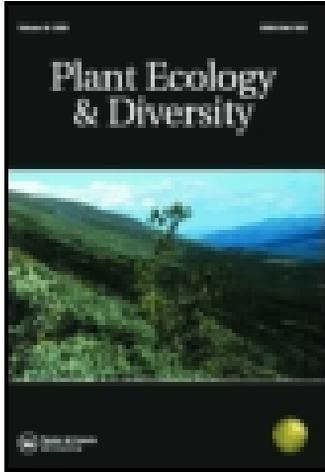


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V. On the Economical uses of the Bamboo

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Date.	Mean Temperature open air.	Growth during 3 days.
July 3 to 6	54 deg.	1½ inches.
6 ... 9	46 "	2½ "
9 ... 12	43 "	3¾ "
12 ... 15	48 "	7 "
15 ... 18	50 "	9½ "
18 ... 21	45 "	10¾ "
21 ... 24	44 "	13¾ "
24 ... 27	51 "	17 "
27 ... 30	54 "	18½ "
30 ... 2 Aug.	52 "	19¾ "
Aug. 2 ... 5	47 "	17½ "
5 ... 8	47 "	18½ "
8 ... 11	43 "	19½ "
11 ... 14	45 "	20½ "

From the 14th of August to the 24th of September, the extra height reached was 25 feet, being an average of 2 feet for every three days. On the 24th of September, the extreme height of the shoot was 40 feet, the growth of 81 days. The plant was shifted into its present tub during the spring of 1858. The soil used was turf loam, about 4 inches of bruised bones covered the drainage previous to the plant being retubbed.

IV. *Measurement of certain Coniferous Trees, taken at St Fort, Fife*, by GEORGE PATTON, Esq., Advocate. Communicated by Mr M'NAB.

Cryptomeria Japonica (in cone)—height, 21 feet; circumference of stem, 14½ inches. *Taxodium sempervirens*—height, 13½ feet; circumference of stem, 10 inches. *Abies cephalonica*—height, 14½ feet; circumference of stem, 20 inches.

V. *On the Economical uses of the Bamboo*. By ALEX. HUNTER, M.D., F.R.C.S.E., Madras School of Industrial Arts.

The Bamboo (*Bambusa arundinacea*), the largest known plant of the family of the gramineæ or grasses, grows luxuriantly in India, China, and other tropical countries. There are from eighteen to twenty species of bamboo already

known and described, seven of these are common in India, four in Ceylon, and six in Cochin China, but it is doubtful if they are all distinct, as the plant is known to present very different characters according to the soil, climate, and exposure. Of the common *B. arundinacea* there are three varieties. In the wild state it springs up in the jungles in small circular patches, presenting all the appearance and habits of a grass, but growing with great rapidity, and shooting out a few long, bare, reed-like stems, the first of which are strong, single, and pointed. These are soon followed by more delicate, branched, and gracefully drooping stems. The former are usually considered the male bamboos. They are solid at first, and shoot up to a considerable height before bearing leaves or lateral shoots. The thin, delicate and drooping stems are usually considered to be the female bamboo, but this point is not yet precisely determined. The number of solid bamboos is very small in proportion to the hollow, and the latter are more branched and slightly angular in their growth, there being a deflection at each joint, with at first a strong spine starting from the axil of a large leaf or stipule, which is persistent until the spine enlarges into a lateral branch. In the joints of what is called the female bamboo there is often found a white, hard substance called *tabasheer*, composed of seventy parts of silicic acid, and thirty of potass. This is used by the Hindus as a medicine, and is supposed to be possessed of tonic, cardiac, and anthelmintic properties. It is much used amongst the Gentoos of the Northern Circars as a tonic, and in internal bruises. The bamboo varies prodigiously in size in proportion to the supply of water and the richness of the soil. In dry, hilly localities it grows only to 8 or 10 feet, while in moist jungles, and in swamps, particularly on the banks of sluggish rivers, it attains the height of 90 to 100 feet, growing sometimes as much as 18 inches in twenty-four hours. The largest bamboos are probably those found in Burmah, where they occasionally grow to 10 inches in diameter, each joint being from 20 to 24 inches in length.

The plant is often cultivated in clumps, and to form ornamental archways for avenues and gardens; also as a hedge, being bent over and interwoven so as to combine the qualities of both a hedge and a paling. It does not answer the

purpose well, however, except in damp localities, as it grows irregularly and in clusters.

