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Pacific Forms of *Lepturus* R. Br. (Gramineae)*

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INTRODUCTION

Lepturus is a genus of a few species, mainly halophytes, found on the coasts in the warmer parts of the world and to a lesser extent in dry interior regions in the Old World. It is not proposed to make a general revision of the genus, but to place on record certain observations on the Pacific islands species, and to describe one, *L. gasparriensis*, as new. All of the remaining Pacific forms are here referred to the widespread *L. repens* (Forst. f.) R. Br.

Lepturus repens, one of the commonest and most widespread strand plants of the tropical Pacific, extends throughout the Indian Ocean. The only important gaps in this range are the Pacific coasts of the Americas and the main islands of the Hawaiian group. Its absence from these areas, especially the Hawaiian Islands, is one of the more interesting and, as yet, unelucidated features of its distribution. This distribution is more or less parallel to that of such strand species as *Pisonia grandis*, *Thuarea involuta*, *Pemphis acidula*, and *Triumfetta procumbens*; but these species are all absent from the leeward Hawaiian Islands.

A species so widely distributed may be expected to be variable, and *Lepturus repens* is no exception. It is, in fact, bewilderingly variable in a number of ways. It is worth while to discuss this variation in some detail because it is an example of a phenomenon that is not at all understood, the variability of widespread strand species.

The most striking variable character of this species is pointed up by the discrepancy between the specific epithet *repens* (creeping) and

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one of the ordinary vernacular names of the species, bunch grass. The plants are usually conspicuously caespitose, forming erect tufts. In most localities, however, the tufts are capable of sending out long stolons, or runners, rooting at the nodes and forming loose mats. Spikes may be produced by both the erect and the creeping stems; those of the latter are usually smaller. In certain places or under certain conditions the caespitose habit is scarcely evident; and the plants are elongate, creeping, and tangled together. Whether the tendency to produce stolons is a genetic matter or whether it is ecologically controlled is not known, but it is more pronounced in some varieties than in others.

There is striking variation in stature, thickness of stems, length and width of leaf blades, length of joints of spike, length and shape of outer glume, and degree of development of upper floret of spikelet which is, to a certain extent, geographical. One difficulty is that these characters seem to vary independently, at least to some extent. Some correlation, however, is evident, both in field study and in study of herbarium specimens. The degree of correlation is actually sufficient to show that we are not dealing with mere random fluctuation, but it is not adequate to justify segregation of species. Although a number of the extreme forms would be easily regarded as species, they are only nodes in an almost continuous pattern of variation. These nodes show some geographical localization, but with entirely too many disconcerting exceptions.

The above facts became evident after wide field observation and superficial examination of herbarium material. An experimental closer examination with tabulated measurements was made of 110 collections in the United States National Herbarium. Four features were selected for tabulation. These were thickness of spike, length of joints of spike, length of joints of spike plus glume, and shape of apex of glume. These figures were arranged graphically in several ways calculated to bring out discontinuities between combinations of correlated characters. The results were not much more definitive than those of mere visual inspection. Both approaches indicate that several regional varieties may be segregated, though their geographic ranges are not very clear and their distinctive characters overlap in various directions. It seems likely that further clarification of these entities will require more extensive field work, mass-collecting, and statistical analysis of a considerably greater series of varying features.

Data available make it possible to define a number of entities that seem to merit varietal rank. This will make it possible to refer to them in floristic and ecological studies and will provide a starting point for further investigation of the variability of this species.

The matter of variability of widespread strand plants requires some further comment. *Lepturus* is by no means the only genus in which such patterns are evident. *Pandanus tectorius*, *Scaevola frutescens*, *Messerschmidia argentea*, *Boerhavia diffusa* and its relatives, *Lepidium bidentatum*, *Wedelia biflora*, and *Guettarda speciosa* are other examples. The variation in such species does not follow a clear geographic pattern. There may be more or less localization of combinations of characters in certain populations or over certain geographical areas.

The distribution of strand plants is largely insular. In addition to long continental shorelines, there are numerous insular strands isolated from each other by expanses of salt water. In general, the plants growing in these habitats are very wide-ranging species with little local endemism. This seems quite contrary to the usual situation with insular species. Ordinarily the greater the degree of isolation, the higher the proportion of endemic species, other things being equal. With strand plants even the remotest islets are likely to have the same species found in other strand habitats in the same climatic belts.

