

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.

(Continued.)

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LEGUMINOSAE.

THE flora of New Zealand is remarkable in containing so few genera, species, and individuals of that great family *Leguminosae*—the pea or pod-bearers—although it is the second largest family of flowering-plants, containing over four thousand genera and seven thousand species. Cheeseman (1906), indeed, considered ("Manual," p. 107) the paucity of legumes to be one of the most remarkable peculiarities of the flora. There are practically no native plants analogous to the clovers on the main islands of this Dominion, the alpine *Swainsonia*—the only approach to a herbaceous legume—being so rare as to be negligible. The family is represented by a comparatively small number of leafless broom-like shrubs, the well-known kowhai (*Sophora tetraptera*), and the kaka-beak (*Clianthus puniceus*).

The kowhai is the one instance in the native flora of a suspected poisonous legume. Its affinities in other countries are certainly suspected—namely, *Sophora sericea* and *S. secundiflora* in America. The former is supposed to be one of the plants which cause "locoism" in horses. It may here be remarked that a number of poisonous plants in the wild pastures of America are termed "loco" weeds, the symptoms they occasion being termed "locoism." Regarding the New Zealand species of *Sophora*, which will probably be split up by future systematic botanists into a number of species, the only evidence the writer has as to the poisonous nature of the tree is that two persons were made very ill by eating food with a spoon made of kowhai wood. Lauder Lindsay, in his paper on the "Toot Plant," mentions it as suspicious.* Colenso (1868) states ("Essay," p. 38) that it was used as a purgative medicine by the Maoris. Wounds were dressed with the bark, which had been steeped in water. He notes that the bark is intensely bitter. Goldie (1904) states that the inner bark of the kowhai was used for pakipaki (itch) by the Maoris.

ROSACEAE.

The pipiriri (*Acaena* sp.), which by its clinging burrs annually causes such trouble in lowering the value of wool, is the only plant of which anything can be said of those species belonging to this large family. The latter, however, is but poorly represented in the Southern Hemisphere. The leaves of *Acaena sanguisorbae* are used as a substitute for tea, according to Maiden ("Useful Plants," p. 4), by Australian settlers. An infusion of the plant has been found useful in preventing scour in

*Dr. Hulme (Provincial Surgeon of Otago) informed Lindsay that he suspected the wood and seeds of poisonous properties (*Brit. and Foreign Med. and Chir. Rev.*, July, 1865).

calves by settlers in the Strathmore district of Taranaki. According to Hooker ("Handbook"), it has been used medicinally by the South Island settlers, while the Maoris used it medicinally in various ways (Goldie).

SAXIFRAGEAE.

The bark of *Weinmannia racemosa* and *W. sylvicola*, the kamahi or tawhero of the Maori, contains much tannin. Up to 20 per cent. has been found to be present by modern methods of analysis in the Chemical Laboratory of this Department. The bark was very largely used by the early settlers for tanning leather. Goldie states that the bark was used medicinally by the Maoris.

MYRTACEAE.

Leptospermum scoparium, the manuka or tea-tree of the settler, is a common plant throughout New Zealand. The leaves have been used as a substitute for tea. *Metrosideros* is the genus to which the ratas and pohutakawa belong. The bark of these trees, although thin, contains a large percentage of tannin, and was used medicinally by the Maoris for various disorders (Goldie).

PASSIFLOREAE.

The fruit of the native passion-flower, *Passiflora tetrandra*, is very much relished by rats, and contains a large amount of an easily expressed oil, which is worth chemical investigation. The Maoris used the oil medicinally (Goldie).

UMBELLIFERAE.

Hydrocotyle asiatica must be regarded as a suspicious plant. Grandpré found that in small doses it is an energetic stimulant, and in large doses a narcotic producing stupor, headache, and, in some persons, vertigo with a tendency to coma. Mr. R. H. Meade, Government Veterinarian at Palmerston North, reported in May, 1922, a case of suspected poisoning in sheep by this plant at Akitio, on the Wellington east coast. The symptoms he noticed were vertigo, stupor, and falling down and struggling at times, the animals remaining in this state for about a fortnight before death. On post-mortem the livers were found creamy-looking and atrophied, and the kidneys diseased, but the carcass fat and well nourished.

The genus *Hydrocotyle* is one of world-wide distribution. In America these plants are called "water pennyworts." In England the only indigenous species is *H. vulgaris* ("marsh pennywort"). It is significant that the other trivial names are "sheep-rot" and "white rot," from its supposed poisonous effect on sheep. Long (1917) ("Plants Poisonous to Live-stock," page 93) states that it is reputed to have caused inflammation of the digestive tract and hæmaturia, and to contain a toxic substance, vellarin.

RUBIACEAE.

