 2 mm. long or a little less, oblong-elliptic, glabrous; first glume one-third as long as spikelet; second glume and sterile lemma about equal or the glume a little shorter, 7-nerved, the palea half as long as the lemma; fruit a little less than 2 mm. long (fig. 84).

Forming tussocks in open bogs at the summit of mountains. Originally described from the "swampy summit of Mt. Eeka, Maui."

Kauai: Near Kaholuamano, Forbes 401. Alakai bog, Forbes 879. Waialeale, Rock 5644; Forbes 402; Rock in 1911.

Oahu: Koolauloa Mountains, between Punaluu and Kaipapau, northern part of island, Forbes in 1909.

Molokai: Kawela bog, Forbes 191; Rock; Hitchcock 15195; Forbes 15.

Maui: Puu Kukui, West Maui, Hitchcock 14732, 15505½; summit of Eeka, Forbes 390; Rock.

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FIGURE 86.—Panicum lanaiense. From Munro in 1916, Lanai.



FIGURE 87.—Panicum hillebrandianum. From Hitchcock 14731, Maui.

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17. **Panicum hillebrandianum** nom. nov.

Panicum monticola Hillebr. Fl. Haw. Isl. 500. 1888. Not *Panicum monticolum* Hook. f. 1864.

Plants perennial; culms erect, 10 to 20 cm. tall, rather stout; sheaths villous, pilose on the collar, longer than the internodes; ligule densely ciliate, about 2 mm. long; blades somewhat coriaceous, flat, ascending, striate, 3 to 6 cm. long, 6 to 7 mm. wide, more or less villous on the margins, otherwise glabrous; panicle about 5 cm. long, the branches ascending; spikelets 3 mm. long, oblong, glabrous; first glume scarcely 1 mm. long; second glume and sterile lemma equal, the glume 7-nerved, the lemma 9-nerved, the sterile palea oval, less than 1 mm. long; fruit about 2 mm. long (fig. 87).

Open mountain bogs. Originally described from the "swamps on the summit of Mt. Eeka, Maui."

Maui: Open bog at summit of Puu Kukui, Hitchcock 14731. Top of mountain of West Maui, Mann & Brigham 435 (Gray Herbarium).

Hawaii: Puu Oo, Forbes 811.



FIGURE 88.—Panicum forbesii. From the type specimen.



FIGURE 89.—Panicum cynodon. From Hitchcock 15503, Kauai.

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FIGURE 90.—Sacciolepis contracta. From Hitchcock 14615, Hawaii.



FIGURE 91.—Isachne pallens. From Forbes 1603, Oahu.

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18. **Panicum forbesii** sp. nov.

Plants perennial, in large tufts; culms radiating or erect, 5 to 30 cm. tall; sheaths glabrous or hispidulous; ligule densely ciliate, about 0.5 mm. long; blades flat, spreading, 2 to 5 cm. long, 1 to 3 mm. wide, glabrous; panicle oval, rather few-flowered, 2 or 3 cm. long, the branches ascending or somewhat spreading, 1 cm. long, rather sparsely villous, flexuous; spikelets a little over 2 mm. long, glabrous; first glume less than 1 mm. long; second glume and sterile lemma equal, the glume 9-nerved, the lemma 7-nerved, the sterile palea more than half as long as the lemma; fruit as long as the sterile lemma (fig. 88).

Type in the U. S. National Herbarium, no. 1038972, collected on the banks of Kawaikoi and Waiakoali streams, in the Waimea drainage basin, Kauai, Hawaiian islands, July 3 to August 18, 1917, by C. N. Forbes (no. 1052).

The only other specimen seen is from the Alakai Swamp, also in the Waimea drainage basin.

19. **Panicum cynodon** Reichardt, Sitzungsb. Akad. Wiss. Math. Naturw. (Wien) 76[1]:724. 1878.

Plants perennial; forming mats; culms 10 to 15 cm. long; sheaths glabrous or hispidulous; ligule densely ciliate, less than 1 mm. long; blades flat, puberulous on the upper surface, 1 to 2 cm. long, 2 to 3 mm. wide; panicle narrow, 1 to 2 cm. long, the branches ascending or appressed, glabrous or puberulous; spikelets about 2.5 mm. long, glabrous, oblong; first glume half to two-thirds as long as the spikelet; second glume and sterile lemma equal, 7-nerved, the sterile palea half as long as the lemma; fruit 1.5 mm. long (fig. 89).

Open bogs and swampy woods on summits of mountains, forming mats. In the open the culms are short, among other plants the culms are 20-25 cm. tall.
Kauai: Kauluwehi Swamp, Hitchcock 15517. Waialeale, 3600-5080 ft., Hitchcock 15503.

37. SACCIOLEPIS Nash.

Spikelets oblong-conic; first glume generally much shorter than the spikelet; second glume broad, inflated-saccate, strongly many-nerved; sterile lemma narrower, flat, fewer nerved, its palea nearly as long, often subtending a staminate flower; fertile lemma stipitate, elliptic, chartaceous-indurate, the margins inrolled, the palea not inclosed at the summit. Annuals or perennials, of wet soil, usually branching, the inflorescence a dense, spikelike panicle, commonly elongate.

1. **Sacciolepis contracta** (Wight & Arn.).

Panicum contractum Wight & Arn.; Steud. Syn. Pl. Glum. 1:84. 1854.

Plants annual, glabrous throughout; culms erect from a spreading and branching base, 30 to 60 cm. tall or even as much as 1 meter; blades flat, 5 to 10 cm. long, 3 to 6 mm. wide; panicle spikelike, 4 to 8 cm. long, about 5 mm. thick; spikelets 2.5 to 3 mm. long, rather sparsely hispidulous on the upper half, the terete glabrous pedicels 1 to 2 mm. long; first glume broad, nearly half as long as the spikelet, several-nerved; second glume and sterile lemma equal (fig. 90).

A weed in moist fields; introduced. Originally described from the East Indies.
Maui: Haiku, Hitchcock 14887. Olinda, Hitchcock 14910.
Hawaii: Glenwood, Hitchcock 14602, 14615.

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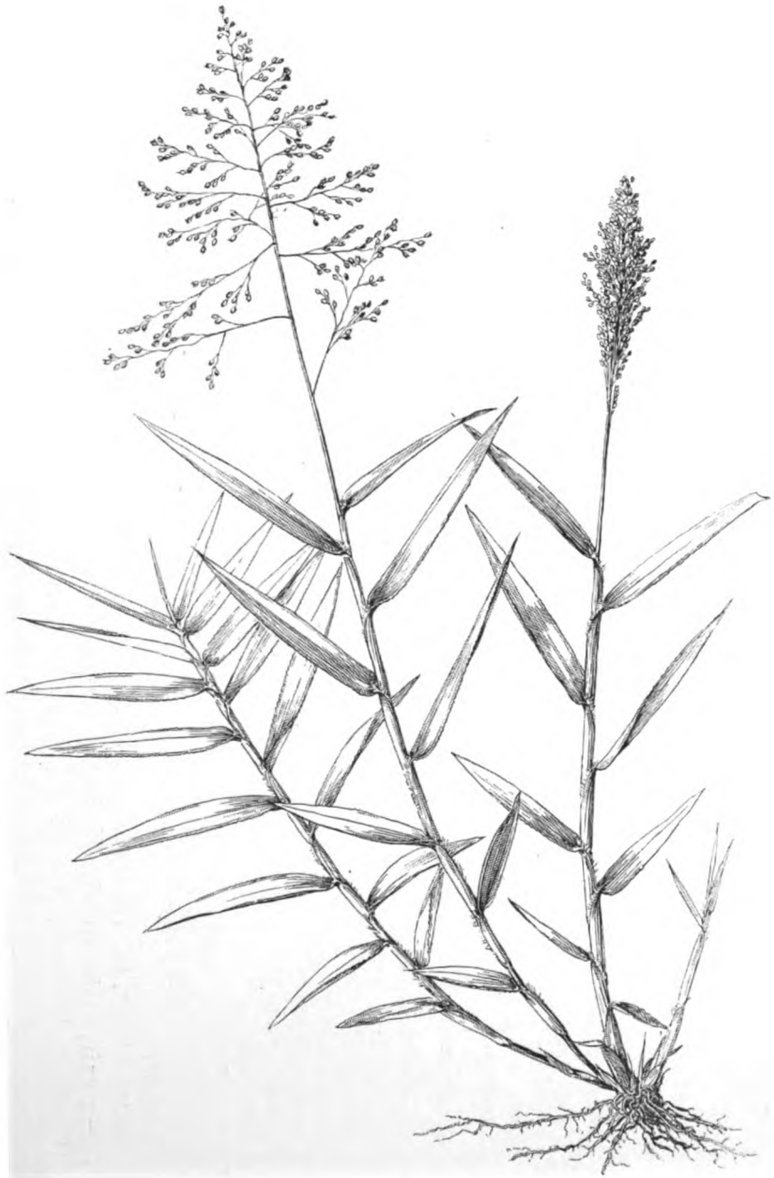


FIGURE 92.—Isachne distichophylla. From Hitchcock 14598, Hawaii.



FIGURE 93.—Oplismenus hirtellus. From Hitchcock 14035, Oahu.

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38. **ISACHNE** R. Br.

Spikelets obovoid to subglobose. Glumes membranaceous, about equal and as long as the fruits or at maturity exceeded by them. Lower floret perfect or staminate, its lemma and palea indurate and similar in form and texture to those of the upper floret. Both florets (or fruits) plano-convex, obtuse, equal in size or the upper shorter, the pair usually remaining attached by the minute rachilla joint between them.[17] Perennial or rarely annual grasses with simple or usually branching stems, flat, strongly nerved blades, and paniculate inflorescence.

Fertile florets strongly villous.....1. **I. pallens.**
Fertile florets nearly glabrous.....2. **I. distichophylla.**

1. **Isachne pallens** Hillebr. Fl. Haw. Isl. 504. 1888.

Plants perennial, glabrous; culms rather lax, decumbent, 30 to 60 cm. tall; blades mostly 3 to 10 cm. long and 5 to 7 mm. wide, firm; panicle ovoid, 3 to 8 cm. long, 2 to 3 cm. wide; spikelets 2 mm. long, elliptic; fertile florets elliptic, strongly villous all over with a crisp pubescence (fig. 91).

Damp forests. Originally described from "Woods of the eastern division of Oahu."

Kauai: Between Kawaikoi and Waiokooli, Forbes 1055. Along Hanapepe River, near the falls, Heller 2489.

Oahu: Nuuanu Valley, Forbes 1603; Koolauloa Mountains, Forbes in 1909. Waiahole Valley, Rock 17326; without locality, Forbes in 1907.

2. **Isachne distichophylla** Munro; Hillebr. Fl. Haw. Isl. 504. 1888.

Plants perennial, glabrous; culms rather stout, 50 to 100 cm. tall; blades stiff and firm, lanceolate, flat, mostly 8 to 15 cm. long, 1 to 2 cm. wide; panicle oval or elliptic, 10 to 15 cm. long, 6 to 8 cm. wide; spikelets ovoid, a little less than 2 mm. long, the glumes rather faintly nerved; fertile florets glabrous except for a few hairs at the base and along the margins (fig. 92).

Moist woods. Originally described from the Hawaiian islands. "In the forests of all islands! at altitudes of 2000-3000 ft.; but not common."

Oahu: Without locality, Forbes 1845; Mann & Brigham 213. Behind Honolulu, Wilkes Expl. Exped.

Molokai: Wailau Valley, Forbes 558; without locality, Forbes 236.

Lanai: Upper part of mountain, Hitchcock 14642; Forbes 256; Munro 346, 364.

Maui: Mt. Eeke, Forbes 358.

Hawaii: Alakalei, Rock 4135; Kilauea, Rock; Hitchcock 14598. Papaaloa, Forbes 412; Waimea, Hitchcock 14395; Koolapuuwale, Forbes 277. Na Puu o Pele, Wilkes Expl. Exped. (Gray Herbarium). Without locality, Forbes 710.

39. **OPLISMENUS** Beauv.

Spikelets terete or somewhat laterally compressed, subsessile, solitary or in pairs, in two rows crowded or approximate on one side of a narrow scabrous or hairy rachis; glumes about equal, emarginate or 2-lobed, awned from between the lobes; sterile lemma exceeding the glumes and fruit, notched or entire, mucronate or short-awned, inclosing a hyaline palea; fertile lemma elliptic, acute, convex or boat-shaped, the firm margins clasping the palea, not inrolled. Freely

[17] For further discussion see Chase, Agnes, Genera Paniceae IV: Proc. Biol. Soc. Washington, Vol. 24, p. 149, 1911.

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branching, creeping, shade-loving annuals or perennials, with erect flowering shoots, flat, thin lanceolate or ovate blades, and several one-sided, thickish, short spikes rather distant on a main axis.

1. **Oplismenus hirtellus** (L.) Beauv. Ess. Agrost. 54, 168. 1812.

Panicum hirtellum L. Syst. Nat. ed. 10. 2:870. 1759.

Plants perennial, branching, creeping and rooting, the fertile culms ascending, 20 to 40 cm. long, glabrous; sheaths glabrous or appressed pubescent, villous on the margin, the surface in some plants hirsute; blades lanceolate, acuminate, commonly somewhat asymmetric at base, 5 to 10 cm. long, 8 to 17 mm. wide, thin, more or less hispid on upper surface, hispid or glabrous beneath; panicle mostly 7 to 15 cm. long, the axis scabrous, or hispidulous above, sometimes pilose-hispid on the angles above; racemes several, ascending or appressed, the lowermost distant, 2 to 4 cm. long, the others successively shorter and closer together, the rachis hispidulous at base and with long stiff whitish hairs, above the base scabrous and hispidulous with here and there long stiff hairs intermixed; spikelets approximate, more or less clustered along the rachis; first and second glumes about two-thirds as long as the spikelet, more or less appressed-hispidulous, 3 to 5-nerved, slightly truncate or emarginate at the apex, extending into a smooth terete purplish awn, the first 5 to 10 mm. long, the second reaching about to the end of the spikelet; sterile lemma broad, several-nerved, hispidulous like the glumes, apiculate or short-awned, 3 to 4 mm. long, the palea narrow, more than half as long as the lemma, sometimes inclosing stamens; fruit about 2.5 mm. long (fig. 93).