This wide distribution seems to indicate that, in some way, the apparent isolation is ineffective. Most strand plants have very obvious dispersal mechanisms—floating fruits, sticky or prickly fruits for adherence to birds, or fleshy fruits. It is probable that transportation across water is much more frequent for these plants than for most, and it is obvious that the strand is likely to provide more open habitats and greater opportunity for establishment than is usual on higher ground.

The slight but perceptible degree of differentiation evident in these strand species shows that there is some evolution taking place. The sporadic nature of the occurrence of many of the variations and combinations of characters is further indication that we are here dealing with the effects of incomplete isolation rather than continuous exchange of genes. The long-continued occasional exchange that would be predicted from the nature of the barriers and means of crossing them could very likely produce just such a pattern of variation as seems to be evident from the present rather superficial survey of *Lepturus* in the Pacific.

A synopsis of the discernible entities that seem to be of taxonomic significance is here presented, but with no idea that it is more than a rough outline of the actual population pattern in the genus. It is recognized that at least some of the records of varieties well out of their main areas of distribution may actually be extreme variants of other varieties. To this extent, and because more characters were not studied, the arrangement may be somewhat mechanical rather than natural. Critical study of other sets of characters may tend to correct this. The specimens listed are in, or are to be deposited in, the United States National Herbarium, abbreviated (US) except as otherwise indicated. Other abbreviations are: Gray Herbarium (GH), Bishop Museum Herbarium (Bishop), New York Botanical Garden (NY), Cambridge University Herbarium (Ca), and Kyushu University, Fukuoka, Japan (Ky).

The collection of specimens made by me in the northern Marshall Islands was done as a part of a United States Geological Survey assignment to study that area under a cooperative program with the Corps of Engineers, United States Army.

SYSTEMATIC SYNOPSIS

Genus *Lepturus* R. Br.

Tufted grasses, producing secondary branches from base; leaf blades flat, shortly ligulate; inflorescence a spike, which at maturity becomes thick and spongy, disarticulating into cylindrical joints, each with one spikelet embedded in a cavity in its side; spikelets arranged distichously, alternately (very rarely and sporadically oppositely) on the rachis, in our species spikelets one- (rarely two-) flowered, first glume lacking except on terminal spikelets, second glume covering the cavity in the rachis, lemma flat against rachis, palea subequal with it or slightly shorter, second floret, if absent, represented by a prolongation of the rachilla and, frequently, by a rudimentary sterile lemma.

Lepturus repens (Forst. f.) R. Br., Prodr. Fl. Nov. Holl., 207, 1810.

Rottböllia repens Forst. f., Fl. Ins. Austral. Prodr., 9, 1786.

Monerma repens Beauv., Agrost., 117, 1812.

Plants caespitose, secondary branches prostrate, rooting at nodes; leaf blades chartaceous to subcoriaceous, variable in length and width; spikes 3 cm. to 20 cm. or more long, up to 2 mm. thick, those on secondary branches shorter than those on primary culms; glumes of mature spikelets strongly exceeding the rachis joints to which they are attached, acute to strongly subulate-acuminate, 4 mm. to 15 mm. long, more or less indurate; disarticulated mature rachis joints with attached fruits acting as dispersal mechanisms, floating because of their spongy internal tissue and possibly clinging to bird feathers by means of the sharp glume which is appressed elastically against the joint.

***Lepturus repens* var. *repens*.**

Lepturus repens vars. α , β , η F. Brown, B. P. Bishop Mus., Bull. 84: 89-90, 1931.

Habit fairly slender, markedly stoloniferous; mature spike 1.2-1.5 mm. thick; glume acuminate or only slightly subulate, usually 7-10 mm. long.

Distribution: Principally in southeastern Polynesia, but extending, rarely, even as far as the Philippines. First described from the Society Islands.

Society Islands: Raiatea, *St. John* 17230, 17208.

Austral Islands: Raivavae, *St. John* 15898, 16068; Tubuai, *St. John* 16410, 16431, 16495; Maria, *Fosberg* 12105, 12082.

Tuamotu Archipelago: Arutua, *Beck* 1875 (US, Bishop, type of var. α); Makatea, *Jones* 903; Ahii, *Jones* 948; Nengonengo, *Quayle* 583; Marutea, *Quayle* XI (Bishop, type of var. β); Takoume, *Quayle* 2075 (Bishop, type of var. η , two fertile florets in some spikelets); Vahanga, *Quayle* 492; Mangareva, *St. John* 14588, 14600, 14944, 14756, *Fosberg* 11160; Henderson, *St. John and Fosberg* 15091 (rachis much thicker than usual); Timoe, *St. John and Fosberg* 15221; Oeno, *St. John and Fosberg* 15190; Napuka, *St. John* 14311; Tepoto, *St. John* 14321; South Marutea, *St. John* 14430; Niau, *Moore* 288; Hao, *St. John* 14369; Anaa, *St. John* 14272; Fakarava, *Moore* 329.

