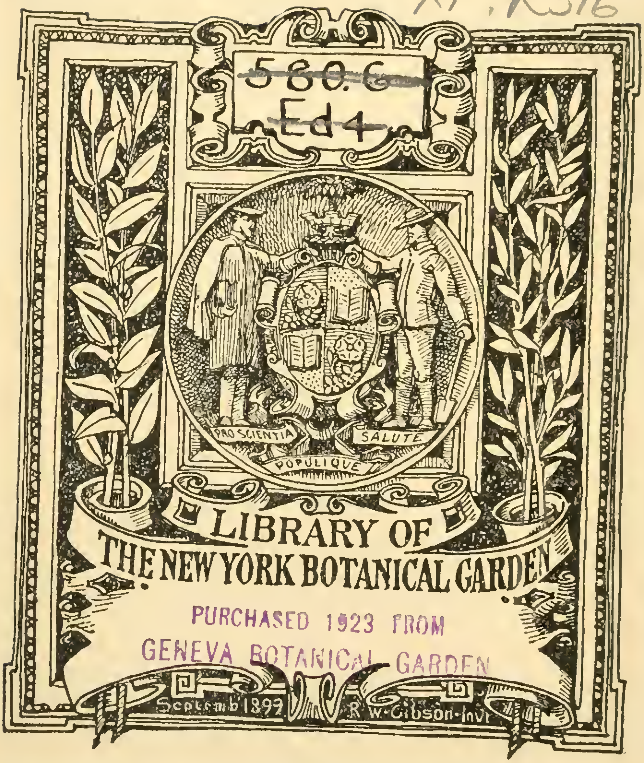
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TRANSACTIONS

OF THE

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BOTANICAL SOCIETY.

VOLUME XVIII.

EDINBURGH:

PRINTED FOR THE BOTANICAL SOCIETY.

MDCCCXCI.

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OF THE

BOTANICAL SOCIETY.

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Dr Spruce's important work, "Hepaticæ of the Amazon and of the Andes of Peru and Ecuador," consisting of 600 pp. letterpress and 22 plates, forms Vol. XV., and may be purchased separately. Price 21s. The work is in Latin, with a few notes in English.

Dr Aitchison's "Notes on the Products of Western Afghanistan and of North-Eastern Persia," forming the first part of the present volume, may be purchased separately. Price 10s. 6d.

TRANSACTIONS

OF THE

BOTANICAL SOCIETY.

SESSION LIV.

Notes to assist in a further Knowledge of the Products of Western Afghanistan and of North-Eastern Persia. By J. E. T. AITCHISON, C.I.E., M.D., LL.D. Edin., F.R.S. Lond. and Edin., &c., &c., *Naturalist with the Afghan Delimitation Commission, Brigade-Surgeon retired H.M. Bengal Army.*

(Read March 13, 1890.)

DURING my sojourn in the regions of Western Afghanistan and of North-Eastern Persia I felt extremely the want of some work to assist and guide me, and therefore it is that I propose to lay before you the information I gained whilst there, believing that it will prove useful in the future to those visiting the same countries, as well as to those who may be studying, or may wish to study, their products. I have, as you will see, placed my information in a dictionary form, as I expect that this will prove a more ready means of reference for all. The construction of the dictionary is based upon the scientific terminology, with the native and English synonyms interspersed in alphabetical order. For local work there can be little doubt, in my opinion, that the native names are invaluable, and therefore, whilst making my collections, I not only took great trouble to obtain them, but also to verify their correctness by checking, so far as lay in my power, the information received. Whenever any of these native names are authorised, as the lawyers say, "by being in the books," I have given the dictionary word in addition, in Persian characters. The other native names are transliterated in English characters, spelt according to the etymology of the word when that is known, or according to the sound as pronounced. I have tried to carry out, as far as my time would allow, the etymology of the various native synonyms, and to give in the alphabetical arrangement the word or words from which each name may be supposed to be derived.

In the transliterated native synonyms the vowels are pronounced thus:—

a, short as in *hat*, *had*.	*ī*, as in *police*, *machine*.
ā, long and broad as in *far*, *father*.	*ŏ*, short as in *rod*, *fog*, *frog*.
e, always as in *eight*, *prey*, *obey*.	*ō*, long as in *rode*, *mote*.
i, short as in *thin*, *win*, *spin*.	*u*, always long as in *flute*, *rude*, *rural*.

When the letters *p* and *h* come together in a word, they are sounded separately and *not* as *f*.

A very short abstract of information, for assistance to further reference, will be found under the following headings:—

Cattle, Chemicals, Drugs, Dyes, Fibres, Fodders, Foods, Fuel, Glue, Gums, Gum-Resins, Hair, Minerals, Narcotics (not employed as Drugs), Oils, Resins, Skins, Tanning Materials, Timbers, Trade, Wool.

I cannot conclude this Preface without thanking the following officers who were also on the Afghan Delimitation Commission, and who, owing to the interest they took in my work, as well as in the products of the country, were ready at all times to furnish me with any information they might have picked up, or to discuss with me any subjects of mutual interest:—Captain A. F. Cotton, B.S.C.; Major A. C. Talbot, R.E., C.I.E.; Nawab Mirza Hassain Ali Khan, C.I.E.; and Mr Alexander Finn, Her Britannic Majesty's Consul, who at that time was on duty in Meshad.

For further information relative to some of the products of this part of the world I would refer the reader to—

Report on the Trade and the Resources of the Countries on the North-Western Boundary of British India, by R. H. Davies (now Sir Henry Davies, K.C.S.I.), Secretary to the Government of the Punjab, 1862.

Handbook of the Economic Products of the Punjab, by Baden H. Powell, H.M. Bengal Civil Service, 1868.

Supplement to the Pharmacopœia of India, by Moodeen Sheriff, 1869.

Handbook of the Trade Products of Leh, with the Statistics of the Trade, by J. E. T. Aitchison, 1874.

Terminologie Medico-Pharmaceutique, &c., par Joh. L. Schlimmer. Teheran, 1874.

The Vegetable Materia Medica of Western India, by W. Dymock, 1884.

In laying this Paper before the Society, I ought no doubt to have limited my notes to botanical matter alone, but in this I take rather the view of the man who is working in the field, and who prefers to have his information so served up to him that he has only to refer to one book, than that of the worker in the city, who prefers to keep distinct each branch of study. I have therefore to thank the Society for their great consideration and courtesy in accepting this Paper without limiting its usefulness by restricting it to botanical requirements alone.

Explanations regarding the uses of the various forms of Type.

1. The scientific nomenclature, in the alphabetical arrangement, has the generic and specific name in **heavy** type; 2. The author's name in *Italics*; 3. The natural order to which the plant belongs in Small Capitals.

4. The scientific nomenclature, that occurs through the text, is in Small Capitals.

5. English words and English synonyms that are in the alphabetical arrangement are in Small Capitals.

6. English synonyms and the English names for certain substances occurring in the text, are in the type of the text, but commence with a Capital letter.

7. All native names and native words in the alphabetical arrangement, as well as those in the text, are in *Italics*.

8. When hyphens divide a native name into parts, each part is a word which will be found in the alphabetical arrangement.

9. Such native names and words as have dictionary authority, are printed also in Persian characters.

10. Words included within brackets [ ] give the literal translation of the preceding native terms.

Āb—اب—water.
Āb-i-panīr—اب پنير—[water of cheese], whey.
Āb-khez—اب خيز—a spring of water.
Ābnus—ابنوس—Ebony, the wood of DIOSPYROS sp.
Ābrak—ابرق—Mica.

Acacia Catechu, *Willd.* LEGUMINOSÆ.

From this tree is obtained the extract Catechu, *kāt-a-gulābī,* which is so largely imported into these regions, either *via* the Persian Gulf or directly from India, to be employed in dyeing, tanning, or as a medicine.

Acantholimon, *species.* PLUMBAGINEÆ.

The dense, spinous, cushion-like masses of several species * of ACANTHOLIMON and ACANTHOPHYLLUM, covered with a most lovely inflorescence, varying from pure white to rose pink, gave the appearance of artificial bouquets, which one was never tired of looking at, as each set of varied clusters and tints came into view. These formed much of the fodder for camels in many of the more stony and exposed localities.

Acanthophyllum macrodon, *Edgew.* CARYOPHYLLEÆ.

The root stock of this, as well as of GYPSOPHILA PANICULATA, under the same name *bekh,* is employed as a substitute for soap in the washing of clothes, woollens, &c. The root is found for sale in all the bazaars of the larger villages.

Acer, *species.* SAPINDACEÆ.

A maple, called *shakh, shaghs, shaghz,* as a medium sized tree, was found occurring in the deeper valleys of the Badghis, between Kushk and Palounda. The bark of the root is employed as a dye-stuff to produce a brown colour.

ACID—*ishkī, ishkīn, tursh, trush.*

Acorus calamus, *Linn.* AROIDEÆ.

The sweet-flag, *agar, igir, bach, waj, wach.* I did not collect this plant, but the roots are a well-known trade article from Central Asia, employed in medicine.

* "The Botany of the Afghan Delimitation Commission," *Transactions of the Linnean Society of London,* vol. iii. part i., 1888.

Āda—Ādas—ادس—the plant and pulse of LENS ESCULENTA, also sometimes applied to VICIA ERVILIA.

Ādar—ادر—fire.

Āduīa—ادویه—medicines, drugs. The plural of *dawā*.

Āduīa-deg or *āduīa-dek*—[the medicine of the mortar]. This is a well-known aromatic powder of the country, consisting of black-pepper, cumin seeds, and cinnamon carefully pounded together in a large iron mortar.

Āduīa-garm—ادویه گرم — [heating-medicines]. Condiments.

ADULTERANTS, or substitutes.

A red clay, *tawa*, is employed in adulterating the gum-resin Asafœtida. The flowers of CARTHAMUS TINCTORIUS to adulterate Saffron. The corms of COLCHICUM those of MERENDERA PERSICA. The gum-resin of MICRORHYNCHUS SPINOSUS to adulterate the drug SARCOCOLLA. The bulbs of TULIPA and ALLIUM to replace the tubers of ORCHIS. The tubers of the roots of EREMOSTACHYS LABIOSA, and other species, are employed as a substitute for those of CURCUMA ZEDOARIA. The wood of MORUS ALBA is employed as a substitute for, and passed off as Ebony, the wood of DIOSPYROS species. The roots of FERULA SUAVEOLENS are passed off as those of the true *sambal*, FERULA SUMBUL.

Aeluropus littoralis, *Parl.* GRAMINEÆ.

A useful fodder grass, met with all over the country, called in Baluchistan *kandar*. In its creeping habit of growth it much resembles the *dub* of India, CYNODON DACTYLON.

Āfīun — افیون — Opium. The inspissated juice of PAPAVER SOMNIFERUM.

Afsantīn — افسنتین — or *absanthīn*. The flower-heads of a species of ARTEMISIA.

Agar—اگر—*igir*, the rhizomes of ACORUS CALAMUS; a tuberous root; the tubers of a CYPERUS.

Agar-magar.—The tubers on the fibrous roots of Eremostachys labiosa and other species. This word is no doubt merely a repetition of *agar*, with the consonant thrown in for euphony.

Agaricus, *species.* Fungi.

Large Fungi of several species are traded with in Central Asia under the name *gharī-kun* as a specific remedy for several diseases, and as a surgical remedy for stopping bleeding. I collected quantities of Xylopodium Aitchisoni. The usual locality they were found growing on was the mounds of soil erected by white ants (Termites); these were considered as good for food, but the natives said that they were usually only collected by the dealers in drugs.

Agriophyllum latifolium, *Fisch. et Mey.* Chenopodiaceæ.

Charkho, chīrkho.—This is the plant of the sand-hills of Baluchistan, that used to be seen being rolled across the desert flats, carried by the wind hither and thither, and occasionally met with in sheltered localities drifted into great heaps. It had been called by the mission the "wanderer" before we knew the native name for it, which means the spinner, or the spinning about one. In Persia during autumn Gundelia Tournefortii was seen being driven about in the same way, but being a much larger plant, was apt to produce by its gyrations a panic amongst cattle.

Agropyrum cristatum, *Boiss.* Gramineæ.

Valuable as a fodder grass.

Āhak—آهك—lime.

Āhan—آهن—*āhun*, iron.

Āj—آج—a little, a small quantity.

Ājkān—an umbelliferous fruit, collected in Afghanistan and in the jungles of Balkh, employed medicinally, said to be the same as *ajwain*.

Ājwain—اجوين—the plant Carum copticum, and its fruit.

Ak—this final syllable made by adding the letter *k*—ک—to a Persian word gives the diminutive; as *mekh*—میخ—a nail; *mekhak*—میخک—a little nail, a clove.

Akal—عقل—memory, wisdom.

Ākal—اکال—(Arabic) provisions, victuals.

Ākhkūk — اخکوک — Apricots, the fruit of PRUNUS ARMENIACA, when collected in an unripe state, and dried.

Ākhkūsh—اخکوش—unripe fruit.

Āl, ul—ال—the Arabic for the English article, "the."

ALABASTER—*marmar-i-safed, malmal-i-safed, sang-i-marmar*, or *sang-i-malmal.*

At the encampment at Zaru, we found a fakir's shrine and other graves covered with fine specimens of a very pure white alabaster, also great pieces of limestone composed of layers of different colours, along with some good pieces of chrysolite: all thesê were indifferently called *sang-i-malmal.* We met with similar specimens in several places to the south of, and along the Helmand. These were all said to have been brought from a place in the vicinity called Rewat, whence these stones are carried to great distances as shrine offerings. Between the hills of Malikdan, near Galicha, is said to be a salt-mine, from which Alabaster, Gypsum, and other minerals were taken to Cabul for the purpose of finishing a mosque lately built there.

Ālaf—علف—grass, herbs, forage, hay, or straw.

Ālaf-i-shīrāg—[the grass, milk herb], EUPHORBIA CÆLADENIA.

Ālaf-kharez—[the fodder of the conduit], the Hawthorn, CRATÆGUS OXYACANTHA.

Ālaf-khez—[the fodder of the spring], the Hawthorn.

Alhagi camelorum, *Fisch.* LEGUMINOSÆ.

The camel-thorn, *khar, khār-i-buz, khār-i-buze, shutharkhar.* One of the most common and prolific shrubs met with over the whole country from Quetta to Bala-morghab and Meshad. Where it grows in luxuriance it is from three to four feet in height, and covers vast tracts of country. In cultivated land it is a troublesome weed, where whilst the corn is standing it is invisible, but upon the crop being cut it is seen to occur in dense masses. After all other shrubs and plants have dried up owing to the autumnal hot winds, this still remains of a vivid green, and is eagerly sought for as fodder by camels, donkeys, and goats. During certain seasons, and in special districts, when its fruit is beginning to ripen, the whole shrub becomes covered with tears of glass-like beads, the largest the size of a pea; this is the manna produced on this shrub, called in these parts *tar-anjabīn*, which is very extensively collected, both for local consumption and exportation.

Alk, *alak*—علک—*ālk*, *ālak*, *ilk*—الک—a resin, gum-resin, or mastich, Olibanum or Frankincense, Spikenard, Nardostachys Jatamansi.

Ālk-ul-labān—الک ال لبان—[the milk resin], Olibanum or Frankincense, the gum-resin of Boswellia species.

Ālk-undaru, *alk-kundaru*, *alk-kundar*—[the resin, a remedy for bleeding], Olibanum or Frankincense, the gum-resin of Boswellia species.

Alkali, see Barilla.

Allium cepa, *Linn.* Liliaceæ.

The Onion, *pīāz*, met with cultivated in all gardens, as a vegetable is much relished by the natives.

Allium M'Leanii, *Baker.* Liliaceæ.

The bulbs of this species, with no doubt that of others, are collected in southern Afghanistan and exported to India to be sold under the name of *badsha-sālab*, or *ambar-kand*, as a substitute for Orchis tubers. See *Annals of Botany*, vol. iii., No. X., May 1889, page 149; *Trans. Bot. Soc. Edin.*, xvii. 434.

Allium sativum, *Linn.* Liliaceæ.

Garlic, *sīr; lahsan* (Hind). Is cultivated in all gardens.

Allium, *species.* Liliaceæ.

A red dye, for dyeing silk thread with, is said to be obtained from a species of Allium. I regret that at the time

I took little note of this matter, as since then I have seen that on the juice of certain ALLIUMS being exposed to the action of the air it takes on a bright red colour.

Allium xiphopetalum, *Aitch. et Baker.* LILIACEÆ.

A strongly garlic-scented plant, collected and eaten as a vegetable by the natives, who look upon it as a sort of garlic, hence its name *sīr-pīāz-ak.*

Ālmlōk, ālmaluk—الملوک—In Afghanistan the fruit of DIOSPYROS LOTUS is so called. A cherry in Arabia.

ALMOND. The fruit and kernal of PRUNUS AMYGDALUS.

Althæa Hohenackeri, *Boiss.* MALVACEÆ.

An indigenous shrub, with handsome large flowers, clumps of which are very showy and characteristic of the country in which it grows, resembling much our cultivated Hollyhocks.

Althæa lavateræflora, *D.C.* MALVACEÆ.

The flowers *gul-i-khatmī,* the seeds *tukhm-i-khaira,* or *khair, khairu, kheru,* the roots *resha-khatmī.* A cultivated plant usually grown on the ridges between fields. It is grown not only for the showiness of its flowers, but for the petals, which are collected as they fall off the plant, as well as for the seeds, and for its roots, all of which are exported, or employed in local medicine.

