

From *R. flexuosus*, the common Native Dock, it is at once distinguished by the branched rootstock, rosulate leaves, peculiar habit, stout depressed panicle, and crowded inflorescence, and especially by the tuberculated inner lobes of the perianth.

ART. LXXI.—Notes on the Economic Properties of certain Native Grasses.

By T. KIRK, F.L.S.

[Read before the Wellington Philosophical Society, 11th November, 1876.]

THE following notes embody the result of observations made in different parts of the Colony, and extending over a lengthened period. They are placed on record chiefly in the hope of assisting those settlers who are testing the value of our Native Grasses by actual experiment. The fact that in Auckland and Canterbury, seeds of some few Native Grasses and condimental plants are now in demand at remunerative prices, may be taken as a proof of the success of their efforts, and of the interest taken in the subject. If we consider the valuable aid afforded by a few native species in facilitating the progress of settlement in the Southern Island, we shall find that its importance cannot be easily over estimated.

If a colonial botanic garden had been in existence, on a proper basis, many important questions connected with the subject would have been solved years ago, and the welfare of the community advanced. Many doubtful points of interest can only be made clear by experiments extending over a series of years, and conducted on a uniform plan. Work of this kind is of necessity costly, and it would be unreasonable to expect that the few settlers who are competent to conduct investigations of this kind should do so at their own expense. Experiments of this kind can only be carried out at the cost of the community, and it is to be hoped that New Zealand will not much longer be the only Australasian Colony in which no provision is made by the Government for an experimental botanic garden.*

Microlæna stipoides, Br.

This is a common grass north of the Taupo country, becoming rather local in the southern part of the North Island, although it crosses Cook Strait and is found growing freely about Nelson. It is a nutritious grass, closely cropped by horses, cattle, and sheep, wherever it grows, and is taking its place in permanent pasture about Auckland and Wellington. On the shingle at the mouths of some of the small streams running into Cook Strait it is almost the only grass, and the first to commence a new growth after the winter rest.

* See "Trans. N.Z. Inst.," Vol. II., p. 102; Vol. IV., p. 292.

About Wellington and Nelson it suffers slightly from the early frosts, but not to so great an extent as might be expected.

It grows with equal luxuriance on the light scoria soils and tertiary clays of the Auckland Isthmus, and, allowing for the difference of climate, in the jurassic clays of Wellington and Nelson. Although it would yield rather less per acre than Rye-grass or Meadow-fescue, it commences to grow earlier in the season, and is of quicker growth after cropping, while it is adapted for a greater variety of soils than either. If we add to these good qualities, its high nutritious value, it must be allowed a high place amongst the best of our Native Grasses, and may be recommended for all permanent mixed pasture at low elevations in the North Island at least.

Microlena avenacea, Hook., f.

This species produces a considerable quantity of rather coarse herbage, which is eaten by horses and cattle in the absence of better kinds. As it grows under the shade of trees, it is well adapted for sowing in woods to which cattle have access, but it is not suitable for mixed open pasturage.

Hierochloe redolens, Bn.

Further observation of this grass has confirmed the opinion already expressed, that although eaten by horses and cattle it is not adapted for general cultivation. In the South Island it ascends to 3,500 feet, and becomes less coarse in habit. In this state it is sometimes cropped by sheep, but in nearly all cases it may be advantageously replaced by other species.

Hierochloe alpina, Ræm. and Sch.

In the South Island this species occurs from 2,000 to 4,000 feet, mostly in sheltered moist spots. Although of slender habit it yields a considerable quantity of herbage, which is eaten by stock of all kinds. It seems of value for mixed sub-alpine pasturage, especially in moist situations.

Paspalum distichum, Burm.

Apparently restricted to maritime situations north of the Taupo country. Not adapted for general cultivation, but of special value for sowing in salt marshes and swamps, where it is always sought after by horses and cattle.

Isachne australis, Br.