Line Islands: Christmas Island, *Fosberg* 13196 (GH).

Tonga Islands: *U. S. Expl. Exped.*

Swains Island: *Schultz* 18.

Gilbert Islands: Maraki, *Moore* 66.

Marshall Islands: Eniwetok, *Taylor* 46-1241 (GH).

Mariana Islands: Guam, *Guerrero* 3,759, *G.E.S.* 120, *McGregor* 527 (the Guam material all tends toward thick spikes and very slightly acuminate glumes); Tinian, *Fosberg* 24843 (glumes short, 6-7 mm.).

Caroline Islands: Palau, Angaur, *Fosberg* 25922 (glume 5-5.5 mm. long).

Philippine Islands: Mangsi, *U. S. Expl. Exped.*

Marcus Island: *Bryan* in 1902 (Bishop, five sheets).

Leeward Hawaiian Islands: French Frigate Shoal, *Caum* 88 (Bishop); Midway Island, *Bryan* 1 (Bishop).

Cocos Keeling Atoll: *Darwin* (Ca).

Lepturus repens var. **subulatus**, n. var.

Lepturus repens var. γ F. Brown, B. P. Bishop Mus., Bull. 84: 90, 1931.

Ab var. *repens* *spicibus* vix *crassiores*, *glumibus* valde *subulatis* recedit.

Quite variable, tends to be stoloniferous; differs from var. *repens* in somewhat thicker spikes, usually 1.3-1.6 mm., and in definitely subulate acuminate glumes, 6-15 mm. long.

Distribution: Principally in the central Pacific and Micronesia, but extending more rarely to the Tuamotus, Okinawa, Formosa, and the Philippines.

Marshall Islands: Ujelang, *Fosberg* 34173 (type); Wotho, *Fosberg* 34271; Bikini, *Taylor* 46-1058 (Bishop); Aur, *St. John* 21373 (Bishop); Utirik, *Fosberg* 33681; Arno, *Stone* 1046, *Anderson* 3647; Majuro, *Fosberg* 26183; Ailinglapalap, *Fosberg* 26833; Kwajalein, *Fosberg* 26510, *Bryan* in 1946 (Bishop); Eniwetok, *St. John* 23800 (Bishop), 23820 (Bishop), *Fosberg* 24325. (Some of the Marshall Island specimens have rather slender spikes.)

Leeward Hawaiian Islands: Midway, *Bartsch* s. n., *Bryan* s. n. (US), 1 (Bishop), 5 (Bishop); Laysan, *Schauinsland* X (Bishop).

Caroline Islands: Without locality, without collector (GH); Lukunor, *Anderson* 2117 (spike 1.2 mm. thick); Nukuoro, *Hosaka* 3453; Kapingamarangi, *Fosberg* 26085; Ifaluk, *Burrows* in 1948 (Bishop); Truk, *Fosberg* 24659, *Wong* 114 (US, Bishop), *Hosaka* 2740; Ponape, *Hatusima* 11126 (Ky); Nomwin, *Fosberg* 24608; Yap, *Wong* 385 (GH, Bishop, US), *Kanehira and Hatusima* 4355 (GH, Ky) (spike very slender); Palau, *Fosberg* 25818, *Hosokawa* 7472 (US, Bishop), *Burcham* 143; Kayangel, *Gressitt* 34.

Mariana Islands: Guam, *G.E.S.* 120 (GH, Bishop), *McGregor* 527 (GH, Bishop); Rota, *Fosberg* 24951.

Ryukyu Islands: Okinawa, *Walker* 6404, 6911.

Formosa: *Henry* 756, 13733.

Philippine Islands: *Merrill* 940, 5354 (spikes very slender).

Line Islands: Washington, *Bergman* 8; Flint, *St. John and Fosberg* 17458.

Phoenix Islands: Canton, *Fosberg* 30212.

Samoa: Ofu, *Yuncker* 9548.

Tuamotu Archipelago: Fakarava, *Moore* 329; Mangareva, Aukena, "coral atoll," *Quayle and Curtis* 442 (Bishop, type of var. γ Brown).

***Lepturus repens* var. *septentrionalis*, n. var.**

Planta valde gracilis, laminis foliarum angustissimis, spicis valde gracilibus, glumis 5-7 mm. longis, acuminatis vel acuminato-subulatis.