Hillebrand refers the Hawaiian species to *O. compositus sylvaticus* and cites as a synonym *O. oahuensis* Nees. The latter is a *nomen nudum*. It was listed by Steudel [18] as a synonym of *Panicum oahuense* (Steud. Ins. Oahua) which also is a *nomen nudum*.

This species differs from *O. compositus* (L.) Beauv. in the shorter racemes with more compactly arranged spikelets. It may have been introduced into the Hawaiian islands from tropical America where it is common.

Rain forest and shady slopes. Originally described from Jamaica.

Kauai: Wailua Falls, Forbes 495, 497.

Oahu: Mountains east of Schofield Barracks, Hitchcock 14035; Nuuanu Pali, Hitchcock 13776, 14057; Waialae Valley, Forbes 1951. Valley behind Honolulu, collector unknown, probably Wilkes Expl. Exped. Tantalus, Heller 2061. Kaala Mountains, Wilkes Expl. Exped. (Gray Herbarium).

Without locality, Hillebrand 484; Mann & Brigham 20; Seeman 2248 (Gray Herbarium).

Molokai: Pukoo, Hitchcock 15041.

Maui: Lahaina, Hitchcock 14878, 14879.

Hawaii: Honaunau, Hitchcock 14544. Puu Waawaa, Hitchcock 14479. Hilo, Hitchcock 14199; Newell in 1917. Without locality, Remy 104 (Gray Herbarium).

40. ECHINOCHLOA Beauv.

Spikelets plano-convex, often stiffly hispid, subsessile, solitary or in irregular clusters on one side of the panicle branches; first glume about half the length of the spikelet, pointed; second glume and sterile lemma equal, pointed, mucronate, or the glume short-awned and the lemma long-awned, in some species conspicuously so, inclosing a membranaceous palea and in some species a staminate flower; fertile lemma plano-convex, smooth and shining, acuminate-pointed, the

[18] Steudel, Ernst G., Nomenclator botanicus, 2d ed., Vol. 2, p. 260, 1841.

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margins inrolled below, flat above, the apex of the palea not inclosed. Coarse, often succulent, annual or perennial, grasses, with compressed sheaths, linear flat blades, and rather compact panicles composed of short, densely flowered racemes along a main axis.

Racemes without stiff hairs at base, simple, rather distant, 1 to 2 cm. long; spikelets crowded in about 4 rows, the awn of the sterile lemma reduced to a short point; blades 3 to 6 mm. wide ..... 1. **E. colonum.**

Racemes hispid at base with long stiff hairs, more or less branched, commonly more than 2 cm. long; spikelets irregularly crowded and fascicled, not arranged in rows, the awn of the sterile lemma more or less developed; blades commonly more than 5 mm. wide..... .....2. **E. crusgalli crus-pavonis.**

1. **Echinochloa colonum** (L.) Link, Hort. Berol. 2:209. 1833.

Panicum colonum L. Syst. Nat. ed. 10. 2:870. 1759.

Plants annual; culms prostrate-spreading, ascending, or erect, commonly 20 to 40 cm. long, glabrous, compressed; sheaths glabrous, compressed; ligule wanting; blades rather lax, 5 to 10 cm. long, rarely longer, 3 to 6 mm. or rarely as much as 1 cm. wide, somewhat scabrous on the margins, occasionally with transverse purple bands (zonate); panicles 5 to 10 or even 15 cm. long, the axis smooth or slightly scabrous; racemes several, 1 to 2 cm. long or rarely longer, appressed or ascending, single or two approximate, the lower ordinarily distant as much as 1 cm., the rachis triangular-flattened, scabrous; spikelets about 3 mm. long, crowded, nearly sessile, in about 4 rows; second glume and sterile lemma short-pointed but not awned; fruit about 2.5 mm. long, short-pointed (fig. 94).

Along streets and in fields; introduced. Originally described from India.
Oahu: Honolulu, Hitchcock 13709, 13746; Munro 7. Waialua Mountains, Mann & Brigham 268. Makiki, Heller 1978.
Hawaii: Hilo, Newell in 1917.

2. **Echinochloa crusgalli crus-pavonis** (H. B. K.) Hitchc. Contr. U. S. Nat. Herb. 22:148. 1920.

Oplismenus crus-pavonis H. B. K. Nov. Gen. & Sp. 1:108. 1816.

Plants annual; culms erect or sometimes decumbent at base, as much as 1 meter or even 1.5 meters tall, glabrous; sheaths glabrous; ligule wanting, the ligular area sometimes slightly pubescent; blades 2 to 8 mm. wide, sometimes wider, scabrous on the margins, sometimes on the upper surface; panicles nodding, rather soft, 10 to 20 cm. long, the axis scabrous; racemes mostly ascending or appressed, the lower somewhat distant, as much as 10 cm. long but as a rule shorter, commonly unbranched, the upper approximate, shorter, the rachis scabrous, hispid, especially at the base; spikelets crowded, about 2.5 mm. long, excluding the awns, strongly hispid or papillose-hispid on the nerves, hispidulous on the internerves; sterile lemma with a well-developed palea, neuter, the awn variable in length, mostly 5 to 10 mm. long, on at least a part of the spikelets, sometimes as much as 3 cm. long; fruit elliptic, turgid, narrowed into a cusp or point, about 2 mm. long, whitish or brownish (fig. 95).

This variety of the cosmopolitan *E. crusgalli* is common in tropical America. It differs from the species itself in having nodding rather soft panicles, the spikelets averaging smaller, less strongly hispid, the awn variable in length, but as a rule not over 1 cm. long. Awned and awnless or partially awnless panicles may occur on the same plant. In some plants only the spikelets near the end of the raceme are awned. In Hitchcock's 14462, Waimea, Hawaii, the sterile lemmas are indurate like the fertile. This specimen has awnless, rather larger spikelets, and possibly might better be referred to *E. crusgalli zelayensis* (H. B. K.) Hitchc. of Mexico.

Along ditches and especially in rice fields; introduced. Originally described from Venezuela.

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Kauai: Hihi Mountains, Forbes 630. Lihue, Forbes 478, 480.
Oahu: Waikiki, Hitchcock 13800. Waialua, Rock in 1912. Kalihi Valley, Hitchcock 14101, 14117, 14119. Upper Manoa Valley, Hitchcock 13736. Fort Shafter, Hitchcock 13846. Kaneohe, Hitchcock 13900, 13901. Schofield Barracks, Hitchcock 14031. Lower Pauoa, Heller 2384, 2384a. Without locality, Mann & Brigham 24.
Molokai: Kamalo Bog, Hitchcock 15105. Pukoo, Hitchcock 15110.
Hawaii: Hilo, Hitchcock 14151, 14181; Newell in 1917. Kukuihaele, Rock 4536. Waimea, Hitchcock 14462.
Without locality: Hillebrand.



FIGURE 94.—Echinochloa colonum. From Contr. U. S. Nat. Herb. Vol. 22, fig. 35.



FIGURE 95.—Echinochloa crusgalli crus-pavonis. From Contr. U. S. Nat. Herb. Vol. 22, fig. 34.



FIGURE 96.—Chaetochloa verticillata. From Contr. U. S. Nat. Herb. Vol. 22, fig. 43.

41. **TRICHOLAENA** Schrad.

Spikelets on short capillary pedicels; first glume small, much shorter than the spikelet, villous; second glume and sterile lemma equal, raised on a stipe above the first glume, emarginate or slightly lobed, short-awned, covered, except toward the apex, with long silky hairs, the palea of the sterile lemma well developed; fertile lemma shorter than the spikelet, cartilaginous, smooth, boat-shaped, obtuse, the margins thin, not inrolled, inclosing the margins of the palea. Perennial or annual grasses, with rather open panicles of silky spikelets.

1. **Tricholaena rosea** Nees, "Cat. Sem. Hort. Vratisl. a. 1836"; Fl. Afr. Austr. 17. 1841. NATAL GRASS.

Plants perennial; culms slender, erect from a normally decumbent base, about 1 meter tall; sheaths glabrous, or the lowermost appressed-hispid, puberulent on the collar; ligule densely ciliate, about 1 mm. long; blades flat, 5 to 10 cm. long, 2 to 5 mm. wide, glabrous, or sometimes pilose about the base; panicle ovoid, purple or tawny, 7 to 15 cm. long, the branches slender, scabrous, the pedicels capillary, flexuous; spikelets about 3 mm. long, the silky hairs 2 to 3 mm. long (fig. 98).

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This species is a good forage grass and has been grown successfully on Hawaii and Molokai. It thrives in loose or sandy soil at medium altitudes in the drier regions. A fine field of this was observed on Mr. George Cooke's ranch, Molokai.

Grassland and along roadsides; introduced, abundantly naturalized in Molokai and Hawaii. Originally described from South Africa.
Kauai: Hanamaulu, Faurie 1354.
Oahu: Kaimuki, Forbes 1938. Schofield Barracks, Hitchcock 13980.
Molokai: Western part, Hitchcock 15150. Kaunakakai Gulch, Forbes 625.
Hawaii: Kukuihaele, Rock 4511. Kukaiau Ranch, Hitchcock 14206.

42. **CHAETOCHLOA** Scribn.

(Setaria Beauv.)

Spikelets subtended by one to several bristles (sterile branchlets), falling free from the bristles, awnless; first glume broad, commonly less than half the length of the spikelets, 3 to 5 nerved; second glume and sterile lemma equal, or the former shorter, several-nerved; fertile lemma coriaceous indurate, smooth or rugose. Annual or perennial grasses, with narrow terminal panicles, these dense and spikelike, or somewhat loose and open.

Blades narrowly elliptic, as much as 9 cm. wide, plaited; bristles below only a part of the spikelets; panicles loose and open.....1. **C. palmifolia.**
Blades linear-lanceolate to linear, mostly not over 1 cm. wide; bristles below all the spikelets; panicle spikelike, cylindric.
Bristles below each spikelet 1 to 3, retrorsely scabrous.....2. **C. verticillata.**
Bristles below each spikelet more than 5, antrorsely scabrous.
Plants annual.....3. **C. lutescens.**
Plants perennial.....4. **C. geniculata.**

1. **Chaetochloa palmifolia** (Willd.) Hitchc. & Chase, Contr. U. S. Nat. Herb. 18:348. 1917.

Panicum palmifolium Willd.; Poir. in Lam. Encycl. Suppl. 4:282. 1816.

Panicum nervosum Roxb. Fl. Ind. ed. Carey 1:314. 1820. Not *P. nervosum* Lam. 1798.

Panicum neurodes Schult. Mant. 2:228. 1824.

Plants perennial; culms erect, 1 to 2 meters tall, some plants depauperate, more or less appressed-hispid below and at the nodes; sheaths papillose and more or less hispid; blades resembling those of a young palm, narrowly elliptic, as much as 50 cm. long and 9 cm. wide, acuminate, narrowed almost to a petiole, flat, strongly nerved and plicate, scabrous on the upper surface, pubescent beneath; panicle large and open, as much as 60 cm. long, consisting of numerous slender spreading branches as much as 20 cm. long, the spikelets on short appressed branchlets or toward the ends single, the axis and branches very scabrous, the branchlets bearing here and there slender flexuous bristles, about 1 cm. long; spikelets lanceolate, green, glabrous, about 4 mm. long on scabrous pedicels about 1 mm. long; first glume broad, ovate, rather obtuse, 3-nerved, about one-third as long as the spikelet; second glume a little shorter than the fruit, 7-nerved; sterile lemma with a point extending a little beyond the fruit, 5-nerved, the narrow palea about two-thirds as long; fertile lemma lanceolate with a short somewhat incurved point; rather obscurely transversely rugose (fig. 97).

This species belongs to the section Ptychophyllum, characterized by the large plicate blades and usually loose panicle with lanceolate fruit and few bristles. The name *Panicum plicatum* Lam. has been applied to this species but an examination of Lamarck's type at Paris showed it to have narrow blades 20 cm. long and 12 mm. wide and a narrow panicle.

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FIGURE 97.—Chaetochloa palmifolia. From Hitchcock 14076, Oahu.



FIGURE 98.—Tricholaena rosea. From U. S. Dept. Agr. Bull. 772, fig. 147.

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Damp open woods or moist open ground; introduced. Originally described from India.

Oahu: Mt. Tantalus, near Halfway House, Hitchcock 13877, 14076. Upper Manoa Valley, Hitchcock 13732.

Hawaii: Kukuihaele, Rock 4519. Hilo, Hitchcock 14148, Newell in 1917.

2. **Chaetochloa verticillata** (L.) Scribn. U. S. Dept. Agr. Div. Agrost. Bull. 4:39. 1897.

Panicum verticillatum L. Sp. Pl. ed. 2. 1:82. 1762.

Setaria verticillata Beauv. Ess. Agrost. 51. 1812.

Plants annual; culms erect or decumbent at base, 30 to 60 cm. tall, or even as much as 1 meter; sheaths keeled, glabrous; blades flat, 5 to 15 cm. long, as much as 1 cm. wide or even more, scabrous; panicle cylindric, dense, 2 to 8 cm. long, 1 cm. wide, somewhat lobed, the crowded branches as much as 1 cm. long, the bristles below each spikelet 3 to 6 mm. long, retrorsely-scabrous; spikelets oval, about 2 mm. long; first glume about one-third as long as the spikelet; second glume slightly shorter than the fruit; sterile lemma as long as the fruit; fertile lemma obscurely transversely rugose (fig. 96).