There are some forty species of *Coprosma* in New Zealand, which range in size from tree-shrubs to herbs. The genus belongs to a family which has given many valuable plants to mankind. In medicines may be mentioned quinine and ipecacuanha; in dyestuffs the madder and other dyes; in foodstuffs the coffee-plant—all of which are obtained from plants of this family.

It has been suggested that the New Zealand species of *Coprosma* should be examined for caffeine; Skey (1869) did so with a negative result (*Trans. N.Z. Inst.*, Vol. 1, p. 152). J. C. Crawford (1876) (*Trans. N.Z. Inst.*, Vol. 9, p. 546) recommended the ground and roasted taupata (*C. Baueri*) seed as a substitute for coffee, stating that it has then a splendid coffee-aroma, and that when made into coffee the result seems thoroughly satisfactory. J. T. Armstrong (1891), "On Economic Plants," states that the leaves of the karamu were used as a substitute for China tea, and that the decoction is a good febrifuge.

There is no doubt as to the excellence of this genus as a source of dyes. Those species which have the inner bark coloured yield with hot water dyeing-solutions which give perfectly fast colours on wool, with and without mordants, and equal in permanence to those given by the madder (see the writer's papers in *N.Z. Journal of Science and Technology*, 1918, Vol. 1, p. 3, and this *Journal*, 1918, p. 363; also Perkin and Everest, "Natural Organic Colouring-matters," 1918, p. 578).

There is no group of New Zealand plants which, from a scientific point of view, offer a more alluring field for investigation to the plant chemist than the genus *Coprosma*. Not only are the species closely allied, but they exist in comparative abundance throughout New Zealand, and there is considerable evidence that different chemical compounds found vary with the species. Hence chemistry might be of value in determining the relationship of the species to one another.

The fruit of several species was eaten by the Maori. Colenso (1868) states that the root of *C. acerosa*—a littoral species—was used as an alternative by the Maoris ("Essay," p. 39). The roots of this species, which is found growing on sand-dunes, are of great length, and could easily be unearthed from the loose sand.

COMPOSITAE.

This, the largest family of all flowering-plants, contains, so far as is known, very few poisonous plants in New Zealand. *Brachyglottis rapanda* (rangiora, wharangi, or pukapuka), a characteristic shrub of the North Island, is no doubt poisonous. Baber (1886) (*Trans. N.Z. Inst.*, Vol. 19, p. 320) states that this shrub is seldom eaten by cattle or sheep, but horses are fond of it. Its effects are staggering of the legs and falling; it is often fatal; after death, the body is much distended. The popular remedy is to keep the animal moving. Skey (1881) (*Trans. N.Z. Inst.*) failed to isolate any active principle to which the poisonous nature could be referred. He made the interesting discovery that the resinous matter which exudes from the trunk and branches of the tree gives with alcohol acidified with hydrochloric acid a rich deep-blue colour—a reaction which has been verified by the present writer.

Colenso (1868) (*Trans. N.Z. Inst.*, Vol. 1, p. 38) states that the leaves, which are large and have a white under-surface, were used by the Maoris as a protection for wounds and old ulcerated sores. The poison of poisonous wild-honey may be due to the fact that the honey has been gathered from *Brachyglottis*, as large quantities of pollen-grains from the plant have been found in poisonous honey (Annual Report of Department of Agriculture, 1908, p. 428).

(To be continued.)

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COMPOSITAE—continued.

BEFORE leaving the subject of the rangiora (*Brachyglottis repanda*) some additional evidence as to the poisonous nature of this species may be given. Mr. D. Sinclair, of Terrace End, Palmerston North, wrote on 5th April, 1915, that he had a saddle-horse become tipsy, or almost unable to stand up, from having eaten some rangiora. From Mangamaire, Upper Wairarapa, a correspondent wrote on 22nd December, 1914, that he had just lost three cows, and the only thing that could possibly have hurt them was one rangiora-tree in full flower which the cows had been eating. Another cow in the same paddock was drunk from the same cause, and could only just walk. The owner stated that he had seen a horse affected in just the same way as was this cow after eating rangiora, but had never experienced having cattle poisoned by it before.

A Taihape farmer, in August, 1914, sent to this Laboratory the stomach-contents of a yearling heifer calf. He had lost two within a few weeks, although the stock were in good condition and had plenty of pasture and hay. The owner was at a loss as to the cause of the deaths, the symptoms being, according to his description, that the calves seemed to lie about as if sleepy, and then die without a struggle. There was, he added, a little tutu and rangiora growing on the place. Upon examination in the laboratory the stomach-contents were found to consist largely of fragments of the leaves of rangiora.

A Wanganui settler, in August, 1900, informed the writer that rangiora was most poisonous to horses in winter. He had known a few to die, but the majority recovered, the symptoms being staggering as if drunk, and swelling of the head and legs. Those which recovered were always "groggy on their pins" for a few weeks.

