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J. E. T. Aitchison C.I.E. M.D. F.R.S. c.

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Some Practical Hints relative to the Material required for a Botanical Expedition. By J. E. T. AITCHISON, C.I.E., M.D., F.R.S., &c.

(Read 8th May 1890.)

After much experience in making Botanical Collections, I have come to the conclusion that it is the best plan to take all the material that is likely to be required for an expedition with one, and on no account to depend upon obtaining any of it in the countries likely to be traversed. The cost of carrying all one's own material, ready packed, to the locality where it is proposed to commence work, is not to be compared with the wear and tear of life upon finding that what you require cannot be obtained at the locality you depended on.

The whole of the requisite material should be made up in packages of 40 lbs. each. The reason for this is, that such a weight can be carried by one man in the most hilly and difficult district likely to be traversed, and I personally have not as yet come across a carrier who has objected to convey a parcel of that weight for an ordinary march of twelve miles.

The contents of a 40 lb. or primary package would no doubt depend much upon the climate to be botanized in. Where I have botanized it has been what is usually considered a dry country, viz., North West India, the Himalayas west of Simla, Ladak, Kashmir, the Punjab, Baluchistan, Afghanistan, and as far north as Meshad in Persia. I should consider Europe, Northern Africa, Arabia, Persia, and all the country to the north of these, as belonging to a dry climate; collecting in the Himalayas to the east of Simla, in Bengal, Central India, Bombay, and all to the south of these as a wet country, that requires other appliances in which I am not experienced. For a dry country good stout blotting-paper, with sheets of mill-board and wooden boards, is all that is required. The best paper for the purpose that I have as yet met with is the ordinary paper made in the Punjab Jails for native use.* This is hand-made paper, the sheets of which are put upon walls to dry. These sheets, taken off the walls as they dry, without having had any pres-

* As per sample attached.

sure or size applied to their surface, proves to be all that is required. It is tough, strong, and not too bibulous. The sheets ought to be cut all of one size by being laid on each other, not after being folded one within another, and then cut; by the latter method of cutting the sheets vary in size.

In addition to this drying paper a few sheets of very thin but tough packing paper should be taken, in which fragile specimens can be laid out and dried without removal.

The paper should be cut to $19\frac{1}{2}$ inches by 11 inches, and each sheet laid on the top of the other, not packed up in bundles of so many sheets, one within another.

Locality tickets, 4 inches by 3 inches, of coarse paper, with a rough surface on which to write with pencil. Four tickets, at the very least, should be allowed for each sheet of paper.

There should be ten good strong pieces of millboard, each cut to 20 inches by $11\frac{1}{2}$ inches; these should be placed through the drying paper, so as to divide it up into so many equal parcels.

FIG. 1.—Diagram of board with cross pieces attached, and showing the run of the grain of the wood.

FIG. 2.—Section of fig. 1.

FIG. 3.—Diagram of nail.

To each primary package should belong two boards, each with two cross pieces *attached*. The boards should measure

20 inches by $11\frac{1}{2}$ inches by $\frac{1}{2}$ inch thick, and be made of ordinary deal wood; the cross pieces should be $11\frac{1}{2}$ inches by 2 inches by $\frac{1}{2}$ inch, and of the same wood as the boards.

The grain of the wood of the boards, and of the cross pieces, should run longways; the grain of the cross pieces, when attached, runs across the grain of the boards.

These cross pieces should be attached to the boards, two on each, placed $2\frac{3}{4}$ inches from the end of the boards; they should be fixed to the board by means of long malleable iron nails, fully 2 inches in length, with large flat heads of fully half an inch; the length of the nail when bent, and the flat broad heads, give a good solid grip of the wood, without causing splitting. The two outer nails should not be driven into the wood further from the end of the cross piece than 1 inch.