A weed in fields and waste places; introduced. Originally described from the Old World.

Oahu: Honolulu, Hitchcock 13707, 14065; Newell in 1917. Waikiki, Heller 1961, 2289.

3. **Chaetochloa lutescens** (Weigel) Stuntz, U. S. Dept. Agr. Bur. Pl. Ind. Inv. Seeds 31:36, 86. 1914.

Panicum lutescens Weigel, Obs. Bot. 20. 1772.

Plants annual; culms erect or geniculate below, sometimes prostrate-spreading, rather succulent below, as much as 1 meter tall but usually lower, scabrous below the panicle; sheaths smooth, compressed-keeled; blades as much as 25 cm. long and 1 cm. wide, flat, twisted in a loose spiral, the upper surface along the upper half faced downward, acuminate-pointed, often glaucous, toward the base on the upper surface beset with long lax hairs; panicle dense, evenly cylindric, spikelike, yellow at maturity, mostly 5 to 10 cm. long, about 1 cm. thick, rounded at the summit, the axis densely pubescent, the branches mostly less than 1 mm. long, the cluster of bristles below each spikelet usually more than 5, sometimes 20 or more; bristles antrorsely scabrous, yellow, the longer ones 2 or 3 times as long as the spikelets; spikelets about 3 mm. long, oval; first glume about half, the second about two-thirds as long as the spikelet; sterile lemma equaling the fruit, the palea well developed; fertile floret strongly transversely rugose (fig. 102).

This species has usually been called *Chaetochloa glauca* (L.) Scribn. or *Setaria glauca* Beauv., but the basis of those names, *Panicum glaucum* L., properly applies to the pearl millet (*Pennisetum glaucum* (L.) R. Br.)

A weed in fields; introduced. Originally described from Europe.

Hawaii: Waimea, Hitchcock 14461.

4. **Chaetochloa geniculata** (Lam.) Millsp. & Chase, Field Mus. Bot. 3:37. 1903.

Panicum geniculatum Lam. Encycl. 4:727 (err. typ. 737). 1798.

Setaria purpurascens H. B. K. Nov. Gen. & Sp. 1:110. 1816.

Panicum imberbe Poir. in Lam. Encycl. Suppl. 4:272. 1816.

Plants perennial, producing short knotty branching rhizomes as much as 4 cm. long; culms erect, spreading or prostrate, tufted or solitary, as much as 1 meter tall, the base usually hard and wiry; sheaths keeled; blades flat, scabrous, villous toward the base on the upper surface, mainly straight (not twisted as in *C. lutescens*), as much as 20 cm. long and 8 mm. wide;

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panicle as in *C. lutescens*, but rather more slender, yellow, purple, or greenish; bristles mostly 8 to 12 below each spikelet, yellow or purple, 1 to 3 times or even as much as 6 times as long as the spikelets, antrorsely scabrous; spikelets 2 to 2.5 mm. long, otherwise about as in *C. lutescens* (fig. 100).

This species differs from *C. lutescens* in being perennial and in the wiry or less succulent base of the culms.

Grassland and waste places; introduced. Originally described from Guadeloupe.

Kauai: Olokele Gulch, Hitchcock 15249. Hanapepe River, Heller 2469. Without locality, Remy 106 (Gray Herbarium).

Oahu: Nuuanu Pali, Hitchcock 13783, 14054. Nuuanu Valley, Forbes 1523. Mt. Tantalus, Hitchcock 13880, 14077.

Hawaii: Hilo, Newell in 1917.



FIGURE 99.—Coix lachryma-jobi. From U. S. Dept. Agr. Bull. 772, fig. 174.



FIGURE 100.—Chaetochloa geniculata. From Contr. U. S. Nat. Herb. Vol. 22, fig. 41.

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43. **DISSOCHONDRUS** (Hillebr.) Kuntze.

Spikelets subtended by a single persistent bristle (sterile branchlet), awnless, consisting of 2 membranaceous glumes and 2 cartilaginous florets, the 2 fruits similar and closely contiguous by their flat inner faces; first glume broad, about one-fourth as long as the spikelet; second glume a little longer than the 2 florets; lemmas cartilaginous-indurate, smooth, nerveless, the margins inrolled over the cartilaginous palea, the 2 fruits similar, the lower a little longer but rising to the same height. Rather tall perennial grasses with flat petioled blades, auriculate sheaths and slender spikelike panicles.

The genus is based on *Setaria biflora* Hillebr., the only species, and was first described as a subgenus of Setaria by Hillebrand.[19] Kuntze[20] raised this subgenus to generic rank but inadvertently gave the species as "*Dissochondrus bifidus* OK. = *Setaria bifida* Hillebr."

1. **Dissochondrus biflorus** (Hillebr.) Kuntze; Hack. in Engl. & Prantl, Pflanzenfam. 1: Nachtr. 41. 1897.

   Setaria biflora Hillebr. Fl. Haw. Isl. 503. 1888.

   Culms 60 to 120 cm. tall, compressed, puberulent at the nodes; sheaths glabrous, compressed-keeled, extending at the summit beside the petiole into 2 membranaceous, more or less deciduous or fragile auricles as much as 4 cm. long, especially prominent on the innovations; ligule short, scarious; blades flat, firm, 15 to 30 cm. long, 1 to 2 cm. wide, gradually acuminate, contracted at base into a petiole, glabrous, scaberulous on the margin and toward the tip; panicle cylindric, slender, spikelike, 10 to 20 cm. long, somewhat loosely flowered, more or less interrupted at base, the branches short and appressed, the axis puberulent; bristles flexuous, antrorsely scabrous, 5 to 10 mm. long, solitary below each spikelet or wanting below some of the spikelets; spikelets 2.5 to 3 mm. long, pointed, glabrous; first glume broad, obtuse, one-fourth to one-third as long as the florets, puberulent, scarcely nerved; second glume pointed beyond the florets, puberulent, faintly 5-nerved; florets yellowish, smooth and polished, about 2 mm. long, slightly pointed, the tip minutely puberulent (fig. 101).

Rocky slopes in partial shade. Originally described from Lanai.

Oahu: West of Schofield Barracks, Hitchcock 13952. Makaleha Ridge, Rock 17081.

Molokai: Puu Kolekole, Forbes 219.

Pennisetum macrostachyum (Brong.) Trin. was found near a garden, Hilo, where the species was cultivated for ornament (Hitchcock 14175). It is a tall graceful perennial with flat blades 1.5 to 2.5 cm. wide, and a feathery purplish panicle 15 to 20 cm. long, the numerous bristles 2 to 3 cm. long.

44. **CENCHRUS** L.

Spikelets solitary or few together, surrounded and inclosed by a spiny bur composed of numerous coalescing bristles (compound sterile branchlets), the burs sessile or nearly so, falling with the spikelets and permanently inclosing them, the seed germinating within the old involucre, the spines usually retrorsely barbed. Annual or perennial, commonly low branching grasses, with flat blades and racemes of burs, the burs readily deciduous.

Plants perennial; burs fusiform..... 1. **C. agrimonioides.**
Plants annual; burs globular.
  Foliage glabrous..... 2. **C. echinatus.**
  Foliage pubescent..... 3. **C. hillebrandianus.**

[19] Op. cit., p. 503. 1888.

[20] Kuntze, Otto., Revisio generum plantarum, Vol. 2, p. 770, Stuttgart & Tubingen, 1891.

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FIGURE 101.—Dissochondrus biflorus. From Hitchcock 13952, Oahu.



FIGURE 102.—Chaetochloa lutescens. From Contr. U. S. Nat. Herb. Vol. 22, fig. 40.

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1. **Cenchrus agrimonioides** Trin. Gram. Pan. 72. 1826.

Cenchrus calyculatus uniflorus Hillebr. Fl. Haw. Isl. 505. 1888.

Plants perennial, very leafy; culms glabrous, scabrous below the panicle, robust, swollen at the nodes, 30 to 60 cm. tall, the internodes short; sheaths compressed-keeled, much longer than the internodes, glabrous; blades flat or folded, 15 to 30 cm. long, 4 to 8 mm. wide, glabrous beneath, scabrous on the upper surface; racemes 5 to 10 cm. long, the axis densely puberulent; burs approximate, mostly somewhat reflexed at maturity, fusiform, about 1 cm. long, the base narrow below, expanding above, 2 to 3 mm. long, densely pubescent; basal series of bristles numerous, more or less spreading, 2 to 3 mm. long, retrorsely scabrous, the larger ones tomentulose at base; body of bur cleft only one-third to scarcely one-half its length, lobes erect, appressed, forming an irregular beak, densely tomentose along the middle part, the apex retrorsely scabrous; spikelets 1 in each bur (fig. 104).

The Laysan specimens have somewhat larger burs and flat blades 15 to 20 cm. long and 1 to 2 cm. wide, and the base of the bur is more abruptly enlarged upward. These may represent a distinct species. The specimens are said to be 3 or 4 feet tall.

Originally described from the Hawaiian islands.
Laysan: Bryan 8729; Snyder in 1902.
Oahu: Without locality, Wilder in 1912.
Lanai: Munro 404.
Maui: Auwahi, Rock. East Maui, Wilkes Expl. Exped.
Without locality: Hillebrand; Wawra.

2. **Cenchrus echinatus** L. Sp. Pl. 1050. 1753.

Plants annual; culms much branched, decumbent at base, 30 to 50 cm. tall, scabrous below the inflorescence; sheaths glabrous; blades flat, 5 to 10 cm. long, about 5 mm. wide, glabrous beneath, scabrous on the upper surface; racemes 3 to 5 cm. long; the axis scabrous on the angles, the burs rather loosely arranged, barely touching each other; burs globular, about 5 mm. wide, the obconical base about 1 mm. long, tomentulose, the basal series of bristles 2 to 3 mm. long, the inner series flattened, ascending or the innermost connivent below the middle, tomentose except the apex; spikelets usually 3 or 4 in each bur (fig. 103).

Weed in fields; introduced. Apparently rare in the Hawaiian islands; common in the American tropics. Originally described from Jamaica.
Oahu: Honolulu, Hitchcock 13854.
Hawaii: Hilo, Newell in 1917.

3. **Cenchrus hillebrandianus** sp. nov.

Plants annual, usually much branched and decumbent at base; culms glabrous, 30 to 50 cm. tall; sheaths and blades soft-pubescent or villous, the sheaths mostly longer than the internodes, compressed-keeled; the blades flat, ascending or spreading, mostly 10 to 15 cm. long, 3 to 6 mm. wide; racemes mostly 3 to 6 cm. long, oblong, the axis angled, scabrous and pilose, flexuous, the internodes 2 to 3 mm. or the lower sometimes 5 to 8 mm. long; burs globular, mostly 5 to 6 mm. wide, the base villous, obconical, about 2 mm. long; outer series of spines numerous, irregular in length, the longer about 3 mm. long; inner series stout, flattened below and subulate above, about 5 mm. long, spreading or ascending, or the innermost incurved, villous except the tip; spikelets mostly 3 or 4 in each bur, about 6 mm. long; first glume triangular-ovate, broad, about 2 mm. long, 1-nerved; second glume minutely scaberulous, about two-thirds as long as the spikelet, strongly 3-nerved with 2 outer weaker pairs of nerves; sterile lemma acuminate, a little shorter than the fertile, nerved about as the second glume, minutely

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FIGURE 103.—Cenchrus echinatus. From U. S. Dept. Agr. Div. Agrost. Bull. 17, fig. 407.



FIGURE 104.—Cenchrus agrimonioides. From Snyder in 1902, Laysan.

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scaberulous, containing a more strongly scaberulous palea and, sometimes, stamens; fertile lemma acuminate, cartilaginous, smooth below, nerved and scaberulous above; caryopsis oblong-oval, a little compressed, 3 mm. long, about 2 mm. wide (fig. 106).

Type in the U. S. National Herbarium, no. 836482, collected in sandy soil at Waikiki, near Honolulu, Hawaiian islands, June 19, 1916, by A. S. Hitchcock (no. 13801).

Hillebrand[21] refers this species to *C. echinatus*, but parts of the spikelet, such as the scaberulous sterile palea, are slightly different. *C. hillebrandianus* differs from *C. echinatus* also in the villous or pilose foliage. The species may be the same as *C. laniflorus* Steud.[22] from Tahiti, of which I have seen no specimen. The description indicates a much taller plant, having very minute sparse pubescence on sheaths and blades, and a densely lanate axis of the raceme and densely plumose burs.

Besides the Hawaiian specimens there are in the National Herbarium two others, one from Easter Island (Fuentes 9) and one from Tahiti (Moore 220).

A common weed in waste places and cultivated soil; apparently introduced.

Oahu: Pass west of Schofield Barracks, Hitchcock 13960. Honolulu, Hitchcock 14068, Forbes 1021. Waikiki, Heller 1964; Hitchcock 13801. Without locality, Mann & Brigham 1.
Molokai: Pukoo, Hitchcock 15056.
Lanai: West end, Hitchcock 14716.
Hawaii: Kau Desert, Forbes 393. Kilauea Crater, Hitchcock 14610.

Sugar Cane (*Saccharum officinarum* L. Sp. 54. 1753) is extensively cultivated in the Hawaiian islands and sometimes persists but does not spread. It is a tall stout grass, 2 to 5 meters tall or even taller, with solid juicy stems, broad flat blades, and large plumelike panicles, 30 to 60 cm. long, with numerous small spikelets about 3 mm. long, each surrounded at the base by a tuft of silky hairs two or three times as long as the spikelet.