Althæa officinalis, *Linn.* MALVACEÆ.

The Marsh-mallow, *khadmī.* In the Harirud valley, not uncommon near villages and in wet soil. The petals are collected to be employed in medicine.

Āltīb, or *Ultīb*—الطيب—can this be a corruption, and contraction of the Arabic word *āllatīm*—اللطيم—ال لطيم—meaning the musk, or any odour with which they perfume the temples?

Ālu—الو—a plum, the fruit of PRUNUS species. In Hindustani a potato.

Ālu-bālu—الوبالو—[mole-like plum].

The bitter Cherry, fruit of PRUNUS CERASUS, var.

Ālu-bokhāra—[the Bokhara plum].

By this is usually understood a dried plum or prune, fruit of a PRUNUS species; but this term is also applied to the fresh fruit.

Ālucha—الوچه—[a little plum], the fruit of several species of PRUNUS.

Ālu-sīa — الوسیه — [black-plum]. A large, deep purple, almost black-coloured plum, a very excellent grafted fruit; PRUNUS species.

ALUM—*zama, zuma, zamch, khourī.*

Imported in some quantities to this country to be employed in dyeing, also in medicine. It is said to be manufactured in Kohistan, but that the greatest bulk of it is imported through Persia from Bombay.

AMARANTH. The plant AMARANTUS PANICULATUS.

Amarantus paniculatus, *Linn.* AMARANTACEÆ.

The Amaranth, *tāj-kharus,* occurs only as a cultivated plant, usually seen thinly scattered through melon and tobacco fields, both the red and yellow flowered varieties. I never met with what I should consider a regular crop of the plant, but it occurred through fields rather as if the natives held, in superstitious veneration, the necessity of growing a few of these plants sparsely spread through their fields. The seed is eaten cooked, and the leaves employed as a pot-herb.

Āmbarud—امبرود—a pear, the fruit of PYRUS species.

Ambar-kand, probably a contraction for *ambarud-kand* [the pear-shaped testicle]. The bulbs of an ALLIUM species, sold as a Salep in Bombay. The word *kand* here corresponding exactly to the Arabic word *sālab* or fox's testicle as applied to the tubers of an ORCHIS.

AMBER—*kāh-ruba, kāh-rewah.*

Worn in the form of beads as amulets, and employed in medicine. Imported to these parts chiefly through Persia.

AMMONIACUM—the gum-resin of DOREMA AMMONIACUM.

Ammothamnus Lehmanni, *Bunge.* LEGUMINOSÆ.

Called by the natives *talkhak,* meaning bitter-weed; no animals seem to eat this, or yet SOPHORA PACHYCARPA, plants which, except in the flowering or fruiting stages, can scarcely be distinguished from each other.

Āmrucha —امروچه— [small pear]. The term is technically applied to the indigenous pear tree, and its fruit, PYRUS species.

Āmrud—امرود—the cultivated pear of gardens, and its fruit; PYRUS COMMUNIS.

AMULET—beads of Amber, pieces of CELTIS wood, and seeds of CÆSALPINIA BONDUC are usually worn as amulets or charms.

Ānāb—عناب—the fruit and tree of the Jujube, ZIZYPHUS VULGARIS.

Anabasis eriopoda, *Benth. et Hooker.* CHENOPODIACEÆ.

Ishlan, ishlun, ishlun-i-bandak.—By burning certain Chenopodiaceous shrubs is obtained a coarse Barilla. This plant is the one considered as giving the greatest yield, and the best in quality of the alkali.

Anabasis, *species.* CHENOPODIACEÆ.

Herbarium specimens Nos. 54, 42, 1884. The shrub called *lā-rag,* and an ANABASIS on the Helmand was called *trīthk* and *gulmai;* all these were said to be employed in the manufacture of Barilla.

Ānār—انار—the shrub and fruit of the Pomegranate, PUNICA GRANATUM.

Anchusa Italica, *Retz.* Boragineæ.

A very handsome weed in cornfields, the corollas collected to be exported, and employed in local medicine, *gul-i-gao-zabān.*

Andar—اندر—more or most rare (Arabic).
Andar-ultīb, converted sometimes to *Indarlutīb* [the rare scent]. The root stocks of Valeriana Wallichiana.

Andropogon laniger, *Desf.* Gramineæ.

A highly-scented, aromatic grass, by no means uncommon all over the dry country; readily noticed when crushed under foot by its odour.

Angabīn—انگبين—Honey.
Angrez—انگريز—English.
Angur—انگور—Grapes, the fruit of Vitis vinifera.
Angurak—انگورک—a small grape, or grape-like. The fruit of Astragalus Gompholobium.
Anguza—انگوزه—the gum resin of Ferula fœtida; Asafœtida.
Anguza-kema—the plant Ferula fœtida.
Aniline—*jaohar.*

These dyes are very largely employed in these parts, for which purpose they are greatly imported into this country; although it is generally reported that, in Persia at least, the Government punish those found employing them.

Anise, Aniseed—*bādīān*—the fruit of Pimpinella Anisum.
Anjadān—انجدان—an umbelliferous fruit, collected to be employed in medicine and as a condiment; also called *gul-pār.*
Anjīr—انجير—a fig, the fruit and shrub Ficus Carica.
Anjīr-kōhī—the indigenous [hill fig], Ficus Carica.

Anzarut—انزروت—*anzerut, anzrud,* the drug SARCOCOLLA; also the resin of a pine from India.

Āo—او—water.

Āo-karut—اوقروت—the whey that separates from the curd of sour butter milk or Oxygal. The same name is also applied to a preparation made with the whey and liquorice, which is a common household remedy.

Āol, āul, āwal—the shrubs PRUNUS EBURNEA and PRUNUS BRAHUICUS.

Āoras—اورس—the tree Juniper, JUNIPERUS EXCELSA.

Āo-tarnak — a Turkoman term for EUPHORBIA CÆLADENIA.

Apium graveolens, *Linn.* UMBELLIFERÆ.

Celery, a common herb on the sides of water-courses, near the water.

Apocynum venetum, *Linn.* APOCYNACEÆ.

Dum-i-roba, dum-i-gosāla, gāo-gosh; kundār (Turkomani).—A perennial shrub, with an underground creeping stem that throws up annual shoots from four to five feet in height; growing in a wet clay soil, in brackish water.

From the fibre of the annual shoots the natives make twine and rope; and a tribe of Turkomans, named Kazak, who live at Kala, east of Bokhara, make a cloth. This cloth is here known by the term *katān;* but it must be remembered that this term by the Persians is usually applied to linen made from flax. The bark of the underground stem is employed in tanning and preparing skins which are intended for holding water. The local native names allude to the appearance of the ripe seed, whereas the Turkoman name signifies that it is a fibre-producing shrub, as this name is by them applied to other plants also that yield fibres.

The late Colonel Prejvalski, the celebrated Russian traveller, mentions a cloth being made at Lob-nor from the fibre of an Asclepiad; and Sir Douglas Forsyth, in his Yarkand report, mentions a cloth called *Luf;* both of these I believe to be the produce of the above fibre, as the plant has a very wide range of habitat, extending from Venice on the Adriatic eastwards through Persia, Southern Russia, Songaria, Afghanistan (where I collected it), eastwards through Western Thibet, and in China. Messrs Cross and Bevan, consulting chemists, report very highly on the quality of the fibre, in a letter addressed to the director of the Royal Gardens at Kew. They state: "The ultimate fibres of APOCYNUM VENETUM vary from 20 to 45 mm., making the average length a little more than flax;" and again, "this cellulose is peculiarly lustrous and very strong." Supposing the fibre to prove sufficiently valuable for the cultivation of the plant, a further inducement for doing so would be, that once planted in a fitting locality, little further trouble or outlay would be required than that expended in the original raising for several years. It would be raised by planting out portions of the underground stem, and not, as is the case with most fibres, by annual sowings. The annual shoots would yield stripes of bast and bark on an average over two feet in length. Besides, the plant prefers a wet clay soil, permeated with saline or brackish water; it could thus be raised in localities which at present are barren, owing to the presence of salt, as at the mouths of rivers where the land is occasionally flooded by the sea. Whilst in Afghanistan, I sent portions of the underground stems to the Botanical Gardens of North-Western India at Seharanpore, from which Mr Duthie raised the plant and subsequently supplied me with flowering specimens for the Herbarium at Kew.

APPLE—the fruit of PYRUS MALUS.

APRICOT—the fruit of PRUNUS ARMENAIACA.

Arak—عرق—a strong spirit prepared from raisins.

Ārcha—the tree Juniper, JUNIPERUS EXCELSA.

Ārd—ارد—or *aurd*. Flour.

Ārd-i-amrucha—flour made from the dried fruit of the indigenous Pear, PYRUS species.

Ardij—اردج—the tree Juniper, JUNIPERUS EXCELSA.

Areca Catechu. PALMEÆ.

From this palm is obtained the areca nut *supārī*, called here *sepāru*; imported in quantity to be employed with oak-galls in the tanning of sheep-skins to which the wool is still attached. I doubt if the catechu obtained from this palm is ever imported.

Arenaria holosteoides, *Edgew.* CARYOPHYLLEÆ.

A prolific weed in wheat fields; hence the native name *gandamak*, or the wheatling. This is the name given to the locality in Eastern Afghanistan where the celebrated treaty of 1879, called Gandamak, was concluded.

Ārghawān—ارغوان—also *arghamon*—the Judas tree, CERCIS SILIQUASTRUM.

Ārī—آری—*Āra*—آره—the roots of the teeth.

Ārī-lang—the bark from the roots of a Boraginaceous plant employed in medicine.

Aristida plumosa, *Linn.* GRAMINEÆ.

Honey grass, *mazj.* A most vividly green grass, occurring in small tufts over the whole country, but most noticeable on the sand-hills of Baluchistan, no doubt from the want and scarcity of other vegetation. Greedily fed upon by sheep.

AROMATIC POWDER—*aduīa-deg.*

ARSENIC

Is met with in several forms for sale in all the larger bazaars; imported chiefly through Persia proper to these regions, to be employed for dyeing with, as a poison, or in medicine. White arsenic, *marg-i-mush.* Impure arsenic, *sankhīa.* Yellow arsenic or orpiment, *zarna, zarnīkh.*

Artemisia campestris, *Linn.* COMPOSITÆ; and
Artemisia maritima, *Linn.* COMPOSITÆ.

These two common British plants, our field and sea Artemisiæ, both called *trek,* exist everywhere over the dry and stony country, forming the chief fodder for cattle on those arid tracts; their root stocks and apparently ever dry stems, over many districts, are the mainstay of the traveller for fuel. Owing to their value for fuel they do not exist for miles round large villages, as in those places these shrubs are regularly hunted down and exterminated. As these plants grow where little else can possibly exist, the arid desert land surrounding some villages is made more desert and barren by their removal. Camels and donkeys thrive on this fodder. Horses that are unaccustomed to this diet apparently prefer anything else, but the horses of the country seem to relish and fatten upon it.

Artemisia scoparia, *Waldst. et Kitaib.* COMPOSITÆ.

Occurred in quantity along the banks of the Helmand, *luling, gurās.*

Artemisia, *species.* COMPOSITÆ.

The drug *afsantīn* consists of the flower heads of some species of ARTEMISIA, and so does the medicine *bārang-bōīa.*

ARTICHOKE—CYNARA SCOLYMUS.

ARTICHOKE, Jerusalem—HELIANTHUS TUBEROSUS.

Āru—آرو—Hindustani for a peach, the fruit of PRUNUS PERSICA.

Arum Griffithii, *Schott.* AROIDEÆ.

Phanār. So named, as is also HELICOPHYLLUM CRASSIFOLIUM, from the likeness of their spathes to the hood of a cobra.

Arundo Donax, *Linn.* GRAMINEÆ.

Nal, nāī. This reed grows in great luxuriance all over the country, wherever there is water, and a clump is to be found cultivated in many gardens for the requirements of the household. The young leaves make good fodder, and the old ones bedding for cattle. The reeds are employed in all sorts of basketwork, whether in the construction of houses or to carry material in, for screens, as tubing for pipes, flutes, holders of gunpowder, and such like. The term *nāī* is applied more correctly to PHRAGMITES and ERIANTHUS, the reeds of which are smaller than those of ARUNDO.

Arzan—ارزن—Millet, PANICUM MILIACEUM.

Arzān—ارزان—cheap, of small value.

ASAFŒTIDA—the gum resin of FERULA FŒTIDA.

ASAFŒTIDA-SCENTED—the herb TEUCRIUM SERRATUM.

Asal — اصل — the root, origin, source. *Asul*, a medicine made up of several roots.

Asal-ālsus—pronounced *asal-āsus*—اصل السوس—the root of the Liquorice plant GLYCYRRHIZA GLABRA.

Asal-pishāk, *asal-poshāk*—[the source of the small bark]. The Elm, ULMUS species.

Asāl—عسل—Honey.

Asbarg—the flowers of DELPHINIUM ZALIL.

ASH—FRAXINUS OXYPHYLLA, and another species.

Ashar—عشر—or *ashīr*, any milky plant.

Ashtak—اشتک—swaddling clothes. The dried flesh of the Apricot, PRUNUS ARMENIACA, also *astak*.

Asp—اسپ—a horse.

Asp-i-kema—[the *kema*, as high as a man on horseback]. The plant DOREMA GLABRUM.

ASS (domestic), the Donkey, *khar*.

The ass in this district of Persia is to the Persian agriculturist his sole means of conveying his material and self to and from his fields, or market, as well as for ploughing his fields. In Afghanistan and by the Afghans this animal is not commonly used.

ASS (wild), EQUUS HEMIONUS.

Āstar—استر—*āstār*—استار—a mule.

Astragalus Gompholobium, *Benth.* LEGUMINOSÆ; and Astragalus species, specimen No. 1047, collected May 21, 1885.

The pods of both these species are large, as large as a good sized gooseberry, inflated and full of liquid; these are collected by the natives and eaten, being called *angurak*, and *kharbuze*. They are nice in flavour, somewhat like young green peas. As the pods ripen the fluid becomes absorbed and the pods soon become like dry leather, when the peas rattle in the interior.

Astragalus heratensis, *Bunge.* LEGUMINOSÆ, and Astragalus species, specimen No. 571, May 25, 1885.

The shrub *gabīna*, *kōm*, *kōn*, *kum*. These two species of ASTRAGALUS are very common in the stony soil of the Hari-rud Valley, and Khorasan, at an altitude of 3000 feet. From them is obtained a gum called *katīra*, *gabīna*, exuding from fissures in the bark, in the form of TRAGACANTH, or on cutting across the stem it shoots out of the medullary cavity like pipe Tragacanth. This is collected in large quantities at a village called Kalla-roving near Bezd, in Khorasan, for exportation in all directions from this to India, Persia, and Turkestan, to be chiefly employed in the stiffening, glazing, and facing of local fabrics. Most of the gum sold in India as *katīra* is this, and not the product of any Indian plant. See *Pharmaceutical Journal and Transactions*, December 11, 1886, page 467.

Astragalus Holdichianus, *Aitch. et Baker.* LEGUMINOSÆ. A. KAHIRICUS, *D.C.;* A. AUGANUS, *Bunge;* A. BUCHTORMENSIS, *Pall.*

All these ASTRAGALI have long fibrous, whip-like roots, of which the bark makes splendid twine and rope, for which purposes they are employed by the natives. To obtain as much of the root entire as can be done at one operation, they employ the following plan,—they pass one end of a short loop of twine over the neck of the root, and through the other end of the loop a stick, then use the latter as a lever against the ground, the root fractures deep down in the soil, and thus pieces of from one to two feet in length are obtained. I first heard of this plan in the Kuram Valley, but only saw it put in execution here.

Astragalus hyrcanus, *Pallas.* LEGUMINOSÆ.

Udish (Baluchi). A most valuable fodder in the desert, arid tracts. The very marked pyramidal shape of this shrub, causes its recognition at long distances; at first I had the idea that this peculiar form might be due to the browsing of cattle, but this is not the case, it seems to grow naturally thus.

Astragalus Sarcocolla, *Dymock.* LEGUMINOSÆ. (*Pharmacographia Indica*, vol. i. p. 476, 1890.)

As these pages were passing through the press I only received the *Pharmacographia Indica*, in which the authors consider that Sarcocolla is the product of an ASTRAGALUS, not only from finding the fruit of an ASTRAGALUS amongst the gum, but also from the fact that "the seed when soaked in water swells, bursts, and a mass of Sarcocolla protrudes; some of the pods are abortive and are full of the gum." Without, however, a further knowledge of the plant, I think it should not have been identified as a new species, as in all probability it will be found to be a species, already described, of Bunge.

The substance or drug called Sarcocolla in England, from the Greek, meaning "flesh-glue," is known in Persia as *anzarut, anzrud, anzerut.* It consists of pale yellow irregular minute grains, somewhat like crushed resin, or some forms of soft brown sugar, but more irregular in the size of the particles: it is said to be obtained from the surface of a spinous shrub, collected much in the same way as manna, being shaken off the shrub on to a cloth, laid on the ground for the purpose of catching the falling grains. It is eaten by the ladies of the Harem to improve their appearance, and to give the skin a gloss, but is exported as a medicine. It is said to be chiefly collected near Koin, Birjand, and Yezd, and also not far from Turbat-i-Haidri. A false *anzarut* is collected from the shrub MICRORHYNCHUS SPINOSUS.

