THE FOREST FLORA OF NEW ZEALAND.

The Forest Flora of New Zealand. By T. Kirk, F.G.S., late Chief Conservator of State Forests to the Government of New Zealand, &c. Folio, 345 pages and 160 plates. (Wellington: By authority; George Didsbury, Government Printer, 1889.)

MR. EDWARD BARTLEY states[1] that only four kinds of New Zealand timber are used in Auckland for building purposes, and that these are: kauri (*Dammara australis*), rimu (*Dacrydium cupressinum*), totara (*Podocarpus totara*), and kahikatea (*Podocarpus dacrydioides*); but Mr. Kirk's "Forest Flora" goes far beyond the timber-yielding element of the New Zealand forests. It illustrates and describes nearly the whole of the shrubby and arboreous plants of New Zealand, and gives very full particulars of their dimensions, qualities, uses, distribution, and propagation. It is by no means a mere compilation; and, although the author acknowledges various sources of information, a slight examination of the work is sufficient to convince us that it is very largely based upon personal observation, and that the details are elaborated with great care.

Altogether the flora of New Zealand contains rather less than a thousand species of flowering plants, and of these 115 are illustrated in the present work; some of the more important and specially interesting species by several plates. The tree ferns, which form so conspicuous a feature in the vegetation of the country, are not included, and some shrubby plants are omitted whose claims to notice are at least equally as strong as some of those admitted; but this is explained by the author's desire to do the work thoroughly as far as he went. For this reason, several of the small shrubby Coniferæ are figured, and a considerable number of plates are devoted to the illustration of the heterophyllous members of various natural orders.

Heterophylly is not a peculiar feature of insular floras, though it is perhaps nowhere more conspicuously developed than it is in New Zealand and Rodriguez.[2] Many of the New Zealand Coniferæ, the most valuable of the timber-trees, exhibit this peculiarity in a high degree, insomuch that different parts of the same tree have been referred to different species and even to different genera. Thus different parts of *Dacrydium Colensoi* might represent a juniper and a cypress, while in *D. Kirkii* there is a still more remarkable dimorphism. In explanation of Plate 97, Mr. Kirk writes:—

"As in the preceding species (*D. Colensoi*), the foliage is of two kinds, but the difference is of a still more striking character. The lower branches are spreading, the upper ascending or erect, the ultimate branchlets forming fan-shaped masses. The lower branches, sometimes to the height of 40 feet, are clothed with long narrow flat leaves; the upper branches are clothed with small scale-like, closely appressed leaves; so that the lower part of the tree resembles a silver-fir, while the upper part puts on the appearance of a cypress."

Figures are given of the dimorphic foliage of these conifers, and the confusion in nomenclature which has arisen in consequence of one kind only having often been taken by collectors is unravelled. It should be added that it is only the cypress-like branches that bear flowers and fruit.

In these New Zealand Coniferæ the foliage is dimorphic, but in several plants belonging to other natural orders it is polymorphic. Noteworthy among these are several members of the Araliaceæ, also *Rubus australis* and *Hoheria populnea*, of the order Malvaceæ. Mr. Kirk has very fully illustrated some of these remarkable plants, devoting five plates to the last-named, and as many to *Pseudopanax crassifolium* (Araliaceæ), a plant not unknown in cultivation in this country. The earliest leaves following the cotyledons of this *Panax* are small, narrow, and sharp-pointed, with entire margins; "but the leaves next produced are very different: they are distinctly stalked, 1 to 2 inches in length, rhomboid or elongate rhomboid in shape, and sharply toothed or deeply lobed, bearing some resemblance to those of the common hawthorn. Succeeding leaves are longer and of uniform width, until they sometimes attain the length of 3 feet 6 inches, while they scarcely exceed half an inch in width and are invariably deflexed. In this stage the leaves are thick and leathery in texture and acute at the apex, with distant sharp marginal teeth." This is the form in cultivation in this country, sometimes called the fish-bone tree, which Sir Joseph Hooker named *Panax longissimum*, as it had retained its peculiar character unchanged for fifteen years; though subsequent investigation proved that it was no other than *P. crassifolium*. In this stage of development the stem is invariably unbranched, and rises to a height of 20 feet; and, as it often retains its leaves almost to the base, it presents a very remarkable appearance. Following these long, narrow, undivided leaves, come others composed of three to five separate leaflets, and borne on petioles from 1 to 5 inches in length. The leaflets are less stiff than the long leaves, narrower, and having sharply-toothed margins. These are succeeded by similar leaves on longer petioles, having broader leaflets, thicker in texture, with coarser, more distant teeth. Flowers are sometimes produced at this stage, but not unless the stem has given off lateral branches. In the usual flowering stage the leaves have again become simple, and they gradually become thicker, the toothing almost wholly disappears, and they are from 4 to 6 inches in length, and borne on short stout petioles. To add to the perplexities of the plant, the male and female flowers are borne on different individuals. It is not surprising, therefore, that botanists working with herbarium specimens only have failed to limit or define the species correctly. As already stated, many other New Zealand plants are remarkable for the great variability of their leaves at different stages of development, and the kind of variation is as diverse as the extent of it.

There are so many other interesting subjects in Mr. Kirk's book that one is at a loss which to select for notice. Specially noteworthy is the presence in New Zealand of three species of *Fuchsia*, a genus otherwise restricted to America; and remarkable among these is *F. excorticata*, which sometimes attains a height of 45 feet, with a gnarled trunk up to 3 feet in diameter. The Central American *F. arborescens* is the only species that equals or approaches it in dimensions. *F. excorticata* has

[1] "The Building Timbers of New Zealand," Transactions and Proceedings of the New Zealand Institute, xviii. p. 37.