45. **ISCHAEMUM** L.

Spikelets in pairs, along a straight disarticulating rachis, one sessile and perfect, the other pediceled and usually perfect though not always fruitful; fertile lemma of both spikelets awned, the awn usually developed. Annual or perennial grasses with 2, or rarely more, racemes in pairs at the summit of the culms.

1. **Ischaemum byrone** (Trin.).

Spodiopogon byronis Trin. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 2:301. 1832.
Ischaemum lutescens Hack. in DC. Monogr. Phan. 6:221. 1889.

Plants perennial, sending out stolons; culms erect from a decumbent base, glabrous, weakly long-pilose at the nodes, 40 to 80 cm. tall; sheaths glabrous; ligule prominent, 2 to 4 mm. long, truncate, membranaceous in the center, coalescing at the margins with firm auricles extending up from the sheath; blades flat, tapering to a fine point, 10 to 20 cm. long, 3 to 5 mm. wide, glabrous, the uppermost much reduced; racemes 2, digitate, tawny or yellowish, 4 to 10 cm. long, the rachis joints pilose at the base and along the margins toward the top, triangular, about 4 mm. long, 1 mm. thick, cupshaped at summit; sessile spikelet about 7 mm. long, exclud-

[21] Op. cit., p. 506.
[22] Steudel, Ernst G., Synopsis plantarum glumacearum, Vol. 1, p. 110. Stuttgart, 1854.

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FIGURE 105.—Cenchrus hillebrandianus. From the type specimen.



FIGURE 106.—Andropogon saccharoides. From U. S. Dept. Agr. Bull. 772, fig. 161.

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ing awns, the hairs at base about half as long; first glume oblong, flat on the back, acute, scaberulous, pilose on the back with several long hairs, the apex bidentate, the teeth short-awned; second glume keeled, scaberulous toward the tip, about as long as the first, tapering into an awn 5 mm. long; sterile lemma hyaline, about as long as the first glume; fertile lemma hyaline, bidentate, between the teeth extending into an awn 2 cm. long, tightly twisted to the first bend (about 5 mm.); pediceled spikelet about 5 mm. long, the pedicel about 3 mm. long, thick and triangular like the rachis joint, long-pilose on one angle, ciliate on the other angles; glumes similar to those of the sessile spikelet, the first more distinctly nerved, the second shorter-awned; awn of fertile lemma shorter than that of sessile spikelet (fig. 109).

Open rocky places. Originally described from "O-Wyhee (inss. Sandwich—in sinu Byronis 11)." Hackel,[23] who received from Maximowicz an authentic specimen, states that it does not well agree with Trinius's description. He therefore describes the species anew. In the Gray Herbarium is a specimen of this species from "Herb. Soc. Hort. Lond." collected on "Ins. Owhyhee, ad sinum Byron" by Macrae. Macrae visited the Hawaiian Islands about 1825, having been sent out on an expedition by the Horticultural Society of London. Trinius's description applies to our plant fairly well, except that he gives the number of spikes as 3 or 4 and states that the nodes are glabrous and the first glume 11 to 13-nerved. There are also slight discrepancies in some of the measurements, but altogether the differences do not seem to be important enough to justify discarding Trinius's name in view of the evidence presented by the authentic specimens. It is highly probable that the specimen cited by Trinius was a duplicate from the Macrae collection, another specimen from the same collection being the type of Hackel's *Ischaemum lutescens*. I have therefore taken up Trinius's name.

Oahu: Without locality, Remy 110 (Gray Herbarium).

Molokai: Wailau Valley, Forbes 527.

Hawaii: Hilo, Hitchcock 14144; Newell in 1917; Wilkes Expl. Exped. Halawa, Faurie 1349. Rainbow Falls near Hilo, Hitchcock 14194.

Without locality: Wilkes Expl. Exped.

Spodiopogon aureus Hook. & Arn. is admitted to the Hawaiian flora by Hillebrand on the authority of Munro but this reference is probably incorrect.

46. **ANDROPOGON** L.

Spikelets in pairs at each node of an articulate rachis, one sessile and perfect, the other pedicellate and either staminate, neuter, or reduced to the pedicel, the rachis and the pedicels of the sterile spikelets often villous, sometimes conspicuously so; glumes of the fertile spikelet coriaceous, narrow, awnless, the first rounded, flat, or concave on the back, several-nerved, the median nerve weak or wanting; sterile lemma shorter than the glumes, empty, hyaline; fertile lemma hyaline, narrow, entire, or bifid, usually bearing a bent and twisted awn from the apex or from between the lobes; palea hyaline, small, or wanting; pedicellate spikelet awnless, in some species staminate and about as large as the sessile spikelet, in some consisting of one or more reduced glumes, or glumes wanting, only the pedicel present. Rather coarse perennials with solid culms, the spikelets arranged in racemes, these numerous, aggregate on an exserted peduncle, or single, in pairs, or sometimes in threes or fours, the common peduncle usually inclosed by a spathelike sheath, these sheaths often numerous, forming a compound inflorescence.

[23] In De Candolle, Alphonso, et Casimir, Monographie phanerogamarum, Vol. 6, p. 222. 1889.

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The Hawaiian species are all perennials belonging to the sections of the genus having the racemes aggregate at the end of the culms on an exserted peduncle. They have all been introduced for trial as forage grasses and have escaped from the plots where they were being grown.

Racemes numerous, in whorls or fascicles, scattered along an axis 10 to 20 cm. long; awns about 1 cm. long..... 1. **A. intermedius**
Racemes 2 to several, approximate at the summit of the culm; awns more than 1 cm. long.
Culms pubescent below the panicle; spikelets pubescent but not silky..... 2. **A. nodosus.**
Culms glabrous below the panicle.
Awns brown; racemes moderately pilose..... 3. **A. sericeus.**
Awns pale; racemes densely silky..... 4. **A. saccharoides.**

1. **Andropogon intermedius** R. Br. Prodr. Fl. Nov. Holl. 1:202. 1810.

Culms erect, 1 to 1.5 meters tall, glabrous, pilose at the nodes; sheaths smooth; blades flat or folded, elongate, about 5 mm. wide, glabrous, pilose around the base; panicle oblong, 10 to 20 cm. long, the axis smooth, the branches slender, in whorls, naked below, branching above, the branchlets appressed, pilose at base, bearing short racemes; joints of rachis pilose above, enlarged and cup-shaped at the upper end, about 2.5 mm. long and as long as the pedicel of the sterile floret, the latter pilose on the margins; sessile spikelet short-pilose at base, narrowly elliptic, about 4 mm. long, appressed-pilose, especially below; glumes about equal; sterile lemma narrow, two-thirds as long as the glumes; fertile lemma consisting of a slender awn about 1 cm. long, twisted below, obscurely geniculate above; sterile or pediceled spikelet consisting of a single elliptic glume 3 to 4 mm. long.

Cultivated ground; introduced. Originally described from Australia.
Molokai: Eastern end, along edge of taro field, Hitchcock 15079.

2. **Andropogon nodosus** (Willem.) Nash, N. Amer. Fl. 17:122. 1912.

Dichanthium nodosum Willem. Ann. Bot. Usteri 18:11. 1796.
Andropogon caricosus mollicomus Hack. in DC. Monogr. Phan. 6:569. 1889.

Culms erect from a more or less geniculate base, glabrous, 1 to 1.5 meters tall, pubescent at the nodes; sheaths glabrous; blades flat, 10 to 20 cm. long, 2 to 6 mm. wide, pilose around the base, scabrous on the upper surface; panicle of 2 to 5 peduncled racemes approximate at the summit of the culm, this and the peduncles densely and softly pubescent; racemes flexuous, 3 to 8 cm. long, the spikelets crowded, the broad outer glumes of the sessile and pediceled spikelets imbricate, concealing the rachis and the remainder of the spikelet, the rachis pilose; sessile spikelet 4 mm. long, short-pilose at base; outer glume broad, oblong, rounded at the apex, several-nerved, appressed-pubescent on the lower half, hispidulous on the margin; second glume narrower than the first, about as long, keeled, glabrous on the back, pubescent along the margin; sterile lemma very thin, nearly as long as the glumes; fertile lemma very narrow, continued into a bronze-brown awn 1.5 cm. long, tightly twisted to the first bend, loosely twisted to the second bend, straight beyond.

Introduced for trial by G. P. Wilder and called Wilder grass. Tropics of Asia. Originally described from Mauritius.
Escaped from grounds of the United States Experiment Station.
Oahu: Honolulu, Hitchcock 14071; Westgate in 1915.

3. **Andropogon sericeus** R. Br. Prodr. Fl. Nov. Holl. 201. 1810.

Culms erect, or decumbent at base, glabrous, pilose at the nodes, 50 to 100 cm. tall; sheaths glabrous; blades flat or more or less involute, often glaucous, scabrous, attenuate-pointed, 10 to 20 cm. long, 1 to 5 mm. wide, the uppermost very short; inflorescence of 2 to

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several nearly digitate racemes 3 to 6 cm. long on a glabrous exserted peduncle; rachis internode and sterile pedicel about half as long as the spikelet, pilose with long ascending hairs; sessile spikelet about 3.5 mm. long; first glume membranaceous, oblong-oval, obtuse, faintly nerved, pilose at base and on the lower half of the back, the hairs appressed, papillose-pilose along the margin above and in a curved line across the top below the apex, the hairs 2 to 3 mm. long; second glume as long as the first, coriaceous, ridged along the middle, included in the inrolled edges of the first, glabrous, or with a few long hairs at the apex; sterile lemma very thin, acute, two-thirds as long as the glumes; fertile lemma very narrow, continued into an awn about 2.5 mm. long, this bronze-brown, tightly twisted to the second bend; pediceled spikelet about 3 mm. long, cuneate-terete below and pilose with short hairs at base, broad, flat, obtuse above, glabrous on the back, pilose with long hairs along the margin and apex, about 7-nerved; second glume thin, about two-thirds as long as the first, the flat edges turned inward, the tip minutely puberulent.

Escaped from grounds of the United States Experiment Station. Originally described from Australia. Called Australian blue grass.
Oahu: Honolulu, Hitchcock 14122, 15606; Westgate in 1915.

4. **Andropogon saccharoides** Swartz, Prodr. Veg. Ind. Occ. 26. 1788.

Culms erect 60 to 100 cm. tall, glabrous, the nodes pilose; sheaths glabrous; blades flat, 10 to 20 cm. long, 2 to 4 mm. wide, scabrous-pilose about the base; inflorescence an oval or flabellate mass of very silky racemes on a glabrous exserted peduncle, the panicle glossy white, 5 to 10 cm. long, the axis 2 to 4 cm. long; racemes 2 to 4 cm. long; rachis internodes about 3 mm. long, densely pilose with ascending silky-white hairs as much as 7 mm. above, the lower shorter, the sterile pedicel similar; first glume of sessile spikelet elliptic, about 5 mm. long, several-nerved, densely silky-pilose on the callus and on the lower part of the back, glabrous above, scabrous along the margin at the apex; second glume narrower and included in the incurved edges of the first glume, firm, strongly ridge-keeled, glabrous, scaberulous at tip, as long as the first glume; sterile lemma very thin, shorter than the glumes; fertile lemma very narrow, extending into a pale, obscurely geniculate awn about 2.5 cm. long, tightly twisted to the bend; pediceled spikelet narrow, about 5 mm. long, concealed in the silky hairs of the pedicel, reduced to a single scaberulous-pubescent glume (fig. 105).

Dry ground along roadside; introduced or escaped from cultivation. Originally described from Jamaica.
Oahu: Honolulu, near the United States Experiment Station, Hitchcock 14073.
Molokai: Ka Lae o Ka Laau, Rock 8703.

The lemon grass (*Cymbopogon citratus* (DC.) Stapf; *Andropogon citratus* DC.) is sometimes planted but has scarcely become established. It has been collected in the Hii Mountains, Kauai (Forbes 695). This is a robust reedlike grass, 2 to 3 meters tall, with a large compound inflorescence, a meter or more in length, the 2 short racemes subtended by spathelike sheaths 1 to 2 cm. long. The outer glume of the sessile spikelet is concave on the back.

47. **HOLCUS** L.

(Sorghum Pers.)

Spikelets in pairs, one sessile and fertile, the other pedicellate, sterile but well developed, usually staminate, the terminal sessile spikelet with two pedicellate spikelets. Annual or perennial, tall or moderately tall grasses, with flat blades and terminal panicles of 1 to 5-jointed tardily disarticulating racemes.

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FIGURE 107. Rhaphis aciculata. From Hitchcock 13713, Oahu.



FIGURE 108.—Holcus halepensis. From U. S. Dept. Agr. Bull. 772, fig. 162.

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Plants perennial, with creeping rhizomes..... 1. **H. halepensis.**
Plants annual..... 2. **H. sorghum.**

1. **Holcus halepensis** L. Sp. Pl. 1047. 1753. JOHNSON GRASS.

Andropogon halepensis Brot. Fl. Lusit. 1:89. 1804.
Sorghum halepense Pers. Syn. Pl. 1:101. 1805.

Plants perennial, with stout scaly creeping rhizomes; culms erect, glabrous, 60 to 120 cm. tall; sheaths glabrous; blades flat, 6 to 15 mm. wide, the white midrib prominent; panicle 15 to 25 cm. long, more or less spreading; sessile spikelet about 5 mm. long, lanceolate; glumes pubescent, becoming glabrous and shining except at base and margins; pediceled spikelets narrow, 4 mm. long, on pedicels 3 mm. long, the glumes membranaceous, nerved, glabrous (fig. 108).

Introduced in fields and along roadsides. Originally described from Syria. Oahu: Nuuanu Valley, Forbes 1331. Manoa Valley, Hitchcock 13734.