Asus — *alsus* — السوس — the extract LIQUORICE, obtained from the roots of GLYCYRRHIZA GLABRA.

Aswarg—the flowers of DELPHINIUM ZALIL.

Atār—عطار—a druggist, a pedlar.

Ātish—اتش—fire.

Atish-barg—اتش برگ—[fire-leaf], tinder-box. The holder of the fire-leaf.

Atish-bark — اتش برک — [fire-lightning], the steel employed in obtaining a light from flint.

Atriplex Flabellum, *Bunge.* CHENOPODIACEÆ; and

Atriplex Moneta, *Bunge.* CHENOPODIACEÆ.

Both these ATRIPLEX go by the same names, *frang, farang*; they are considered excellent vegetables by the Afghans, and I found them very good.

AUBERGINE, or Egg-plant, SOLANUM MELONGENA.

Āuranj—اورنج—the Orange, CITRUS AURANTIUM.

Avena fatua, *Linn.* GRAMINEÆ.

The wild oat, *gao-dār, jaon-dār, kīagh-dāna-dār, tak-tak, jao-tak-tak.* A common weed in corn-fields.

AXE—*tabar.*

Azād—آزاد—free, liberated.

Azān—آذان—or *azan*—اذن—lobes of the ear.

Azrak—ازرق—or *arzak*—ارزق—azure, cerulean, blue, pure limpid.

Bach—بچ—the rhizomes of ACORUS CALAMUS.

Bād—a goat.

Bād—باد—wind.

Bād-ghīs—بادغیس—a district of Afghanistan, the name meaning abundance of wind; according to Vambery the old reading was *bad-khīz*, the place where the wind rises.

Bādām—بادام—the almond, PRUNUS AMYGDALUS.

BADGER—*gōrkan*, MELES species.

Bādīān—بادیان—Aniseed, the fruit of PIMPINELLA ANISUM.

Bādīān-kohī — [the hill aniseed], PRANGOS PABULARIA.

Bādinjān — بادنجان — the Egg-plant, SOLANUM MELONGENA.

Badra-kema—the Galbanum plant, FERULA GALBANIFLUA.

Badrang-bōīa—[the scented (remedy) for flatulent colic]—بادرنگ بویه—or *badranj-bōīa*—بادرنج بویه—the seeds of a labiate employed in medicine.

Bādsha—بادشه—a king. When applied to a product, it means a superior kind of.

Bādsha-salap—the bulbs of a species of ALLIUM.

Bāgh—باغ—an orchard, a garden.

Bāghcha—باغچه—or *bāgh-ī-cha*, a small orchard, or garden.

Bahman—بهمن—or *buhman*. A medicine from Cabul imported into India; CENTAUREA BEHEN.

Baingan (Hind.)—SOLANUM MELONGENA.

Bajindāk, or *bijindāk*—the plants KUSCHAKEWICZIA TURKESTANICA and LEPIDIUM DRABA.

Bājrā—باجرا (Hind.)—spiked millet, PENNISETUM SPICATUM.

Bakas—بقس—*bakis*, the Box tree, BUXUS SEMPERVIRENS.

Bakhla — بخله — *bakhlī*, the Field-bean, VICIA FABA.

Balag, *balak*—بلك—a leaf.

Baland—بلند—tall, lofty, great.

Balanophora, *species.* BALANOPHOREÆ.

On the banks of the Helmand was picked up a specimen of BALANOPHORA; this a Baluchistan camel driver called *labu*, but this name is also applied by the Baluchis to an OROBANCHE.

Bālchīr, *bālchōr*—بال چهر (Hind.)—the root-stock of NARDOSTACHYS JATAMANSI.

Balīla— بليله —Beleric Myrobalans, the fruit of TERMINALIA BELERICA.

BALL—*gol*, *gola*, *golī*, *gul*, *gulī*, *bandaka*.

Balourī, *malourī*—the Bramble, RUBUS species.

Balsamodendron Myrrha, *Nees.* BURSERACEÆ.

Yields the gum-resin Myrrh, *mur*, *bol*.

Balsamodendron Mukul, *Hook.* BURSERACEÆ.

This yields the *gugal* of Baluchistan.

Balsamodendron, *species.* BURSERACEÆ.

At Meshed I obtained a gum-resin, said to be imported, called *mulk-i-azrak*, *mukal-i-azrak*, *bōī-kōhī buī-kuhī*; this was a form of Bdellium. The same names were, however, applied to a fragrant gum-resin obtained at the roots of spinous shrubs, in the dry desert parts of the country, and which was unrecognisable, from the former. At Sha-Ishmaīl alone, on the 8th October, I picked up, on the gravel plains, a piece of gum-resin much resembling the Meshed products, being highly fragrant.

Bālu—بالو—a cherry, a wart, a mole.

Balut—بلوط—an oak, QUERCUS species.

BAMBOO-GRASS—*bārshonk*, PENNISETUM DICHOTOMUM.

Ban, *bān*— بان —*bun*, *bana*—a tree, a root, in Baluchistan the name for PISTACIA TEREBINTHUS, var. MUTICA.

Banaush, *benaush*, *binaush* — the Ash tree, FRAXINUS OXYPHYLLA, and another species.

Band—بند—a knot, a joint, a mound, a dyke, a dam, a weir.

Band-ak, *bandakai*, *bandukai*—EPHEDRA FOLIATA, CALLIGONUM species, and ANABASIS ERIOPODA, all so named from the joints or nodes found occurring on their stems.

Bandaka—بندقه—a little ball, or round stone.

Bāng—بانگ—*bhāng*—بهانگ—Indian hemp, CANNABIS SATIVA.

Banjan—Aubergine, SOLANUM MELONGENA.

Bānu—بانو—a lady, a princess.

Barak—برک—the fine soft hair of the camel, or a fabric made from it, Camlet.

Bārang—بارنگ—the seed of a PLANTAGO employed in medicine.

Bārang-bōïa — بارنگ بویا — [the scented *barang*]. The seed of an ARTEMISIA, used as a drug.

BARBERRY—BERBERIS VULGARIS.

Barg—برگ—a leaf.

Barg-a-bana—[the leaves of the tree]. The leaves of PISTACIA TEREBINTHUS, var. MUTICA.

Barg-a-sumāghk—[the leaves of the Sumach]. The leaves of RHUS CORIARIA.

BARILLA—*khār*, *ishkhār*.

The Alkali of the country, a very impure carbonate of soda and potash, manufactured by burning various salsolacious shrubs — SALSOLA FŒTIDA, SALSOLA ARBUSCULA, SUÆDA FRUTICOSA, HALOXYLON AMMODENDRON, and several species of ANABASIS, besides others ; but ANABASIS ERIOPODA is considered the best for the purpose. The substance thus obtained is a saleable article in all villages and towns where it is locally expended, and as far as I could hear there is no export trade in it. It is employed in the manufacture of soap and glass, in the preparation of skins during the process of tanning in the removal of the hair, and in washing.

BARK—*post, posh.*

Bark—برق—Lightning.

BARLEY—*jao, jow,* HORDEUM species.

BARLEY harsh—*jao-tursh,* HORDEUM VULGARE.

BARLEY huskless—*jao-makai,* HORDEUM HEXASTICHUM, var.

BARLEY pickles—*jao-dana.*

BARLEY sweet—*jao-shīrīn,* HORDEUM HEXASTICHUM.

BARLEY of the desert — *jao-dashtī,* HORDEUM ITHABURENSE.

Bārshonk—Bamboo-grass, PENNISETUM DICHOTOMUM.

Bārtang—بارتنگ—the seeds of several species of PLANTAGO are employed as a drug under this name.

Bārud—بارود—Gunpowder.

Bārzat, barzad—بارزد—*bīrzand,* Galbanum, the gum-resin of FERULA GALBANIFLUA.

BASKET—*sabad, sapad, sabat, kōar,* and *kōara.*

The coarsest forms of basket-work, such as are employed in the walls of houses, the construction of roofs, the building of enclosures for cattle, and the formation of breakwaters to dam up the flow of water, are usually constructed of the branches of the willow, poplar, and tamarisk; the finer kinds of basket-work of the reeds ARUNDO and PHRAGMITES, and by far the best for quality and fineness from the annual shoots of the Judas tree, CERCIS SILIQUASTRUM. Not frequently are to be seen baskets made from the leaves of the bulrush, TYPHA species.

BAT—*shapara.* A small bat, a butterfly, or moth—*shabparak, shaprak, shauprak.*

Bata—Punjabi for PERIPLOCA APHYLLA.

Baz—بز—*bōz*—بوز—*buz, burz, bād*, the goat in general, or the female goat in particular.

Baz-anjīr—[the goat's fig]. The Castor-oil plant, RICINUS COMMUNIS.

Bazbāz—بزباز—Mace, the aril of the Nutmeg, MYRISTICA FRAGRANS.

BDELLIUM—a gum-resin, yielded by BALSAMODENDRON species.

Be, or *bī*—بي—without.

Be-ābān—بيابان—[without water], a desert.

BEAN—the Field-bean, VICIA FABA ; the French-bean, PHASEOLUS VULGARIS.

Bed—بيد—a willow, SALIX species.

Bedal—an indigenous SALIX.

Bed-anjīr—[Willow-fig]. The Castor-oil plant, RICINUS COMMUNIS.

Bed-i-mushk—[Musk-willow], SALIX CAPREA ?

Bed-i-sīa—[Black-willow], SALIX ALBA.

Bed-i-surkh—[Red willow], SALIX SONGARICA.

Beda—the hay of the Medick clover, Lucerne, MEDICAGO SATIVA.

Bedām—the Almond, PRUNUS AMYGDALUS.

BEE. Any bee or wasp is called *zambur*.

Taking the country over which I traversed as a whole, there were no honey bees, either in a natural state or domesticated. The only hive I came across was in the remains of an old tower at Karez Ilias, where they were in the act of swarming. Bees are said to be common in the woods at Sarakt in the Koh-bāba range, and also in Kohistan. At Herat they are said to be domesticated. The natives say that the tree in which they usually hive is the Honeysuckle, LONICERA NUMMULARIFOLIA, which is generally found hollow. A Bumble, or Humble bee, with a very long proboscis, was common in the Badghis, and a very small species, ANTHOPHORA ATROALBA (?),* was frequently found in an unconscious condition in the sheathing stipules of the Asafœtida plant.

* "Zoology of the Afghan Delimitation Commission," *Transactions of the Linnean Society of London*, vol. v. part 3, 1889.

BEET—the plant that yields Beet-root, BETA VULGARIS.

BEKH—بیخ—the root of any shrub; technically applied to the root-stocks of ACANTHOPHYLLUM MACRODON and GYPSOPHILA PANICULATA, their roots are "the root."

Bekh-i-gao-gosh—[the root of the cow's ear]. The underground creeping stem of APOCYNUM VENETUM.

Bekh-i-gul-i-abās—[the root of the flower *abās*]. The roots of MIRABILIS JALAPA.

Bekh-mahk [the root, of the root] and *bekh-sus*—[the root of the root]. The root-stock of GLYCYRRHIZA GLABRA.

Bekh-i-zīr-balak—[the root of the (thorn) under the leaf]. The wood, and root-stocks of the Barberry, BERBERIS VULGARIS.

BELERIC MYROBALANS, the fruit of TERMINALIA BELERICA.

Benincasia cerifera, *Savi.* CUCURBITACEÆ.

Gourd, *sabcha*, cultivated freely in gardens for its gourd, which is much used as a vegetable.

Beranj—*berinj*—برنج—Rice, the grain of the plant ORYZA SATIVA.

Berberis vulgaris, *Linn.* BERBERIDEÆ.

The Barberry, *jīr*, *jīr-khār*, *zer-khār*, *zīr*, *zīr-bār*, *zīr-balak*, *zīr-khār*, the fruit *zīrishk*, *sīrishk*. A very common shrub, growing at an altitude of 2000 feet and upwards, from which is largely collected the fruit; this is consumed locally, as well as being exported in some quantity to India, where it is highly appreciated by the natives as a condiment. Usually the fruit contains no seeds; it is then much more oval, longer, and of a much lighter colour than that which has seeds. On reaching the Punjab the fruit, or preserve, is called *zīrishk-tursh*, to distinguish it in the trade from small, dried, black grapes; the latter are our European Currants, or Corinths. From the root-stocks and wood of the BERBERIS is obtained an extract called *ībrān;* this is a yellow dye, which is also employed in medicine as a local application to inflamed eyes.

BERRY—*chām, dāna, hab.*

Beta vulgaris, *Linn.* CHENOPODIACEÆ.

Beet. The plant, and Beet-root, *chuk-andar, lablabu.* The leaves are employed whilst still young as a pot herb, but the plant is grown for its root, of which there are the two varieties, red and white. The ordinary beet-root of Afghanistan and Persia is larger and finer in quality than that usually met with in markets in England. The Afghans especially are very fond of this vegetable.

BEVERAGES—

The usual beverage of the Persians is tea, a commodity procurable in the smallest shop, and obtainable in a prepared state by the traveller at almost any house; by the Afghans it is said not to be nearly so much used as it is by the Persians. Milk made sour by the addition of oxygal is the usual offering of a household, especially amongst the nomads, where that article is plentiful, on the arrival of a friend or stranger at the house, accompanied with some bread. At certain seasons, or when milk cannot be procured, an infusion of mulberries, or vinegar to which has been added water and sugar, is offered to the guest in lieu of milk. Wine and spirits, except in the houses of the wealthy, are drunk in private, and not ordinarily as a beverage.

Bhāng—بهانگ—Indian-hemp, CANNABIS SATIVA.

Bhi—به—*bhī*—بهي—the Quince, PYRUS CYDONIA.

Bhī-dāna—بهي دانه—Quince seeds, the seeds of PYRUS CYDONIA.

Bhusa—بهوسا—the Indian term for the crushed straw of various crops, usually applied to that of wheat and barley; its Persian equivalent is *ka, kā.*

Bī, be—بي—without.

Biborate of Soda.

Borax, *tanakār, tanakāl, tunakār, tinkāl, tinkār, tingār;* crystalline Borax, *kalmī.* Is imported through Persia, to be employed chiefly by iron and tin smiths; a little is used by goldsmiths.

Bī-dāna—بيدانه—seedless, without seeds, applied to special kinds of raisins, pomegranates, and other fruits, when seedless.

Bīl—بيل—a shovel-like spade, with a long handle of willow wood.

Bīrīje—the Galbanum plant, Ferula galbaniflua.

Bīrzad—بيرزد—*bīrzand, bīrzat.* The Galbanum plant, Ferula galbaniflua.

Black—*sīa, shām, shōm, khul.*

Black Pepper—the fruit of Piper nigrum.

Bōā—بوا—Arabic for the Nutmeg, the kernel of the fruit of Myristica fragrans.

Bōī—بوي—odour, fragrance.

Bōīa—بويا—odoriferous, fragrant.

Bōī-kohī—بوي كوهي—or *buī-kuhī*—[the scent of the hills], Bdellium, the gum-resin of Balsamodendron species.

Bōl—بول—Myrrh, the gum-resin of Balsamodendron myrrha.

Boraginaceous. The root bark of a Boraginaceous shrub, employed in medicine, *arī-lang.*

Borax, Biborate of Soda.

Boswellia, *species.* Burseraceæ.

Yields the gum-resin Frankincense or Olibanum—*alk, alak, ālk, ālak, īlk, alk-ul-labān, alk-undaru, alk-kundaru, alk-kundar, kundur, ganda-firoza.* Is imported into Meshad from the south and west, and passed on through Herat and Cabul to India in very small quantities; it is an extremely rare and scarce product in these parts. Is considered a valuable resin-medecine for stopping bleeding.

Bottle-Gourd—Lagenaria vulgaris.

BOW—*kamān* ; bowed, bent—*kamānī*.

BOXES—for the exportation of fresh grapes, apples, and pears are usually made of the wood of POPULUS NIGRA, and SALIX species.

BOX-WOOD—BUXUS SEMPERVIRENS.

Bōz, *buz*—بوز—*baz*—بز—*bād*, *burz*. Applied to goats generally, or to the female goat in particular.

Bōz-dān—[the goat's house, or pen], the name of a locality.

Bōz-ganj—بز گنج—*boz-ghanj*—بز غنج—[the goat's store], a term applied to the galls of PISTACIA VERA.

Bōz-i-kohī—[the hill goat], the female Ibex.

Bōz-i-āhu—[the female Gazelle].

BRAMBLE—RUBUS species.

BRANCH—*shāk*, *shākh*, *shakh*, *shāgh*.

Brassica campestris, *Linn.*; subspecies **Napus**, *Linn.* CRUCIFERÆ.

Rape, Colza, *shersham*, *sarsham*, *sarshaf*; Hind., *sarson*. Only of late years has this been cultivated round Herat; it is common enough in the vicinity of Kandahar. It is grown for its seed, from which is obtained the oil, *roghan-i-shersham*, chiefly employed for lighting with, but also as a food oil.

Brassica campestris, *Linn.*; subspecies **Rapa**, *Linn.* CRUCIFERÆ.

