

times only 0.0003 inch.* They taper each way to a more or less blunt point, each cell being distinct from the rest, and not joined together end-ways. Notwithstanding their strength they are of very delicate structure, colourless, translucent, and almost devoid of secondary deposits, the cell-wall being from 0.0001 inch, to 0.0002 inch, thick. They are hollow, and filled only with the air, but are highly hygroscopic, imbibing water quickly, and during the operation twisting about in all directions. The fibres, although round when separated, are not so when collected into bundles, being then compressed into ovals, polygons, &c., so as to fill up the whole space, and leave no interstices. They have the same thickness in all parts of the leaf.

At the base of the leaf the vascular bundles are scattered through the cellular tissue, in about four irregular rows. They are arranged in ovals of two sizes; the largest, whose major axis is about 0.02 inch, and minor axis 0.014 inch, enclose in their centres a rhomboidal cluster of spiral vessels; while the smaller, whose major axis is 0.015 inch, and minor axis 0.007 inch, contain none. Near the outer surface of the leaf four other irregular rows of fibre bundles, without spiral vessels, are found, whose section is lanceolate, thus making eight rows altogether in the base of the leaf. The fibres here are generally much weaker than in any other part, and can be easily torn across with a needle.

Near the outside of the leaf the cellular tissue, in which these bundles are imbedded, is lax and translucent, but towards the interior it is open and spongy, the cells being arranged in single rows, enclosing irregular intercellular spaces, which are of a tubular form, the tubes running parallel with the vascular bundles. These intercellular passages begin to be developed when the leaf is about four inches long, and they are found only in those parts where gum is exuded. At present I have always found them empty, but it is possible that they may be gum-canals, or the glands or ducts by which gum is secreted.

In the thick part of the butt of the leaf, the internal rows of bundles are reduced to one, the others having died out. They are here club-shaped, with a constriction in the middle, and enclose a rhomboidal bundle of spiral vessels. Besides these there is also a marginal row of bundles, the largest of which alternate with the bundles of the interior row. They are of an elongated clavate form, constricted in the middle, and with a rhomboidal bundle of spiral vessels in the thick part of the club. Between these occur three smaller bundles, of an oval form, also constricted in the middle. The central one of these, which is situated just opposite to the interior bundle is rather more than half the length of the largest, and encloses near its inner end a rhomboidal bundle of spiral vessels. The other two are of the same form as the central one, but not much more than half its length, and the bundles of spiral vessels, which are also near the inner end, are in section like the sector of a circle, or a boy's kite. The cellular tissue which encloses these bundles is rather lax, and of a light-green colour, becoming close, and densely filled with chlorophyll, towards the outer side. All traces of the intercellular passages have disappeared, but in their place two cylindrical bundles of large, loose, translucent cells appear near the end of each of the smallest marginal bundles, and these continue to the point of the leaf. The cells that surround the interior bundles, and the rounded interior ends of the largest marginal bundles, are filled with a red fluid, as are also those of the midrib and margins of the leaf.

The vascular bundles in the free part of the leaf, at the butt, are rhomboidal in section, reaching the epidermis on the outer or inferior surface, but separated by several rows of cells from the inner or superior epidermis; they enclose bundles of spiral vessels that are also rhomboidal in section. Midway between these, and near the superior surface, there sometimes occurs another small cylindrical bundle of liber-cells, without any spiral vessels, but more often this is absent. Between each of the vascular bundles there is also a cylindrical bundle of large loose cells, similar to those in the thick part of the butt. The midrib is formed by an elongated bundle of fibres, enclosing a rhomboidal bundle of spiral vessels near its inner end, and it is surrounded by three circular bundles of fibres alone.

Higher up in the blade, as the free parts of the leaf get larger, the interior bundles of the butt die out, and the medial-sized marginal bundles elongate, until they, as well as the larger ones, reach almost across the leaf from the outer to the inner surface, the smaller ones retaining their relative size. All have, however, now altered in shape; the larger ones are still clavate, but are swollen, instead of constricted, in the middle; and the swollen parts contain their bundles of spiral vessels, which neither in shape nor in relative position have changed with the liber-cells. The smaller or intermediate bundles have become more clavate; but their spiral vessels have still retained their shape of the sector of a circle. Occasionally, on the inner side of the leaf small round bundles, composed altogether of fibre, are found, alternating with the bundles that cross the leaf.

The average thickness of these bundles on the superior or inner surface of the leaf is 0.005 inch, and on the inferior or outer surface, 0.0027 inch, and their distance from one another is 0.018 inch, or fifty-five bundles to the inch. There are, therefore, about two hundred and fifty bundles of fibres in the whole breadth of the leaf, not including the intermediate bundles, which would give about as many more in the lower part of the blade near the butt; but towards the point of the leaf these intermediate bundles die out, leaving only the large ones, that go the whole way across. These also get finer and closer together the nearer they get to the point, so that there are almost as many of them close to the tip of the leaf as there are near the butt. On the inferior or outer surface, the bundles of fibres reach to the epidermis, but on the superior or inner surface, several rows of cells intervene. Each bundle of fibres is separated from the next to it, in the interior of the leaf, by a mass of lax translucent cells similar to those found in the butt of the leaf. The rest of the cellular tissue is densely filled with chlorophyll.

The Maoris, in cleaning the fibre, cut through the outer or inferior surface of the leaf, as far as the lax tissue in the centre, then tearing out that part which contains one half of each of the bundles that cross the leaves, and the intermediate bundles, with the small quantity of cellular tissue between them,

* What are called the cotton-like, or hair-like, filaments of the flax, are far from being the ultimate fibres, but are single bundles containing perhaps 100 or more liber-cells; the ultimate fibres are all but invisible to the unassisted eye.