2. **Holcus sorghum** L. Sp. Pl. 1047. 1753. SORGHUM. SORGO.

Sorghum saccharatum Moench. Meth. 207. 1794.
Sorghum vulgare Pers. Syn. Pl. 1:101. 1805.

Plants annual, usually robust, the spikelet characters similar to those of *H. halepensis*, the panicle large and spreading or compact. Many varieties are in cultivation throughout the world. Some of these have been grown in the Hawaiian islands and may occasionally be found growing spontaneously, though I have seen no specimens except the Sudan grass (*H. sorghum sudanensis* (Piper) Hitchc. Proc. Biol. Soc. Washington 29:128. 1916; *Andropogon sorghum sudanensis* Piper, Proc. Biol. Soc. Washington 28:33. 1915.), which has been found on the experiment plots at Schofield Barracks and has escaped in the vicinity. It was also found at Honolulu (Hitchcock 13674) and Lihue (Forbes 591). Hillebrand[24] describes two species, *Sorghum vulgare*, the sorghum or Guinea corn, and *S. saccharatum* the sweet or sugar sorghum. Sudan grass is widely grown in the United States for forage.

48. **RHAPHIS** Lour.

Spikelets in threes, one sessile and perfect, the other two pedicellate and sterile, or a pair below, one fertile and one sterile; fertile spikelet terete, the glumes coriaceous; sterile and fertile lemmas thin and hyaline, the latter long-awned. Perennial grasses, with open panicles, the three spikelets (reduced racemes) borne at the ends of slender naked branches.

1. **Rhaphis aciculata** (Retz.) Desv. Opusc. 69. 1831.

Andropogon aciculatus Retz. Obs. Bot. 5:22. 1789.
Rhaphis trivialis Lour. Fl. Cochinch. 553. 1790.
Andropogon acicularis Willd. Sp. Pl. 4:906. 1806.
Chrysopogon aciculatus Trin. Fund. Agrost. 188. 1820.

Desvaux uses the specific name *aciculare*, basing it upon "*Andropogon aciculare* Retz."

Plants perennial, creeping and rooting, the base of the sterile shoots in open ground covered with imbricate, scalelike old sheaths; culms ascending or erect from a decumbent base, 10 to 30 cm. tall; sheaths glabrous, mostly overlapping, ciliate or villous on the margin; blades mostly toward the decumbent base of the culm, flat, glabrous, scabrous on the margin with sharp rather distant teeth, 2 to 5 cm. long, 3 to 5 mm. wide, the uppermost much reduced; panicle narrowly elliptic, 3 to 6 cm. long, the slender branches ascending or appressed, smooth, as much

[24] Op. cit., p. 511.

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FIGURE 109.—Ischaemum byrone. From Hitchcock 14144, Hawaii.



FIGURE 110.—Heteropogon contortus. From U. S. Dept. Agr. Bull. 772, fig. 165.

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as 1 to 1.5 cm. long, some in whorls, others scattered; spikelets in clusters of 3 at the ends of the branches, the cluster 6 to 8 mm. long, disarticulating from the pedicel or branch by a long oblique callus extending down one side as a brown appressed-hispidulous ridge 5 mm. long, the callus forming a retrorsely bearded or barbed point to the fruit; sessile spikelet excluding the callus about 4 mm. long, acute, glabrous, hispidulous-scabrous on the margins above, and on the keel of the second glume, the latter awned, the awn about 2 mm. long; sterile lemma nearly as long as the first glume; fertile lemma rather narrow, tapering into an awn 5 mm. long; grain oblong, 2 mm. long; sterile spikelets on pedicels 2 to 3 mm. long, the pedicel hispidulous at the summit; glumes acuminate or awn-pointed, about 5 mm. long, scabrous at the tip; lemmas about equal, awnless, shorter than the glumes (fig. 107).

Common and often dominant on the central plain of Oahu. (Pl. XXXI, *C.*) The detached fruits are very troublesome as they work their way into the clothing by the barbed callus. Called by the Hawaiians pilipiliula.

Rocky slopes and open rather dry grassland; probably introduced. Originally described from the East Indies.

Kauai: Lihue, Forbes 734. Hanapepe River, Heller 2476.
Oahu: Schofield Barracks, Hitchcock 13931. Palolo Valley, Hitchcock 14143. Honolulu, Hitchcock 13713. Koko, Mann & Brigham 34. Hauula, Farmer 7.
Molokai: Pukoo, Hitchcock 15053. Above Kaluokoi, Rock 6179.
Hawaii: Hilo, Hitchcock 14171; Newell in 1917.

49. **HETEROPOGON** Pers.

Spikelets in pairs, one sessile, the other pedicellate, both of the lower few to several pairs staminate or neuter, the remainder of the sessile spikelets perfect, terete, long-awned, the pedicellate spikelets, like the lower, staminate, flat, conspicuous, awnless; glumes of the fertile spikelet equal, coriaceous, the first brown-hirsute, infolding the second; lemmas thin and hyaline, the fertile one narrow, extending into a strong bent and twisted brown awn; palea wanting; glumes of the staminate spikelet membranaceous, the first green, faintly many nerved, asymmetric, one submarginal keel rather broadly winged, the other wingless, the margins inflexed, the second glume narrower, symmetric; lemmas hyaline; palea wanting. Annual or perennial, often robust grasses, with flat blades and solitary racemes terminal on the culms and branches; rachis slender, the lower part, bearing the pairs of staminate spikelets, continuous, the remainder disarticulating obliquely at the base of each joint, the joint forming a sharp barbed callus below the fertile spikelet, the pedicellate spikelet readily falling.

1. **Heteropogon contortus** (L.) Beauv.; Roem. & Schult. Syst. Veg. 2:836. 1817.

Andropogon contortus L. Sp. Pl. 1045. 1753.

Plants perennial, cespitose, without rhizomes; culms erect, glabrous, 50 to 100 cm. tall; sheaths glabrous, compressed-keeled; blades mostly folded, glabrous, 10 to 30 cm. long, 2 to 5 mm. wide when unfolded; racemes excluding the awns 4 to 8 cm. long, somewhat falcate, 1-sided, green or tawny, the awns brown; outer glumes 7 to 8 mm. long, more or less papillose-hispid; awn of fertile lemma about 10 cm. long, with two rather indistinct bends, the terminal segment about 5 cm. long (fig. 110).

Called by the Hawaiians pili grass and used by them to form the walls of huts by binding to the frame. (Pl. XXXI, *A.*)

Open rocky slopes. Tropics of both hemispheres. Originally described from India.

Kauai: Nonou Mountains, Forbes 594a. Hanapepe River, Heller 2522.

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Oahu: Honolulu, Hitchcock 13721, 14069. Without locality, Mann & Brigham 2; Didrichson, 1845-47; Remy 109 (Gray Herbarium).
Molokai: Pukoo, Hitchcock 15053. Above Kaluokoi, Rock 6179.
Lanai: Hitchcock 14686.
Hawaii: Hilo, Hitchcock 14202.
Without locality: "Sandwich Islands" Wilkes Expl. Exped.

50. **COIX** L.

Spikelets unisexual; staminate spikelets 2-flowered, in twos or threes on the continuous rachis, the normal group consisting of a pair of sessile spikelets with a single pedicellate spikelet between them, this sometimes reduced to a pedicel or wanting; glumes membranaceous, obscurely nerved; lemma hyaline, nearly as long as the glumes, awnless, 5-nerved; palea hyaline, a little shorter than the lemma; stamens 3; pistillate spikelets 3 together, 1 fertile and 2 sterile at the base of the inflorescence; fertile spikelet consisting of 2 glumes, 1 sterile lemma, a fertile lemma, and a palea; glumes several-nerved, hyaline below, chartaceous in the upper narrow pointed part, the first very broad, infolding the spikelet, the margins infolded beyond the 2 lateral stronger pair of nerves, the second glume narrower than the first, keeled; sterile lemma about as long as the second glume, similar in shape, but a little narrower, hyaline below, somewhat chartaceous above; fertile lemma hyaline, narrow, somewhat shorter than the sterile lemma; palea hyaline, narrow, shorter than the lemma; sterile spikelets consisting of a single narrow tubular glume as long as the fertile spikelet, somewhat chartaceous. Tall branched grasses with broad flat blades, the monoecious inflorescences numerous on long, stout peduncles clustered in the axils of the leaves, each inflorescence consisting of an ovate or oval, pearly white or drab, beadlike, very hard, tardily deciduous involucre (much modified sheathing bract) containing the pistillate lower portion of the inflorescence, the points of the pistillate spikelets and the slender axis of the staminate portion of the inflorescence protruding through the orifice at the apex, the staminate upper portion of the inflorescence 2 to 4 cm. long, soon deciduous, consisting of several clusters of staminate spikelets.

1. **Coix lachryma-jobi** L. Sp. Pl. 972. 1753. JOB'S TEARS.

Freely branching perennial as much as 1 meter tall; blades cordate-clasping, 2 to 3 cm. wide; involucres or "beads" 8 to 10 mm. long (fig. 99).

Moist places; introduced. Originally described from the East Indies.
Kauai: Along Hanapepe River, Heller 2554.
Oahu: Upper Manoa Valley, Hitchcock 13738.
Hawaii: Hilo, Hitchcock 14176.

Indian corn or maize (*Zea mays* L. Sp. Pl. 971. 1753) is cultivated and waifs are found occasionally.

The following species were received too late to be included in the text:

Bromus rubens L. Cent. Pl. 1:5. 1755. An annual with compact ovoid inflorescence, narrow spikelets, and straight awns about 2 centimeters long. Puu Oo Ranch, Hawaii. Introduced from Europe. Communicated by Dr. H. L. Lyon.

Bromus sterilis L. Sp. Pl. 77. 1753. An annual with open panicle, pendulous, narrow, glabrous spikelets, the awns 1.5 to 2.5 centimeters long. Parker Ranch, Hawaii. Introduced from Europe. Communicated by Dr. H. L. Lyon.

Axonopus compressus (Swartz) Beauv. Ess. Agrost. 12. 1812. (*Milium compressum* Swartz, Prodr. Veg. Ind. Occ. 24. 1728. *Paspalum compressum* Raspail, Ann. Sci. Nat. 5:301. 1825.) Carpet grass. A glabrous stoloniferous perennial, with flat thin blades 8 to 10 mm. wide, and 2 to 5 slender racemes along a short axis. Kona, Hawaii. Introduced from tropical America. Collected by Herbert Shipman and communicated by Dr. H. L. Lyon.

Chaetochloa barbata (Lam.) Hitchcock & Chase, Contr. U. S. Nat. Herb. 18:348. 1917. (*Panicum barbatum* Lam. Tabl. Encycl. 1:171. 1791.) A weak-stemmed geniculate annual with thin, scabrous, more or less plicate blades 1 to 3 centimeters wide, narrow rather open panicles, belonging to the section Ptychophyllum. Introduced from tropical Asia. Mrs. Foster's grounds, Honolulu. Hitchcock 16699.

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CATALOG OF SPECIMENS CITED

Unless otherwise stated all specimens cited are in the United States National Herbarium. List is arranged by collectors' names and numbers.

BRYAN

8729. Cenchrus agrimonioides
8730. Eragrostis variabilis
8731. Eragrostis variabilis

CURRAN

18. Chloris gayana

DIDRICHSEN

3444. Capriola dactylon

FARMER

7. Rhaphis aciculata
11. Paspalum orbiculare
12. Capriola dactylon
16. Syntherisma chinensis

FAURIE

1282. Chloris paraguayensis
1283. Chloris radiata
1284. Aira nubigena
1300. Syntherisma chinensis
1306. Poa mannii
1316. Panicum xerophilum
1318. Panicum fauriei
1320. Sporobolus virginicus
1329. Eragrostis grandis
1332. Eragrostis variabilis
1340. Garnotia sandwicensis
1348. Stenotaphrum secundatum
1349. Ischaemum byrone
1354. Tricholaena rosea
1356. Gastridium ventricosum [presumably Faurie]
1358. Trisetum glomeratum
1359. Trisetum glomeratum
1363. Aira nubigena
1366. Aira nubigena

FORBES

Specimens are independently numbered for each island. Duplicate numbers are here distinguished by the initial letter of the island represented.