There should be two plain pieces of board, 20 inches by $11\frac{1}{2}$ inches by $\frac{1}{2}$ inch, with four loose cross pieces $11\frac{1}{2}$ inches by 2 inches by $\frac{1}{2}$ inch, ready for use when required with 18 nails, as described, rolled up in a piece of leather.

	lbs.	oz.
The weight of the 4 boards and 8 cross pieces,	8	0
" " 36 nails,	0	8
" " 10 mill-boards,	6	4
" " packing cloth of gunny, two pieces, each 72 inches long, . 30 inches broad,	4	0

One piece of waterproof sheeting 36 inches wide, 10 feet long; this is intended for covering two packages of paper, but it is best to keep it as an entire piece, and only divide it when required for use with two parcels. The material I got in India weighed 3 0

Equally as good waterproof sheeting for the purpose can be got in England, weighing half the amount; this would allow more weight for paper.

Rope of hand-twisted twine, about the thickness of the ring finger, two pieces 40 feet long, each weighing together 1 4

Some good stout twine, two pieces, each 40 feet,	lbs. oz.
together weighing	0 3

Total weight of boards, cross pieces, nails,	
mill-boards, packing cloth, waterproof, rope	
and twine,	23 3
300 sheets of paper 15 lbs. 4 oz., and locality	
tickets to be made up to	16 13

The total making	lbs. 40 0
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To pack each primary package, commence by dividing off the drying paper into equal parts, with the ten sheets of mill-board; on this lay the locality tickets, then pack this into the piece of waterproof, binding all together with the two pieces of twine. Place one piece of board that has cross pieces attached to it with the bars against the table, the plain surface uppermost; on this place one of the plain boards, on this lay the package of paper that has been bound up in the waterproof, on the top of this lay the second plain board, and on the top of all the second board which has the cross pieces attached to it with the cross pieces uppermost; rope the whole together with one piece of rope, then slip in under the rope the four spare cross pieces so that they may lie between the fixed cross pieces on the top of the package; then fold round one piece of gunny material, packing in as most convenient the second piece of rope, and the package of nails; and lastly, pack the whole into the second piece of gunny cloth, carefully sewing the parcel up with twine. Here you have a handy package of 40 lbs. in weight, with your paper thoroughly protected from damp and moisture.

(This package in the field becomes converted into two, upon the paper being filled with dried plants. Although forming thus two packages the weight is not doubled; probably what was 40 lbs. only rises to a little above 60 lbs.)

Then two of the 40 lb. or primary packages should be packed together in a piece of packing cloth (a similar spare piece of cloth and a spare rope being enclosed in the package), and well roped together, so as to form a solid parcel or load of 86 lbs.

The packing cloth for this should consist of two pieces, each

36 inches broad and 78 inches long, together weighing 5 lbs.; and two pieces of a harder twisted rope, length 26 feet, together weighing 1 lb. The total weight of this external packing material should not amount to more than 6 lbs.

On starting upon the expedition all the primary parcels should thus be packed, two together, making loads of 86 lbs.; and only during the expedition, when necessity requires it, should these loads be divided down to their original 40 lb. packages.

An ordinary carrier's load for a march of twelve miles in the hills of India is 60 lbs., that is, amongst people who are accustomed to carry. An ordinary horse load in the countries I have traversed is considered to be 240 lbs., and where camels were employed 640 lbs. was considered a good camel load; but much depends upon the condition of the animals, the usages of the country, or the rapacity of the owners of the carriage.

Most carriers will carry, on an ordinary march of twelve miles, a well-packed package of 86 lbs., if allowed their own time and way in which to do it. Should there be any difficulty about it, a little extra pay will generally smooth over the matter; but there are places and circumstances where no more than 40 lbs. can be carried by one man at a time, and it is to meet this latter emergency that it is essential to have the whole botanical material packed, so as to get over such a difficulty without injury to the material. Once the necessity and difficulty is got over, the 40 lb. packages can again be repacked to 86 lb. loads.

In Persia, and in the Kuram Valley, Afghanistan, in both of which places donkeys are a means of transport, they easily carried 172 lbs., or two such loads, and some of the larger animals were laden by their owners with 258 lbs. Owing to its being in this form, I never had any difficulty with the conveyance of my material, although in some cases the packages were fully 93 lbs. in weight each.

