1½ tenths inch diameter. Cells 4. Styles 4, connate into a cone, with their summits free, but scarcely recurved.

Common throughout the islands. The trifoliate state of the young leaves is rare at Dunedin, as also at Wellington, but common in Auckland and Canterbury Districts.

This species may be distinguished from *Panax crassifolium* by the long linear leaves of the young plant, more or less serrate, the thrice compound wide-spreading umbels, and the small 4-celled fruit.

Much difficulty has been experienced by local collectors in discriminating between the present species and *Panax crassifolium*, in consequence of the absence of a full description of *P. longissimum* in the "Handbook of the New Zealand Flora;" and, as this difficulty can be easiest remedied in the Bush, the present attempt—the result of observations made there—is offered for that purpose.

DESCRIPTION OF PLATE XXI.

Fig. 1. Plant nat. size. Fig. 2. Fruit nat. size. Fig. 3. Section of fruit enlarged. Fig. 4. Fruit enlarged.

ART. LXXVII.—*On a few of the Grasses and other Herbage Plants that might be advantageously introduced into Cultivation in New Zealand.*

By Dr. S. M. CURL.

[*Read before the Wellington Philosophical Society, September 16th, 1876.*]

THE introduction, acclimatisation, and cultivation of economic plants in a young colony like New Zealand is a work not only of interest to those engaged in it, but is of the utmost importance to all colonists, and to the best interests and progress of the Colony generally, as from these plants articles of commerce and raw materials for manufactories are procured, and the dwellers in urban and extra-urban districts participate in the advantages.

In Colonies with a climate similar to New Zealand, where the flocks of sheep and herds of cattle and horses are not only of importance to the grazier and pastoralist, but to all the mercantile and other classes who dispose of the products, wool, tallow, hides, riding and draught horses, etc., but also to all who eat the meat of the sheep and cattle, it must be a matter of consequence to introduce and get into cultivation those grasses, clovers, and fodder plants that will improve the fields and pastures whereon the flocks and herds are kept and fed. Impressed with these views, I have for a number of years obtained from other countries, and endeavoured to

acclimatize here, new exotics, and among them certain grasses, clovers, and fodder plants, which my experiments have shown would be very valuable if cultivated in the fields and pastures of this colony. For although in the New Zealand flora *Gramineæ* are numerous, and experiments prove to me that many of the New Zealand grasses are very valuable for their feeding and fattening properties, such as the *Danthonias*, *Isachnes*, *Hierochloe redolens*, the *Poas*, *Festucas*, *Dichelachnes*, and others; yet in the winter, and also in the summer, the growth is not rapid enough, and the nutrient elements are not sufficiently developed in the indigenous grasses, to supply the flocks and herds with all that they require.

The introduction of the *Dactylis glomerata*, the *Festucas* of various kinds, the *Alopecurus pratensis*, *Anthoxanthum odoratum*, *Cynosurus cristatus*, *Phleum pratense*, *Loliums* annual and biennial, so called perennial, especially the Devon Evergreen Rye, various *Poas*, and many other kinds are valuable, and from my test culture, analysis, and feeding, their properties are all useful in their proper places, as are also the *Trifoliums* (clovers), and some others; but even yet more grasses are required to make up the deficiencies of all these, and it becomes necessary to discover and obtain other grasses and fodder plants that would supply these defects. Having therefore obtained and cultivated several hundred species of grasses during a space of fourteen years, and subjected them to various tests, it was found that some were very excellent, and others for divers reasons could be discarded, and their culture given up; while others being still under experiment a future verdict will have to be given upon their merits. The experience of graziers in most parts of the Colony of New Zealand is that in the spring and autumn, if not over-stocking their fields or pastures, feed or herbage is abundant, yet in the summers, and also in the winters the grasses, clovers, and other food plants do not grow quickly enough to supply the sheep or cattle with the necessary nutritious feed to keep up their condition for their owners' benefit. After the rains and dampness, with the increasing warmth of the spring, has caused the grasses and clovers on the best pastures to grow very rapidly for a few weeks, the drought and hot sun of summer too soon causes this rampant growth to cease, and the pastures become dry and brown looking, and cannot maintain the same amount of live stock in good condition as in the spring. According as the pastures have been more or less carefully sown with a larger or smaller number of various grasses, so is this state of barrenness sooner or later arrived at. For the pasture is better all through the year the greater the number of well-chosen grasses and clover sown upon it.