The Turnip, *shalgham*, a common vegetable in all gardens, some varieties are excellent. This is one of the few plants that may be said to yield two crops during the year, the first sowing in early summer yields seed, which seed is sown in autumn, and during winter yields turnips.

Brassica oleracea, *Linn.* CRUCIFERÆ.

The cultivated plant, yielding the varieties of cabbage, *karam*, these are cultivated in all gardens. The Afghans, however, I think use cabbages much more freely than the

Persians. I do not remember, nor have I any note, that I had seen the cauliflower.

BREAD—*nān*—

Is usually made with ferment, and hence differs from the bread of the peasant in India, which is unleavened. The nomads and camel men often bake unleavened bread by rolling the dough round hot stones, and covering the whole with ashes; this form of bread is called *kāk*. Flour made from the dried fruit of the indigenous pear, PYRUS species, of the CELTIS, and Mulberry is generally employed in the manufacture of bread, in the localities where these fruits are common.

I regret that I made no inquiry into what the leaven or ferment was with which the Persians and Afghans raise their bread.

BRICKS—*khesht, khisht.*

Bricks in these countries may be the natural production of the soil, or made of clay and dried in the sun, or the latter subsequently kiln burnt.

One has only to see the effects of the heat of the sun's rays on a clay plain that has lately been inundated with water, to recognise how such soil "produceth bricks;" for very temporary huts these act well enough.

BRINJAL—SOLANUM MELONGENA.

Bühman, bahman—بهمن—a medicine imported into India from Cabul, CENTAUREA BEHEN; intelligent, acute, adroit.

BULB—*gōl, golī, gul, gulī.*

BULRUSH—TYPHA ANGUSTATA.

Burz—a female goat, applied to the female of the Ibex and Gazelle.

BUTTER—*maska.*

The ordinary method of making butter amongst the nomads is by putting freshly warmed milk into a leathern skin, adding to it some sour butter milk, a little water, and then hanging the skin on a tripod over a light fire just hot enough to prevent the warmed milk from losing its temperature; the milk is now churned by swinging the skin backwards and forwards by pulling on a piece of string.

The butter is here usually called *muska,* the fresh butter milk *dogh.* The butter to enable it to keep and allow of exportation is clarified; it is then called *roghan-i-zard,* or the Hindustani term *ghī* may be employed by the traders. This clarified butter is one of the great export and trading commodities of this country to the towns of Persia, Afghanistan, and India.

BUTTER-MILK—fresh *dogh,* (Hind.) *lasī;* made sour *mās, māst;* the dried curd of butter milk *karūt, māstāwa,* to which our old English term Oxygal corresponds.

BUTTERFLY—*shaprak.*

Buxus sempervirens, *Linn.* EUPHORBIACEÆ.

The Box-wood, or Box-tree, *shamshād.* This tree or shrub I did not meet with, nor is it known to be found over any part of the country which I traversed, although it is by no means a rare shrub in certain districts of Persia, or in some parts of Afghanistan. I found it cultivated at Meshad. Its wood is valued chiefly for making combs. The Tortoise takes its name, *shamshātu,* from it.

Buz, bōz—بوز—*burz, baz, bād*—Goats generally, or the female goat in particular.

Buz—for *puz*—a snout.

CABBAGE—BRASSICA OLERACEA.

Caccinia glauca, *Savi.* BORAGINEÆ.

A common herb in the Badghis and in the Hari-rud Valley, called *gāo-zabān.* It has a large fleshy root-stock, which is eaten in a raw state, and the leaves are used as a pot herb. The corollas, *gul-i-gāo-zabān,* are employed in local medicine, and exported.

Cæsalpinia, *species.* LEGUMINOSÆ.

The seeds of C. BONDUCELLA, and probably also of C. BONDUC; these are called *khāia-iblīs,* and in Hindustani *kat-*

karounja. In the shops of the vendors of small wares I found these seeds set in metal, and sold to be worn as a charm against the evil eye. These are largely imported into the country from the south.

Calligonum comosum, *L'Hérit.* POLYGONACEÆ.

The glass-wort tree, *pog, phog.* A common shrub in Baluchistan, valuable for its fodder, which is much eaten by camels, sheep, and goats.

Calligonum, *species.* POLYGONACEÆ.

Herbarium specimen No. 1104, collected during May and July 1885. Called *bandak* and *bandukai,* from the numerous corky joints it has on its stem and branches.

CAMEL—*shuthar, shutar; uch* (Baluchi).

The chief means of transport for the Commission from Quetta to Bala-morghab were camels, varying in form from the thin racer-like, rapid walking animal, to the great coarse, thick set, weight carrier; with an occasional Bactrian, the Turkistan double-humped animal,—all vicious lazy brutes; but certainly they received neither sympathy, kind treatment, nor good food to aid in improving their tempers. Owing to the great rapidity of our marches, our transport animals had to be fed on barley and crushed straw, as there was no time to permit of them being allowed to graze, except when we made halts. Had they been permitted to graze, they would have found abundance and varied fodder along the whole of our route, consisting of shrubs of PROSOPIS, TAMARIX, CALLIGONUM, HALOXYLON, ALHAGI, POPULUS, SALSOLA, and ANABASIS. In fact our route lay through a country extremely well adapted for camels, both as regards conditions of country and its capability for supplying fodder. The nomad tribes possess large numbers of camels, which are chiefly employed in the transport of their tents and households, as well as in the conveyance of the merchandise of the country. The hair of these animals is collected at certain seasons of the year when it is falling off and made into a fine valuable camlet, of which much is exported to the various countries surrounding, the finest cloth being eagerly sought after by the better classes in Persia.

CAMEL-THORN—ALHAGI CAMELORUM.

CAMEL-TURNIPS, the root-stocks of CRAMBE CORDIFOLIA.

CAMLET—*barak*—

Is an excellent warm soft cloth. The finest qualities are of the natural colour of the camel's hair; the ordinary cloth, to make it appear all of one colour, is dyed with walnut bark.

Camellia theifera, *Griff.* TERNSTRŒMIACEÆ.
(Thea chinensis, *Linn.*)

The Tea plant. Tea, *chā, chāe.* Tea is imported in immense quantities from all directions, even from Bokhara and Russia, of course the largest importation takes place from Southern Persia and India. The Persians are very fond of the beverage, and partake of it at any hour during the day. The introduction of the tea tray is always an excuse for social intercourse. Tea is to be found for sale in the smallest hamlet, and prepared tea, ready for drinking, is offered to the traveller at nearly every bazaar.

CANDLES—*sham.*

Tallow candles, made of mutton fat, are manufactured in each household as required. A kind of candle, *maluk,* is made by removing the covering of Castor-oil seeds, then crushing the kernels along with raw cotton, until the oil is expressed, then rolling the oil-laden cotton into the form required. Of these usually only enough is made to last the day's consumption. These are chiefly used by the women whilst cooking, to enable them to see into their great caldrons and other cooking pots.

Cannabis sativa, *Linn.* URTICACEÆ.

Indian hemp, *bāng, bhāng.* This plant is certainly not indigenous to the part of the country I went over, I only met with it on one occasion in Persia, where it was cultivated in the garden of a Hindoo. It is, however, well known to the natives as being cultivated in Turkistan for its resinous exudation *chars,* its dried leaves *bhāng,* seeds *tukhm-i-bhāng,* oil of seeds *roghan-i-chars,* and its intoxicant oil *majun.* An informant who had lived a good deal in Turkistan, said that Indian hemp was a field crop, sown annually; the shrub when in flower was cut over close to the roots, and hung up in a room with the root end of the stems upwards ; under the hanging shrubs on the floor of the room was laid a sheet. The plants on drying were shaken over the sheet, on shaking them a dust, *gard*, fell upon the sheet; this is collected and sold as *chars*. The dried leaves crushed into a powder is *bhāng*. The oil of the seeds is employed in burning as a lighting oil. The resinous exudation and the crushed dried leaves are employed as intoxicants, scarcely ever as medicines ; the prepared oil *majun* is a very violent intoxicant, and most unsafe to employ. The stems are subsequently placed in water and then left to steep for several days, when by beating is obtained a fibre, from which are made excellent ropes.

Capparis spinosa, *Linn.* CAPPARIDEÆ.

The Caper, *kawar, kawarz, kawarza, kawark, kāwarg, kāwarglā, kāhwarg, kāhwan, kowwarg.* A common shrub from Quetta to Bala-morghab and Meshad. It is here a very much larger shrub than I ever saw it in the Punjab, and its habit is very different ; it grows forming great bushes in the open country, fully five feet in height, and spreading from the centre with great trailing branches, like a huge overgrown bramble. In the Punjab I only collected it as a pendant shrub, growing from the crevices of rocks, in conglomerate formations. The flower buds all through Persia are collected for household use to be made into pickles. Its leaves give excellent fodder, and are collected in quantity for this purpose. *Kawar* is the Caper plant, or it means a place deserted by its inhabitants, desolation, exactly like the old ruins on the Helmand where we saw this shrub growing in the greatest luxuriance and profusion ; the other terms mean the fodder plant, the fodder leaf. The fruit, which is large, is eaten and relished by the natives.

Capsicum, *species.* SOLANACEÆ.

The Capsicum, or Red pepper plant, in all probabilities CAPSICUM ANNUUM, *Linn.*, and CAPSICUM FRUTESCENS, *Linn.* Much cultivated in gardens for the fruit, *march-i-surkh, pīlpīl, fīlfīl ;* by the Turkomans called *karan-pul, kalam-pur, kalanfur*, which is largely employed as a condiment; at

Panjdeh a variety is grown yielding a fine fruit, which is greatly exported.

CARDAMOMS—the fruit of ELETTARIA CARDAMOMUM.
CARDOON—CYNARA CARDUNCULUS.

Carex physodes, *Bieb.* CYPERACEÆ; and
Carex stenophylla, *Wahlb.* CYPERACEÆ.

These are called *tut*, and where they cover meadows, as at Gulran, are considered excellent fodder and very fattening for horses.

CARROT—the root of DAUCUS CAROTA. The hill-carrot ZOZIMIA ABSINTHIFOLIA.

Carthamus tinctorius, *Linn.* COMPOSITÆ.

Safflower, *kājīra, kājura.* The flowers *gul-i-kājīra.* Is cultivated to some extent as a field crop for the flowers, which are employed as a dye stuff. On the 27th October 1884, between De-kamran and De-doda, I found a plant spread over the country, which seemed to be either an escape or a wild condition of this; but alas, all the plants that I collected at this, the most interesting, stage of our journey were destroyed from having apparently lain in water for some time. The petals are employed in the adulteration of Saffron, CROCUS SATIVUS.

Carum Bulbocastanum, *W. D. J. Koch* (?). UMBELLIFERÆ.

The tubers of this plant, Earth-nuts, *yagī-shāk, jāgī-shāk, jīrī-shāk, jīra-shāk,* are collected to be eaten either raw, or cooked as a vegetable. Another species of CARUM, No. 152, of my collection yields a tuber, called *kors-i-gurba* or *kos-i-gurba,* meaning Cat-nuts. Pigs in searching and digging for these tubers destroy the cultivation terribly.

Carum copticum, *Benth. et Hook.* UMBELLIFERÆ.

The Omum plant, and its seed, *ājwain, jowain, joanī.* A cultivated herb in gardens, grown for its fruit, which is in great request as a condiment and medicine by the natives. *Ājkān* is an indigenous herb that is said to grow in the jungles of Afghanistan and Balkh, and is said to be this plant, but this requires confirmation.

Cassia, *species.* LEGUMINOSÆ.

The leaves of a species of Cassia, which yields the drug Senna, *sanā, sanā-i-makaī,* probably CASSIA OBOVATA, *Collad.,* are imported in some quantities, brought chiefly by pilgrims from Mecca; this is a common drug amongst the natives, and is one of the articles carried by pilgrims for purposes of exchange and barter.

Castanea vulgaris, *Lamark.* CUPULIFERÆ.

The sweet or Spanish chesnut; cultivated in Persia, also indigenous in Northern Persia, called the Royal-Oak, *shā-balut.*

CASTOR-OIL plant—RICINUS COMMUNIS.

CAT—*gurba, pīshak.*

CAT-NUTS—CARUM species.

CATECHU—the extract obtained from ACACIA CATECHU or ARECA CATECHU.

CATERPILLAR—*kirm;* of the silk-worm, *kirm-pela.*

CATTLE—

The Cattle of the country are Camels, the ordinary single humped as well as the Bactrian, or double humped; Horses, Ponies, Mules, Donkeys, Oxen with or without humps, but the humps are never very large; Sheep, and Goats.

CELERY—APIUM GRAVEOLENS.

Celtis caucasica, *Willd.* URTICACEÆ.

Tāghun, tokhm. A common indigenous tree in the Badghis and Khorasan; in the Hari-rud country cultivated near shrines. The wood is considered valuable for household furniture, but chiefly for the manufacture of spoons and bowls; it makes good fuel. There is a superstitious veneration attached to the tree from its being so frequently cultivated in the vicinity of shrines and holy places; as also to its wood, small pieces of which are hung round the necks of women and children as amulets to protect them from evil spirits. The fruit is eaten, and made into flour to be mixed with ordinary flour to be made into bread. The colour of the fruit I saw was orange-yellow.

Centaurea Behen, *Linn.* Compositæ.

Dr G. Watt in his dictionary of the "Economic Products of India," gives this as the plant from which is obtained the root *bahman*, or *buhman safed*, the white *bahman* root, and that the plant is a native of the Euphrates valley; Boissier gives Bunge as his authority for the plant, as also from the hills of Khorasan.

Centaurea moschata, *Linn.* Compositæ.

Maia-mesh. The base leaves eaten raw or employed as a pot-herb.

Cercis Siliquastrum, *Linn.* Leguminosæ.

Judas tree—*arghawan, arghamon.* The wands or annual shoots of this tree shrub are of a deep red-black colour, very elastic and strong, hence in the vicinity of Meshad, where it abounds, they are employed in the manufacture of all sorts of basket-work, ladles, sieves, and strainers. Cattle do not seem to feed on the foliage.

Cereals.

Wheat and barley are the chief cereals cultivated throughout this region. The Herat district has long been celebrated for its grain-producing capabilities, and hence is generally alluded to as the granary of this part of Asia. I had no means of obtaining exact information concerning the yield. It was, however, generally stated that wheat was raised in sufficiency to admit of a very large export, in addition to any local consumption; but that barley was chiefly raised for local use. As far as I was able to judge, the quality of these grains did not come up to the same grown in the Punjab, and on the whole appeared poor. The huskless variety of Barley is occasionally cultivated near Bala-morghab and Maimanna, obtaining its local name from the assumption that it originally came from Mecca. The other cereals in the attached list are comparatively sparingly grown,—Rice I saw only once, and that was in Khorasan, it is said to be grown in quantity at Panjdeh, and that most of the rice consumed in Herat and Meshad is imported from that district, or from the east of Herat. Maize, with the greater Millet Sorghum, are cultivated on a large scale near Bala-morghab and in the Turkoman country generally ; whereas in the Hari-rud Valley and Khorasan I only saw these growing as scattered plants through fields of other crops, as of Melons and Tobacco. The natives speak of Maize and the greater Millet under the common name *jaohrī*, but if asked which they mean, they identify the Maize as "the edible," and the Millet as "that from Turkistan." There is said to be a smaller variety of the latter with large grains ; this I never saw. The Millet, Panicum miliaceum, is commonly grown and employed to a large extent as food. Of Pennisetum spicatum I only saw a few plants once in Khorasan.

Wheat—Triticum vulgare.
Barley—Hordeum hexastichum, Hordeum vulgare.
Maize—Zea Mays.
Greater Millet—Sorghum vulgare.
Spiked Millet—Pennisetum spicatum.
Common Millet—Panicum miliaceum.
Italian Millet—Pennisetum italicum.
Rice—Oryza sativa.

Cha—چه—this syllable in Persian added to words forms the diminutive—as *alu*, a plum; *alucha*, a small plum : *amrud*, a pear; *amrucha*, a small pear.

Chā—چا—*Chāe*—چاي—Tea, the prepared leaves of Camellia theifera.

Chā—چاه—a well, or shaft where water is to be found.

Chāb—a rush, Juncus maritimus.

Chaghān—چغان—a cotton cleaner.

Chaka—چکه—small, minute.

Chakh-māk—چخماق—a flint.

Chakh-māk-dāshe—Turki for a flint.

Chām—چام—a grain, a berry, a seed.

Chaman—چمن—a garden, an orchard, a green place.

Chaman-i-bed—[a garden of willows]. The name of a locality.

Chambar—چمبر—*chanbar*—چنبر—a circle, a hoop.

Chambāra—a loop of wood, employed as a pulley.

Chana—چنه—*chanā*—چنا—a Hindustani term for the pulse of CICER ARIETINUM.

Chanar—چنار—*chinār, chunār*—the oriental plane, PLATANUS ORIENTALIS.

Chār—چار—four.

Charā—چرا—a pasture, meadow, grazing; why, wherefore.

Charas, chars—چرس—the resinous dust collected from CANNABIS SATIVA.

CHARCOAL—*jughāl, shughāl, zoghal, zughāl, zugāl, zagāl.*

The charcoal in ordinary use is that made from the woods of PRUNUS EBURNEA and P. BRAHUICA; the best for the use of the goldsmith and blacksmith is made from the wood of JUNIPERUS EXCELSA. For the manufacture of gunpowder the charcoal is made from willow wood, the wood of several species of SALIX, or from the shell of the Cotton-pod.