This species is plentiful in swampy places and by river-sides, from the North Cape to Upper Waikato, occurring sparingly from that district to Lake Taupo.

It is a slender species, affording a heavy yield of excellent herbage, which is greedily eaten alike by horses, cattle, and sheep. Its value was fully realized during the early settlement of the Waikato, where in many situations it was almost the only species available during the summer months.

For cool moist lands, especially those liable to occasional inundation, it must be considered a grass of the highest value, and should be generally cultivated in these situations. On the margins of rivers it assumes a sub-fluitant habit, and in some parts of the Waikato may be pulled from the water-margin in immense quantities. It is not adapted for cultivation in the South Island.

Zoysia pungens, Willd.

A creeping-rooted grass, which often forms a dense sward of short herbage, especially in moist places near the sea. The herbage is sweet and nutritious, and is of quick growth after cropping. Although greedily eaten, especially by sheep, its peculiar dwarf habit renders it ineligible for mixed cultivation. It is plentiful in the Taupo country, where it usually exhibits a depauperated appearance, caused by the dry character of the soil.

Dichelachne crinita, Hook., f.

This grass is common on all dry soil of ordinary quality, and is usually abundant on deserted Maori cultivations. It affords a considerable yield of useful herbage for horses and cattle, but is not a grass of the first-class.

Dichelachne sciurea, Hook.

This species appears to be remarkably local. I have not seen it south of the Manukau. It occurs freely on dry soils in several localities about Auckland, where it is closely cropped by horses and cattle, but suffers from drought, almost disappearing with the first continued dry weather.

Sporobolus elongatus, Br.

Rat's Tail or Chilian Grass of the settlers. This grass occurs in abundance from Cape Reinga to Taupo, when it becomes rare and local. It is found in a few places about Wellington, and sparingly near Nelson. Like *Microlana stipoides*, it is increasing from the extension of agricultural operations. In some districts, as at Hokianga and Port Waikato, it has taken possession of cleared places on the hills, and forms a dense sward, to the exclusion of other grasses.

It adapts itself to soils of the most opposite descriptions, and grows with equal luxuriance on the stiffest clays, the lightest scoria, and the finest sand, while its deep-rooted habit enables it to resist the most severe drought.

It is somewhat harsh, so that horses and cattle accustomed to Rye-grass do not care about it at first, but soon acquire a liking for it, and eat it with avidity.

It does not appear so well adapted for general mixed pasturage, as for special mixtures for working cattle, but this can only be settled by actual experiment. The best testimony to its nutritive value is the capital condition of cattle feeding largely or exclusively upon it. In many places it

forms a dense sward under the Tea-tree, where it is kept as closely cropped as if constantly mown. A walk over the cropped surface gives the sensation of walking over the surface of a hard-bristled brush.

This species is somewhat tussocky in habit when not closely cropped, but yields a vast quantity of extremely nutritious herbage, although of a slightly harsh quality.

Agrostis canina, L.

A variable plant; in this Colony restricted to mountain districts, where it ascends to 5,000 feet. The larger forms afford a moderate supply of nutritious herbage, but except in sub-alpine districts it offers no advantages to the cultivator.

Agrostis pilosa, A. Rich.

This species occurs from Lake Taupo southwards, but is most abundant in the South Island; where it ascends from the sea level to 3,500 feet, and attains its greatest luxuriance in open places in forests. It is coarser in habit than the last, and yields a much larger quantity of valuable herbage. It appears to be well adapted for mixed permanent pasturage on ordinary soils.

Agrostis quadriseta, Bn.

A variable grass, attaining great luxuriance on ploughed land of ordinary quality. It is usually eaten by horses and cattle, but is scarcely worth cultivation. Found throughout the colony, and ascends the mountains to 3,500 feet.

Danthonia cunninghamii, Hook., f.

Occurs from the Bay of Islands to Otago, but is rather local; ascends to 2,500 feet.

Danthonia flavescens, Hook., f.