For while in some of the best pastures and fields of the grazing counties of England, over 40 kinds of grass and clover are to be found, it is unfortu-

nately the case that, in many fields laid down to grass in New Zealand, only two or three kinds of grass and clover are sown as a mixture, and then not always of the best sorts. Some pastoralists think it sufficient to sow one of the *Loliums* and a clover; and, not knowing that the so-called Perennial Rye Grass will not last longer than two or three years if closely fed down, their fields soon cease to fatten enough live stock to give a profitable return for the capital invested. If they knew that the Rye Grass is naturally a biennial, but that by Pacey, Lawson, Sutton, Stickney, and others, it has been by careful growing and experiment so changed that it will live longer than its natural two years, if carefully treated, but, if not so treated, it will in no wise be perennial. In no case should this grass alone, or with a clover, be the only grass sown, or it will soon die out, and useless weeds will take its place. But as neither space nor opportunity will in this place permit me to go into the merits of the numerous useful grasses for sowing upon perennial pastures, I will confine myself to a short description of some of the grasses that could be introduced with advantage by graziers, and, without crowding too many into this space, a few may be now mentioned as of considerable value—some for summer, and others as winter herbage, being among others, *Elymus condensatus, Panicum spectabile, Panicum hispidulum, Stenotaphrum glabrum, Bromus secalinus, Festuca gigantea, Cynodon dactylon, Dactylis cæspitosa, Elymus cristatus, Gynerium argenteum, Milium multiflorum, Phalaris canariensis, Briza major.*

The Californian Lucerne, or Alfalfa, a *Melilotus* from Thibet, *Trifolium incarnatum, Pentzia virgata.* Among the more than 800 kinds of panic grass, there is one, the

Panicum spectabile, or Coapin Grass of Angola, that, if introduced into a mixture for permanent pasture, will be most desirable for its valuable property of growing very luxuriantly in the hottest and dryest summer weather. Having obtained the seed of *Panicum spectabile* from various places and persons—some from Mr. Phillips, some from Dr. Schomburgh, and others—the different lots of seed were sown in the month of October in several successive years. The seed vegetated, and came up readily in the drills where sown, and continued to grow all through the dryest and hottest weather, until the plants were four and five feet high, when it set its seed and ripened it, and continued to grow vigorously until stopped by the winter frost, when it ceased to grow during the winter; and in the month of October following, in each year, it again came up from the roots that had been dormant during the cold weather, and again grew each year as vigorously as at first. Its strong succulent herbage was much relished by stock, and when cut down quickly grew again without any irrigation or watering. It contains large quantities of nutriment, and is in every way valuable as a summer or hot-

weather grass, no heat or drought seeming to stop its luxuriant growth, and in various kinds of soil it flourished. It was vigorously growing while the *Loliums* and other British grasses planted in its neighbourhood were dry and withered. It is therefore for these and other reasons one of the best summer grasses.

Panicum hispidulum is another good summer grass. It grows indigenously in Queensland. The seed I obtained was sown in October, and came up in November, and continued to grow rapidly during the hottest and dryest weather, stoling out and covering the ground between the drill, and when allowed to perfect its seed producing an abundance. It continued growing unceasingly all the time the hot weather lasted. It becomes dormant during the winter and cold weather, but appears again in the spring, and proves itself a valuable summer grass.

Milium multiflorum.—The seed of this grass should be sown in October. It comes up in about a month, grows rapidly, keeping green and abundant in the dryest season. If not fed or cut down, forms large tufts two feet six inches to three feet high; all through the summer it is growing, and even at the latter end of May and June, when the cold wet weather sets in, it still continued to grow; therefore besides being an excellent summer grass it will be useful in the winter.

Elymus condensatus can also be highly recommended. It is the Bunch Grass of British Columbia, and in its native home it is thought more of than any other grass. The mules and horses of the travellers and packers will work and keep in excellent condition, getting quite fat, while working all day and turned out at night to feed on this grass, and in winter will scrape off the snow to get at the withered tufts. The seed of this grass I received from many places and persons, amongst others from Mr. Anderson Henry. It was sown in November, and came up immediately. During the first year it does not make much progress. In the second year it commences to grow in August, and grows quickly during the summer, and if not cut or grazed its herbage is two or three feet long, and if allowed to perfect its seed-stems they will be four to six feet high. It requires more moisture than the previous grasses, but with occasional moisture and heat is very luxuriant, nutritious, and fattening, and well worthy of extensive cultivation, and will prove one of the best grasses the pastoralists can sow to meet the demands of a large quantity of stock, as it will fatten them quickly.

The *Elymus cristatus* is also a good grass. The seed I sowed in April, soon came up, and kept green and healthy through the hottest weather. The foliage is from nine inches to a foot high; seed stems about eighteen inches in height, and until the frost comes it continues to grow and keep the pastures green.