Caespitose, occasionally stoloniferous, very slender; leaf blades 1-2 mm. wide; mature spike 1-1.2 mm. or less thick; glume 5-7 mm. long, acuminate to acuminate-subulate.

This was given an unpublished varietal name by Munro on a United States Exploring Expedition sheet from Wake Island deposited in the Gray Herbarium. On both Pokak and Wake this variety grows beside *L. gasparricensis*, showing little or no evidence of hybridization or intergradation.

Distribution: From Wake Island and the Marshalls, especially the northernmost ones, extending to the Carolines. In the dry northern Marshalls it is a dominant plant in one of the principal vegetation types.

Wake Island: *U. S. Expl. Exped.*, Fosberg 34462, 33627, 34941, 34942, 34943, 34944, 34950, Branckamp in 1936 (Bishop, two sheets), Lyons 18 (Bishop).

Marshall Islands: Pokak (Taongi), Fosberg 34509 (glumes 7.5-8 mm. long), 34504, 34506; Bikar, Fosberg 34571 (type), 34577; Eniwetok, Fosberg 24395, 24353, St. John 23854 (Bishop); Bikini, Taylor 46-1076 (GH, Bishop), 46-1162 (Bishop), 46-1451 (Bishop); Rongerik, Taylor 46-1405 (GH, Bishop); Taka, Fosberg 33732; Ailuk, Fosberg 33923; Jemo, Fosberg 33864; Likiep, Fosberg 26995; Kwajalein, Wagner 3387 (glumes longer than usual for this variety), Fosberg 26477 (glumes longer than usual, spikes slightly thicker); Lae, Fosberg 34064 (spikes slightly thick); Ujae, Fosberg 34359, 34378; Majuro, Fosberg 26912 (glumes slightly long); Jaluit, Fosberg 26694 (glumes slightly long).

Caroline Islands: Nama, Anderson 902; Ngatik, Burton H2 (glumes 8-9 mm. long); Lukunor, Anderson 2142; Satawan, Anderson 961, 1023 (both of these have glumes about 9 mm. long); Kapin-gamarangi, Hosaka 3431 (glumes longer than usual); Ulithi, Hosaka 3200.

***Lepturus repens* var. *occidentalis*, n. var.**

Spica valde crassa, glumae acuminatae vel subulatae.

Spikes usually 1.7-2 mm. thick; glumes 10-15 mm. long, acute-acuminate to subulate-acuminate.

This is a western Pacific form, of which little material is available. It is principally distinguished by its very thick spike, which is

matched by that of *L. gasparricensis* and by an aberrant specimen of var. *repens* from Henderson Island.

East Indies: Klein Kamberes, *Backer 3106* (type); Poeloe Tikoes, *Kornassi 1271*.

Philippine Islands: *Merrill 5246*.

Queensland: Green Island, *Roe 1047*.

Solomon Island: San Cristoval, *Brass 3071* (Bishop).

Mariana Islands: Saipan, *Kanehira and Hatusima 4280* (Ky).

Marshall Islands: Eniwetok, *Taylor 46-1315* (US, Bishop), *St. John 23766* (Bishop).

Leeward Hawaiian Islands: Pearl and Hermes Reef, *Caum 39* (Bishop, two sheets), *46* (Bishop).

Lepturus repens* var. *cinereus (Burcham), n. comb.

Lepturus cinereus Burcham, U. S. Nat. Herb., Contrib. **30** (2): 424-425, 1948.

Spikes 1 mm. thick; glumes about 4 mm. long, acute.

The type looks as though only fertile stolons with dwarfed spikes had been collected, as no tufts or erect stems are present. It does not seem specifically distinct from *L. repens*, especially from var. *maldenensis*.

Russell Island: Pavuvu, *Burcham 169* (type).

Samoa: Savaii, *Christophersen 2648* (Bishop, two sheets; one sheet more or less typical, other approaching var. *septentrionalis*).

Mariana Islands: Saipan, *Kanehira and Hatusima 4288* (Ky, glumes a bit longer than usual, plant more compact).

Leeward Hawaiian Islands: Kure (Ocean), *Caum 19* (NY, Bishop, two sheets).

Lepturus repens* var. *maldenensis F. Brown, B. P. Bishop Mus., Occ.

Papers **9** (4): 6, 1930.

Glumes narrowly ovate, acute 5 mm. long.

Central Pacific, close to var. *palmyrensis* but with much smaller glumes.

Malden Island: *Wilder 1* (type, Bishop).

