repens), &c.—grow on or close to the shore itself. On the other hand, the plants of dune hollows, where the ground-water is fresh and comes to the surface, are in part those of brackish water and salt meadows—*e.g.*, *Leptocarpus simplex*, *Selliera radicans*.

(*c.*) The Plant-covering.

Wherever there is a plant-covering the force of the wind is more or less broken, though adjacent tussocks or shrubs which are at some distance apart may lead to a wind-channel being formed, and consequent denudation. Where the plants are not far apart, and occupy a patch of ground, even though there are bare spaces between them, the sand will not move, and within the plant zone the principal dune condition is eliminated, and xerophytes other than sand-binders can flourish. A plant-covering, too, helps to conserve the moisture, and adds a little humus to the soil.† Generally the plants are far apart, and their presence does not hinder the settling-down of other species, and this to some extent takes place, various European weeds, not dune plants at all, entering into the association—*e.g.*, *Bromus hordaceus*,‡ *Trifolium arvense*, *Hypocharis radicata*, &c.

C. THE MOST CHARACTERISTIC PLANTS, THEIR LIFE-FORMS AND ADAPTATIONS.

(*a.*) General.

Were it not for the instability of the dunes caused by the drifting sand, no special "adaptations" would be required by their plants other than those demanded by excessive wind, dry soil, strong insolation, &c., and which are possessed to no small degree by plants of various other formations.

The dune plants proper—*i.e.*, those which not only tolerate but benefit by a partial sand-burial—are almost as highly specialised for their mode of life as lianes, which in some respect they resemble in their great length of stem. This latter enables them to spread over wide areas, and to increase rapidly by vegetative means, a great advantage under conditions so antagonistic to the welfare of seedlings. But it is the special power of the shoot-apex to grow upwards, as it is buried, which enables this life-form to cope with the constant increase of sand. This peculiarity possessed by dune plants of all regions has already been mentioned under the term "sand-binding," and is present to a greater and lesser degree in different species, so that one may speak of *major* and *minor sand-binding plants*. This "sand-binding" form is so admirably in harmony with the conditions of life that one may well conclude it has arisen by degrees in ordinary rhizomatous plants subject to a sand burial, while the presence of the form to a most intense degree in an endemic subgenus in New Zealand, an isolated land-mass, can be better explained as an hereditary acquired character than it can by either the principle of mutation or natural selection.

Other dune plants only catch the sand, or at best can lengthen their shoots to some limited extent, and either are finally buried and die or the sand is blown away. These may be called *sand-collecting plants*. These latter may really seem as if adapted for the purpose, as in the case of certain low-spreading shrubs resembling thick mats or cushions made up of many wiry or flexible branches; or they may simply arrest the sand, as do certain plants of the tussock form.

Finally, there are the plants of moist hollows, which have no special dune "adaptations," though one (*Gunnera arenaria*) is found nowhere else, but are merely species of other wet or moist stations without the dune area.

As for the plants of the stable dunes, the heaths, swamps, and lakes, their life-forms, &c., have evidently nothing to do with dune conditions, and so receive no treatment here.

In what follows a brief account is given of each species, there being altogether too few to allow of generalisations as to life-forms and plant organs. Here it need only be said that the New Zealand dune plants—though several belong to genera unknown in most dune areas of the world, and the leading sand-binding plant *Scirpus frondosus* belongs to *Desmoschoenus*, an endemic section of the genus—possess life-forms and "adaptations" similar to those of dune plants elsewhere.§

The following are the most important species of the moving dunes and dune hollows, the ones peculiar to the dune areas being marked with an asterisk:—

(*b.*) List of Leading Dune Plants.

(*α.*) *Sand-binders.*

(1.) *Major.*

**Spinifex hirsutus* (Gramineae).
**Scirpus frondosus* (Cyperaceae).
**Euphorbia glauca* (Euphorbiaceae).

(2.) *Minor.*

**Carex pumila* (Cyperaceae).
**Calystegia Soldanella* (Convolvulaceae).

(*β.*) *Sand-collectors.*

(1.) *Major.*

**Coprosma acerosa* (Rubiaceae).
**Pimelea arenaria* (Thymelaeaceae).
Cassinia leptophylla (Compositae).
,, *fulvida* (Compositae).
,, *retorta* (Compositae).

† This must not be overestimated, for reasons given before.
‡ Generally known as *Bromus mollis*.
§ These are detailed by Warming (51, p. 251, and 55, p. 264 and pp. 266–268).