Southern Island, ascending to 3,000 feet.

Danthonia raoulii, Stend.

From the Ruahine Mountains, to Southland, ascending to 3,500 feet.

The above three species are the chief "snow grasses" of the South Island, but the first is less plentiful than the others, and its herbage not quite so harsh. All are large "tussock" grasses, the leaves being often from 3-5 feet in length. After the flowering season, the large grain, which they produce in great abundance, forms the chief food of cattle and horses which can gain access to them. The coarse stringy herbage is not much eaten except when snow is on the ground and the smaller grasses are not accessible. It is, however, a common practice to burn off the tussocks in the spring to encourage a younger growth, which is greedily eaten by sheep, but the tussocks are speedily destroyed by this process.

It will be seen that, although of great value in the early settlement of a

sub-alpine district, they are not adapted for cultivation, and will recede before the advance of agriculture; although a wise policy would encourage their preservation in gullies and broken country on account of the great value of their copious herbage during the severe portion of the winter. They afford excellent material for paper manufacture, for which purpose they are largely used at the Mataura Paper Mills.

Danthonia semi-annularis, Br.

The most generally diffused grass in New Zealand, being found from the North Cape to Stewart Island, and ascending from the sea level to 6,000 feet. As may be expected it varies widely in habit and value.

Var. *a* (*D. unarede*, Raoul) is usually found in rocky places near the sea, and is easily distinguished by the drooping tips of its deep green leaves, and the large size of its florets. It is eaten by horses and cattle, but I have no data on which to found an opinion as to its value for cultivation, although inclined to regard it favourably.

β. pilosa. This form is distinguished by its slender habit and small panicle. The joints of the culm are usually hairy. It is the most common form, and is found in all soils and situations, except those of a moist character, from the sea level to 6,000 feet, where it forms the chief herbage on dry soils, as on the hills above Wellington Harbour; it becomes harsh and brown early in the season, giving for two or three months a parched appearance to the landscape, but when mixed with European grasses on ordinary soils it retains its verdure through the year, and produces a large quantity of rather dry but very nutritious herbage. It is eaten by stock of all kinds, especially when mixed with the ordinary introduced grasses, which are greatly improved by the addition.

Several sub-varieties occur alike in lowland and mountain districts, but the only one requiring special notice is a small form with an unbranched pale-coloured panicle. It is not uncommon about Auckland, where it forms a compact sward of fine herbage on light soils.

All the forms of this variety are of high value for ordinary mixed pasturage. They are also well adapted for sparing use in lawn mixtures.

Var. *alpina*. This remarkable variety is chiefly confined to altitudes of from 2,500 to 5,500 feet, where it forms the "carpet grass" or "hassock grass" of the shepherds, the name being given in allusion to its depressed cushion-like habit. In dry weather it becomes very harsh and slippery.

Deschampsia cespitosa, Pal.

This handsome grass is abundant in moist places in mountain districts, and attains its northern limit at the Waihi Lake, Waikato. It is occasionally eaten by horses and cattle, but is not adapted for cultivation.

Kæleria cristata, Pers.

A slender grass of considerable value, although its yield is less than that of Meadow Fescue or Rye-Grass. It is highly nutritious and well adapted for mixed permanent pastures on ordinary soils. Of similar habit and value to the Dog's-tooth Grass, *Cynosurus cristatus*.

In New Zealand it is restricted to the South Island, where it ranges from the sea-level to 3,500 feet. Cultivated in England.

Trisetum antarcticum, Trin.

A nutritious grass, affording a considerable yield of slender herbage, eaten by horses, cattle, and sheep. It is found throughout the Colony, but is most abundant in the South Island, ranging from the sea-level to 4,500 feet. It is one of the most valuable of our Native Grasses, and should form part of all ordinary mixed pasture, especially in rather moist soils. I am inclined to prefer it to the European *T. flavescens*—the Yellow-oat Grass, which is generally cultivated.