Cynodon dactylon, the Doobj Grass of India.—I found a little difficulty at first in acclimatising this grass, but it now seems to ripen its seed without difficulty, and kept green during a considerable portion of the winter, but is especially good as growing during the hot and dry season.

Stenotaphrum glabrum, Buffalo Grass, is an excellent grass for summer herbage. During the winter it remains stationary, but during the summer no weather appears too dry or too hot for it. It continues to spread over as large a space of ground as the stock feeding upon it will permit. It does not readily ripen its seeds, but is easily propagated by dividing its roots and planting them, each root sending out stems which form rootlets at every joint. It is also a useful grass for covering sandy lands and hill sides.

Briza major is a grass worthy of some introduction; for although in some places it is only an annual, yet in others it will appear year after year; but in all situations it makes such an abundance of seed that it is sure to drop enough down to perpetuate itself, and its great merit is that it begins growing very early in the winter and all through the spring, and gives an abundance of early herbage before other grasses begin to shoot. All stock are fond of it, and it is nutritious and useful for them, making feed before other grasses begin to grow.

Phalaris canariensis, although another annual, I believe to be a useful grass from its early habit, the readiness with which stock eat it, its fattening properties, and large amount of seed. I would not advise its use so much for permanent pastures as sowing it with Rape, or *Trifolium incarnatum* for one year's lay in alternate husbandry, the *Trifolium incarnatum* growing such an abundant crop for hay or herbage that a very large number of stock may be fed off the acreage so laid down, and, although these three latter plants are annuals, they will be found very serviceable to the farmer and to the grazier.

Bromus unioloides, Prairie Grass.—This useful perennial grass is of the utmost value in permanent pasture as a winter grass, and grows all the year, but most luxuriantly during the winter months. It produces a considerable quantity of sweet and succulent herbage. As soon as the wet weather sets in it rapidly throws up its nutritious foliage, growing through frost; and the stock relish it so much that they will even eat it out by the roots if allowed to stay on it too long at one time. It seeds abundantly, yielding large quantities, which are as good as corn for the stock that eat it. If cut for hay it makes an excellent kind, well filled with nutriment. When permitted to seed the stems are from three to four feet high. It contiuues to ripen its seeds all through the winter if kept free from stock.

Bromus schrœderi, Schrœder's Brome Grass, is even more permanent in pastures than the Prairie Grass, as, from its habit of growth, the crown of

the root is not so near the surface of the ground, so stock cannot so soon kill it when it is overstocked. It stoles out, covering the ground rapidly, and seeds freely; seeds-stems about eighteen inches to two feet high. It is good for hay, for winter fodder, and for grazing.

Gynerium argenteum, Pampas Grass.—This is a noble grass, with seed-stems 10 feet high if allowed to seed, but, if within reach of stock, they will keep it low, being particularly fond of its rather coarse leaves. It contains a large amount of nutriment, grows through both winter and summer, no cold affecting it, and as the young leaves appear all cattle and sheep will quickly eat them, leaving more delicate herbage to feed on this.

Bromus seccalinus.—This valuable grass, described by Baron Von Muëller as being one of the best fattening grasses in cold damp lands, growing so rapidly that it supersedes all others, is one that, after considerable difficulty, I obtained from Germany. At present I have not permitted it to seed, with a view to gaining all the growth I can from it, and thus rendering the roots as permanent as possible. It is a grass that will eventually establish itself as one of the most valuable of our winter grasses, especially on damp lands, where other grasses are innutritious or valueless. This will not only supersede those of no value, but will be very fattening and nutritious, and will support a large number of sheep and cattle.

Dactylis cæspitosa, the Tussac Grass of the Falkland Islands, is another valuable winter grass; grows through the coldest and wettest weather, sending out abundant verdant leaves, and will eventually prove itself, to all grass-growers who fairly try it, a very superior winter grass for feeding and fattening stock. It is a pity that it is not more generally diffused, as it has been very difficult for many who are experimenting with grasses to obtain it. I believe I have been one of the first in this and the Australian Colonies who obtained the true seeds and got them to vegetate. Of this valuable fattening grass, from what I observe of its mode of growth, the readiness with which it is eaten by stock, and the nourishment it contains, I believe it will rank among the best of our winter grasses.

Festuca gigantea, the Giant Fescue, is amongst all the Fescues one that both summer and winter gives the largest amount of nutriment. So quickly does it grow after the first year that if the stock are removed from it a short time it shoots up above the neighbouring grasses, and quickly overtops them. Its seed-stems are between four and five feet high, and produce a large quantity of seed, which my experience proves to vegetate easily.

