

(2.) *Minor.*

- **Festuca littoralis* (Gramineae).
 **Calamagrostis Billardieri* (Gramineae).
Scirpus nodosus (Cyperaceae).

(γ.) *Wet-ground Plants.*

- Leptocarpus simplex* (Restionaceae).
 **Günnera arenaria* (Halorrhagaceae).

(c.) DESCRIPTIONS OF PLANTS.

(a.) *Spinifex hirsutus* (the *Silvery Sand-grass*).

Found in New Zealand in the northern and central floristic provinces only. Also indigenous in Australia and New Caledonia.

The special sand-drift "adaptation" of *Spinifex hirsutus* is the extremely long, quickly growing, much-branching rhizome, which, if all the branches of an old plant were taken, would measure many yards; indeed, it seems capable of quite unlimited extension. Normally, the rhizome creeps over the surface of the ground, putting forth roots at the nodes; but it is soon buried by the drifting sand, in which case its apex may again emerge, but more usually branches or leafy shoots pass upwards to the light. Such a stem creeping on the surface is a runner rather than a rhizome, since it roots at the nodes, also putting up erect shoots, each of which is virtually an independent plant. These creeping stems, which frequently extend to the flat ground along a windward dune slope unbranched and perfectly straight for many feet, are soft and juicy for their three or four apical internodes, but elsewhere hard, smooth, woody, and of a pale-brown or yellowish colour. The soft portion is well protected from damage by the strongly developed leaf-sheaths closely pressed to the stem, the sheaths themselves being also protected by a close almost tomentose covering of adpressed silky hairs.

The path of a subterranean stem is indicated by the bunches of leafy branches which at intervals pierce the sand, the leaves reaching a variable height above the surface; they are not crowded together, as are those of marram grass (*Ammophila arenaria*), but sand is always visible through a bunch of leaves. The leafy shoots may descend 20 in. or more to the rhizome from which they branch, and such, rooting and deeply descending, bind the sand to an extraordinary degree. The leaves consist of blade and sheath; they are of two kinds, *protecting leaves* and *ordinary leaves*, the former having much broader sheaths and very short blades and function as already described. An ordinary leaf has a blade about 19 in. long and $\frac{1}{10}$ in. broad; it terminates in a fine, tapering, but usually dead point. In texture it is flexible, coriaceous, and thick; the margins are much incurved, so much so frequently as to make the apical half or third into a pipe. Both surfaces are thickly covered with adpressed silky hairs. The sheath is about 5 in. long, pale coloured, thick and fleshy, especially at the base, and rather brittle. The flowers are dioecious. Frequently extensive patches are all of one sex, in which case probably there may be only a few plants. The male spikes are arranged in a terminal umbel; the spikelets are two-flowered, and about $\frac{1}{3}$ in. long. The pollen is being shed from the middle of November to the beginning of December. The female inflorescence is a large globose head sometimes a foot in diameter; the usually one-flowered spikelets are at the base of long sharp-pointed spines, each about 5 in. long, and spreading out radially. The roots are of great length, and descend deeply into the sand.

(β.) *Scirpus frondosus* (the *Pingao*). (For rhizome development see Photo. No. 14.)

Found only in New Zealand, occurring on dunes in all parts, except on the Kermadec and Subantarctic Islands.

The important features of this plant with regard to drifting sand are: (1) The great power of vegetative increase by means of the much-branching, stout, excessively long rhizome; (2) the tendency of the growing point to seek the surface—i.e., the light—and the rapid lengthening of the stem; (3) the protection afforded to the very tender growing point, young stem, and leaves by the overlapping of the broad leaf bases and their fastening together by a resinous exudation; (4) the leaf-texture so suitable to withstand the sand-blast; (5) the close packing of the inner leaves, owing to the concave upper surface; (6) the arching of the leaves so as to bring the convex undersurface, which is strengthened by abundant stereome, into opposition with the wind.

The rhizome is stout (about $\frac{1}{2}$ in. diameter), somewhat woody, stiff, much-branching, covered with old leaf-sheaths, and many yards in length. Normally, it creeps close to the surface of the ground, branching near the apex into leafy shoots given off rather closely, but it is soon buried, finally forming a complete network of rope-like stems reaching to far down within the dune. The leaves are in bunches, lightly bound together at the base by their sheaths, the diameter there being about $\frac{7}{8}$ in., but they gradually open out, also curving gently inwards. Each leaf consists of sheath and blade. The sheath is about 4 in. long and 2 in. broad at the base, somewhat triangular in shape, moderately thick in the middle, but translucent and membranous at the margins, and everywhere sticky with a resinous exudation. The blade is about 2 ft. long by $\frac{1}{4}$ in. broad, tapering very gradually to a long trigonous point; the texture is very thick, coriaceous, stiff but flexible. It is concave on the upper surface and convex on the under. Its colour is rather dark glossy green near the base and on the under surface, but on the upper it is frequently orange or reddish, especially above. The branches are given off quite close together, so that the separate leaf-bunches touch, making tussocks or lines. The inflorescence is 4 in. to 8 in. long, and consists of clusters of sessile reddish-brown globose spikelets spirally arranged round the stem, each cluster subtended by a linear bract similar to the leaf above described. The roots are of great length, very numerous, as may be seen when the wind lays them bare, and descend deeply.