Glyceria stricta, Hook.

This species is confined to maritime localities, ranging from the North Cape to Dunedin, and, although not very nutritious, is occasionally eaten by horses and cattle. It is, however, inferior to other grasses for cultivation in salt marshes and places liable to marine inundations.

Poa imbecilla, Forst.

A slender species, occurring in greater abundance and luxuriance in the South Island than the North, but not adapted for cultivation on account of its brief duration, although it is always eaten where it grows in abundance.

Poa breviglumis, Forst.

Not uncommon on sandy soils, especially in maritime situations, where it is closely cropped by stock of all kinds. A grass of great value, well adapted for general cultivation, especially on light or sandy soils, although it does not yield so heavy a crop as the Common Meadow Grass. This species will be found of great value in the reclamation of coastal sand wastes.

Poa foliosa, Hook., f.

Of this valuable species there are two forms:—

a. with long leafy culms, the leaves longer than the culms, and yielding a large amount of herbage. This variety is confined to the Auckland Islands, etc.

β. is distinguished by the broad leaves, shorter than the culms, and the singular drooping habit of the panicle. It is common in mountain districts, where it ascends to nearly 6,500 feet, and is everywhere greedily eaten by sheep, horses, and cattle.

In all probability both forms would prove suitable for cultivation on cool moist land. They appear to be adapted either for special crops or for general mixtures.

Poa enysi, M.S.

A remarkable species with the habit of *Zoysia pungens*, and producing a dense even sward of short but nutritious herbage at altitudes of 3,000 to 4,000 feet in the South Island. It is a great favourite with sheep, but, although valuable in the localities where it occurs, is not adapted for general cultivation.

Poa purpurea, M.S.

A grass apparently undescribed, occurring at an elevation of 3,000 to 4,000 feet in the Valley of the Clarence, where it is eaten alike by horses, cattle, and sheep. It appears well adapted for mixed pasturage on cool lands, but requires further observation.

Poa anceps, Forst.

A variable plant which in one or other of its forms ranges throughout the Colony from the sea level to 6,000 feet, the large forms affording a heavy yield of herbage of good quality, eaten by all kinds of stock.

a. elata.—This variety is recognised by its large open panicle, which is sometimes ten or twelve inches in length. It appears to be restricted to the Auckland district, where it is occasionally found growing amongst cultivated grasses, and must be considered a valuable grass for cultivation.

β. foliosa.—This is the most common form, and is especially plentiful on maritime cliffs. It has a considerable range in altitude, but above 3,000 feet usually assumes a depauperated aspect. On the Rimutaka mountains it is abundant, and kept closely cropped by cattle and sheep. It is probably inferior in nutritive value to var. *a*, although it produces a larger amount of herbage.

γ. breviculmis.

δ. densiflora.

ε. alpina.

These are small varieties only found in mountain districts, where they are kept closely cropped by sheep, but so far as present observations extend do not appear to offer any decided advantages to the cultivator. Var. *ε* is apparently confined to mountain shingle, and appears to be a distinct species.

Poa australis, Br.; var. *lævis*.

Silver Tussock Grass.

This species is abundant from central Waikato southwards, forming tussocks of harsh dry herbage, eaten by cattle and horses in the absence of better food, but not in any way valuable for cultivation.

In a paper on New Zealand Grasses, written seven years ago, I wrote of this plant as a grass of great value, having mistaken for it a slender form of the variety *elata* of *Poa anceps*. At that time I had not seen the

present plant, which is (erroneously as it appears to me) regarded by Mr. Buchanan as "a grass of the first quality."

An attempt made a few years back to establish sheep stations in the Taupo country resulted in great loss to the projectors, the only grass available being the present species (*P. australis*, var. *lavis*), which contains but a small amount of nutritive matter, so that the sheep began to fall away as soon as they were placed on the runs.