Pentzia virgata, the Sheep Bush of the Cape of Good Hope, is a valuable herbage or fodder plant for summer feeding where sheep are kept. Dr. Schomburg kindly sent me some seeds, a few of which vegetated, growing all through the dryest and hottest weather during summer, and by the

autumn they had become nice little bushes between a foot and fifteen inches high. Cuttings were taken as soon as the first showers came. These struck readily, and grew into healthy little plants. From the manner in which it grows I am satisfied it is a very useful introduction into sheep pastures. The sheep like it, and it gives the mutton fine quality. This is even more useful than the *Achillea millefolium*, which latter is also a desirable addition to sheep runs as a condiment plant, as is also *Poterium sanguisorba* Burnet, which latter stands drought well, and grows all through the summer, and the sheep eat it greedily.

Californian Alfalfa, a species of Lucerne, cultivated in California.—Having obtained seed of this Alfalfa from several growers in California, and also a small packet from Dr. Hector, I have grown this plant from the several packets of seeds, and although some varieties grow much more vigorously than others, they all grow well in summer. Some of them had stems between three and four feet long, and those that were cut grew very fast during the hottest and dryest weather, seeming to luxuriate in heat, and not requiring any moisture. I think this plant well adapted for sowing in permanent pastures, as although it grows but slowly during winter it amply makes up for it during summer, and is greatly relished by stock of all kinds. I learn there are several varieties of this plant in cultivation in California, and there is another kind grown in Chili, the seed of which I obtained and am now experimenting with. This Chilian Alfalfa is said to be more vigorous and altogether better than the Californian, and it was from this Chilian species the Californian varieties were at first produced.

I obtained a *Melilotus* that is indigenous to Thibet. I sowed it, and during the spring, summer, and autumn it grew well. It does not appear to like frost if placed in a damp situation, yet in sheltered, warm spots it thrives in the winter as well as the summer. But it may be found a valuable summer herbage and fodder plant. It has a very fragrant scent, grows tall, is succulent and tender, grows a heavy crop, and is in some respects preferable to Alfalfa, and will make a full and very excellent crop of hay. Having thus briefly indicated what I believe are very valuable grasses and herbage, I will cease from enumerating others, although there are many that I have found will grow well in this Colony, and analytical tests for starch, salts, and other nutritive matters, as well as actual feeding of stock, experiments have proved are very valuable and desirable for culture, such as the *Festuca dives*, a magnificent grass said to grow ten feet high in Australia, also the Australian Kangaroo Grass, and very many others.

I have refrained from giving anything but results and conclusions, as details of analysis, feeding, experiments, modes of acclimatization, and

mere cultural operations would have extended this paper to over-large dimensions. There are many plants that I might have referred to, but determined to only point out, to the pastoralist and others interested, those grasses that it will be well to bring into cultivation immediately. I might in passing, state, that the Sugar Beet, upon which, some years since, I wrote for the newspapers several articles, showing its advantages when grown for sugar-making and for other purposes, would be very useful if grown to feed and fatten cattle, pigs, etc., upon.

From time to time I shall be happy to give results of my experience, as my acclimatization experiments upon all kinds of economic or useful plants, etc., are still going on; and I am always trying the merits of new Grasses as well as other things sent me by my correspondents from all parts of the world.

I would add that those plants and grasses I have recommended for summer culture are well adapted for cultivation in Auckland and the North, and those growing in winter are all suitable for Otago and the South; but, for the places in this latitude, they are all adapted for summer and winter culture, and may with great advantage be introduced into the fields and pastures whereon the cattle, sheep, and horses feed.

Art. LXXVIII.—*Notes on some Otago Plants.* By G. M. Thomson.

[*Read before the Otago Institute, 24th October, 1876.*]

Since the publication in Vol. I. of the "Trans. N.Z. Institute" of Mr. Buchanan's excellent List of the Flowering Plants of Otago, no additions seem to have been made to our knowledge in this respect by local botanists. The following supplementary list of plants collected by Messrs. Petrie, Purdie, and myself, is intended as a small contribution in this direction. There is no doubt that if more information of this kind were obtainable it would be found that species hitherto considered to be very limited in their range would be found to be widely distributed. So much is this the case that Hooker's Flora is found to be of no use as an authority on the distribution of the species, most of those in the accompanying list being given as from the North Island only, and in some cases from only one locality. There are many agencies at work throughout the Colony, such as enclosing of land for grazing, burning, clearing of bush, etc., which greatly affect the indigenous flora. As instances of the above, and of the rapid appearance and disappearance of plants, the following facts are interesting. Three years ago *Gentiana montana* began to be noticed on the Town Belt of Dunedin. In the summer before last it had increased to such an extent that