

3. That no woody fibre exists in the leaf, but the liber-cells have thin walls of delicate construction, which probably accounts for the quick deterioration of the fibre by over-bleaching, or by the use of chemicals.

4. That the gum appears to offer no peculiar obstacle to the manufacturer, provided the leaves are above the butt, for in the state in which it alone exists in the interior of the plant it readily mixes with cold water.

ART. XXIII.—On the NEW ZEALAND FLAX, (*Phormium tenax*). By Major HEAPHY, V.C.

[Read before the Auckland Institute, October 18, 1869.]

THIS plant grows in nearly every part of New Zealand, Chatham Islands, and Norfolk Island. It is said to exist on the Lachlan plains in New South Wales. In New Zealand it occupies a zone from the beach to an elevation of 4000 feet.

It has been generally supposed that there were three varieties, viz., the *P. tenax*, *P. Colensoi*, and another kind, discovered by Dr. Hector on the south-west coast of the Middle Island.

The *P. tenax* is described as having a leaf from 3 to 6 feet in length, and a flower-stalk from 6 to 16 feet in length, with a yellow and red flower, and inhabiting the Bay of Islands and northern districts.

The *P. Colensoi* is described as having a leaf 2 to 3 feet in length, and a flower-stalk from 3 to 6 feet in length, with a pale flower, and being found as far south as lat. 46° 30'.

Sir William Hooker doubts if these are distinct varieties, as they do not appear to be more dissimilar than Fuchsias and other flowers will become by different modes of cultivation.

The largest flax grows on the immediate margins of rivers, such as the Waikato, Wairoa, and Thames, where the rich slime brought down in the freshets affords the nutriment fitting for the most luxuriant growth of the plant. The plant growing in swamps is of inferior size to this.

The quality of the fibre which the leaf contains, varies much with the character of the soil, the hilly and dry ground producing a kind very much superior to that of the river-edge and swamp,—a rule modified, however, by the quality of the soil.

According to the natives, the various kinds on the east coast of the North Island are:—

1st. The Witau, yielding a poor fibre.

2nd. The Motu-o-rui and Awanga, a variegated kind, the fibre un-serviceable for manufacture.

3rd. The Wara rika, and Manga eka, yielding a fibre of ordinary character.

4th. The Oue or Tapoto, yielding a beautiful glossy or silky fibre, but of so brittle a character as to require a mode of preparation in which a knife or scraping implement may not be used. The natives soak the leaf to soften the epidermis, which they strip off by shaking and drawing it through the hand, whence it obtains the name of "Tihore," by which the plant is generally, but improperly, known.

The Oue should be grown on a rich, deep soil, not swampy. The best fibre is very much prized, and is used for the Kaitaka, or bordered mat.

Some of this flax was manufactured in France into fabrics, that resembled fine jean and silk in delicacy of gloss.

The Oue is frequently planted by the natives in borders to divide small cultivations near a village, and where it is convenient for occasional use in mat-making. In this case, it constitutes quite a property. It may be seen in the cultivations at Coromandel harbour, Kawhia, and the Waikato.

The Oue is rarely more than 5 feet high. The leaves are very glossy, and rather red at the edges, causing the plant to assume, at a distance, rather an orange-green colour, as against the bluish-green of the other kinds.

5th. The Rongotainui. This flax grows most extensively on the East Coast, and at the Bay of Plenty; it is, of all, the most prized for the manufacture of fishing lines and cordage.

The Rongotainui is probably the best for commercial purposes generally; it is rather scarce in its wild state, but is carefully grown about the native settlements. The leaf of this kind of flax may be scraped or beaten without injury to the fibre which it contains. The natives cut across the epidermis on the under side of the leaf, previous to drawing it over the edge of a shell or knife.

On the West Coast, and at Taranaki, the flax called *Hati rau kawa* is used by the natives for the finest mats; it is probably the same as the Oue. The following are also known to the West Coast natives, viz:—

1st. The *Pare kore tawa*, *Huhiroa*, [probably "Oue roa"] *Rataroa*, and *Tihore* yielding the best fibre.

2nd. The *Ngaro*, *Tara riki*, *Wara riki* and *Pato*. The *Ngutunui*, *Ngutu parura*, and *Tai* one contain a stiff fibre.

The *Raumoa* and *Manunui* are good kinds for cordage.

Mr. Hursthouse states that, at Taranaki, the *Takaiapu*, *Ate weka*, and *Korako* are of a first-rate quality. There are also kinds called the *Tepuna* and *Tutai wiki*.

It is probable that many of the above-mentioned are the same, under different names; there appears to be no marked generic difference in any, save that from the South-west Coast; but difference of climate, locality, and soil will no doubt alter the relative quality and quantity of the fibre, and the appearance of the plant.

The Oue should be grown in rich, deep soil, properly drained. The hill flax as a rule yields the largest proportion of fibre, to weight of leaf, but the leaf is generally short.

The leaves may be cut twice a year. After steeping, the natives make the Oue leaves up into small bundles, and hang them on horizontal poles to dry, shaking and rubbing the leaf, from time to time, to get off the fleshy part of the leaf. A chemical process would probably be more suited to the preparation of this kind of flax. It is important to remember that the Oue or *Tihore* should not be exported for rope-making purposes, nor, if possible, the other kinds for textile fabrics.

The native names for the various parts of the flax plant, are:—*Purake* or *Pakauka* for the outside leaves, which are rejected, the *Muka*, or inner leaves, are collected for use, and the *Rito*, or unfolded leaf, is carefully left uncut.

The *Korari* is the name of the flower stalk, often, but wrongly, used as the name of the plant. The edible root is the *Aruhe*.

The word "*Muka*" is commonly applied to the dressed fibre; it is the correct name for the inner leaves.

Cleared bush-land is suitable for the cultivation of the flax plant, and even swamp-land is improved by drainage. In the various flax swamps near Nelson, through which roads have been made, it is invariably found that the finest plants grow upon the soil that has been thrown out of the ditch, at the road side.

When cultivated, each plant should have about two square yards of ground. An acre would thus give room for 2420 plants. About 10 lbs. of leaf will be obtained from each plant. A farm of one hundred acres would give 1085 tons of leaf. Allowing one-sixth of this to be convertible into fibre, 180 tons of marketable flax would be the result.