Line Islands: Christmas Island, *Fosberg and Metraux 13206* (NY).

Lepturus repens* var. *palmyrensis F. Brown, B. P. Bishop Mus., Occ.

Papers **9** (4): 6, 1930.

Spikes 1.7-1.8 mm. thick; glumes more or less elliptic, acute, 8-9 mm. long.

Known only from Palmyra Island.

Line Islands: Palmyra, *Rock 10276A* (Bishop, type), 10 (duplicate of type?).

This variety approaches *L. gasparricensis*, but is more slender, has longer, acute glumes, and is well separated geographically.

***Lepturus gasparricensis*, n. sp.**

Planta caespitosa robusta dura, ramibus secundariis valde adscendentes; foliis granulatis supra scabris; spicis crassis, glumis brevibus muticis, lemmis paleisque 4 mm. longis; granis 2 mm. oblongis.

A stiff, coarse, tufted plant, up to 50 cm. tall, without stolons but with the branches corresponding to stolons stiffly ascending, culms up to 2.5 mm. thick; leaf blades up to 8 (rarely 10) mm. wide and 20 cm. long (usually much shorter), linear to linear-lanceolate, with callose acute tip, this involute, whole blade tending to be involute when dry, finely and densely granulate-papillate on both sides, scaberulous on upper surface on the closely spaced nerves, and especially so on the margins; sheaths smooth, somewhat auriculate, auricles obtuse to rounded, ligule very short, scarious to brownish; spikes up to 12 or more cm. long, 2 mm. thick, readily disarticulating, peduncles included to somewhat exerted, mature joints of rachis 5.5-8 mm. long; glume indurate, ovate-elliptic with blunt apex, 5.5-6 mm. long, overlapping next joint by only 1-2 mm., 9-nerved basally, 5-nerved distally, margins inrolled below, apical part ciliate; glumes of terminal spikelet 9 mm. long, acute, cuspidate, weakly nerved toward base, scabrous rather than ciliate on margins apically; lemma membranous, ovate, boat-shaped, 4 mm. long, carinate toward acute apex, becoming flattened in fruit, margins strongly inrolled, glabrous; rachilla evident, 1 mm. long; caryopsis smooth, light brown, oblong, subterete, 2 mm. long, 1 mm. wide, slightly dorsiventrally compressed, tipped with a small tubercle and two persistent style bases, the oval embryo about 1 mm. long, with a linear suture almost its whole length from the base.

Distribution: Apparently endemic to Pokak and Wake Atolls, and common only locally on Kamome Islet of Pokak Atoll, and in a small area on Peale Islet, Wake, growing in both places with *L. repens* var. *septentrionalis*. Named for Gaspar Rico, an old name for Pokak Atoll.

Marshall Islands: Pokak Atoll, Kamome Islet, July 22, 1952, *Fosberg 34511* (US, type).

Wake Atoll: Peale Islet, near extreme west end, small colony of 40 or 50 clumps in open scrub, *Fosberg 34940*.

In view of the tremendous variability of *L. repens* it was only after careful thought that these populations were described as a species. Two considerations weighed very heavily, in addition to a greater difference in habit and spikelet structure than exists between the varieties of *L. repens*. These were the fact that *L. gasparricensis* coexists in exactly the same habitat with *L. repens* var. *septentrionalis* and the fact that the two differ, at least somewhat, in almost every part. It is interesting

that this is one of the very few plants known to be endemic to coral atolls.

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After the present paper was finished and submitted a paper by I. Hansen, and E. Potztl entitled Beiträge zur Anatomie und Systematik der Leptureae (Bot. Jahrb. 76: 250-270, 1954) came to hand. In this paper three new species of the genus were described, two of them from the central Pacific. These two are *L. pilgerianus*, from Canton Island, and *L. mildbraedianus*, from Radak [Marshall Islands]. The type of neither of these is available for examination, but study of the descriptions indicates that they are probably the equivalent of two forms here recognized as varieties, respectively *L. repens* var. *palmyrensis* and *L. repens* var. *septentrionalis*. This is not entirely certain, since not all features here regarded as diagnostic were described by Hansen and Potztl; but nothing in their descriptions seems to warrant regarding either of the two as other than varieties of *L. repens*. The supposed annual habit of *L. pilgerianus* is especially meaningless to any one who has seen *L. repens* extensively in the field, as this feature is a purely facultative one, depending on the climate at certain stages in the life of the plants. Since the types have not been examined, it does not seem advisable to make formal reductions of these species or to make any changes in the present tentative treatment.