Charīsh—چريش—*chirīsh, chīresh*—glue, viscous, clammy.

Charīsh-charm—[skin-glue], *charīsh-shōm*—[black-glue], glue prepared from animal refuse.

Charkh—چرخ—circular motion, a wheel, a pulley, a reel, a cart.

Charkha—چرخه—a wheel of any kind, the name applied to MICRORHYNCHUS SPINOSUS.

Charkhī—چرخي—a spinning wheel.

Charkho, chīrkho—the shrub AGRIOPHYLLUM LATIFOLIUM.

Charm—چرم—leather, the skin of an animal.

Char-maghz—چارمغز—[four-brains]. The fruit of JUGLANS REGIA, the Walnut.

Chars, charas—the resinous exudation collected from CANNABIS SATIVA.

Chashma—چشمه—a spring of water, a fountain.

CHEESE—*panīr.*

This I was informed was made in these regions, thus: to make cheese add *panīr-māīa* (rennet), which is a portion of the stomach of a lamb or kid, to sweet milk, then collect the curds by pressure in a cloth, the compressed curd is cheese. When the stomach of a kid or lamb cannot be got, then the juice of a EUPHORBIA is employed in lieu of it, but this gives the cheese a bitter taste. Cheese is only used by the wealthy, it is quite unknown as a food to the poorer Persians.

CHEMICALS, or chemically prepared products.

Barilla, Glass, Gunpowder, Lime, Pitch or Tar, Plaster of Paris, Sal-ammoniac, Saltpetre, Soap.

CHERRY—the fruit of PRUNUS CERASUS.

CHESNUT—CASTANEA VULGARIS.

CHICORY—CICHORIUM INTYBUS.

Chigak—chogak—PROSOPIS STEPHANIANA.

Chik—چق—a curtain made of reeds to give privacy, or exclude glare and flies.

Chīl—چل—*chihal*—چهل—forty.

Chīl for *chīr*, a pine tree.

Chil-ghoza—چلغوزه—[Pine-nuts]. The seeds, or nuts, of PINUS GERARDIANA.

Chilim—چلم—a pipe for smoking with.

Chilimī—چلمي—the bottle gourd, LAGENARIA VULGARIS; so named from its being usually employed to make that portion of the *huka* that holds the water.

Chīn—چين—China.

CHINA-ROOT—the root of SMILAX CHINA.

CHINESE—*chīnī.*

Chīnī—چيني—Chinese; applied to a sugar candy; is the Punjab term for PANICUM MILIACEUM.

Chīr—چير—*chīl*, Hindustanī. The name for the tree PINUS LONGIFOLIA to the east of the Indus, and for PINUS GERARDIANA to the west of the Indus.

Chirīsh, charīsh—چريش—glue.

Chirīsh-shom—[black glue], animal glue.

Chish-khām—a pea cultivated in fields at Meshad, PISUM species.

Chloride of Ammonium, Sal-ammoniac.

Naoshādar. An import into the country, the finest is said to come from Bokhara. Employed chiefly by tinsmiths and gunsmiths.

Chloride of Sodium, Common Salt.

Namak, namik, nemak ; Turkomani, *thuz.* Herat seems to be the place to which all the salt in the trade gravitates, and from this it is exported to the surrounding countries. From Panjdeh and the great saline plains in the vicinity, called Nemak-sar, is obtained a white salt. At Cha-fil, where some new shafts have been lately sunk, some 40 miles from Do-cha-i-ibrahim-khan, is obtained a very coarse brown, almost black salt. Quarries of rock-salt are said to exist in the hills of Malik-dan, near where we encamped at Galicha on the 12th October 1884. These were worked by Afghans, and the produce is said to be a kind of black salt. There is, however, a red rock-salt for sale in Herat, the same as our Punjab rock-salt, no one could tell me where it came from, it may be entirely an imported article from India. Meshad obtains all its salt from Herat, but European prepared fine salt is to be found for sale in the bazaars.

Chob—چوب—*chub, chu*—a piece of wood, a stick, the plant, wooden.

Chobak—چوبک—[a small stick] employed in separating cotton from the pods.

Chob-i-chīnī—[China stick]. The root of SMILAX CHINA.

Chob-i-dast—[stick for the hand]. A staff or stick to be carried in the hand.

Chob-i-ghoza—[the cotton plant], GOSSYPIUM HERBACEUM.

Chukandar—چقندر—Beet, BETA VULGARIS.

Chukrī—چکري—the edible, indigenous Rhubarb, RHEUM RIBES.

CHURN—

The churn of this country, and such as all the nomads use, is the prepared skin of a goat; *mashk.*

Cicer arietinum, *Linn.* LEGUMINOSÆ.

Anglo-Indian, *gram; nakhud, chana.* This I saw cultivated at an altitude above 4000 feet. The roasted pulse, mixed with sugar and butter, is in common use by travellers, as a convenient food on their journeys, called *kulcha.*

Cichorium Endivia, *Linn.* COMPOSITÆ.

The Endive—*kasnī, kāsnī, kāshnī, kashnīj, kashnīz, kishnīj*—raised annually by seed in gardens; the herb is used as a vegetable, and the seeds employed as a cooling medicine.

Cichorium Intybus, *Linn.* COMPOSITÆ.

"This is the plant that is cultivated in Europe for fodder, and for its roots, Chicory, to mix with Coffee." This indigenous, perennial plant, goes also under the same names as are given to the Endive, the natives do not distinguish between them. It is a common weed over all well-cultivated land, in the vicinity of water-courses, and wherever there is damp, clay soil.

Cinnamomum Cassia, *Blum.?* LAURINEÆ.

A Cinnamon bark, *dār-chīnī, dāl-chīnī,* is imported to be employed as a medicine, and is said chiefly to come from Bokhara. This may still be the case, but no doubt a good deal of a coarse Cinnamon is imported from India.

Citrullus Colocynthis, *Schrad.* CUCURBITACEÆ.

The Colocynth, *khar-khushta, talkhak,* in the desert country of Baluchistan, and on the high lands of the Helmand, this plant was in profusion; the fruit is employed as a medicine for horses.

Citrullus vulgaris, *Schrad.* CUCURBITACEÆ.

The water-melon, *hinduānī,* was seen cultivated as a field crop over the whole country traversed; for two months in the year the water-melon may be looked upon, with a little bread, as the food and drink of the people. The fields of the water-melon are a great attraction to the wild pig, which do much injury to the crop unless the fields are well watched. Whether it is owing to the climate, or the soil, I cannot say, but the melon in flavour, and sweetness is much superior to any that I ever met with in the Punjab. The natives assert that at Herat a syrup, or molasses, and even a sugar is prepared from the water-melon.

Citrus Aurantium, *Linn.* RUTACEÆ.

The sweet, and a bitter orange, *nauring, auranj, utranj;* are extensively cultivated in the Caspian provinces of Persia, whence the fruit is imported through Meshad into Herat and Afghanistan. The fruit cut in two, with the pulp removed, is dried and sold in the bazaars as *post-i-naurinj,* to be employed as a condiment.

Citrus medica, *Linn,* var. **acida.** RUTACEÆ.

The Lime, *līmon.* This fruit in a fresh state is imported from the Caspian provinces of Persia. In a dried condition from both India and the Caspian. It is largely consumed both in the fresh and dried state, and the importation is said to be much larger than that of the sweet-orange.

CLAY—*gil.*

A coloured clay is *gil-i-barang,* red clay *gil-i-surkh;* these are obtained at the localities Barang and Fara in Persia. A red clay employed in the adulteration of Asafœtida is called *tāwa.* The great plains of clay left by deposit from water are called *pat.*

CLOTH—

The commonest coarse cotton country fabric is *karbas* and *kanawez;* made of camel's hair, *barak;* of fine goat's hair, *kurk, kurg,* also *pat, patu;* made of sheep's wool, *patu.* The material of which the black tents are made is coarse goat's hair.

CLOVE—the flower buds of EUGENIA CARYOPHYLLATA.

CLOVER—the clovers cultivated for fodder are

MEDICAGO SATIVA, TRIGONELLA FŒNUM-GRÆCUM, and TRIFOLIUM RESUPINATUM.

COAGULATE—

The substances employed in the coagulation of milk are, milk that has already been coagulated, rennet, and the milky juice of a EUPHORBIA.

COBRA—

Although a Cobra is common in the Badghis, viz., NAIA OXIANA, it goes by the same native name as VIPERA OBTUSA, viz., *shutar-mar*, and not by the Sanscrit and more southern name *phan-dhār;* yet it is curious enough to note that an ARUM and a HELICOPHYLLUM, owing to their prominent spathes, are called *phanār*, no doubt a contraction from *phan-dhār*. Naturalists say that this Cobra does not exhibit a hood; if this is the case it accounts for the name, "the hooded one," not being applied to it.

COCHINEAL—the dye stuff; *karmīz*.

It is imported into these regions from Bokhara and Persia, the finest it is said coming from Bokhara.

COCOON—of the silk-worm, *pela*, *pīla*, *kokh-i-pela*, *gola*, *goza*, *kawa*.

Codonocephalum Peacockianum, *Aitch. et Hemsley.* COMPOSITÆ.

Landār. This shrub, from four to six feet in height, covers great expanses of country with its splendid foliage, which is greedily fed upon by goats and sheep. The tracts of the country covered with this herbage form grand feeding grounds for these animals; the shrub might, I believe, be introduced into this country profitably for feeding sheep.

Colchicum speciosum, *Stev.* LILIACEÆ.

I met with this occasionally throughout the Badghis, Harirud, and Khorasan, but only in fruit. The corms are used to mix with those of MERENDERA PERSICA.

COLOCYNTH—CITRULLUS COLOCYNTHIS.

COLZA—Rape, BRASSICA CAMPESTRIS.

Comb—*shāna.*

The sellers of combs say they are made of Ebony, whereas the buyers consider the wood to be of Mulberry, Morus alba, that has been buried for a time to give it a dark colour. Those I saw were certainly not made from Ebony.

Condiments—*aduīa-garm.*

Under this head I class other products than probably the exact meaning of either the Persian or English words would allow.

I. Locally Produced.

a. From Indigenous Plants.

The fruit of Berberis vulgaris.
Manna from Alhagi camelorum.
Manna from Cotoneaster nummularia.
The fruit of Psammogeton setifolium.
Sarcocolla, a manna-like product from Astragalus Sarcocolla.

b. From Cultivated Plants.

Vinegar—from the juice of the grape, Vitis vinifera.
Syrup—from grapes.
The oil of the seeds of Luffa acutangula and other Cucurbitaceæ.
Cumin seeds, the fruit of Cuminum Cyminum.
Anise, the fruit of Pimpinella Anisum.
The fruit of Carum copticum.
Red-pepper, the fruit of Capsicum species.
Sesamum seed, the seed of Sesamum indicum.
Garlic, the bulbs of Allium sativum.

II. Imported from the Country in the Vicinity.

Honey—Salt.

III. Imported from a Distance.

The dried fruits, Oranges, and Limes of Citrus Aurantium, var.
Cloves, the flower buds of Eugenia caryophyllata.
Nutmegs, the kernel of Myristica fragrans.

Cinnamon, the bark of CINNAMOMUM species.
Black-pepper, the fruit of PIPER NIGRUM.
Cardamoms, the fruit of ELETTARIA CARDAMOMUM.
Ginger, the rhizomes of ZINGIBER OFFICINALE.
Turmeric, the rhizomes of CURCUMA LONGA.
Saffron, the stigmata of CROCUS SATIVUS.
Sugar—Salt.

IV. CONDIMENTS EXPORTED.

The fruit of BERBERIS VULGARIS, vinegar, the two kinds of Manna, the fruit of PSAMMOGETON SETIFOLIUM, and Sarcocolla.

CONE—

Is called by the same name as the tree PINUS HALEPENSIS, viz., *naoju, nāju;* as it is the only pine tree of these parts, cones are not well known. Owing to their rarity, as well as from some superstitious idea, one is usually kept in the work-bags of the ladies of the nomad tribes.

Conium maculatum, *Linn.* UMBELLIFERÆ.

Hemlock. At Kharobagh I met with plants of this fully seven feet in height.

Convolvulus, *species.* CONVOLVULACEÆ.

The plant *nīla-fār*, the seeds *tukhm-i-gul*, which I believe will prove to be a species of IPOMŒA, is cultivated for its beautiful blue flowers, and of which the seeds are employed in medicine.

COPPER—the metal, *mis;* sulphate of copper, *sang-tutia, nīl-tutia* (Hind.), *zangāl, zangār* (Turkomanī).

The metal in sheets is imported in quantity through Persia and from India, to be forwarded to Turkistan as well as for local industry. Copper dishes, owing to the trouble of conveyance, are not now much imported.

The salt, Sulphate of Copper, comes chiefly from Bokhara.

Cordia Myxa, *Linn.* CORDIACEÆ.

The fruit Sebestens, *sapistan*, are chiefly imported from

Southern Persia, to be employed in medicine, and are forwarded in quantity to Turkistan.

Coriandrum sativum, *Linn.* UMBELLIFERÆ.

The Coriander, *kashnīz,* cultivated in gardens.

CORINTHS, or Currants, a small black grape dried, the fruit of a variety of VITIS VINIFERA.

Cotoneaster nummularia, *Fisch. et Mey.* ROSACEÆ.

Sīa-chob, gab-chīr, gab-shīr, gap-chīr, gapshīr. Is a common shrub on the Sīa-koh and Safed-koh ranges, at an elevation of 3000 feet and upwards. In certain localities it is met with forming gregarious copses, as on the Erdewān pass, where it grows to a size almost permitting of its being considered a tree. Its wood is highly valued next to that of ZIZYPHUS VULGARIS for supplying handles to agricultural implements, for staves, and owing to its great elasticity makes the best loops or pullies, *chambara,* of any wood. It yields in certain seasons, from the surface of its smaller branches, a manna called *shīr-khisht ;* this manna is largely collected both for local use, being much eaten by the people either along with their food in its natural condition, or converted into some form of sweetmeat, as well as for exportation chiefly to Afghanistan proper and India.

COTTON—the fibre of the plant GOSSYPIUM HERBACEUM.

COTTON-GIN—*halaji.*

Cousinia, *species.* COMPOSITÆ.

Herbarium specimen No. 365, May 1, 1885.

Pulush. The leaves of this plant are covered on the under surface with a cottony tomentum ; owing to this structure the leaf makes a good tinder.

Crambe cordifolia, *Stev.* CRUCIFERÆ.

The Camel-turnip, *tātrān, tāterān, tetrān, taturān, tatrang.* A very handsome perennial, the annual shoots springing up in numerous clusters from the large underground root-stock. The annual shoots and foliage make splendid forage for all cattle, and the root-stocks are collected for feeding camels with during winter by the nomads. The low hills round Bala-morghab were honeycombed with pits from which the nomads had collected these great turnip-like roots. They are too fibrous and woody to be eaten by any other cattle than camels, whose massive jaws are alone able to crush such woody diet. The gazelle is very fond of the tender herbage of this plant, and ordinarily hides its young under a dense cluster of its leaves.

Cratægus Oxyacantha, *Linn.* ROSACEÆ.

The Hawthorn, *alaf-khez, alaf-kharez, koha, kohja, kocha, guj-i-kohja, gohja, daluna.* A shrub or small tree, at an altitude of 3000 feet and upwards; common at spring heads and in the low hills, hence the names, alluding to its being a fodder at springs, and as occurring amongst the hillocks. It gives excellent fodder to goats, sheep, and camels. The wood is valuable for the manufacture of spinning wheels and cotton-gins.

CREAM—*kīmāk, kaimāq, sar-shīr, sirshīr, postīgī.*

Crocus sativus, *Linn.* IRIDEÆ.

The Saffron Crocus yields the dye and condiment *zāfrān*, which is imported from Candahar to Herat, as also from Persia. As a condiment it is much consumed by the Persians, they being exceedingly fond of the flavour. It is also employed as a dye. I was informed by a traveller that it was a good medium to carry about one, as a means of making payments in lieu of small sums of money. Good saffron, owing to the difficulty of procuring it, is readily sold in all parts of Persia. In Persia it is greatly adulterated with the flowers of CARTHAMUS.

CROPS—see Cereals, Cultivation, Drugs, Dyes, Fibres, Fodder, Fruits, Oils, Pulse, Scents, Tobacco, Vegetables.

SECOND CROPS are almost unknown; as a rare occurrence the harsh barley, HORDEUM VULGARE, the millet, PANICUM MILIACEUM, and the Lucerne, Medick clover, MEDICAGO SATIVA, may follow a crop of wheat or barley. The chief reason why a second attempt at a crop is so rare, is the extreme temperature that occurs at the end of July or beginning of August, necessitating a free supply of water, which is then becoming scarce, being required for the other crops—Melons, Cotton, and Tobacco, so that what with the excessive heat and absence of a good supply of water a second crop almost always proves a failure. Natives tell one of second crops of Lucerne, MEDICAGO SATIVA, but this usually is not a true second crop, it is merely second, third, or fourth cuttings from the originally raised roots, the plant throwing up fresh stems after each cutting. A crop of this in a rich, well-watered orchard, where there is abundance of rich soil, and shelter from both excessive heat and cold, will allow of cuttings all through summer and winter. The turnip in one sense yields two crops, in early summer it yields seed which are sown in autumn, the plants of which yield turnips in winter.