Mr. Elsdon Best, in September, 1900, reported from Ruatahuna that horses sometimes die of eating wharangi, blood-letting and violent exercise being the native cures. His own horse, shortly before writing, was "wharangied," and had to be taken for a three-mile sharp canter as a cure.

A correspondent on the Wanganui River, in February, 1906, wrote that rangiora is better known as the "paper-leaf," and that he had seen a good many horses drunk from eating it, but did not know of a single instance of a horse dying from it. In fact, the packhorses in many places lived and thrived on it, and got very fond of it. As soon as an affected animal was worked so as to get heated and to sweat, the effects wore off. This correspondent also related a case of poisoning by honey on 20th November, when the rangiora would be in flower. Three bushmen were poisoned, but gradually recovered. He stated that the Maoris never take the wild honey when the rangiora is in blossom.

Centipeda orbicularis (*Cotula minuta* Forst.), a small native weed usually found in swampy places in the North Island, is stated by Lauder Lindsay to be possessed, under certain circumstances, of pungent, irritant, or sternutatory properties, causing sneezing when bruised under the nose.

Celmisia sp. is the native "cotton-plant" or "horse-daisy" of the New Zealand mountains. In Otago one or more of the species is dried and smoked as tobacco. Neil (1889), ("N.Z. Herb Doctor," p. 495), states that it relieves asthma.

APOCYNACEAE.

A great many plants of this family are physiologically active, and some of them intensely poisonous. The New Zealand representatives are small climbing shrubs of the genus *Parsonsia*, with yellowish-white or pink flowers produced in great profusion. There are two species—*P. heterophylla* and *P. capsularis*. They probably contain saponins, and from the fact that they belong to such a poisonous family are worthy of chemical investigation.

GENTIANAEAE.

The genus *Gentiana*, which includes the beautiful gentians of our New Zealand mountains, is remarkable for the bitter principle which every member contains. Possibly some of the larger species might be made to yield a gentian root or gentian bitter similar to the well-known imported tonic.

CONVOLVACEAE.

Calystegia sepium—the pohue of the Maori and the bindweed of the settler—is a widely spread weed, and one which in the Northern Hemisphere is undoubtedly poisonous. Long remarks that the two species *C. sepium* and *C. arvensis*, when eaten in considerable quantity, appear to be cathartic and purgative, causing symptoms similar to those due to jalap. Colenso ("Essay," p. 31) remarks that the roots of *C. sepium* were cooked and eaten by the Maoris. Lauder Lindsay remarks that the large tuberous rhizomes, although eaten by the Natives, are in Europe regarded as poisonous, and yield a resin resembling scammony, which is a general characteristic of the *Convolvaceae*, although there are marked exceptions, such as *C. batatas*, the sweet-potato. Dr. Hooker very justly remarked that the properties of the same species may vary eminently in various localities. This is notoriously the case in many medicinal plants which are of violent action in one climate and innocuous in another. It is not to be thought, however, that because the roots are edible when cooked by the Maori they are non-poisonous when raw.

SOLANACEAE.

This is a family containing many poisonous and many useful plants, but in New Zealand there are only two native representatives—*Solanum nigrum*, the "garden nightshade," and *S. aviculare*, the poroporo of the Maori. *S. nigrum* is widespread throughout the world. Cases of poisoning in stock, calves, sheep, goats, and pigs are recorded in other countries. Long remarks that though it must always be regarded as poisonous, the plant varies considerably in toxicity according to soil, climate, and general conditions of growth. The symptoms of poisoning

are apparently much the same in man and animals—stupefaction; staggering; loss of speech, feeling, and consciousness; cramps; and sometimes convulsions. The pupil is generally dilated. The writer has come across one case in New Zealand in which lambs confined to a paddock on which was a large aftermath growth of *S. nigrum* went off in condition and a number died.

SCROPHULARINEAE.

Veronica is the only New Zealand genus of this large family (which derives its name from the supposed virtues of some of its members in curing scrofula) of which anything can be said. There are many medicinal plants belonging to the family, perhaps the best known now being the *Digitalis* (foxglove), which will be discussed later in this series of articles.

The leaves of some of the hundred or so species of *Veronica*, or koromiko, which are so abundant throughout New Zealand, have a great reputation as a cure for diarrhoea, both among the settlers and the Natives. There is some doubt if the young leaves, which are the part used as a medicine, yield their virtue to the patient by any other means save that obtained through the chewing of the leaves. Dr. Bell (*N.Z. Medical Journal*, April, 1900, p. 135) notes that it is stated that when koromiko is prepared as a tincture or infusion it is not so effectual. Dr. Bell tried large doses of both these preparations without their having the slightest effect on diarrhoea. Neither did he notice any marked astringent effect in a fresh decoction. The leaves themselves are so easily obtained from bush or garden, where they are generally grown as ornamental shrubs, that there would seem to be no reason for making them into a preparation if the mere chewing of the leaves would accomplish the desired result. The leaves of all the species appear to have a similar astringent taste.