[2] For particulars of the latter, see Dr. Bayley Balfour's account of the botany of the island in the Philosophical Transactions of the Royal Society of London, vol. clxviii., 1879.

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medium-size flowers, at first of a greenish colour streaked or blotched with purple, and finally of a dull red, with very small, almost black petals. The tube of the calyx is very much constricted immediately above the ovary, and there is a second constriction a little higher up. Moreover, the flowers are trimorphic in the relative lengths of the style and stamens. That this *Fuchsia* yields "one of the strongest and most durable timbers in the colony" will be news to most people. But, as the trunk is often crooked or gnarled, it is difficult to procure logs exceeding 8 or 9 feet in length, and its commercial value is therefore greatly diminished. Mr. Kirk says the wood is hard, dense, compact, and even, and deep brown in colour, relieved by streaks of a paler shade, and short narrow waved black markings. When much waved, it is of a highly ornamental character. Further, it is almost indestructible even by fire, except in a closed furnace.

Many more interesting facts might be extracted from this admirable book, the botany of which appears to be equally as good as the practical part. A few new species are described, and the female flower of *Podocarpus totara* and the male catkin of *Dacrydium cupressinum* are figured and described for the first time.

One more point deserves mentioning. Mr. Kirk is very much concerned about the many inappropriate popular colonial names, which he proposes to reform; but we think he has undertaken a task in which he must inevitably fail. From the time of the earliest settlements, the various species of native beech (*Fagus*) have been called red birch, white birch, &c., though not uniformly throughout the colony; and the Maori language has only one common name for all the species. Now, Mr. Kirk proposes calling them "entire-leaved beech," "tooth-leaved beech," and so on. Supposing it were possible to effect a reform in this direction, the substitution of such uncouth names as those proposed is less to be desired than the retention of their present botanically inaccurate appellations. W. BOTTING HEMSLEY.

AN ELEMENTARY TEXT-BOOK OF CHEMISTRY.

An Elementary Text-book of Chemistry. By William G. Mixter. Second and Revised Edition. (London: Macmillan and Co., 1889.)

THIS volume belongs to the well-known series of "Manuals for Students," and will pleasantly surprise those who imagine that the multitude of elementary text-books of chemistry has made originality impossible. Of those smaller matters that readers and students generally accept with no more thought than their daily mercies, the index deserves especial mention as being exceptionally inclusive, and bearing evident signs of having been compiled by someone who had a sufficient knowledge of the subject to go beyond the mere verbiage, and enough patience to carry the task through.

Looking at the book simply as a treatise on chemistry, the adoption of the periodic system as a method of classification is very desirable, but the difficulty as to which of its elements a compound shall be associated with is not easily settled. The tendency is doubtless to keep the compounds of any one metal together, and this is what the author has done as far as possible, but as, for example, nine metals are treated of before oxygen and sulphur, and thirty-eight metals before carbon, the compounds of those metals that are considered in the earlier pages are spread through the book in a manner that is doubly confusing, the interpolated sections seriously interfering with the general arrangement. The sulphates of sodium, for instance, cannot be considered with sodium itself before sulphur has been mentioned, nor can they be added to sulphuric acid, as that would disturb the natural sequence of sulphur, selenium, and tellurium compounds, and the best place remaining for them is in the middle of one of the groups of elements. As a natural result of this apparently unavoidable irregularity, such a common salt as manganese sulphate finds no place at all, and it cannot be supposed that it is intentionally omitted when manganese tetrafluoride, hydrogen auryl sulphate, gold sulphate, and other equally rare compounds have considerable space allotted to them.

There is another marked innovation that certainly deserves success—namely, the introduction of gravimetrical quantitative experiments. The very first experiment in the division of the book headed "Chemistry" is the preparation of hydrogen by the action of sodium upon water, and the student is directed, after weighing the sodium and measuring the gas, to calculate the relative weights of the two, making all due corrections. In the next experiment the proportion between the weights of equivalent amounts of zinc and hydrogen is determined.

If the volume before us were simply an experiment in text-books, we might leave off here by congratulating the author on the measure of success that he has realized; but his first words in the preface are, "This work is designed for use in schools and colleges." The tendency at the present time is not merely to introduce the study of chemistry, but to extend the general scope of education in many other ways, so that the time devoted to chemistry has been very much reduced in some cases to allow of the addition of other subjects to the student's carriculum. It would be difficult to find a student who would have time to work through 238 experiments in elementary chemistry, especially when many of them are in reality a combination of three or four; and besides the specific experiments enumerated there are suggestions in the text that the student should prepare certain compounds and verify their properties. We do not hesitate to say that the intelligent performance of a fifth of the number of experiments set down to be done, accompanied with suitable study, would give the student as serviceable a knowledge of the subject as if he went through the mass of practical work prescribed.

The author also says in his preface that "Graphic and constitutional formulas are much used," and the body of the book fully bears out the statement. Graphic formulæ have been perseveringly tried in this country as an aid to the elementary student of inorganic chemistry, and have been deliberately discarded as uselessly cumbrous, and as making what is difficult to the beginner more difficult still. Such formulæ, however, are occasionally useful; but we would ask what good end is served by setting down the graphic formula of $Na_4W_3O_{11}$, which is given at p. 190? The best formula is that which most

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