15. Panicum imbricatum
16. Eragrostis variabilis
43. Eragrostis leptophylla
47. Eragrostis variabilis
58. Eragrostis variabilis
70. Eragrostis grandis
95. Dactylis glomerata
96. Anthoxanthum odoratum
98. Agrostis stolonifera
99. Lolium multiflorum
102. Festuca bromoides
150. Panicum torridum
168. Trisetum glomeratum
170H. Aira nubigena
170M. Sporobolus elongatus
171. Polypogon lutosus
182. Eragrostis grandis
190. Panicum isachnoides
191H. Eragrostis deflexa
191M. Panicum imbricatum
199. Aira nubigena
205. Festuca megalura
211. Festuca bromoides
217. Eragrostis monticola
218. Panicum kaalaense
219. Dissochondrus biflorus
236. Isachne distichophylla
253. Garnotia sandwicensis
256. Isachne distichophylla
258. Eragrostis leptophylla
259. Panicum tenuifolium
261H. Polypogon lutosus
261M. Syntherisma chinensis
263. Poa pratensis
277. Isachne distichophylla
294. Aira nubigena
306. Garnotia sandwicensis
313. Panicum tenuifolium
315a. Panicum tenuifolium
320. Eragrostis grandis
324. Dactylis glomerata
325. Paspalum dilatatum
358. Isachne distichophylla
367. Eragrostis grandis
368. Aira nubigena
369. Calamagrostis hillebrandi

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371. Calamagrostis expansa
379. Panicum nephelophilum
390. Panicum imbricatum
393. Cenchrus hillebrandianus
401. Panicum imbricatum
402.. Panicum imbricatum
412. Isachne distichophylla
413. Eragrostis grandis
465. Capriola dactylon
466. Syntherisma sanguinalis
474. Agrostis sandwicensis
478. Echinochloa crusgalli crus-pavonis
479. Paspalum orbiculare
480. Echinochloa crusgalli crus-pavonis
487. Eragrostis grandis
495. Oplismenus hirtellus
497. Oplismenus hirtellus
527. Ischaemum byrone
558. Isachne distichophylla
582. Syntherisma pruriens
591. Holcus sorghum sudanensis
594a. Heteropogon contortus
624. Eragrostis variabilis
625. Tricholaena rosea
630. Echinochloa crusgalli crus-pavonis
695. Cymbopogon citratus
703. Panicum kauaiense
710. Isachne distichophylla
714. Eragrostis variabilis
734. Rhaphis aciculata
735. Eleusine indica
737. Paspalum dilatatum
774. Agrostis verticillata
775. Panicum kaalaense
796. Poa sandvicensis
805. Aira nubigena
811. Panicum hillebrandianum
820. Panicum nephelophilum
830. Trisetum glomeratum
852. Aira nubigena
853. Trisetum glomeratum
854. Trisetum glomeratum
855H. Trisetum glomeratum
855K. Eragrostis variabilis
863. Poa annua
875. Aira nubigena
879. Panicum imbricatum
949. Eragrostis variabilis
990. Festuca bromoides
992. Poa sandvicensis
1013. Eragrostis grandis
1018. Agrostis stolonifera
1021. Cenchrus hillebrandianus
1052. Panicum forbesii
1055. Isachne pallens
1063. Eragrostis grandis
1074K. Dactylis glomerata
1074O. Dactyloctenium aegyptium
1086. Eragrostis variabilis
1087. Eragrostis variabilis
1191. Schizostachyum glaucifolium
1331. Holcus halepensis
1454. Panicum torridum
1522. Stenotaphrum secundatum
1523. Chaetochloa geniculata
1526. Briza minor
1603. Isachne pallens
1686. Festuca megalura
1692. Agrostis retrofracta
1693. Panicum kaalaense
1714. Syntherisma sanguinalis
1715. Sporobolus diander
1717. Paspalum orbiculare
1845. Isachne distichophylla
1938. Tricholaena rosea
1951. Oplismenus hirtellus
2294. Eragrostis variabilis
2403. Eragrostis variabilis
2414. Panicum nubigenum
2415. Panicum torridum
2447. Panicum nubigenum
2449. Panicum torridum
2455. Panicum torridum

HANCE

4926. Panicum lanaiense

HAPEMAN

7. Poa pratensis

HELLER

1960. Capriola dactylon
1961. Chaetochloa verticillata
1962. Eragrostis amabilis
1963. Chloris radiata
1964. Cenchrus hillebrandianus
1971. Paspalum orbiculare
1972. Syntherisma pruriens
1975. Paspalum conjugatum
1978. Echinochloa colonum
1992. Eragrostis variabilis
2061. Oplismenus hirtellus
2210. Polypogon lutosus
2288. Eragrostis cilianensis
2289. Chaetochloa verticillata
2290. Eleusine indica
2320. Syntherisma sanguinalis

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2321. Syntherisma chinensis
2359. Stenotaphrum secundatum
2384. Echinochloa crusgalli crus-pavonis
2384a. Echinochloa crusgalli crus-pavonis
2469. Chaetochloa geniculata
2476. Rhaphis aciculata
2489. Isachne pallens
2522. Heteropogon contortus
2554. Coix lachryma-jobi
2779. Agrostis retrofracta
2830. Eragrostis variabilis
2850. Panicum nephelophilum

HILLEBRAND

484. Oplismenus hirtellus
490. Stenotaphrum secundatum
492. Paspalum conjugatum

HITCHCOCK

13672. Paspalum fimbriatum
13674. Holcus sorghum sudanensis
13681. Chloris radiata
13682. Dactyloctenium aegyptium
13683. Syntherisma sanguinalis
13707. Chaetochloa verticillata
13708. Capriola dactylon
13709. Echinochloa colonum
13710. Eleusine indica
13711. Chloris paraguayensis
13712. Syntherisma chinensis
13713. Rhaphis aciculata
13720. Eragrostis amabilis
13721. Heteropogon contortus
13723. Eragrostis amabilis
13729. Paspalum conjugatum
13730. Paspalum orbiculare
13732. Chaetochloa palmifolia
13734. Holcus halepensis
13735. Syntherisma pruriens
13736. Echinochloa crusgalli crus-pavonis
13737. Paspalum larrañagai
13738. Coix lachryma-jobi
13746. Echinochloa colonum
13747. Festuca bromoides
13749. Avena fatua
13750. Poa annua
13751. Polypogon monspeliensis
13768. Stenotaphrum secundatum
13776. Oplismenus hirtellus
13778. Lolium temulentum
13779. Festuca bromoides
13780. Phalaris paradoxa
13782. Poa annua
13783. Chaetochloa geniculata
13789. Polypogon lutosus
13790. Eragrostis variabilis
13791. Eragrostis variabilis
13792. Paspalum orbiculare
13799. Briza minor
13800. Echinochloa crusgalli crus-pavonis
13801. Cenchrus hillebrandianus
13802. Eragrostis cilianensis
13803. Paspalum distichum
13841. Valota insularis
13843. Eragrostis caroliniana
13844. Bromus molliformis
13846. Echinochloa crusgalli crus-pavonis
13849. Chloris truncata
13854. Cenchrus echinatus
13858. Panicum maximum
13859. Lolium multiflorum
13862. Syntherisma pruriens
13863. Syntherisma chinensis
13868. Festuca megalura
13869. Agrostis stolonifera
13870. Agrostis retrofracta
13877. Chaetochloa palmifolia
13879. Paspalum orbiculare
13880. Chaetochloa geniculata
13884. Sporobolus virginicus
13900. Echinochloa crusgalli crus-pavonis
13901. Echinochloa crusgalli crus-pavonis
13914. Bromus molliformis
13915. Phalaris minor
13917. Lolium multiflorum
13920. Hordeum murinum
13922. Bromus rigidus gussonei
13923. Lolium multiflorum
13928. Eragrostis grandis
13930. Paspalum orbiculare
13931. Rhaphis aciculata
13934. Avena barbata
13935. Paspalum orbiculare
13939. Festuca bromoides
13940. Sporobolus elongatus
13941. Syntherisma chinensis
13946. Chloris gayana
13947. Agrostis retrofracta
13949. Sporobolus elongatus
13950. Eragrostis grandis
13951. Eragrostis grandis
13952. Dissochondrus biflorus
13959. Agrostis retrofracta
13960. Cenchrus hillebrandianus
13962. Secale cereale

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13963. Hordeum vulgare
13964. Triticum aestivum
13965. Triticum aestivum
13966. Triticum aestivum
13972. Avena sativa
13975. Bromus molliformis
13977. Syntherisma chinensis
13978. Paspalum orbiculare
13980. Tricholaena rosea
13981. Paspalum dilatatum
14013. Panicum kaalaense
14014. Panicum nephelophilum
14020. Paspalum orbiculare
14031. Echinochloa crusgalli crus-pavonis
14035. Oplismenus hirtellus
14048. Gastridium ventricosum
14054. Chaetochloa geniculata
14057. Oplismenus hirtellus
14064. Bouteloua curtipendula
14065. Chaetochloa verticillata
14066. Chloris paraguayensis
14067. Paspalum conjugatun
14068. Cenchrus hillebrandianus
14069. Heteropogon contortus
14070. Sporobolus diander
14071. Andropogon nodosus
14072. Paspalum dilatatum
14073. Andropogon saccharoides
14074. Eragrostis amabilis
14075. Bouteloua curtipendula
14076. Chaetochloa palmifolia
14077. Chaetochloa geniculata
14081. Paspalum larrañagai
14088. Chloris gayana
14101. Echinochloa crusgalli crus-pavonis
14107. Syntherisma chinensis
14117. Echinochloa crusgalli crus-pavonis
14119. Echinochloa crusgalli crus-pavonis
14121. Chloris radiata
14122. Andropogon sericeus
14123. Eragrostis abyssinica
14139. Eragrostis variabilis
14141. Eragrostis variabilis
14142. Eragrostis variabilis
14143. Rhaphis aciculata
14144. Ischaemum byrone
14145. Panicum repens
14148. Chaetochloa palmifolia
14151. Echinochloa crusgalli crus-pavonis
14152. Stenotaphrum secundatum
14169. Syntherisma chinensis
14171. Rhaphis aciculata
14175. Pennisetum macrostachyum
14176. Coix lachryma-jobi
14181. Echinochloa crusgalli crus-pavonis
14182. Paspalum conjugatum
14183. Panicum barbinode
14186. Syntherisma longiflora
14188. Syntherisma chinensis
14190. Syntherisma pruriens
14191. Syntherisma sanguinalis
14192. Paspalum orbiculare
14193. Garnotia sandwicensis
14194. Ischaemum byrone
14195. Agrostis retrofracta
14197. Festuca megalura
14198. Aira nubigena
14199. Oplismenus hirtellus
14202. Heteropogon contortus
14203. Sporobolus elongatus
14204. Notholcus lanatus
14205. Agrostis retrofracta
14206. Tricholaena rosea
14208. Panicum tenuifolium
14209. Briza minor
14210. Festuca megalura
14211. Bromus unioloides
14212. Anthoxanthum odoratum
14213. Dactylis glomerata
14214. Paspalum dilatatum
14215. Festuca bromoides
14216. Agrostis stolonifera
14219. Bromus rigidus gussonei
14220. Eragrostis grandis
14221. Agrostis verticillata
14223. Poa annua
14225. Aira nubigena
14231. Agrostis stolonifera
14232. Agrostis retrofracta
14235. Trisetum glomeratum
14243. Agrostis sandwicensis
14244. Trisetum glomeratum
14245. Agrostis exarata microphylla
14250. Aira nubigena
14251. Panicum tenuifolium
14252. Notholcus lanatus
14256. Panicum tenuifolium
14264. Panicum tenuifolium
14266. Bromus racemosus
14267. Arrhenatherum elatius
14269. Poa annua
14284. Trisetum glomeratum
14285. Agrostis sandwicenisis
14296. Chloris gayana
14298. Agrostis sandwicensis
14299. Trisetum glomeratum
14348. Hordeum murinum
14376. Agrostis retrofracta
14395. Isachne distichophylla
14413. Panicum tenuifolium
14418. Agrostis sandwicensis
14419. Trisetum glomeratum

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14431. Trisetum glomeratum
14434. Bromus hordeaceus
14435. Festuca bromoides
14436. Festuca bromoides
14437. Aira nubigena
14440. Eragrostis leptophylla
14442. Poa compressa
14445. Eragrostis atropioides
14446. Festuca hawaiiensis
14447. Eragrostis leptophylla
14448. Eragrostis leptophylla
14450. Poa pratensis
14452. Agrostis sandwicensis
14453. Trisetum glomeratum
14455. Poa annua
14457. Trisetum glomeratum
14458. Eragrostis leptophylla
14459. Eragrostis atropioides
14461. Chaetochloa lutescens
14462. Echinochloa crusgalli crus-pavonis
14464. Bromus unioloides
14465. Microlaena stipoides
14474. Agrostis verticillata
14475. Panicum kaalaense
14476. Eragrostis deflexa
14479. Oplismenus hirtellus
14492. Chloris gayana
14493. Eragrostis atropioides
14494. Eragrostis deflexa
14495. Eragrostis atropioides
14510. Trisetum glomeratum
14511. Festuca bromoides
14518. Panicum tenuifolium
14519. Eragrostis brownei
14520. Trisetum glomeratum
14521. Aira nubigena
14527. Trisetum glomeratum
14529. Agrostis sandwicensis
14530. Festuca megalura
14531. Agrostis retrofracta
14536. Festuca hawaiiensis
14544. Oplismenus hirtellus
14591. Eragrostis variabilis
14592. Agrostis sandwicensis
14593. Eragrostis deflexa
14598. Isachne distichophylla
14602. Sacciolepis contracta
14604. Agrostis sandwicensis
14605. Polypogon monspeliensis
14610. Cenchrus hillebrandianus
14611. Eragrostis variabilis
14615. Sacciolepis contracta
14621. Trisetum glomeratum
14622. Aira nubigena
14631. Agrostis sandwicensis
14640. Agrostis retrofracta
14641. Chloris gayana
14642. Isachne distichophylla
14686. Heteropogon contortus
14688. Eragrostis grandis
14691. Eragrostis grandis
14692. Eragrostis grandis
14693. Eragrostis monticola
14715. Eragrostis deflexa
14716. Cenchrus hillebrandianus
14719. Panicum torridum
14722. Chloris radiata
14728. Aira nubigena
14729. Agrostis fallax
14730. Calamagrostis hillebrandi
14731. Panicum hillebrandianum
14732. Panicum imbricatum
14733. Panicum isachnoides
14764. Agrostis retrofracta
14810. Eragrostis grandis
14825. Aira nubigena
14830. Calamagrostis expansa
14871. Polypogon lutosus
14878. Oplismenus hirtellus
14879. Oplismenus hirtellus
14885. Agrostis retrofracta
14887. Sacciolepis contracta
14899. Aira nubigena
14907. Aira nubigena
14910. Sacciolepis contracta
14922. Poa annua
14931. Briza minor
14934. Sporobolus elongatus
14935. Festuca bromoides
14937. Syntherisma chinensis
14938. Aspris caryophyllea
14942. Aira nubigena
14946. Eragrostis grandis
14953. Trisetum glomeratum
14959. Trisetum glomeratum
14963. Eragrostis grandis
14965. Aira nubigena
14969. Aira nubigena
14973. Aspris caryophyllea
14975. Festuca bromoides
14976. Agrostis sandwicensis
14988. Phalaris minor
14993. Trisetum glomeratum
14996. Panicularia fluitans
14998. Trisetum glomeratum
14999. Phalaris californica
15041. Oplismenus hirtellus
15048. Stenotaphrum secundatum
15053. Heteropogon contortus
15054. Paspalum orbiculare
15056. Cenchrus hillebrandianus
15058. Rhaphis aciculata