Croton Tiglium, *Linn.* EUPHORBIACEÆ.

Croton seeds, *hab-dilmaluk, hab-al-salatīm,* are imported from India to be employed in medicine.

Crozophora tinctoria, *A. Juss.* EUPHORBIACEÆ.

Turnsole, *kap-o-chīst,* so called on the Helmand.

CUCUMBER—CUCUMIS SATIVUS.

Cucumis Melo, *Linn.* CUCURBITACEÆ.

The melon, *khar-buz, khar-buza, khar-buze.* Melons are largely cultivated as a field crop, but not to the same extent as the water-melon. The variety *sardā* keeps well, and is exported to India in great quantity during the winter, where it is much appreciated by both Europeans and natives. Europeans in India and elsewhere have tried to raise from seed the *sardā* melon, this has always proved a failure, the fruit produced being of a very ordinary form, and never having the flavour of the Afghan fruit. The word *sardā* means cold, and subsequently came to mean the last fruits of the season, left hanging on the trees, when the main crop had been collected. The melon collected from the plants that yield the *sardā,* whilst the season is hot and there is still no frost, is, comparatively speaking, an ordinarily good melon, but once the season is ending and night frosts have set in, and the plants are beginning to be nipped, the gardeners carefully cover the fruit to prevent it from being injured by the frosts, and then collect it when not quite ripe; these fruits ripen very slowly, will keep through the whole winter, and in flavour seem to improve the longer they are kept. It is this treatment, I believe, that constitutes the difference between the ordinary melon and the *sardā*, and why gardeners out of Afghanistan and Persia have not been able to produce the fine-flavoured Peshawur trade article, and which even in the old caravan, now railway, days were carried in perfection to Southern India. It is curious that another melon, an early ripening one, receives a very opposite name, viz., *garma*, and which has come also to mean first fruits—*garma*, meaning heat.

The flesh of the melon, after the rind is removed, is dried, when it is called *kāk*; this is much eaten by the natives cooked along with other food, and is to be seen hanging up for sale in all bazaars. An oil, *roghan-i-tukhm*, is extracted from the seeds, and is looked upon as a delicacy.

Cucumis sativus, *Linn.* CUCURBITACEÆ.

The Cucumber, *khīār*, *turi* (?), is cultivated in all gardens, the fruit being eaten much raw, as we would an apple; it is a delicious fruit thus eaten on a hot day. The seeds, *hab-i-khīār, tukhm-i-turī* (?), are employed whole in native medicine.

Cucumis trigonus, *Roxb.* (?). CUCURBITACEÆ.

This is supposed by some to be the wild form of CUCUMIS MELO. The fruit is not much larger than a large plum, but has a most delicious aroma when almost ripe. It was in abundance on the low banks of the Helmand. It was eaten raw, and cooked by the camp followers.

Cucurbita Pepo, *DC.* (?). CUCURBITACEÆ.

The Pumpkin, *thambal*, is largely cultivated and much employed as a vegetable.

CULTIVATION—

Taking our lowest altitude in these regions to be 1000 feet above the sea-level, we find that until an altitude at the least of 3000 feet is reached no cultivation of any sort can be carried on successfully without liberal irrigation; this is due to the excessive summer heat for these latitudes, along with the extreme dryness of the climate. Up to 2500 feet, where there is no water, the country is a parched arid waste, except for three or four months during the year, namely, from the middle of March to the middle of July, and then the verdure is only exceptional and dependent upon certain special forms of vegetation. Upon the occurrence of the extreme temperature, accompanied by hot blasts of air, lasting for several days consecutively, even the exceptional vegetation is suddenly swept away. The cereals would also be as suddenly cut off, before they had ripened, were it not for irrigation; and the other crops, cotton, water-melons, tobacco, and garden produce could not possibly live through the extreme dryness, caused by this accession of heat. Orchards and garden crops require, in addition to irrigation, protection by means of high walls from the blasts of the fiery hot wind, which last for several days at a time, and which utterly destroy the chances of any tree life in the open country. So that wherever there are fine orchards, these are always found to be surrounded by high walls, which are usually carried up to the height that the trees enclosed will ordinarily grow to. The cold winds of winter, when the temperature falls frequently below zero Fahrenheit, are said not to do nearly so much injury to the trees as the hot blasts of summer.

From Herat, north and westwards in the Hari-rud Valley, the whole cultivation is carried on by irrigation, the water being led from the Hari-rud itself. These irrigation works are in poor repair, and much land is lying fallow which, were water forthcoming, could be placed under cultivation. Between Meshad, Turbat-i-haidri, and the Hari-rud the water for cultivation is chiefly obtained by tapping springs close to the base of the hills, and conducting the water by underground channels to the localities where the irrigation is required. This method of obtaining water is an extremely laborious one, and owing to the spring-head running dry, from the water above it having altered its course or other causes, much destruction of cultivated lands and ruination of villages result. Around all villages may be noticed the ruins of many irrigation works, the new sources of supply, pointing to the energy of the inhabitants.

In the Badghis, until one reaches as far east as Khushk, and north to Kalla-i-maur, there is no cultivation, nor habitations, but traces of past irrigation works, leading to what had been large areas of cultivation, were noticed during all our marches.

The natives enrich the soil with all the manure they can collect from their great flocks, but notwithstanding this enrichment of their fields, the wheat and barley appeared to me to produce a poorer grain than that of the Punjab.

Cuminum Cymanum, *Linn.* UMBELLIFERÆ.

Cumin, *zīra, jīra.* The fruit is employed in medicine and as a condiment, and forms part of the well-known aromatic powder *aduīa-deg.*

Cupressus sempervirens, *Linn.* CONIFERÆ.

The Cypress, *saur, saro, sarun, sarwī, sawu.* A few trees of this occur cultivated in gardens at Herat; I fancy I saw some at Meshad. The only one I have noted in my Journal is a tree to the west of the fort at Sangun.

CUPS—*pīāla, pīāle.*

Earthenware cups are chiefly imported from Bokhara. The larger portion of those I saw had the appearance of having been manufactured in Russia.

Curcuma longa, *Linn.* SCITAMINEÆ.

Turmeric, *zard-choba,* is very largely imported from India as a dye stuff, and for preparing the leather part of the fur robes *postīn;* a little is employed as a condiment.

Curcuma Zedoaria, *Roscoe.* SCITAMINEÆ.

Zedoary, *jidwār, jizwār, kachur, kachul,* is imported in quantity from India, most of it to be passed on to Turkistan. The long tubers are called *nar-kachul,* and the round ones *mada-kachul,* as if they were the product of two different plants, but I have only seen them mixed together, and not sold as two distinct roots. The Turkomans employ these roots as a rubefacient, to rub their bodies down with after taking a Turkish bath. In this part of the country, in lieu of these, the nodes on the roots of EREMOSTACHYS LABIOSA and another species are collected and sent on to Turkistan. Curcuma roots are employed a little in native medicine, and as a condiment.

CURDLED MILK—

Sweet milk curdled is *kīsht ;* if curdled with rennet, and the curd compressed, this is cheese, *panīr.* Sour milk, or butter milk curdled, is *mās, māst ;* the curd of this compressed is oxygal, *māstāwa, karut.*

CURRANTS, or Corinths, the dried fruit of a variety of the Vine, VITIS VINIFERA.

CUTTLE-BONE, the internal calcareous skeleton of SEPIA species.

Cynanchum acutum, *Linn.* ASCLEPIADEÆ.

Mār-pech. A common climber in the TAMARIX jungles on the Hari-rud. The fruit of this if eaten is considered poisonous.

Cynanchum, *? species.* ASCLEPIADEÆ.

Called by the Afghans *pech-ak,* and by the Baluchis *pīr-wathī.* A tall climber, occurring on the islands and low land on the banks of the Helmand river, covering the trees of the Euphratic Poplar and TAMARIX with its masses of heavy foliage. The foliage makes excellent fodder for camels and goats. The fruit was collected in an unripe green state and eaten by the Baluchis, who call it *shangar.*

Cynara Cardunculus, *Linn.* COMPOSITÆ.

The Cardoon, employed as a vegetable, cultivated in gardens.

Cynara Scolymus, *Linn.* COMPOSITÆ.

The Artichoke. Is a cultivated plant in gardens in Persia. De Candolle, in his "Origin of Cultivated Plants," from Ainslie's *Materia Medica,* gives the Persian name for this plant as *kunghir;* this name must have originated from the Persian name for the shrub GUNDELIA TOURNEFORTII, viz., *kangar.*

Cynodon Dactylon, *Pers.* GRAMINEÆ.

The *dub* grass of the Punjab. It was certainly by no means a common grass in this country.

CYPRESS—CUPRESSUS SEMPERVIRENS.

Daba—دبه—a large vessel, usually intended for holding oil, clarified butter, &c.

Daba-i-charm—[a vessel (made) of skins], or the intestines of animals.

Daba-i-sarīsh—[a vessel (made) of vegetable glue].

Dāl—دال—Hindustani for the dried split peas of the pulses, or a food prepared from them.

Dala—دله—a Marten, MUSTELA species; or Polecat, PUTORIUS species.

Dāl-chīnī for *dār-chīnī*—CINNAMOMUM CASSIA.

Daluna—the Hawthorn, CRATÆGUS OXYACANTHA.

Dān—دان—a vessel, a house, a place of resort.

Dānā—دانا—learned, wise.

Dāna—دانه—a grain, a berry, the seed of any fruit; technically applied to the entire fruit of the indigenous Pomegranate, or to the small uneatable fruit of the cultivated shrub PUNICA GRANATUM; science, knowledge.

Dāna-chaka—[small berries]. The fruit of LONICERA NUMMULARIFOLIA, the tree Honey-suckle, the fruit of which is much eaten by children.

Dāna-dār—دانه دار—full of seeds, containing grain, or seeds, in contradistinction to *be-dāna*, seedless.

Dāna-hīl—دانههيل—[Cardamom seeds]. The seeds of ELETTARIA CARDAMOMUM.

Dānak—دانك—a small grain, or seed.

Dar—در—in, into, within, on, of, because.

Dār—دار—a tree, a beam, wood; in composition, like to, possessing the properties of.

Dār-chīnī—دارچینی—or *dāl-chīnī*—[Chinese stick]. Cinnamon, the bark of CINNAMOMUM CASSIA

Darakht—درخت—a tree.

Darakht-i-stān—درختستان—[a place of trees], a forest.

Darīā—دریا—a sea, river, waters.

DARNEL-GRASS—LOLIUM TEMULENTUM.

Dāru—دارو—a medicine, a remedy.

Dāru-farosh—داروفروش—[a vendor of medicines], a druggist.

Dāru-garm—داروگرم—or *dārue-garm*—داروي گرم—black-pepper, PIPER NIGRUM; or spices in general.

Dāru, dārim, durunī—in the Punjab, the indigenous shrub of PUNICA GRANATUM, and its fruit.

Dasht—دشت—a plain, a desert.

Dashtī—دشتي—wild, indigenous, uncultivated.

Dast—دست—the hand.

Dasta—دسته—the handle, as of an axe, spade, or whip.

DATE-PALM—the tree PHŒNIX DACTYLIFERA, *māch*; the fruit, dates, *khurmā*.

Datura Stramonium, *Linn.* SOLANACEÆ.

The Thorn-apple, *kachola; dhatura, datura* (Hind.), the fruit *goz-i-kanā*. This plant only occurred, I believe, as an introduced weed; the natives knew it to be poisonous, but applied to it the usual name for the seed of STRYCHNOS, *kachola*, or the Hindustani term *dhatura*; upon closer inquiry I found some druggists gave the Persian name for the fruit. At page 16, in the Botany of the Afghan Delimitation Commission, I have by error alluded to *Datura alba*.

Daucus Carota, *Linn.* UMBELLIFERÆ.

The Carrot, *zardak; sabzī* (Turkomani). Greatly valued as a vegetable, and much cultivated, to be found in all gardens. As an escape in fields it is common, but I never met with it here, as I have in the upper parts of the Kuram Valley and Kashmir, where I would certainly consider it an indigenous plant.

Dawā—دوا—(plural *adwīa*—ادویه)—medicine, a remedy.

Deg—دیگ—a large iron pot or mortar.

Delphinium Zalil, *Aitch. et Hemsley.* RANUNCULACEÆ.

Yellow Larkspur, *asbarg, aswarg, isbarg, isbarag, isparak, sparak, sparīg, jalīl, zalīl*; the flowers *gul-i-zalīl, gul-i-jalīl.* A perennial herb, with a thick short woody root-stock, from which several annual shoots spring; these are from one to two feet in height, each usually bearing a terminal spike of exquisite yellow flowers. When the flowers are at their best, the annual shoots bearing the spike of inflorescence is broken off close to the root; these are collected together, and then laid in heaps, usually on the roofs of the houses, to dry. In two or three days they are sufficiently dry, when the twigs are shaken over a sheet; on this all the flowers tumble off, and are now collected, either for local use, or exportation. The petals are of commercial importance, yielding a valuable yellow dye for silk, and are exported for this purpose in large quantities to Persia, Turkistan, Afghanistan, and even to India. The dye is easily obtained by simply boiling the flowers in water; in this decoction the silk is dipped. The dried stems also yield a dye upon being boiled, but this is poor in comparison with that yielded by the flowers. In India the petals are also employed in medicine. The plant has been raised from seed, and has flowered, both in England (at Kew) and in Germany since I collected it. It ought to succeed well in Southern Europe, both in France and Italy, and might prove useful as a dye.

DESERT—*jangal, dasht, be-ābān, maidān.*

Dewāna, dīwāna—دیوانه—imbecile, insane, foolish.

Dhaturā—دهتورا—Hindustani for DATURA species.

DIMINUTIVE—the letter *k*—ک, or the syllable *cha*—چه, added to a word in Persian, gives the diminutive of it.

Diospyros Lotus, *Linn.* Ebenaceæ.

The Afghan name for the tree and its fruit, *ālmlōk.* I did not meet with either the tree or its fruit on this journey, but it is indigenous in the Caspian provinces of Persia.

Diospyros, *species.* Ebenaceæ.

The wood of a species of Diospyros is Ebony, *ābnus.* This is said to be employed in the manufacture of combs, if so, it must be imported.

Dishes—

The ordinary dishes and platters of the agriculturalist and nomads are made of wood, called *tābak* and *kās-i-chobī*; the largest and best are made from Walnut wood, those in ordinary use usually of willow, or Celtis. A dish in which women keep their prepared cotton for spinning is called *kolak.*

Dock, Docken—Rumex species.

Dog—*sag.*

Dog-rose—*sag-zahr*—Rosa Beggeriana.

Dog-snake—*sag-mār*—a species of lizzard, Ophisaurus apus.

Dōgh—دوغ—butter milk.

Dolichos Lubia, *Forsk.* Leguminosæ.

Yields the Lubia-bean, but the *lobia* or *lubia* of Persia is Phaseolus vulgaris.

Dorema Ammoniacum, *Don.* Umbelliferæ.

This is the plant that yields the gum-resin Ammoniacum, it is called *kandal-kema,* and the gum-resin *kandal* or *ushak.* The plant about the time the fruit is forming is attacked by a boring beetle, the result is that at each spot of injury there exudes a thick, viscid, almost pure white juice; this gradually dries owing to exposure, and by the adherence of numerous adjacent exudations forms into irregular-shaped blocks of all sizes, which frequently surround and enclose the fruit and smaller twigs. Whilst fresh, or if the Ammoniacum has been carefully protected from the light, it is of a greyish opalescent colour, but if exposed to the light for even a short time, it gradually changes to a light yellow and then orange-brown, and at last cannot be distinguished by an ordinary observer from the gum-resin Galbanum. The nomads collect Ammoniacum in quantity between Bezd and Sher-i-nao—where I saw vast meadows of the plant—for exportation to the sea-coast towns of Persia. It is curious that none of this drug should ever be sent to India *via* Afghanistan.

Dorema glabrum, *Fisch. et Mey.* UMBELLIFERÆ.

Asp-i-kema, kema-i-asp. This plant exudes a gum-resin, of rather a brittle consistency, and of a light ruby colour, which I myself saw in minute granules, but not in quantity to collect, nor did I ever get any of it.

Drab—the grass, ERAGROSTIS CYNOSUROIDES.

DRUGGIST—*dāru-farōsh, atār, khruda-farōsh.*

DRUGS, Medicines—*dāru, dawā, adwīa.*

DRUGS.

I. Indigenous plants employed in medicine, or from which are obtained substances used as drugs.

DELPHINIUM ZALIL. The flowers, *asbarg, aswarg.*

BERBERIS VULGARIS. The Barberry, an extract from the wood and root-stocks, *ībrān.*

RŒMERIA HYBRIDA. The seeds, *shatīra.*

SISYMBRIUM SOPHIA. The seeds, *khāk-shī.*

ALTHÆA HOHENACKERI. The seeds, *tukhm-i-khatmī;* and petals, *gul-i-khatmī;* and ALTHÆA OFFICINALIS.