MYOPORINEAE.

Myoporum laetum—the ngaio, a common tree throughout New Zealand, especially in coastal situations—is undoubtedly a cattle-poison. Cases of poisoning usually occur in winter, when the grass is short and when branches of the ngaio or the trees themselves are blown down by gales. In the 1900 Annual Report of the Department of Agriculture, p. 127, the writer has recorded that the oil extracted from the leaves (by steam distillation) was non-toxic to guinea-pigs in 6 milligram doses.

The following are instances of poisoning of stock by ngaio which have come under the writer's notice. In May, 1910, the owner of thirty-five cows at Duvauchelle Bay, Banks Peninsula, found fourteen of them staggering about. Two died in twenty-four hours, and three more in another thirty-six hours. The owner opened one and found a dry solid mass of ngaio leaves and twigs in the rumen. The symptoms were compatible with death from acute constipation. A correspondent from Palmerston, Otago, in May, 1911, reported that several cows had died in the district from eating the leaves and fruit of the ngaio, the symptoms being extreme costiveness and severe pain. A typical case occurred in the Wairarapa in August, 1912, where a farmer lost five out of eighteen two- to three-year-old bullocks turned into a 40-acre

paddock about a week previously. The weather had been cold and stormy, and a very large ngaio-tree had been blown down. Three dead cattle were opened, and the small dark-green buds and leaves of the ngaio were found mixed with grass. Mr. Howard, Government Veterinarian, also visited the farm and reported on three of the dead animals, finding the stomachs filled with ngaio leaves, buds, and twigs, mixed with a small amount of dried grass. There is little doubt, he concluded, that the animals were poisoned as a result of eating their fill of ngaio-leaves when there was little or nothing else in their stomachs. Several farmers lost cows through ngaio poisoning at Moumahaki in May, 1918.

Goldie remarks of the use of the ngaio by the Maoris that the bark is chewed for toothache, the twigs and leaves to medicate the vapour bath, and the juice expressed from the leaves is applied to the skin to prevent mosquito and sandfly bites.

An allied species, *M. deserti* A. Cunn., the ellangowan poison-bush of Queensland, has caused, according to Bailey (1906), ("Weeds and Suspected Poisonous Plants of Queensland"), great losses to travelling flocks of sheep. Other species of this genus have been suspected of poisoning sheep.

VERBENACEAE.

Vitex littoralis is the puriri of the northern portion of the North Island, well known as a most useful hardwood tree, valuable for building-construction in which great strength and durability is required, and for fencing, sleepers, &c. Baber remarks that it may be classed among dangerous plants from the severe inflammation which may be caused by splinters penetrating the skin of hands and feet. The dyeing properties of the wood and the dyeing principles have been isolated and investigated by the well-known colour chemist, A. G. Perkin, F.R.S. (*Trans. Chem. Soc.*, 1898, Pt. 1, p. 1019).

PIPERACEAE.

Piper excelsum—the kawakawa of the Maori—is one of the commoner shrubs of the North Island and the northern part of the South Island. It is a plant which possesses, in common with other species of the *Piper* genus (which includes all the trees furnishing the pepper of commerce), the aromatic and stimulating properties which characterize them. The kawakawa of the Polynesian islands, so well known as furnishing an intoxicating drink which is there so ceremoniously consumed, is *Piper methysticum*.

Baber says that the effect of the New Zealand *Piper* is stimulating, exciting the salivary glands, the kidneys, and the bowels slightly. It is aphrodisiac. The fruit and seed, ripe or unripe, are much more powerful than the leaves, although the latter are generally used. An extract of the crushed leaves, made by pouring boiling water upon them and allowing it to cool, affords a pleasant drink when the taste is acquired. The writer has found this decoction an efficient remedy for the cure of boils, and has verified all the symptoms mentioned by Baber as following the use of the extract. Hochstetter remarks that an infusion of the leaves when brewed makes a very refreshing beer. Goldie states that this species does not possess the sedative and narcotic properties of kawakawa. It is used by the Maoris for

toothache, dysentery, and for various other medicinal purposes. Dr. Thompson ("Story of New Zealand") remarks that it is singular that New-Zealanders have forgotten the art of extracting an intoxicating beverage from kawa-root, seeing that the plant grows abundantly in the country. Lauder Lindsay, in his "Toot" paper, corrects Dr. Thompson in confusing *Piper methysticum* with *P. excelsum*, but quotes Dr. Dieffenbach (1843), ("Travels in New Zealand," Vol. 1, p. 426), in saying that its leaves form a good and apparently healthy substitute for tea. The active principles of both these species are well worth careful investigation.

MONIMIACEAE.