There is probably no other plant with which we are acquainted that is put to so many and such opposite and diversified uses. It is occasionally planted so thickly as to form a dense impenetrable belt or wall of vegetation, to protect crops or gardens from the depredations of large animals, like the elephant, elk, and bison. The leaves are tender and delicate when young; they are much eaten by herbivorous animals, and are considered cooling and diuretic for horses. The seeds are also used in the same way, and are administered as a decoction in fevers of cattle. An emulsion is also made from them, and applied locally to bruises and sprains in horses. The young, thin shoots of the female or hollow plant are used for making arrows; those of the male or solid plant are largely exported to Europe, for making the tops of fishing-rods, riding-sticks, and walking-canes. Large bamboos are used as pointers and as fishing-rods. The pointed lateral shoots, which are the rudiments of the branches, are used, when young, as pins with which the leaves of the Banyan, Peepul, and other species of *Ficus*, are fastened together to form plates, which are much used by some castes of Hindus. The temporary plate, which is cool and clean in appearance, is thrown away after the meal, and forms a prize for monkeys or crows. When the bamboo grows a little thicker, the stems are used for a great variety of purposes, as props, palings, posts, and supports for roofing. They are also split longitudinally into halves, quarters, or smaller sections, and are extensively used for roofing, flooring, and wall-mats for light doors, window-shades, rolling and folding blinds. A water-colour sketch exhibits a native house having the rafters and props, the door, and part of the roof, made of bamboo, covered with a thatching of coarse straw, and supported by mud walls; in the distance is a clump of bamboos growing luxuriantly, and at one end of the house a circular umbrella of bamboo, the short stalk or handle of which was represented thrust under the thatching, to keep the umbrella out of the way during the summer months, as it is not a folding one like ours. Other illustrations exhibit houses built entirely of bamboo, the walls and roof being of coarse matting, and the

posts and rafters of strong bamboo; such houses, I need hardly say, are only suited for warm climates, and are neither very durable, nor water or wind proof. In the heavy showers of the monsoons they leak considerably, and in gales they are apt to be blown to pieces. They are more picturesque than the ordinary mud houses of India, and when new they cost from five to eight rupees, or ten to sixteen shillings of our money. They last about three years in dry localities, but require yearly repairs in damp situations.

Among the more important uses of the bamboo is its employment in the manufacture of a fine quality of paper in China. I am indebted to Dr Crommelin of the Bengal medical establishment, for specimens of fine printing bamboo paper, and also for larger and coarser varieties extensively used in papering walls and lining boxes. The following is the process of preparing the paper:—The young shoots of the bamboo, when about the thickness of the thumb, are cut into lengths of 5 or 6 feet, and the hard silicious outer part peeled off in thin strips for making fine table mats, light baskets, and boxes of various kinds. The peeled bamboos, while still green, are beaten with heavy pieces of wood to split them a little; they are then tied up in bundles, and placed in pits full of lime water, in which they are left to steep for a fortnight or three weeks; after which they are bruised into pulp under heavy stampers, and mixed with a further quantity of fresh quicklime and water which serves to bleach the pulp. The mass is then coarsely strained and mixed with a large quantity of water, which is repeatedly changed, so as to wash out all the lime. It is again well pounded and put into vats, from which it is lifted on frames supporting a kind of stretcher of finely-split bamboo, on which the pulp in thin films is lifted. Many parts of the process are very similar to those followed in India and in the manufactories in Europe, where drawing-papers are made by hand. If the paper is to be sized for writing upon, a decoction of the roots of a leguminous plant resembling liquorice, or an *Astralagus*, is added to the pulp in the vat. Sketches and engravings made upon the paper in the Madras School of Industrial Arts show that it is well suited for printing purposes. This paper may be contrasted with another kind

made from the refuse of the silk factories in China. The latter is smoother, and less pulpy than the bamboo paper, and is chiefly used as writing paper. I have not heard the details of the process for making paper from silk refuse, but I believe there are other materials, as cotton, employed in making the pulp. Another manufacture from the bamboo made by the Chinese is a kind of soft cloth, which appears to combine some of the properties of paper and silk. Specimens are seen in the Museum of the Edinburgh Botanic Garden. They have much the same feel and appearance as the paper, but are more tenacious, and may perhaps owe their strength to a small admixture of silk refuse. This bamboo cloth is much used for painting upon, and for covering screens and fans.