When travelling in the Taupo country I observed that my horses would never eat it, so long as any other kind was available, and that usually they preferred the old dry leaves and culms to those of younger growth.

This plant is often difficult to eradicate. Mr. Potts, of Ohinetahi, pointed out a paddock which had been ploughed several times and sown with European grasses, but the tussocks of the *Poa* were as numerous as ever among the introduced grasses, which surrounded but could not overcome them.

It is the common Tussock Grass of the Canterbury Plains and Port Hills, wrongly referred to *Poa anceps* by Mr. Armstrong,* as that species never assumes the rigid tussocky habit of the present plant.

Poa colensoi, Hook., f.

One of the most valuable grasses in the Colony. With the exception of a single species, *Festuca duriuscula*, it has contributed more largely than any other to the prosperity of the settlements in the South Island.

It is a low-growing species, occurring at an elevation of 1,500 feet in the Taupo country and ascending to fully 5,000 feet in the Southern Alps. It produces a large yield of slender nutritious herbage, which is eaten by stock of all kinds, especially by sheep. On barren soils its growth is comparatively stunted, but on those of ordinary quality it is luxuriant, and flourishes on ploughed land.

It is adapted for permanent mixed pasturage on all ordinary soils, and is of the greatest value for sub-alpine sheep-runs. It would be a valuable addition to the cultivated grasses of Europe.

Festuca duriuscula, L.

The "Hard Sheeps' Fescue" is found from Hawke Bay southward, becoming more abundant in the Southern Island. It ranges from the sea-level (Port Nicholson) to 6,000 feet in the Southern Alps, and flourishes in all soils and situations, except those of a moist character. Although extensively cultivated in Europe, where its value is fully recognized, it is comparatively rare under cultivation in this Colony, especially in the Northern Island, yet from its great abundance and wide distribution, com-

* See "Trans. N.Z. Inst.," Vol. IV., p. 303.

bined with its high nutritive qualities and hardy habit, it has more than any other grass aided the rapid progress of Canterbury and Otago. This and the preceding species ought to form part of the armorial bearings of the South Island.

When growing alone it exhibits a remarkably tussocky habit, quite foreign to its character in the British Islands, but the tussocks are not nearly so rigid as those of *Poa australis*, var. *levis*, and they disappear when it is cultivated with other grasses. It is especially adapted for mixed pasturage on rather dry and gravelly soils, and for sheep runs at considerable altitudes, but should form part of all ordinary mixed pastures except on moist land. Of all grasses, native or introduced, this species and *Poa colensoi* are the most valuable for sheep runs, while their herbage is eaten alike by horses, cattle, and sheep.

Triticum scabrum, Br.

Blue Grass.

This is a valuable and nutritious grass, producing a large yield of herbage, which is everywhere eaten by cattle and horses. Although most abundant in the central districts of the Southern Island, it is found from the Great Barrier Island to Southland, and ascends from the sea-level to 6,000 feet.

It is perhaps less nutritious than the preceding species, with which it is often associated, but it affords a much heavier yield per acre, and will grow in moister situations. It is preferred by horses and cattle to most other kinds, and might be cultivated with great advantage either as a special crop for forage purposes, or as forming part of ordinary pasturage.

In the vallies of the South Island it is evidently increasing to a great extent, and in open places often forms large patches of the most luxuriant herbage, to the exclusion of other kinds.

On the Hanmer Plains the slender naked culms of this species sometimes become elongated and prostrate, attaining the extreme length of five or six feet.

ART. LXXII.—*Descriptions of Two New Species of Veronica.*

By T. KIRK, F.L.S.

[Read before the Wellington Philosophical Society, 14th November, 1876.]

Veronica obovata, n. s.

AN erect glabrous shrub, 4–5 feet high, sparingly branched, branches erect, when old strongly marked with the scars of fallen leaves. Leaves concave, loosely imbricated, erect, $\frac{3}{4}$ –1 inch long, narrow, obovate or oblong,