Laurelia Novae Zelandiae—the pukatea, a forest tree—is certainly one of the medicinal plants of New Zealand. Dr. Goldie states that the inner layer of the bark of this aromatic plant is boiled in water by the Maoris, and the decoction thus prepared is applied externally to tuberculous and chronic ulcers and various cutaneous diseases. A strong solution held in the mouth relieves odontalgia (toothache), and it is also taken internally and applied locally in syphilis. The present writer has isolated three alkaloids from the bark (*Trans. Chem. Soc.*, 1910, p. 1381). The physiological action of the principal alkaloid, puketeine, has been investigated by Professor Malcolm, Otago Medical School, who published in the Annual Report of the Department of Agriculture for 1908, p. 226, a short account of his research (which is being continued). The new alkaloid is like strychnine in its action, but very much milder: 0.3 gram per kilo caused convulsions in a rabbit when given by mouth, but the animal recovered; 0.25 gram given hypodermically caused death in a rabbit in half an hour.

The pukatea alkaloids exist in comparatively large quantities in the bark of the tree, amounts of the order of 1 or 2 per cent. of the weight of bark being present. There would therefore be no difficulty in obtaining sufficient of the alkaloid for a thorough investigation. It is noteworthy that two of the alkaloids differ in chemical formula by C_2H_4 , puketeine being $C_{17}H_{17}NO_3$, and laureline $C_{19}H_{21}NO_3$. A more recent investigator, Pyman (1914), (*Trans. Chem. Soc.*, Vol. 105, p. 1679), working on an allied tree from Queensland (*Daphnandra micrantha*, family *Monimiaceae*), isolated alkaloids as follows: Daphnandrine, $C_{36}H_{38}N_2O_6$; daphnoline, $C_{34}H_{34}N_2O_6$; micranthine, $C_{36}H_{32}N_2O_6$. The bark of this tree was found to be remarkably rich in total alkaloids, 6 per cent. being found. The physiological action of these alkaloids appears to resemble somewhat the action of puketeine, and when the formula of the daphnandra alkaloids is halved there appears to be some chemical relation between the alkaloids from the two trees. Thus daphnandrine becomes $C_{18}H_{19}NO_3$, daphnoline $C_{17}H_{17}NO_3$, and micranthine $C_{18}H_{16}NO_3$.

THYMELAEACEAE.

Pimelia is a widely spread genus in New Zealand, the commonest species being known in the North Island as the "Strathmore weed" (*P. laevigata*). One or other of the species may be found at all elevations. The common daphne found in many gardens belongs to this family, and has the same poisonous qualities as the *Pimelia*. The bark

of every one of the New Zealand pimelias has the same physiological action when chewed—it produces after a few minutes an intense burning sensation in the mouth. Of the *Daphne mezereum* and *D. laurcola*, Long remarks that all parts of these plants are acrid and poisonous, especially the bark and berries. The active principle of the daphne is supposed by Emil Pott to be or be contained in an acrid resin, although a vesicating oil is said by Van Rijn to be present. Drying does not destroy the poisonous property. The symptoms of daphne poisoning are severe purging, burning of the mouth and throat, and in severe cases narcotic effects giving rise to convulsions. Lauder ("Veterinary Toxicology," 1912, p. 259) records poisoning of horses after the consumption of daphne, the symptoms being intense colic, constipation, followed by dysentery and copious evacuation of faeces streaked with mucus, blood, and intestinal epithelium. Post-mortem examination showed stomach and intestines and colon much inflamed.

The symptoms of poisoning by daphne are given fully here in order that those interested in the closely allied pimelias of this country may have better opportunity of detecting poisoning by this plant, which, it is highly probable, has a similar action. In September, 1908, several draught horses died in the Wairarapa district, it was supposed, by poisoning from the *Pimelia* (see *Dominion* of 4th September). Leaflet for Farmers No. 55, issued by this Department, gives an illustration of one of the commonest New Zealand species of *Pimelia*. Experiments in this laboratory have shown that 0.82 gram of resinous dry alcoholic extract of bark was poisonous to a guinea-pig (Annual Report, 1900, p. 127). Bailey records that several of the Queensland species of *Pimelia* are suspected of poisoning stock, particularly sheep. In New Zealand, horses are the only animals which *Pimelia* has been suspected of poisoning, so far as the writer is aware. The recent bark of daphne applied to the skin produces inflammation followed by vesication, and the dried bark is the *Mezerei cortex* of pharmacy, used as a blistering agent or for the making of an irritant ointment. The New Zealand species of *Pimelia* might furnish similar preparations. There are about fifteen New Zealand species, some of them growing to a height of 5 ft., and quite worthy of cultivation in gardens as flowering-shrubs.

LORANTHACEAE.