The bamboo is put to a number of other uses by the Chinese. The tender shoots are peeled and cut into strips, then woven into round balls resembling basket-work, and made into pickles, or preserved in syrup, to form one of the ingredients of the celebrated preserve called chou-chou. The thin strips which are peeled off the young plant are woven into light, elegant baskets, or a neat kind of ornamental table mat, used in India to put under hot-water plates and dishes. Some of the delicate Chinese bamboo baskets, mats, and window-blinds, are elegant and light in manufacture, showing considerable dexterity in weaving, and taste in the application of simple means to accomplish useful ends. Ornamental table-mats of a different kind are made by some of the semi-barbarous tribes near Vizagapatam, in the Kimmedy country, on the northern borders of the Madras Presidency; these are the districts in which, till lately, the Meriah sacrifices of children took place yearly on certain feasts, to propitiate the deity supposed to preside over agriculture. This barbarous rite has fortunately been put a stop to by the British government, and we are indebted in a great measure to Mr Knox, the intelligent collector of the district, for extending and improving the manufacture of these table-mats. When examined carefully, and turned to the light, you will see that it is not the fine quality of the weaving that attracts the eye, but that advantage has been taken of the silky gloss of the outer silicious surface of the young bamboo to produce a simple, delicate, and

tasteful manufacture, which would probably be more extensively used if it were better known. The cost of these mats is about twenty rupees, or L.2 for a large set. They must not be confounded with the table-mats of China or of India, made of thin split rattan, which are not nearly so tasteful. Specimens of the latter are seen in the Museum at the Botanic Garden. The bamboo window-blinds, chicks, or tent-purdahs of India are by no means equal in taste to those made from the bamboo in China, though they are equally serviceable.

Another most tasteful and delicate manufacture from the bamboo is the lackered boxes and cups of Burmah. I am indebted to the kindness of Captain Tripe, the government photographer of Madras, for very fine specimens of these, which are superior in taste to the ordinary Burmese boxes and cups;* also for the description of the manufacture of this Burmese bamboo lackered-ware, which is interesting as illustrating the use of shell-lac, a substance which is most difficult to manipulate, from its hardness, and the rapidity with which it solidifies after being melted. The bamboo frame-work of which these cups and boxes are made is prepared in a very delicate way, by cutting thin long strips off the outer surface of the young, fresh bamboo; these are passed through fine holes in a steel plate to bring them all to one size, and of the thickness of packthread or fine wire, according to the size of the article desired. The cups, boxes, or baskets are then woven into the desired shapes or sizes, in the same way as basket-work is made. The articles are then put upon a rude kind of turning-lathe, and made to revolve rapidly, while a ball composed of shell-lac and bees-wax, coloured as required for the ground-work, is firmly pressed upon the basket-work. The heat produced by the rapid revolution melts the ball of shell-lac and wax, which fills up the interstices of the basket-work. When cool, the whole forms a solid, but light and pliant frame-work, which is either turned smooth and polished on the lathe, with a rag dipped in oil, or coated with another colour before being turned smooth.

* The use of the bamboo in building, forming scaffolding, and decorations, has also been well illustrated by a series of photographs collected by Captain Tripe when on an embassy to the Court of Ava.

On comparing samples of this ware, you will see that there are great differences in the quality both of the basket frame-work and of the decoration. In the finest kinds, which are evidently got up with great care, and are expensive, the different colours, and the surface of the bamboo weaving, shine through each other, and produce a very pleasing effect. Another variety of lackered bamboo basket-work is made in Burmah much in the same way as already described, except that a coating of Thetsi, an elastic waterproof varnish, is applied over the lac and wax, or sometimes along with it. This varnish has one very curious property, which is, that it will not dry except in a damp locality. It is usually applied to large and coarse articles,—as shields, pillows, baskets, and bowls for eating or drinking out of; the latter, from their lightness, flexibility, and strength, are more suited for marching than our brittle earthen, or heavy stone-ware.

I could fill and illustrate a large volume were I to enter into a description of all the uses of the bamboo. I must for the present content myself with enumerating simply some of the most important of them, trusting to be able to continue the subject hereafter, or to lay it before the public in some other shape.