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15065. Syntherisma chinensis
15079. Andropogon intermedius
15103. Agrostis retrofracta
15104. Aira nubigena
15105. Echinochloa crusgalli crus-pavonis
15110. Echinochloa crusgalli crus-pavonis
15130. Sporobolus virginicus
15145. Panicum fauriei
15150. Tricholaena rosea
15152. Lolium multiflorum
15153. Paspalum dilatatum
15154. Eragrostis grandis
15155. Eragrostis monticola
15156. Bromus unioloides
15159. Dactylis glomerata
15162. Sporobolus elongatus
15164. Briza minor
15170. Anthoxanthum odoratum
15186. Calamagrostis hillebrandi
15195. Panicum imbricatum
15199. Agrostis retrofracta
15210. Briza minor
15223. Agrostis retrofracta
15229. Poa mannii
15249. Chaetochloa geniculata
15250. Chloris radiata
15253. Agrostis retrofracta
15257. Syntherisma consanguinea
15260. Syntherism chinensis
15274. Eragrostis variabilis
15284. Panicum nephelophilum
15301. Agrostis verticillata
15309. Poa sandvicensis
15340. Aira nubigena
15436. Panicum nephelophilum
15503. Panicum cynodon
15504. Panicum isachnoides
15505. Panicum isachnoides
15505½. Panicum imbricatum
15506. Aira nubigena
15517. Panicum cynodon
15518. Panicum isachnoides
15536. Poa siphonoglossa
15543. Eragrostis variabilis
15561. Paspalum fimbriatum
15606. Andropogon sericeus

MANN AND BRIGHAM

1. Cenchrus hillebrandianus
2. Heteropogon contortus
15. Eragrostis variabilis
20. Oplismenus hirtellus
24. Echinochloa crusgalli crus-pavonis
34. Raphis aciculata
44. Eragrostis falcata
59. Paspalum orbiculare
71. Eragrostis cilianensis
88. Stenotaphrum secundatum
213. Isachne distichophylla
218. Eragrostis variabilis
237. Panicum tenuifolium
245. Sporobolus virginicus
251. Eragrostis variabilis
268. Echinochloa colonum
272. Panicum torridum
273. Agrostis verticillata
274. Poa mannii
279. Eragrostis grandis
300. Panicum nephelophilum
306. Aira nubigena
326. Trisetum glomeratum
368. Poa sandvicensis
383. Panicum lanaiense
435. Panicum hillebrandianum
459. Poa annua

MUNRO

6. Panicum beecheyi
6b. Panicum beecheyi
7. Echinochloa colonum
272. Panicum nephelophilum
295. Panicum xerophilum
317. Trisetum glomeratum
334. Panicum nephelophilum
346. Isachne distichophylla
364. Isachne distichophylla
404. Cenchrus agrimonioides
467. Panicum nephelophilum

REMY

NOTE.—Two sheets are numbered 82.

75. Agrostis sandwicensis
76. Chloris radiata
82. Capriola dactylon
82. Trisetum glomeratum
89. Eragrostis variabilis
92. Eragrostis leptophylla
103. Paspalum orbiculare
104. Oplismenus hirtellus
106. Chaetochloa geniculata
109. Heteropogon contortus
110. Ischaemum byrone

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ROCK

10. Lepturus repens
2180. Eragrostis variabilis
2545. Panicum torridum
3114. Aira nubigena
3155. Festuca bromoides
3198. Hordeum murinum
3212. Dactylis glomerata
3219. Aira nubigena
3260. Trisetum glomeratum
3298. Festuca bromoides
3322. Festuca bromoides
3437. Notholcus lanatus
3457. Briza minor
3461. Lolium multiflorum
3462. Agrostis retrofracta
3467. Festuca bromoides
3628. Trisetum glomeratum
4135. Isachne distichophylla
4176. Aira nubigena
4179. Eragrostis grandis
4189. Polypogon monspeliensis
4508. Sporobolus elongatus
4511. Tricholaena rosea
4519. Chaetochloa palmifolia
4527. Paspalum orbiculare
4536. Echinochloa crusgalli crus-pavonis
4545. Syntherisma pruriens
5120. Agrostis verticillata
5124. Agrostis retrofracta
5128. Bromus hordeaceus
5129. Eragrostis grandis
5131. Eragrostis variabilis
5644. Panicum imbricatum
6148. Eragrostis monticola
6179. Heteropogon contortus
8139. Aira nubigena
8190. Calamagrostis hillebrandi
8403. Bromus rigidus gussonei
8404. Trisetum glomeratum
8405. Eragrostis atropioides
8407. Bromus unioloides
8408. Aira nubigena
8508. Agrostis sandwicensis
8511. Aira nubigena
8512. Trisetum glomeratum
8558. Gastridium ventricosum
8703. Andropogon saccharoides
8704. Panicum torridum
8705. Panicum xerophilum
8708. Panicum pellitum
8709. Trisetum glomeratum
9018. Poa siphonoglossa
12580. Agrostis sandwicensis
12638. Panicum nephelophilum
12639. Poa sandvicensis
12733. Eragrostis grandis
12736. Eragrostis variabilis
12738. Agrostis canina
12740. Eragrostis variabilis
12741. Eragrostis variabilis
12766. Panicum nubigenum
14005. Panicum xerophilum
16001. Agrostis fallax
16002. Eragrostis grandis
16003. Calamagrostis hillebrandi
16004. Agrostis sandwicensis
16005. Eragrostis grandis
17072. Eragrostis grandis
17081. Dissochondrus biflorus
17082. Panicum kaalaense
17087. Eragrostis grandis
17260. Eragrostis variabilis
17326. Isachne pallens

SEEMAN

2248. Oplismenus hirtellus
2249. Paspalum orbiculare

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LIST OF NEW SPECIES AND NEW NAMES

Aira nubigena (Hillebr.) Hitchc.
Deschampsia nubigena Hillebr.

Calamagrostis hillebrandi (Munro) Hitchc.
Deyeuxia hillebrandi Munro

Calamagrostis expansa (Munro) Hitchc.
Deyeuxia expansa Munro

Cenchrus hillebrandianus Hitchc. sp. nov.

Eragrostis deflexa Hitchc. sp. nov.

Eragrostis leptophylla Hitchc. sp. nov.

Eragrostis mauiensis Hitchc. sp. nov.

Festuca hawaiiensis Hitchc. sp. nov.

Ischaemum byrone (Trin.) Hitchc.
Spodiopogon byronis Trin.

Panicum fauriei Hitchc. sp. nov.

Panicum forbesii Hitchc. sp. nov.

Panicum hillebrandianum Hitchc.
Panicum monticola Hillebr. Not *P. monticola* Hook. f.

Panicum kaalaense Hitchc. sp. nov.

Panicum kauaiense Hitchc. sp. nov.

Panicum lanaiense Hitchc.
Panicum affine Hook. & Arn. Not *P. affine* Poir.

Panicum xerophilum (Hillebr.) Hitchc.
Panicum nephelophilum xerophilum Hillebr.

Poa sandvicensis (Reichart) Hitchc.
Festuca sandvicensis Reichart

Poa section **Siphonocoleus** sect. nov.

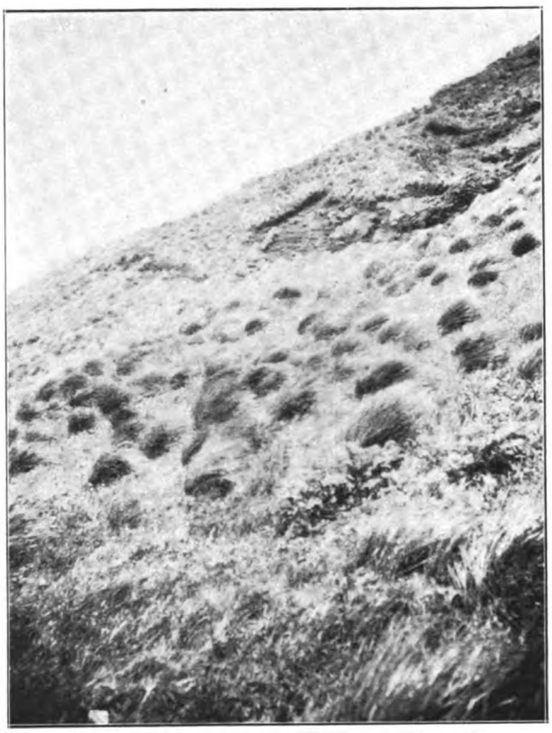
Syntherisma chinensis (Nees) Hitchc.
Paspalum chinensis Nees

Syntherisma microbachne (Presl) Hitchc.
Panicum microbachne Presl

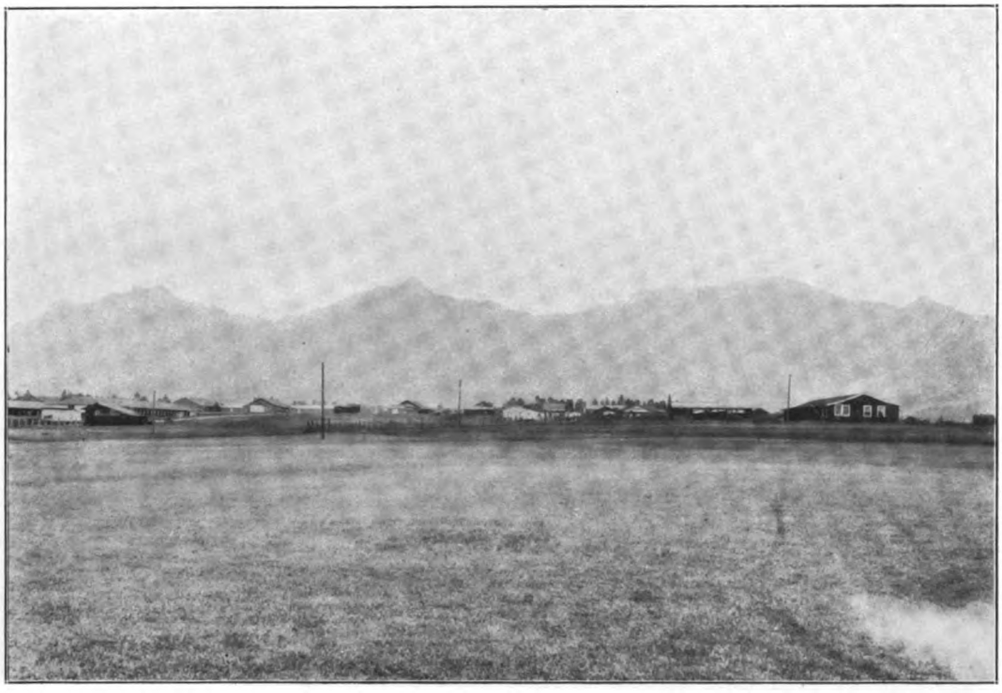
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A. HAWAIIAN HUT THATCHED WITH PILI GRASS (HETEROPOGON CONTORTUS).