The family includes those plants which are parasitic on other trees and known as mistletoes. Some of the New Zealand species must be ranked among the most beautiful flowering-plants of the world. From one of the species an infusion has been prepared and used by an Otago medical man as a heart-tonic. The English mistletoe, although belonging to a different genus, had repute as a medicinal plant. The fruit of this is said to be poisonous.

EUPHORBIACEAE.

In *Euphorbia glauca*, common on many New Zealand seashores, there is one representative of the poisonous *Euphorbia* genus. Suspicion should be attached to the New Zealand species on account of the poisonous nature of many of its allies, some of which are growing wild as naturalized plants in this country.

URTICACEAE.

This family includes the genus *Urtica*, containing the nettles, of which the only dangerous one is *Urtica ferox*, the ongaonga of the Maori or tree-nettle of the settler, common throughout New Zealand. Instances of dogs and horses having been poisoned by coming into contact with this species are given in the Chemistry Division's annual report for 1909 (Annual Report of Department of Agriculture, p. 180). The Australian *U. gigas* is reported frequently to kill horses, and apparently the ongaonga will do likewise if the horse is badly enough stung.

LILIACEAE.

Dianella intermedia, the turutu of the Maori, usually found growing under manuka scrub, is a tufted grass-like plant with very conspicuously beautiful fruits abundantly produced in autumn. In the *N.Z. Medical Journal* for April, 1891, Dr. Ernest Robertson, of Auckland, gave an account of the poisoning and death of a child, aged one year and nine months, in about eighteen hours after eating a number of berries of this plant. There were no convulsions or twitchings at any time except hiccough and laboured respiration, which were prominent symptoms at the last. No post-mortem was made. Suspicion has again been directed to this plant by a note in the *N.S.W. Agricultural Gazette* of November, 1908, by Mr. Maiden, Government Botanist. Several valuable pigs and some suckers which were just beginning to pick about died after eating the roots of a species of *Dianella*. Dragen-dorff mentions *D. nemorosa* and *D. ensifolia* as medicinal plants, and states that the roots were used in dysuria and other complaints. The former species is used in the Straits Settlements as a rat-poison.

Phormium spp., the well-known New Zealand flax, was, according to Goldie and others, used by the Maoris as a cathartic, the root or portion near the root being the part of the plant used. Dr. E. W. Bell also has an interesting account of its uses in a paper, "Medical Notes on New Zealand" (*N.Z. Medical Journal*, April, 1890, p. 135). Dr. F. A. Monckton, in the *Australian Medical Gazette*, bears witness to the efficacy of a strong decoction of the roots and butts of the leaves. He writes: "Somewhere about the year 1869-70 a letter appeared in the Melbourne *Argus*, signed by myself as Provincial Surgeon of Southland, bearing witness to the extraordinary healing properties of *Phormium tenax*, commonly known as New Zealand flax. From that time to the present I have used it in hundreds of cases, including lacerations and amputations of every description, and I have no hesitation in saying that there is nothing known in the Old Country that can equal it in producing healthy granulations. I use a strong decoction—the stronger the better—made from the roots and the butts of the leaves boiled for twelve hours. At one time I had to make it fresh every second day, as it readily ferments and deteriorates, but since carbolic acid came into vogue I keep it for any length of time by adding about an ounce of equal parts of carbolic acid and glycerine to every quart. I require no other antiseptic precautions, but simply syringe the lesions occasionally with it, and maintain cotton wool and lint soaked in it constantly to the parts affected. If there are no foreign matters to be discharged there will be no discharge." The doctor gives details of two very bad cases of shattered and torn limbs

which had been treated by him with perfect results by means of fresh flax decoction and nothing else. He concludes: "I might adduce proofs by scores of its efficacy, but if owing to these facts being made prominently known medical men can be induced to test the remedy for themselves, it will require no assertion from me to cause *Phormium tenax* to take the premier place as a granulating agent."

Sir A. H. Church (1873) investigated the chemistry of *Phormium tenax*, and isolated a bitter principle which he considered a tonic (*Trans. N.Z. Inst.*, Vol. 6, p. 260). Students of phormium would do well to consult the extensive bibliography prepared by Dr. B. D. Cross (1914) attached to a paper, "Investigations on Phormium" (*Trans. N.Z. Inst.*, Vol. 47, p. 61). The bibliography was not published, but is filed for reference in the Dominion Museum Library.

THE DEVELOPMENT AND FUTURE OF ELECTRIC MILKING IN NEW ZEALAND.

LAURENCE BIRKS, B.Sc., M.Inst.C.E., &c., Chief Electrical Engineer, Public Works Department, in the *New Zealand Journal of Science and Technology*.

FOLLOWING an article by the author on electric power for milking, in Volume 4 of the *Journal*,* it is of interest to note the present position of this development, which promised and still promises to grow to such large dimensions, though naturally the drop in prices of agricultural products generally has delayed the extension. The returns show that there are already over a thousand milking plants operated electrically in the Dominion from public electric-supply systems in addition to those operated from private electrical installations, and the number is increasing rapidly.