The whole bamboo is used for a great variety of purposes, according to its size,—as for posts, props, poles of tents, tall frames for pigeons to light upon; sign-posts, with swinging-lamps to denote toddy or drink-shops, or with small toy figures, windmills, bells, &c., to denote trades carried on in the adjacent houses; poles for carrying water, luggage, palankeens or dhoolies for the sick; for floating-rafts, for light scaffolding, which can be erected quickly, and run up to great heights; pecottahs over wells for raising water; swinging-poles at feasts; small light bullock-carts, larger travelling covered carts and ruts, in which images are dragged about at religious ceremonies; raised watch-houses for guarding crops; ladder and fire escapes; fishing-rods; poles for pushing along boats; spear-shafts; pointers, garden-seats, and chairs; frames for supporting plants; walking-sticks, punishing or bastinado-rods; water-pipes; floats for lines and nets; blow-pipes and distilling-tubes; poles with basket-work frames for gathering fruit; hookah and hubble-

bubble pipes, bows and arrows. The joints, when cut into lengths, are also used for a variety of purposes,—as large or small bottles, ewers, jars, pots, oil or sugar vessels, and for a very ingenious mode of decorating floors,* by pricking a pattern through the bamboo, filling the joint with powdered chalk, and tapping it gently with a stick while rolling along the floor, immediately after the latter has been wet with rice water.

The joints are also used for holding letters or documents of value, for transmitting small articles or papers secretly or by post, for musical instruments, handles for tools, a great variety of blowing, spinning, jumping, and whirligig toys; blow-pipes for gold and silver smiths' work, and by the Burmese for a most ingenious method of producing fire by compressed air. (The instrument is described by Dr J. Fayrer, of the Bengal Medical Establishment, in the Asiatic Society's Proceedings.)

The split bamboo is put to nearly as many uses as the whole. When cut in halves it is used for thatching, for lath, and making the framework of partition-walls, upon which bamboo mats are fastened; for pellet bows, basket boats, cowrie or cavady coolie, and water-carriers' poles; framework, and hoops of different kinds; baskets, bird-cages, pegs and nails for fastening planks, and carved wood-work to pagodas in Burmah; net-work cases to protect bottles and water-goglets; tongs, compasses, surgical splints, decks of boats, penholders, fishing-nets, and traps to catch fish and small game; also as pointed stakes in tiger-traps; coarse and fine matting of all kinds for roofs, floors, windows, and packing purposes; and lastly, two of the few uses for which it is exported, are for bonnet-frames and hoops for ladies' dresses.

I have thus noticed the various and multiplied uses to which the bamboo is applied by nations whom we are inclined to call semi-barbarous. I question much if in more civilized countries any one substance can be found that has been so variously and skilfully turned to account. We may

* This was fully described and illustrated by me at the Meeting of the Royal Scottish Society of Arts, on the 13th December 1858, and a great variety of Hindu patterns shown. The process seems to have suggested to our manufacturers the ideas of cylinder printing, and taking out colours in fabrics by the process of discharge. See Reports of the Royal Scottish Society of Arts.

learn from this two or three useful lessons:—(1.) Thank God, who supplies to each country or race of mankind the necessities and luxuries of life, implants in man also the power to use them very differently; barbarous and half-civilized nations often excelling others in ingenuity and natural taste; (2.) That in the bamboo we have a plant which might be much more extensively used in our arts, manufactures, and commerce; and (3.) That if the nations of the East can teach us so much in one department of practical knowledge, it is our duty to try to give them in exchange some of the blessings which we have derived from our Christian civilisation; and should attempts, like the present, to bring to notice some of the arts, manufactures, and raw products of India and China be productive of benefit to our manufactures and commerce, let us take care that when we borrow from other nations hints that may improve our manufactures, we give them in return something that will elevate, improve, and enlighten their understandings, as well as raise them in the scale of civilisation. We already owe to India the ideas for some of our best and most lucrative manufactures; and it is the duty of our merchants and manufacturers to make some return.

VI. *On the Economical Uses of the Roots of Coniferous Trees.* By Mr M'NAB.

The donations of Mrs Millar, prepared from the roots of the *Abies nigra*, received from the Hudson's Bay territory, and presented at the last meeting of the Botanical Society; also the donations of Mr Jeffrey, prepared from the *Abies Menziesii*, from the Oregon territory, and presented December 1854, suggest the idea that something might be done in this country by a more extensive cultivation of these trees. Both species delight in open brown peat soil. Perhaps the finest specimens in Great Britain of the *Abies Menziesii* are to be seen on Keillar Moor, Perthshire, where it is growing vigorously in deep brown peat. This species differs from most of the other conifers, in being easily propagated by cuttings, which, if stuck into the spongy peat, root and form trees. The *Abies nigra*, like *A. Menziesii* also