

they are resinous, and the tomentum of the leaves also affords protection. The flower-heads are numerous, white, and in small terminal corymbs 1 in. or more in diameter at the ends of the branches.

C. retorta and *C. fulvida* are very similar to the above; the former has white tomentum, and the latter is almost of a golden colour from the tomentum on the undersurface of its leaves and final slender branchlets.

It is simply the xerophytic adaptations of the above shrubs which has enabled them to settle upon the dunes, though at the same time the stimulus of the moist sand causes sometimes the putting forth of adventitious roots.

(λ.) *Festuca littoralis* (*the Sand Fescue-grass*).

Found in all parts of the coast of New Zealand, except the Kermadec and Subantarctic Islands; also indigenous in temperate Australia.

Festuca littoralis is a "steppe-grass," forming close-growing tussocks about 2 ft. tall and 5 in. or so through at the base.

The underground stems can lengthen upwards to some degree as buried, new roots arising from near the base of the leaves, and plants may rise in this manner 1 ft. or more, thus withstanding a slow burial. The leaves are narrow, strongly involute, green when young or in the shade, but frequently yellowish. The leaf-sheath is pale-coloured and thick. The lamina is 16 in. long or thereabouts, its upper surface furrowed and waxy. The roots are numerous, wiry, brown, furnished with many short filiform rootlets, and frequently spread out laterally for a distance of 3 ft. The panicle is dense, spike-like, and the spikelets turgid.

In certain parts of Southland this grass builds dunes of considerable size right on the foreshore.

(μ.) *Calamagrostis* (*Deyeuxia*) *Billardieri*.

Common on New Zealand coast, except in the Kermadec Islands and the Subantarctic Islands; also indigenous in Australia.

Calamagrostis Billardieri is a tufted perennial grass forming small green patches about 1 ft. long by 6 in. broad.

The underground stem is pale, slender, wiry, creeping, and furnished with a great number of slender roots about 6 in. long. The leaves are shorter than the culms, and the blade is bent outwards from the sheath, spreading semi-vertically; it is about $3\frac{1}{2}$ in. long by $\frac{3}{16}$ in. broad, bright green, flat, membranous, and tapers to a short point. The panicle is 6 in. to 10 in. long, as broad as long when fully expanded; its branches are hair-like, arranged in whorls, and branch trichotomously.

(ν.) *Scirpus nodosus* (*the Stiff Club-rush*).

Common in New Zealand, except in the Subantarctic Islands, but not confined to the dunes; also indigenous in temperate Australia, Norfolk Island, South Africa, South America, St. Helena, and Amsterdam Island.

Scirpus nodosus forms close tussocks about 30 in. tall, made up of terete, stiff, flexible, pale-green stems arranged closely together, and given off from a short, straight, woody rhizome $\frac{3}{8}$ in. in diameter.

The leaves are represented by sheathing scales at the base of the stems, which latter function as leaves. The roots are wiry and of medium length. The inflorescence is a solitary globose head $\frac{3}{4}$ in. in diameter, of numerous crowded spikelets subtended by a rigid bract, 1 in. or more in length, continuous with the stem.

The tussock form, stiff isolateral stems, and absence of leaves fit this plant for very dry stations, and so it is very common on the dunes themselves, but is quite absent where the sand drifts to any extent, since it has no sand-binding properties and gets buried.

(ο.) *Leptocarpus simplex* (*the Yellow Rush*).

Found only in New Zealand; common on the coast, except in the Kermadec and Subantarctic Islands; occurring principally in salt marshes and sand-plains.

Leptocarpus simplex forms dense tussocks of quite erect, slender, terete, stiff, wiry, flexible, rush-like stems of a dull green, but more frequently reddish or yellowish colour, according to the intensity of the light, being at times, when fully exposed, bright red or orange.

The leaves are reduced to short blackish sheathing scales clasping the stem at distances of 1 in. to 4 in. The rhizome is stout, woody, creeping. The roots are wiry and of medium length. The flowers are dioecious, the male inflorescence panicle, and the female arranged in compact rounded glomerules.

(π.) *Gunnera arenaria* (*the Sand-gunnera*).

Found only in New Zealand; extending along the coast, but confined to dune-hollows, or wet cliffs, from the northern floristic province to Stewart Island.

Gunnera arenaria is a very low-growing herb, forming large round flat patches a yard or more in diameter, the leaves flattened down to the ground.

The rhizome is stout and much-branching. The leaves are of the ovate type, 1 in. or 2 in. long, including the petiole, thick, coriaceous, and of a dull-green colour. The flowers are monoecious. The female peduncle lengthens as the fruit ripens, finally becoming 2 in. or 3 in. in length, and so much raised above the foliage. The drupes are yellowish-red, and crowded on the upper part of the peduncle.

(d.) METHODS OF SPREADING OF DUNE-PLANTS.

The distribution of the special dune-plants takes place most likely by means of coastal currents, for, no matter how far separated are the dunes, their typical flora has gained small dune-areas remote from others, and isolated islands where the amount of sand is trifling. Perhaps succulent fruits may be carried by land-birds, but these latter are rare on dunes, there being little to attract them.