MALVA SYLVESTRIS. The flowers, *gul-i-khatmī.*

ZYGOPHYLLUM FABAGO. The crushed roots, as a poultice to clean sores, *sīmang.*

PEGANUM HARMALA. The shrub is collected in heaps and burnt upon the presence of an epidemic. The seeds are employed in medicine, *harmal, spand, ispand.*

BALSAMODENDRON MUKUL. The gum-resin, *gugal.*

PISTACIA VERA. The oil from the kernels, *roghan-i-pista;* the gum-resin, *kun-jad, wanjad;* and a turpentine obtained from the gum-resin.

PISTACIA TEREBINTHUS, var. MUTICA. The gum-resin and a turpentine obtained from it, *kunjad, wanjad.*

GLYCYRRHIZA GLABRA. The root-stock, *bekh-mahk;* the extract Liquorice, *mahk, rob-asus.*

PROSOPIS STEPHANIANA. The seeds, *tukhm-i jinjak.*

CITRULLUS COLOCYNTHIS. The pulp of the fruit employed in veterinary surgery, *talkhak.*

TRACHYDIUM LEHMANNI. The roots, *shakākul.*

FERULA FŒTIDA. The gum-resin Asafœtida, *anguza, hīng.*

FERULA GALBANIFLUA. The gum-resin Galbanum, *jāo-shīr, bārzad.*

DOREMA AMMONIACUM. The gum-resin Ammoniacum, *kandal, ushak.*

ARTEMISIA species. The flower heads, *afsantīn.*

ARTEMISIA species. The flower heads, *bārang-bōīa.*

CACCINIA GLAUCA. The corollas, *gul-i-gāo-zabān.*

ANCHUSA ITALICA. The corollas, *gul-i-gāo-zabān.*

BORAGINEÆ. The bark from the roots of a Boraginaceous shrub *ārī-lang.*

SOLANUM NIGRUM. The dried fruit, *tāj-i-rizī.*

SALVIA CERATOPHYLLA. The herb.

ZIZIPHORA TENUIOR. The whole plant, *kākutī.*

EREMOSTACHYS LABIOSA, and other species. The tubers of the roots, *agar-magar.*

LABIATÆ. Herbs of which the genera have not been identified —*badranj-bōīa*, the seeds; *kanoucha*, the seeds; *sātar*, the herb and flower heads ; *ustukhudus*, the herb.

PLANTAGO species, *bārtang, bārang.* The seeds of several species.

RHEUM TATARICUM. The fruit and roots-stocks, *rewand-i-dewāna.*

EPHEDRA PACHYCLADA. A decoction of the stems used by the Afghans, *mao, huma.*

MERENDERA PERSICA. The corms, *shambalīt, surinjān.*

Golī-sarnagun. The bulbs of a plant.

Gul-i-nīlī. A brilliant blue flower employed in medicine.

Kawhai. A plant used in medicine.

AGARICUS species, *ghārī-kun.*

Under Condiments—SARCOCOLLA, the Mannas, PSAMMOGETON; *anjadān* or *gulpār, ājkān.*

Under Foods (other)—ORCHIS, ALLIUM, TULIPA.

Minerals obtained in the country, employed in medicine—

Mumīāī. A natural mineral pitch.

Chemically prepared substances employed as medicines—

LIME—*āhak.*

PITCH, or TAR, from the destructive distillation of the dung of sheep and goats, *sīa-roghan.*

II. Cultivated plants employed in medicine, or from which are obtained substances used as drugs.

PAPAVER SOMNIFERUM. Yields Opium, *āfīun, tarīāk.*

ERUCA SATIVA. The oil, *roghan-i-til.*

ALTHÆA LAVATERÆFLORA. The petals, *gul-i-khatmī;* the seeds, *tukhm-i-khaira;* the roots, *resha-khatmī.*

TRIGONELLA FŒNUM-GRÆCUM. The leaves used in poultices, *shamlīd.*

PRUNUS CERASUS, var. The bitter Cherry, the dried fruit employed in surgery, *ālu-bālu.*

LUFFA ACUTANGULA. The seeds, *tukhm-i-turī.*

CUCUMIS SATIVUS. The Cucumber; the seeds, *hab-i-khīār.*

CICHORIUM ENDIVIA. The seeds, *kashnī.*

FRAXINUS species. The seeds, *tukhm-i-banaush.*

IPOMÆA (?) species. The seeds, *tukhm-i-gul.*

RICINUS COMMUNIS. The Castor-oil plant, although Castor-oil as a drug is well known and imported, and CROTON seeds are employed, neither the local oil nor the seeds of the Castor-oil plant are employed in medicine.

JUGLANS REGIA. The Walnut, the oil of the nut, *roghan-i-jauz.*

MIRABILIS JALAPA. The roots, *resha-i-gul*, and seeds, *bekh-i-gul* (*-i-abās*).

Kār-o-zera. The fruit of a cultivated tree.

Under Condiments—CUMINUM, PIMPINELLA, CARUM.

Under Narcotics, not employed as drugs—CANNABIS.

III. Plants or their products exported to be employed in medicine.

DELPHINIUM ZALIL. The flowers, *asbarg, aswarg.*

BERBERIS VULGARIS. The Barberry, an extract *ībrān.*

PAPAVER SOMNIFERUM. The inspissated juice, Opium, *āfīun, tarīāk.*

RŒMERIA HYBRIDA. The seeds, *shatīra.*

SISYMBRIUM SOPHIA. The seeds, *khāk-shī.*

ALTHÆA HOHENACKERI. The seeds and petals, *tukhm-i-khatmī, gul-i-khatmī.*

ALTHÆA LAVATERÆFLORA. The petals, *gul-i-khatmī;* the seeds, *tukhm-i-khaira;* the roots, *resha-khatmī.*

MALVA SYLVESTRIS. The flowers, *gul-i-khatmī.*

BALSAMODENDRON MUKUL. The gum-resin, *gugal.*

PISTACIA VERA, and PISTACIA TEREBINTHUS, var. MUTICA. The gum-resin, *kunjad, wanjad.*

Glycyrrhiza glabra. The root-stock, *bekh-mahk;* the extract, *mahk*, *rob-asus.*

Prosopis Stephaniana. The seeds, *tukhm-i-jinjak.*

Prunus Cerasus, var. The dried fruit, *ālu-bālu.*

Trachydium Lehmanni. The roots, *shakākul.*

Ferula fœtida. The gum-resin Asafœtida, *anguza*, *hīng.*

Ferula galbaniflua. The gum-resin Galbanum, *jāo-shīr*, *bārzad.*

Dorema Ammoniacum. The gum-resin Ammoniacum, *kandal*, *ushak.*

Valeriana Wallichiana. The root-stocks, *sambal-ultīb*, *mahk-ak.*

Artemisia species. The flower heads, *afsantīn.*

Artemisia species. The flower heads, *bārang-bōīa.*

Cichorium Endivia. The seeds, *kashnī.*

Caccinia glauca. The corollas, *gul-i-gāo-zabān.*

Anchusa italica. The corollas, *gul-i-gāo-zabān.*

Boragineæ. The bark of the roots, *ārīlang.*

Solanum nigrum. The dried fruit, *tāj-i-rizī.*

Eremostachys labiosa. The tubers of the roots, *agar-magar.*

Labiatæ. The seeds, *badranj-bōīa;* the seeds, *kanoucha;* the herb, *sātar;* the herb, *ustukhudus.*

Plantago species, *bārtang*, *bārang.*

Merendera persica. The corms, *shambalīt*, *surinjān.*

Golī-sarnagun. The bulbs of a plant.

Gul-i-nīlī A brilliant blue flower.

Kawhai. A herb.

Agaricus species. Fungi, *ghārī-kun.*

Under Condiments—Sarcocolla, Manna, Carum, Cuminum, Pimpinella, Psammogeton; *anjadān* and *ājkān.*

Under Foods (other)—Orchis, Allium, Tulipa.

Under Narcotics, not employed as drugs—Cannabis.

IV. Drugs imported.

Citrus Aurantium. The dried Orange, *post-i-naurinj.*

Citrus medica, var. acida. The dried Lime, *post-i-līmon.*

Cassia species (obovata ?). Senna leaves, *sanā-i-makaī.*

Entada species. The seeds, *kors-i-kamar.*

Acacia Catechu. The extract Catechu, *kāt-a-gulābī.*

Terminalia Chebula, Terminalia belerica, } Myrobalans. The fruit of these two species mixed, *halīla* and *balīla.*

VALERIANA WALLICHIANA. The root-stocks, *sambal-ultīb, mahkak.*

STRYCHNOS NUX-VOMICA. NUX-VOMICA seed, *kachola.*

CORDIA MYXA. The fruit Sebesten, *sapistān.*

RHEUM species. The root-stock of a medicinal rhubarb from Central Asia, *rewand-i-chīnī.*

CINNAMOMUM CASSIA. Cinnamon bark, *dār-chīnī.*

CROTON TIGLIUM. Croton seeds, *hab-dilmaluk.*

RICINUS COMMUNIS. Castor-oil, *roghan-i-bazanjīr.*

PINUS species. The resin, *zuft, ilk.*

CURCUMA ZEDOARIA. The rhizomes, Zedoary, *jidwār, kachur.*

IRIS species. The rhizomes, Orris-root, *orisā.*

ACORUS CALAMUS. The rhizomes of the sweet flag, *agar, bach.*

SMILAX CHINA. Smilax root, *chōb-chīnī.*

Under Narcotics not employed as drugs—CANNABIS SATIVA.

Under Condiments—PIPER NIGRUM.

Minerals and their salts imported as drugs—
AMBER, MICA, SULPHATE of COPPER, ALUM, ARSENIC.

Animal produce, imported as drugs—
CUTTLE-BONE, MUSK.

Dub—دوب—of India, the grass CYNODON DACTYLON.

Dukhtar, or *dokhtar*—دختر—a daughter, a girl.

Dum—دم—or *dumb*—دمب—the tail.

Dum-i-gōsāla [Calf's-tail]. The plant APOCYNUM VENETUM.

Dum-i-rōba [Fox-tail]. The plant APOCYNUM VENETUM.

DUNG—*sargīn, sarkīn*; dried dung of oxen, *pāchak, kōnda.*

Over the portion of Afghanistan and Persia that I traversed, the dung of all cattle, when it can be so employed, is applied as manure to land, and only under exceptional circumstances is it used as fuel. That of sheep and goats is converted by destructive distillation into a tar, or pitch, *sīa-roghan*, which is used as a local application to protect the sores on cattle from flies.

Durunī—the Punjab salt-range name for the indigenous Pomegranate, PUNICA GRANATUM.

Dusha—the name for either ECHIS ARENICOLA or VIPERA OBTUSA.

DYE, or dye stuffs—*rang.*

DYER—*rang-rez.*

DYES.

I. Indigenous plants yielding dyes.

DELPHINIUM ZALIL. The flowers and stems, *zalīl.*

BERBERIS VULGARIS. The Barberry, an extract from the roots, *ībrān.*

ACER species. A maple, the bark of the root, *shākh, shaghz.*

PISTACIA TEREBINTHUS, var. MUTICA. The Baluchistan Pistacio; the leaves, *gōshwāra, barg-a-bana.*

PROSOPIS STEPHANIANA. The galled pods, *hechī, jinjak;* the dye, *zang-o-wach.*

PRUNUS CALYCOSUS. The bark of the roots, *sīa-ling.*

RUBUS species. The roots, *balourī, malourī.*

GUNDELIA TOURNEFORTII. The stems, *kangar.*

PUNICA GRANATUM. The rind of the fruit, *post-ānār, nāspāl.*

HALOXYLON AMMODENDRON. The green wood, *shākha-i-tāgh.*

RHEUM RIBES. The root-stock, *rewand.*

EUPHORBIA species. The herb, *shīr-go, shīr-gīā.*

EPHEDRA PACHYCLADA. The stems, *yehma, uma, huma.*

ALLIUM species. The bulbs, *pīāz.*

II. Cultivated plants that yield substances used in dyeing.

RHUS CORIARIA. The leaves, *barg-i-sumāghk.*

RUBIA TINCTORUM. Madder, the roots, *rodang.*

CARTHAMUS TINCTORIUS. Safflower, the florets, *gul-i-kājīra.*

III. Dye stuffs the products of indigenous plants that are exported.

The flowers and stems of DELPHINIUM ZALIL.

The extract of the roots of BERBERIS VULGARIS.

The rind and fruit of the Pomegranate, PUNICA GRANATUM.

IV. Dye stuffs the products of cultivated plants that are exported.

Madder, the roots of RUBIA TINCTORUM.

The rind and fruit of the Pomegranate, PUNICA GRANATUM.

V. Dye stuffs imported.

INDIGO, CATECHU, WALNUT BARK, TURMERIC, ZEDOARY, SAFFRON, ANILINE, COCHINEAL, ARSENIC.

VI. Local products employed in the dyer's art.

The galls of PISTACIA VERA, and Barilla.

VII. Products imported to be employed in the dyer's art.

The galls of an Oak, QUERCUS species. Areca nuts, the seeds of ARECA CATECHU, and Alum.

VIII. Products exported to be employed in the dyer's art.

The galls of PISTACIA VERA. The galled pods of PROSOPIS STEPHANIANA; the rind and fruit of the Pomegranate, PUNICA GRANATUM.

EARTH—soil, *yāghī, zamīn, khāk.*

EARTH-NUTS—*yāghī-shāk,* the tubers of CARUM species.

EBONY—the wood of a DIOSPYROS species.

EGG of the domestic fowl, *tukhm-i-murgh, khāīa.*

EGG-PLANT—BRINJAL, SOLANUM MELONGENA.

EGYPT—*misar;* EGYPTIAN—*misarī, misrī.*

Ejik-okharasī. The Turkoman term for FERULA OOPODA.

Elæagnus hortensis, *Bieb.* ELÆAGNACEÆ.

The Elæagnus. This is the Oleaster of Lindley, but by De Candolle the indigenous olive, *Olea Europæa,* is spoken of as the Oleaster, therefore it is better to drop the word Oleaster altogether, especially in Afghanistan, &c., where the two trees may both be met with in a wild state, and it would be impossible to know which was being spoken about if this synonym were used. *Sinjad, sinjid, sanjid, sinjit, sanjit;* Eastern Afghanistan, *jigda.* An indigenous tree, or large shrub, common in the hills at an altitude of 3000 feet, near running streams. Much cultivated in orchards for its fruit, which to a European palate does not seem worth eating, to me resembling in the mouth a mixture of dry cotton wool and ashes. The natives approve of it, and carry it with them to eat on their journeys. A fine variety of the fruit grows near the Oxus; Mr Merk brought me some from there; it was certainly larger than that ordinarily obtainable, and if fineness means a nearer approach to cotton wool and ashes, then they certainly were finer. A spirituous liquor (from which is obtained the new Persian pick-me-up "Zingit") and an oil, *roghan-i-sinjit*, are said to be prepared from the fruit by the Turkomans. The wood is hard, and said not to be easily affected by water, hence it is chosen for building bridges, and is employed wherever wood has to be brought for any time in contact with water; it makes good fuel.

Elettaria Cardamomum, *Maton.* Scitamineæ.

The Cardamom plant. Cardamoms, *hāl, hīl, hab-i-hāl, hab-i-hīl,* are imported in some quantities, both through Persia and India; they are much used as a condiment, and in addition to being locally consumed, are exported to Turkistan. The skins are called *hīl-i-kōza* or *hīl-i-gōza* and the seeds *dāna-hīl.*

Elm—Ulmus montana, and another species.

English—*angrez.*

Entada, *species.* Leguminosæ.

The seeds, *kors-i-kamar,* imported from India through Persia, to be employed in medicine.

Ephedra foliata, *Boiss.* Gnetaceæ.

Bandak, bandakai, bandukai, hum-i-bandak. So named from the corky nodes on the stems resembling knots or joints.

Ephedra pachyclada, *Boiss.* Gnetaceæ.

Hum, huma, haoma, um, uma, ychma, kōresh, khōresh, khushk-targ (Koin), *māo* (Khyber). A stiff bush, about three feet in height, consisting of close pressed, erect, leafless, jointed stems, occurring on stony barren ground, common from Quetta to Meshad. The fruit is red and fleshy, and is eaten by children. The stems are employed in dyeing yellow, and this colour is said to be given without the addition of any other material. The stems are also crushed into a powder and applied to the gums in lieu of snuff, or burnt and the ashes mixed with snuff to make it more pungent. A decoction of the stems is employed in tanning the leather for water-bottles. The Afridi tribes in the Khyber crush the stems and allow them to soak for the night in cold water; this infusion is administered to children and others suffering from fever and boils. This is the plant that is at present considered by some to have been the Soma of the ancients, and is at the present time employed by the Parsees in Bombay in being burnt as incense at their places of worship.

Eragrostis cynosuroides, *Beauv.* GRAMINEÆ.

Drab, kīrtag, kīrthag. The sandy plains between Kani and Gazicha were covered with this grass, to the exclusion of all other plants: here in its method of growth and general habit it resembled extremely the Bent-grass of Scotland. It was looked upon as a valuable fodder grass.

Eremostachys labiosa, *Bunge.* LABIATÆ; and
Eremostachys Regeliana, *Aitch. et Hemsley.* LABIATÆ.

On the fibrous roots of these herbs are developed tubers or nodes, called *agar-magar* or *kohar-barar,* about the size of a walnut, but longer in form. These are collected by the Turkomans for rubbing down the body, after having taken a hot bath, in the same way as they employ the tubers of CURCUMA ZEDOARIA. On being crushed these tubers give forth a strong pungent aroma, like that usually associated with the CRUCIFERÆ, and very similar to that given off by the external bark-like covering of the turnip-like root of NEPETA RAPHANORHIZA; to the presence of an acrid substance is no doubt due their rubefacient properties.