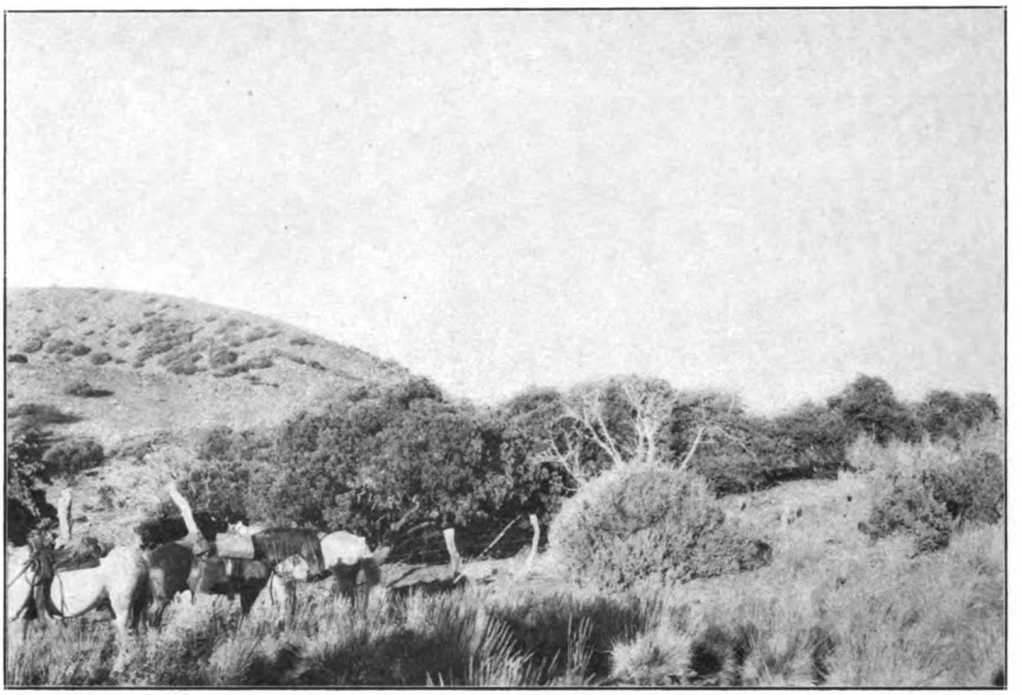


B. ERAGROSTIS VARIABILIS AT NUUANU PALI. A STRONG WIND IS BLOWING THROUGH THE PASS.

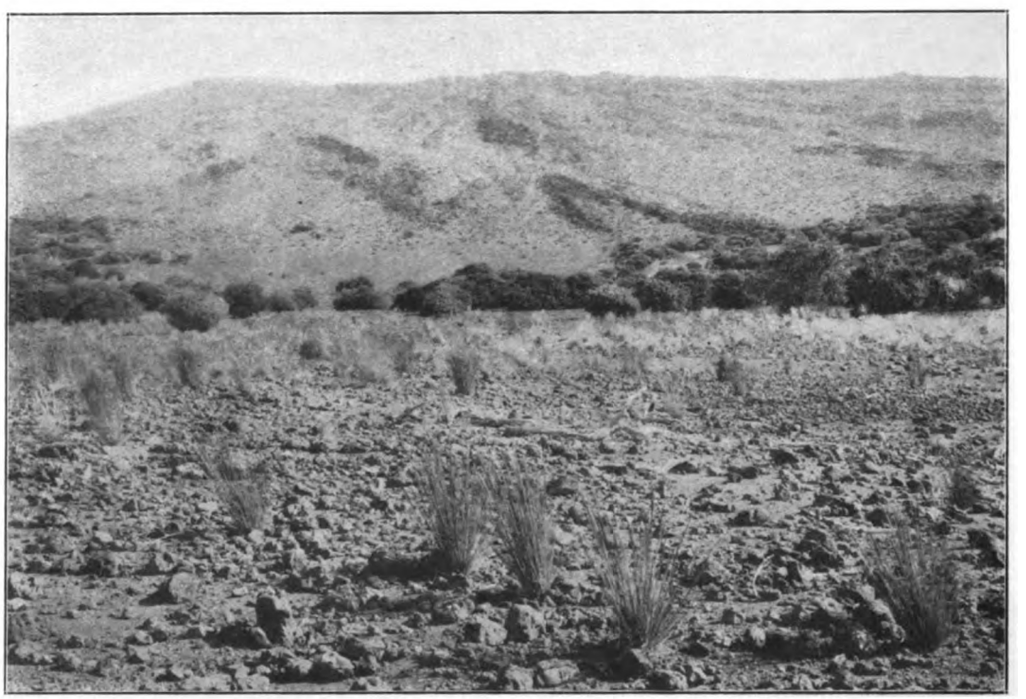


C. THE CENTRAL PLAIN OF OAHU AT SCHOFIELD BARRACKS. THE GRASS IN THE FOREGROUND IS MAINLY PILIPILIULA (RHAPHIS ACICULATA). MOUNT KAALA IN THE BACKGROUND AT THE RIGHT.

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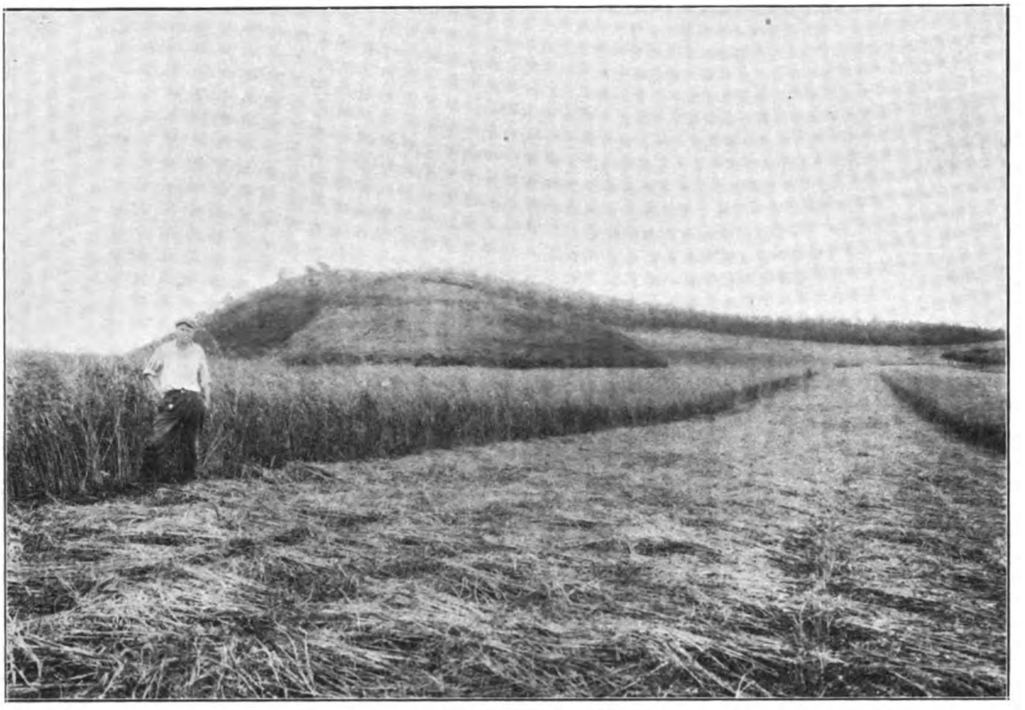


A. TIMBER LINE ON MAUNA KEA, HAWAII. TRISETUM GLOMERATUM IN THE FOREGROUND.

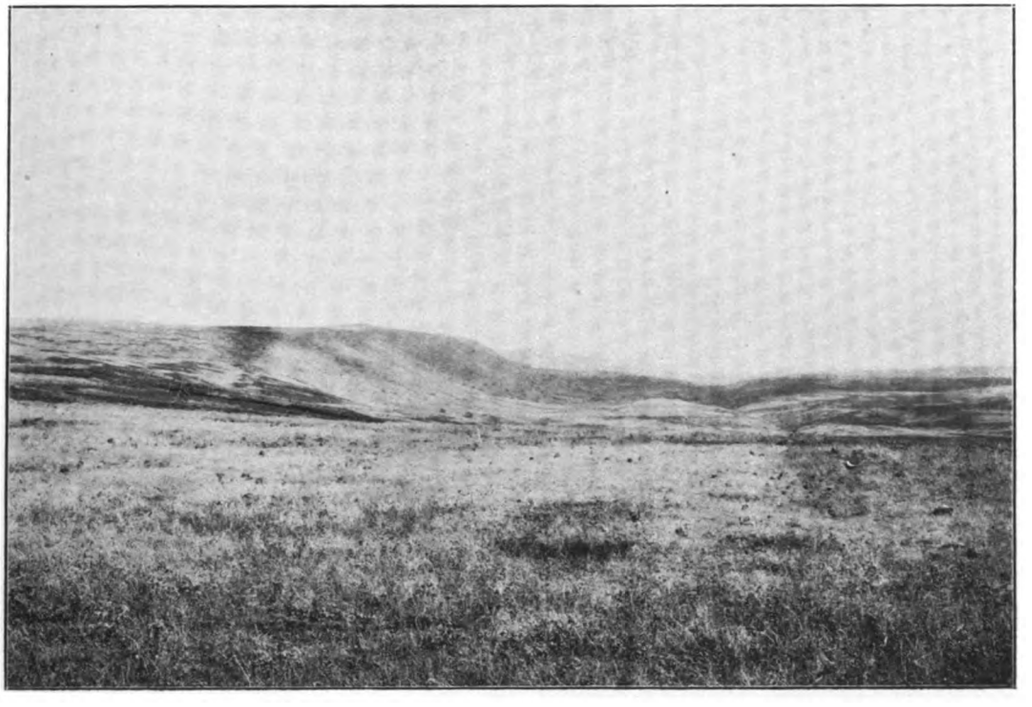


B. MAUNA KEA NEAR TIMBER LINE. AGROSTIS SANDWICENSIS IN THE FOREGROUND AND AIRA NUBIGENA IN THE BACKGROUND. THE SHRUBS ARE MOSTLY MAMANI (SOPHORA CHRYSOPHYLLA).

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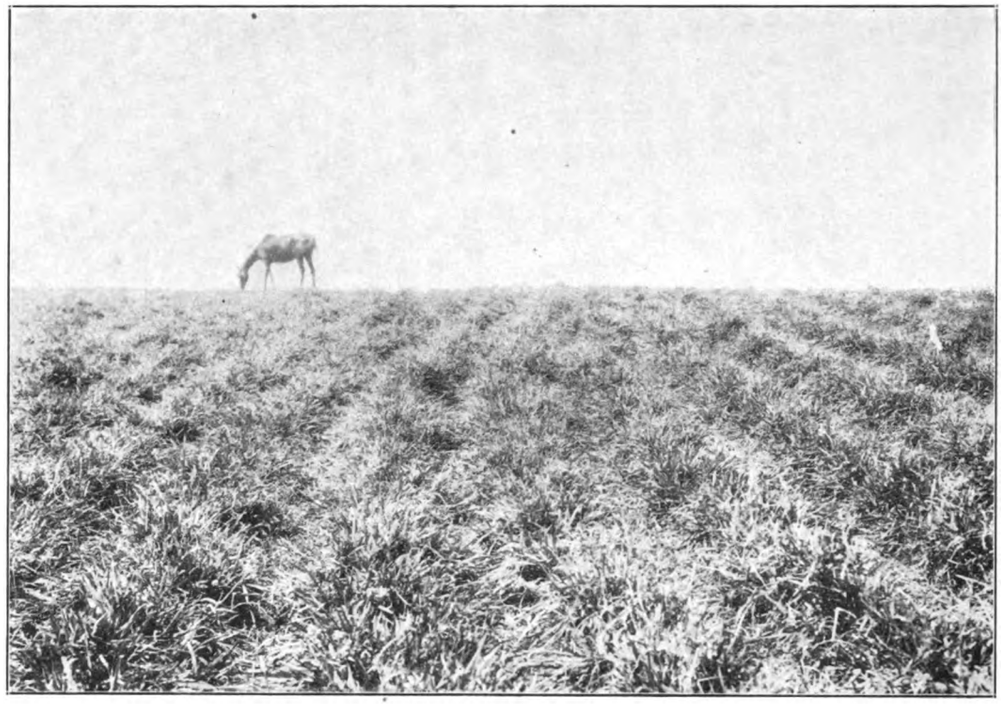


A. A FIELD OF SUDAN GRASS (HOLCUS SORGHUM SUDANENSIS) AT THE UNITED STATES AGRICULTURAL EXPERIMENT SUBSTATION, HAIKU, MAUI.

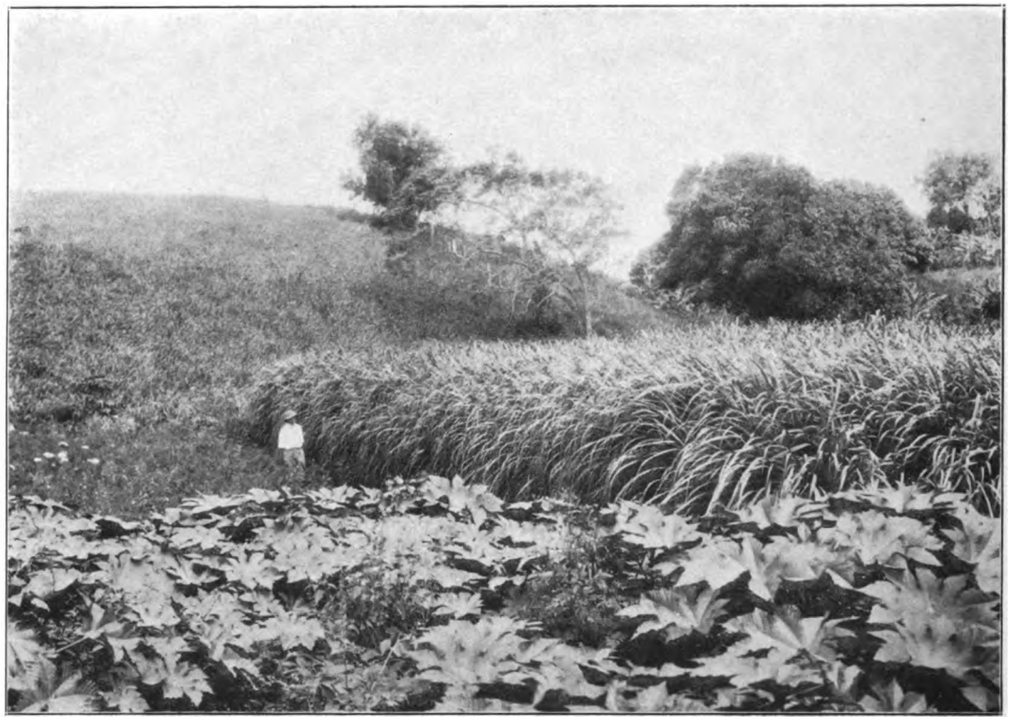


B. GRAZING LAND. CENTRAL MOLOKAI.

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A. A PLANTATION OF PASPALUM (PASPALUM DILATATUM), AN EXCELLENT PASTURE GRASS. AT THE UNITED STATES AGRICULTURAL EXPERIMENT SUBSTATION AT HAIKU, MAUI.



B. UBA CANE, A VARIETY OF SUGAR CANE GROWN FOR FORAGE. AT THE HAIKU STATION. IN THE BACKGROUND IS A FIELD OF PARA GRASS (PANICUM BARBINODE). CASTOR BEANS IN THE FOREGROUND.

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A. POA SIPHONOGLOSSA AT KAHOLUAMANO, KAUAI. SOME OF THE STEMS ARE AS MUCH AS FIVE METERS LONG.



B. THE BASE OF A TUFT OF POA SIPHONOGLOSSA, SHOWING THE PECULIAR LEAFLESS SHEATHS.

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