For the use of each collector a small pick-axe should be taken, the iron head of which should be 9 inches in length and weighing not more than $1\frac{1}{2}$ lbs., the wooden handle 20 inches long, with the iron head made so that it can be easily slipped off one end of the handle; the pick should have a sharp point at one end, and be expanded flat at the other;

this I have found by far the best implement for collecting with. Besides, there should be in store at least six pairs of ordinary dissecting forceps, for aiding in lifting the plants whilst changing them from one set of papers to another (it is a great labour to do this depending alone upon one's fingers, besides the absence of forceps results in much injury to most specimens), a good bill hook, a spade, a saw, an axe, a small hold-all of carpenters' tools, a couple of pairs of strong scissors, some carpet needles, extra twine, a 40 lb. parcel of spare boards, with some tough iron wire such as is used with soda-water bottles, one or a couple of light baskets like the lower part of a fish-wife's *creel*, or the *Kilta* of Kashmir.

It may be asked how much material is it necessary to take with one on an expedition?—This of course depends upon the numbers of sets proposed to be collected of each species. In my opinion it is a very good collection, made in a new country, if 1000 species can be collected during one season. To collect two good sets of 1000 species of plants would require six parcels of paper, of 300 sheets each at the very least, or 1800 sheets of drying paper.

Whilst on my travels, except occasionally dusting over certain classes of plants, such as Umbelliferae, Euphorbiaceae, and Compositae, with a little of M'Dougall's disinfecting powder, I did not otherwise poison the specimens; but if there is any chance of a long period of time elapsing between collecting the specimens and arranging them into a Herbarium, I should certainly poison the dried specimens immediately preceding the process of packing them up ready for despatch from the field, using the strength of corrosive sublimate recommended by the late Asa Gray, in a solution in alcohol (of 95 per cent.), just below the point of saturation, but adding one ounce of carbolic acid to each quart of the above solution. Although the collections I last made had not been much more than a year from the time of gathering, some of these did show signs of becoming affected by insects upon their being opened for distribution.

In making collections I would strongly urge that the plants, as *they are being collected*, be at once placed between sheets of drying paper, and not be gathered first into baskets or *vascula*, to be subsequently arranged in paper. I uphold this plan very strongly, more especially in making large

collections, notwithstanding that there is much trouble connected with carrying it out, especially during the presence of high winds, as when these were present it used sometimes to take three of us all we could do in the open to properly pack in the plants, and at the same time prevent what we had collected, with all the papers, being blown away. But then one had the comfort of feeling, upon arrival in camp of an evening, after a hard day's work, that the plants were arranged and ticketed; and the thought that there was no urgent necessity for further work connected with them, until every one had had food and rest, amply repays one for all this extra trouble. When the marches were ordinary ones, not necessitating much labour, after getting into camp and every one had had their food and rest, and there was still light, my usual procedure was, to place the plants I had collected that morning into fresh paper, and to have sitting by me, inspecting the process, several of the villagers and guides, with whom I conversed, thus obtaining from them all the information they could give me relative to their uses, native names, and products. In this way I gained much, and probably more reliable, information regarding the plants, than if I had only depended upon that of guides or an occasional villager met with whilst collecting. After a heavy hard march all this was left over until the next morning; but had the plan I propose not been adopted it would have been a necessity, although tired out and weary, to have worked on, and to have arranged out the plants lying in the baskets and *vascula*, as after a very few hours they become quite unfit to be properly dried.

In collecting plants I have always considered the mere plant was of little good, without also obtaining all the local information I could gain regarding it.

In conclusion, I may say that the whole of the Botanical material required by me in proceeding with the Afghan Delimitation Commission, in 1884, was manufactured on very short notice (with the exception of the waterproof sheeting, which had to be purchased), made, arranged, and packed for me, in accordance with my instructions, at the Central Jail, Lahore, Punjab, India, and in every detail it gave me complete satisfaction.