In Canterbury electric power is as yet generally available in only three farming districts, and the numbers of electrically operated milking plants in these districts are—Tai Tapu district, 36; Eyre County, 4; Rangiora County, 32; the charge being £21 per year per 3 h.p. motor.

The supply will be available this season in the Banks Peninsula, Ellesmere, and Kowai Electric-power Districts, and it is anticipated that the season will open with about fifty milking plants in each district. The charge in these districts will be £6 per horse-power per year, plus a unit charge of 3d. for the first 80 units per month, 2d. for the next 120 units per month, and 1½d. for all over 200 units per month.

In the Hawera Electric Supply Company's area there are fifty milking plants operated electrically. The charge is by meter at the rate of 4½d. per unit, less 10 per cent., and the consumption and annual cost for four typical milking plants for last season were as follows:—

Farm.	Number of Cows.	Total Units.	Annual Cost.
A	75	1,801	£ s. d. 30 8 3
B	50	1,001	17 6 10
C	34	706	12 16 0
D	28	502	8 16 0

* Reprinted in the *N.Z. Journal of Agriculture* for August, 1921.

THE POISONOUS, SUSPECTED, AND MEDICINAL PLANTS OF NEW ZEALAND.

(Continued.)

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FILICES.

THE common bracken-fern of New Zealand (*Pteris aquilina* var. *esculenta* Hook. f.*), which in some of its varieties is almost cosmopolitan, has long been suspected of causing the death of stock in various countries other than New Zealand. If some of the other genera of this large family are examined it will be found that they are known to be poisonous. Pammel (1911) ("Manual of Poisonous Plants," p. 317) remarks that *Adiantum pedatum* (maiden-hair fern) is probably poisonous. "Male fern" (*Aspidium* (*Dryopteris*) *Filix-mas.*) is used as an official remedy in the British and United States Pharmacopœias, the rhizome "not kept more than a year" being the part employed as a vermifuge. In overdose it is a distinct poison, there being five fatal cases recorded with symptoms of vomiting, diarrhoea, vertigo, headache, tremor, cold sweat, dyspnoea (laboured breathing), cyanosis (blueness of skin), mania, coma, convulsions, amblyopia (impaired eyesight), or even amaurosis (loss of sight) with dilated fixed pupils often present. The loss of sight is usually temporary, but has proved permanent. Animals poisoned with male fern show parenchymatous nephritis (inflammation of kidney-tissue).

A case in which sheep were apparently poisoned by fern in the Auckland District is recorded in Volume i of this *Journal*, p. 215. Mr. A. J. Hickman, Veterinarian, reported visiting the locality of the mortality (on 9th March, 1910), and that out of a mob of seventy ewes and three hundred lambs, twelve ewes and eighteen lambs had died. No symptoms were observed during life; the animals were simply found dead, having apparently died without a struggle. The owner suspected anthrax. The deaths occurred about forty-eight hours after the sheep had been put into a paddock that had twice been sown with turnips. No roots had, however, matured, and there was nothing to be had but fern-shoots and sorrel. Post-mortem examination showed the visible mucous membranes pallid; no discharge from nostrils, mouth, or anus. Carcasses were in good store condition. Decomposition was fairly advanced throughout, and there was much post-mortem staining on both pleura and peritoneum. The rumen was normal and distended with gas, and full of semi-digested fern-fronds, and apparently nothing else. There was no detachment of the mucous membrane, and no signs of inflammation. The other three stomachs—reticulum, omasum, and abomasum—all normal. Spleen normal. Liver very pallid and softened, but not enlarged. The large and small intestines were normal, the colon containing a few free parasites (strongyles). The lungs were engorged with blood, and dark in colour.

* It should be noted that *Pieridium* is the more modern generic name used by botanists to denote the genus to which the common bracken belongs, though *Pteris* is perhaps as frequently used.

The late Mr. J. G. Clayton, M.R.C.V.S., in June, 1904, investigated a case of sudden mortality in a number of eighteen-months-old Shorthorn heifers at Weber, which were in good condition up to three weeks of death. They were running on a block of 600 acres, and had been on for some months. In February 200 acres of the block had been burnt and sown in English grasses, which had taken badly, small fern being the predominant growth. The heifers were generally on the burn, very seldom going on to other parts of the block. Towards the end of May the owner noticed one heifer dead, but did not attach much importance to it owing to the rough nature of the country. He then went away from his farm for about ten days, and on his return he could not see any cattle alive. He found four dead; after further search the bodies of eleven altogether were found, and it was concluded that the rest had died in the bush. No symptoms were observed, and as the animals had been dead about ten days before being inspected no satisfactory post-mortem examination could be made. All that were examined showed the kidneys to have been affected. In some cases the structure was completely broken down, like damson-pulp. The spleens were normal, and anthrax was certainly not the cause of death. In the Veterinarian's opinion the cause of death was to be found in connection with the burn.

Lander (1912) summarizes the results of inquiry by the officers of the English Board of Agriculture in 1909 and 1910. An editorial article in the *Journal of Comparative Pathology* of 1894, p. 165, draws attention to the important features of bracken disease which serve to distinguish it from anthrax. The absence of bacilli in the flesh fluids and tissues, the normal spleen, the subpleural and sub-peritoneal hæmorrhage, considerable effusion of blood in the large intestine, a temperature of 106.8° to 108.4° , the disease lasting a few days with abundant bloody discharge from nose and rectum, and the disease occurring only in cattle, are symptoms which serve to distinguish bracken poisoning from anthrax. The symptoms which are mentioned in the English official reports for 1909 as symptomatic of bracken poisoning are loss of appetite, blood-tinged discharge from mouth and nose, blood from bowels, pallor of membranes of eye, great depression, and coma and death in twelve to seventy-two hours after the onset of the symptoms. The lesions include congestion of the pulmonary membranes and small hæmorrhages in the substance, congestion of the stomach and intestines, the wall of the latter being in some parts deep red and thickened by infiltration of blood, blood also being present in the lumen of the intestine. Areas of diphtheritic inflammation and distinct ulceration may be present in the stomach and intestines; the serous membranes show hæmorrhages in their substance, and there are hæmorrhages in the heart and body-muscle and under the skin.

Sir Stewart Stockman (1918), of the English Board of Agriculture, carried out further experiments (*Journal of the Board of Agriculture*, March, 1918) in which direct evidence was obtained of the poisonous nature of fresh fronds of the English bracken by feeding experiments. A bull calf over a period of twenty-nine days received approximately 260 lb. of the fronds of green bracken (about 10 lb. per day with other food). This had a fatal termination. The animal showed identical symptoms during life and identical lesions on post-mortem examination to those seen in cattle dying in the field of suspected bracken poisoning.

It is concluded to be not improbable that bracken contains a small amount of a poison which is able to accumulate in the system and which requires a certain time to produce its full effect, after which severe illness may begin in an explosive manner, possibly some weeks after the poison has been withheld. It seems probable from practical observation that individuals vary in susceptibility, since some cases develop later than others in the same herd; some animals on the same pasture even seem to be highly resistant, and may not show the least sign of illness, while others are dying around them. It is at least possible that the former animals have acquired resistance by a natural process of immunization, as may happen in the case of poisons of the ricin class, and only those succumb which have too brusquely and continuously fed upon the poisonous substance, with the result that they are fatally attacked before the acquired resistance can establish itself. The article concludes that no time should be lost in changing a herd showing symptoms of fern poisoning on to pasture containing no fern.

Hadwen and Bruce (1920) (see abstract in *Experiment Station Record*, Oct., 1920, p. 471) record the results of their observations on the results of the consumption by horses of common bracken (*Pteris aquilina*) on the Pacific slope of British Columbia. Feeding experiments were made with the dried fern. From these the authors concluded that it can be assumed that an addition to the daily diet of about 6 lb. of dried bracken will kill a horse in about a month.

W. E. Lawrence (1922) ("Principal Stock-poisoning Plants of Oregon," Station Bull. 187, Oregon Ag. College), dealing with the common bracken-fern of that State (*Pteridium aquilinum pubescens* Underw.), states that the symptoms known as fern-staggers in horses are undoubtedly more common than any other trouble caused by poisonous plants in western Oregon. The trouble is confined almost entirely to horses, though there are occasional reports that cattle have been poisoned by this fern. It is noteworthy that in these last two countries, both on the Pacific slope of North America, the mortality should be caused by the dried fern fed as an impurity in the hay, the difficulty being in many localities to harvest the hay without contamination with much bracken. Ferny hay is usually rated dangerous when it contains about one-third of the common bracken. It usually requires about a month of feeding upon ferny hay to cause fern-staggers, which is most common in dry years. Horses are known to acquire a taste for the fern after the initial dislike has been overcome, at which stage even bedding with fern must be discontinued, for the horses will then eat the bedding.

Mr. C. C. Empson, when Stock Inspector for the Nelson District, assured the writer that fern poisoning in cattle was prevalent in his district in the winter, when the young fern is coming through the ground from March until June, especially in the latter month, and even as late as September. The symptoms he records are gradual emaciation and anæmia, the animals being almost bloodless when killed or when they die; and they pass a good deal of blood up to the time of death. A beast will acquire a taste for the fern, and even if put on to good grass will return to the fern if it is possible to do so. The droppings are often mixed with blood-clots. After a burn cases are more prevalent, and it is very difficult to pull cattle round when once they are badly affected.