Eremurus Aucherianus, *Boiss.* LILIACEÆ.

Charīsh, chirīsh, chīresh, sares, gīā-sares, sarīsh, sarīsh-i-kāhī, sires, siresh, siris, sirīsh, gīā-sirīsh, gīā-sirīshim.

This is a giant ASPHODEL, with a spike of most superb flowers sometimes four feet in height; it is abundant over the whole Badghis and in Persia, and abounds in the vicinity of Turbat-i-haidri in similar loamy, soft, sandy soil. It is a plant of great local importance, as from its fleshy roots, and some say leaves also, by drying in a hot sand-bath, and grinding is prepared a flour, which when mixed with hot water yields a most tenacious vegetable glue, with which the natives make great vessels for holding oil and clarified butter. The cobblers employ it in preference to animal glue in their work, and I believe it might be introduced into England as a substance likely to prove useful in the arts. In India vessels made of it might be appreciated by the Hindu community if the raw material were directly placed into their hands, to enable them to construct their own vessels. In Persia these vessels are thus made, the tenacious gum is painted over a hollow earthen mould that has a single layer of some coarse country cloth covering it; on this cloth layer after layer of the glue is painted until a sufficiency is reached; this forms when dry a parchment-like skin, the mould is then broken up and removed through the mouth of the jar, and then usually the jar is sewed into a goat's hair sack. With ordinary moisture, or the amount of moisture likely to affect the jar through the goat's hair covering, no harm is likely to accrue, but if the jar is allowed to stand in water for days, it will in time dissolve or melt away. The flour made by grinding the dried roots or leaves is called *sarīsh-i-narm*, and the vessels *daba-i-sarīsh*. The leaves of this species are not employed as a vegetable; in some cases where they were so used by our camp followers they suffered terribly for their ignorance.

Eremurus aurantiacus, *Baker.* Liliaceæ.

Sich, sīch. The young leaves of this species, and probably those of Eremurus Olgæ, are eaten as a vegetable, in a cooked state, by the natives both in this district as well as in the Kuram Valley of Afghanistan. I and my friends found it a really good and well-flavoured vegetable, well worth the attention of the market gardener in England. As a vegetable the plant would grow well, inasmuch as the leaves are cut over, without injuring, the growing axis of the plant, which would last for several years. I doubt, unless in exceptional localities, whether it would produce ripe seed in this country.

Ergot of Rye—*sīa-khāk.*

Rye, Secale cereale, is the commonest weed in wheat fields, and in many cases quite overruns the wheat; when Ergot affects the Rye it is known to be injurious to the health of those partaking of the flour that has much of this "black earth" mixed with it.

Erianthus Ravennæ, *Beauv.* Gramineæ.

In the Punjab, and by the Turkomans called *munj,* by the Persians *kirta, kandur,* and by the Baluchis *khāsh, khāshk.* A very common grass all over the country traversed, growing in huge clumps in the vicinity of water, to a height of from six to ten feet. The Turkomans make a rope, *rasmān-ālafī,* from it; for convenience they cultivate it round the margins of their fields, although it is quite indigenous in the surrounding country; the same takes place in the Salt-range of the Punjab, where I was informed it was also grown to bank up the fields, and thus prevent the heavy falls of rain from carrying off the soil, as well as to yield the farmer a ready supply of material for his ropes. It is curious that the same name for the grass, *munj,* should extend from the Punjab and the Indus to Turkistan. The reeds of this as well as of Phragmites are called *nai,* as are sometimes those of Arundo; they are employed in basket work, in manufacturing screens, and such like.

Erianthus (?), *species.* Gramineæ.

I met with a species of what I believe to be an Erianthus, cultivated in gardens in Persia, for the reeds to be employed in making pens; it was called *kalmī.*

Erinaceus albulus, *Stoliczka.*

The hedgehog, *khār-pōsht-ak, khāl-pōsht-ak, khār-pusht-ak.*

Erodium cicutarium, *L'Her.* Geraniaceæ.

Susan-ak.

Eruca sativa, *Lamk.* Cruciferæ.

Māndāo, the oil *roghan-i-til.* Cultivated largely as a field crop for its seed, from which oil is extracted; the oil is used in diet, for burning, and in medicine.

Eugenia caryophyllata, *Thunberg.* MYRTACEÆ.
(Caryophyllus aromaticus, *Linn.*)

The clove plant. Cloves, *mekhak*, *kalamfur*, and *karanful*; but this last name is applied by the Turkomans to the CAPSICUM fruit, and its pepper. Cloves are extensively imported through Persia; they are chiefly used by the better classes as a condiment mixed amongst tea.

Eulophia campestris, *Lindley.* ORCHIDEÆ.

Is by no means very rare in the Punjab, Baluchistan, and Afghanistan. Its tubers are collected in the Punjab, and make up the ordinary Salep of Lahore. When the present railway bridge was being constructed over the Chenab, at Wazirabad, some of the islands over which the bridge was built were one season covered with this orchis, specimens of which were sent to me by Captain Clerk, and which are now in the Herbarium at Kew.

Euphorbia cæladenia, *Boiss.* EUPHORBIACEÆ.

Ālaf-i-shīr-āg, *āo-tarnak*, *āo-targanak*, *gāo-targanak.* The milky juice of this plant is employed in lieu of rennet for curdling milk to make cheese. It, however, is said to give a very bitter taste to the curds.

Euphorbia cheirolepis, *Fisch. et Mey.* EUPHORBIACEÆ.

Palti, *roz-gard*, *roj-gard.* The Euphorbia of the sand-dunes of Baluchistan, where its milky juice was called *khīr.*

Euphorbia osyridea, *Boiss.* EUPHORBIACEÆ.

Gīshar. The long, whip-like shoots of this plant, during winter, much resemble the rod-like stems of PERIPLOCA APHYLLA.

Euphorbia, *species.* EUPHORBIACEÆ. Specimens No. 72, collected October 21, 1884.

Collected on the banks of the Helmand, where it was said to be employed as a dye, called *shīr-go*, *shīr-gīā.*

EUROPEAN—*farangī.*

EXTRACTS; of GLYCYRRHIZA GLABRA—Liquorice.
of BERBERIS VULGARIS—*ībrān.*
of ACACIA CATECHU—Catechu.

FALSE *anzarut*—the glue-like inspissated juice of MICRORHYNCHUS SPINOSUS.
Fandak—tinder.
Far—فر—*fār*—beauty, light, splendour.
Farang, frang—a term applied to the pot herbs ATRIPLEX FLABELLUM and ATRIPLEX MONETA.
Farangī—فرنگی—European, English.
Farōsh, farush—فروش—a seller.

Ferula—

The name for all the great Umbelliferæ, but more particularly for the FERULÆ, seems to be *kema, kāma, kamāī,* as a generic term.

Ferula fœtida, *Regel.* UMBELLIFERÆ.

The Asafœtida plant, *angōza-kema, anguza-kema, khurne-kema, khōra-kema.* The gum-resin Asafœtida *anguza,* by the traders and in India it is called *hīng.* The following is my description of the Asafœtida plant in a paper on "Some Plants of Afghanistan and their Medicinal Products," *Pharmaceutical Journal and Transactions,* December 11, 1886, p. 465:—

"In early spring great cabbage-like heads are to be seen distributed at intervals amongst the Asafœtida plants. Their peculiar forms represent the primary stage of the flower heads, enclosed and completely covered up by the large sheathing stipules of the leaves. In a few days these heads become transformed into the semblance of a cauliflower; from this period the stem bearing the inflorescence rapidly shoots upwards to a height of from four to five feet, its proportions being singularly massive and pillar-like. From a general calculation I found that only one out of a hundred plants bore a flowering stem. If you ask a native what plant this is, pointing to a flower-bearing one, he will tell you that it is '*khurne kema,*' and that it has nothing to do with the plants that yield Asafœtida. He will take out his knife, remove the head, cut the stem from its base, strip off the few sheathing stipules that are still adherent to the stem, and in his hand you see what looks like a very large cucumber: from this he will remove the dark-green cuticle, and then slice away at the deliciously cool, soft, crisp, copiously milky stem, and eat slice after slice with the greatest gusto, and then say, 'Did I not tell you it was the edible *kema* and not Asafœtida?' 'Yes,' says an onlooker, 'You will stink like a camel for the next three months!' The method of collecting the drug, as far as I could learn, was as follows:—A few men, employed for the purpose by some capitalist at Herat, are sent to these Asafœtida-bearing plains during June. These take with them provisions consisting of flour, and several donkey-loads of water-melons, the latter in lieu of water, which is not only scarce there, but usually saline. The men begin their work by laying bare the root-stock to a depth of a couple of inches of those plants only which have not as yet reached their flower-bearing stage. They then cut off a slice from the top of the root-stock, from which at once a quantity of milky juice exudes, which my informant told me was not collected then. They next proceeded to cover over the root by means of a domed structure, of from six to eight inches in height, called a *khōra*, formed of twigs and covered with clay, leaving an opening towards the north, thus protecting the exposed root from the rays of the sun. The drug collectors return in about five or six weeks' time, and it was at this stage that the process of collecting came under my personal observation. A thick gummy, not milky, reddish substance now appeared in more or less irregular lumps upon the exposed surface of the root, which looked to me exactly like the ordinary Asafœtida of commerce, as employed in medicine. This was scraped off with a piece of iron hoop, or removed along with a slice of the root, and at once placed in a leather bag, the tanned skin of a kid or goat. My guide informed me that occasionally the plant was operated upon in this manner more than once in the season. The Asafœtida was then conveyed to Herat, where it usually underwent the process of adulteration with a red clay, *tāwa*, and where it was sold to certain export traders, called *Kākri-lōg*, who convey it to India. On August 17, when I crossed the great

Asafœtida plains where this drug is chiefly collected, except for the small domes over each root there was not a leaf or a stem or anything left to point to the fact that any such plant had ever existed there, the heat and winds of July and August having removed every trace.

"In Northern Beluchistan, after much difficulty and searching, I came across one root of Asafœtida, which I believe belonged to a different species; but I did not see a single stem, or even the remains of one, although we traversed immense plains upon which these fragments of leaves still existed, and where, I believe, during summer the plant must have grown in abundance."

On the road to Meshad from Turbat-i-haidri, about four miles from the latter is a mountain called Koh-surkh, or the red hill; in the vicinity of this hill, yearly a large amount of Asafœtida is collected and sent on to Meshad. Lieut.-Col. H. B. Lumsden, now Sir Harry Burnett Lumsden, K.C.S.I., says, "the low ranges adjacent to the Anardara basin are the great Asafœtida producing tracts during the three hottest months of the year, numbers of Kakars resort there to collect that gum" (Appendix to Davies' *Report on the Trade and Resources of the Countries on the North-Western Boundary of British India*, viii. page xlix).

The following is an account given of the collecting, &c., of Asafœtida by Dr Bellew, now Surgeon-General Bellew, C.S.I., when he was attached to the Kandahar Mission in 1857, from Davies' *Report on the Trade, &c.*, Appendix vii. page xli:—

"The frail vaginated stem, or the lower cluster of sheathing leaves, the former belonging to old plants, and the latter to young ones, is removed at its junction with the root, around which is dug a small trench about 6 inches wide and as many deep. Three or four incisions are then made round the head of the root, and fresh ones are repeated at intervals of three or four days, the sap continuing to exude for a week or a fortnight, according to the caliber of the root. In all cases, as soon as the incisions are made, the root head is covered over with a thick bundle of dried herbs or loose stones as a protection against the sun; when this is not done the root withers in the first day and little or no juice exudes. The quantity of Asafœtida obtained from each root varies from a few ounces to a couple of pounds weight, according to the size of the root, some being no bigger than a carrot, whilst others attain the thickness of a man's leg. The quality of the gum differs much, and it is always adulterated on the spot by collectors before it reaches the market. The extent of adulteration varies from one-fifth to one-third, and wheat or barley flour or powdered gypsum are the usual adulterants. The best sort, however, which is obtained solely from the node or leaf bud in the centre of the root head of the newly sprouting plant, is never adulterated, and sells at a much higher price than the other kinds. The price of the pure drug at Kandahar varies from four to seven Indian rupees per *man-i-tabriz* (about 3 lbs.), and of the inferior kinds from one and a half to three and a half Indian rupees per *man*. The Asafœtida is commonly used by the Mahommedan population of India as a condiment in several of their dishes, and especially mixed with *dal*. It is not an article of general consumption in Afghanistan, though often prescribed as a warm remedy for cold diseases by the native physicians, who also use it as a vermifuge. The fresh leaves of the plant, which have the same peculair stench as its secretion, when cooked are commonly used as an article of diet by those near whose abode it grows. And the white inner part of the stem of the full-grown plant, which reaches the stature of man, is considered a delicacy when roasted and flavoured with salt and butter."

Dr Bellew's and my own report combined give a very fair general idea of how the drug is collected, and to what other uses the plant is put; but it would be most interesting to see the whole stages gone through, and this could only be done by residing the entire season at one of these Asafœtida producing districts, along with some of the great nomad tribes, who make the collection of this drug one of their sources of livelihood.

I would bring to your notice a paper in the *Journal of the Pharmaceutical Society of London* for July 14, 1888, on "The Asafœtida Plants," by E. M. Holmes, F.L.S.; from this I learn that in collecting these Ferulas one ought to be very careful in noting, at the time of collecting, any differences that may exist between the flowers that are relatively male and those that are female. In my specimens of FERULA FŒTIDA the flowers (male and female) are white. Bunge describes the male flowers of his Scorodosma fœtidum as yellow, and the female, or hermaphrodite flowers, as white. Mr E. M. Holmes is of opinion that here we may still have two species mixed up.

Ferula galbaniflua, *Boiss. et Buhse.* Umbelliferæ.

The Galbanum plant, *bādra-kema, kema-bīrzad, bārzat, bārzad, bīreza, bīrīje, bīrizan, bīrzad, bīrzat, bīrzand.* The gum-resin Galbanum, *jāo-shīr, gāo-shīr, shilm-i-bārzat, shilm-i-bādra-kema.*

"This plant differs from Boissier's description in having a perfectly hollow stem and woolly petals; but this wooliness so entirely disappears in the herbarium, that unless seen originally one would doubt its having ever existed. Notwithstanding these discrepancies, we have no doubt that it is Ferula Galbaniflua, Boiss. et Buhse. In habit it differs from Ferula fœtida and Dorema Ammoniacum in growing gregariously and in its being found in greatest luxuriance in moister localities, as in the Badghis near Gulran, where it grows in the sandy loam of that district. Its early root-leaves spring from the ground like a fountain of soft green moss, and in this state it is greedily devoured by camels. The stem, which grows very rapidly, is of a semi-opalescent orange colour when young and perfectly glabrous. When in full blossom the flower is of a brilliant orange-yellow; as the fruit forms and ripens the colour changes from the base of the plant upwards, showing various autumnal tints. The stem is thick at the base, but tapers suddenly upwards, terminating in an elegant tall, loose, panicled inflorescence, reaching a height of about four feet. The stem, on injury, from its earliest stage of growth, yields an orange-yellow gummy fluid which very slowly consolidates, usually forming on the stem like the grease on a guttering candle, and possessing in common with the whole plant when crushed a strong odour resembling that of celery. The gum is commonly found adhering to the lower portions of the stem, and is so tenacious that when subsequently examined pieces of the plant are frequently found attached to it. No artificial means are employed to my knowledge in the collection of this drug. It is stated to be an article of export through

Persia *viâ* the Gulf to Arabia and India" ("Some Plants of Afghanistan and their Medicinal Products," *Pharmaceutical Journal and Transactions,* December 11, 1886, p. 466).

The gum-resin Galbanum that I purchased at Meshad, exactly corresponded to that which I myself collected off the plants in the Badghis. It was there said to have been imported from Yezd, in Fars, Persia. It was all in solid lumps of a yellow-orange colour, turning much browner upon exposure to light. For the chemical analysis of a sample of this Galbanum I was indebted to Mr E. G. Baker, who read a paper on the subject at the Pharmaceutical Society of London, see *Journal and Transactions,* December 11, 1886, page 468. This gum-resin burns with a peculiar odour, and hence it is as much exported to India on this account as it is for its uses in medicine. The fruiting stem is hung as a charm about a house when parturition is about to take place in order to keep off devils and all evil spirits, and the gum-resin is administered to the patient, mixed with milk. The resin is also applied to sores and wounds.

Ferula oopoda, *Boiss.* UMBELLIFERÆ.

Ejik-okharasī, kilkī, kalkilī. This Ferula is remarkable for having the stipules of the leaves developed into great cups or bowls surrounding the main stem.

Ferula ovina, *Boiss.* UMBELLIFERÆ.

The sheep, or mountain Ferula, *kema-kohī, stourga.* In certain localities in the Badghis, this covered the sides of the hills, and made grand pasturage for goats and sheep.

Ferula suaveolens, *Aitch. et Hemsley.* UMBELLIFERÆ.

Sambal, sanbal, sumbal, sombala. The large root of this plant whilst fresh was strongly scented, but it lost all its odour on drying. The roots were said to be exported on account of their scent, and this may prove to be one of those roots with which the true Sumbul, FERULA SUMBUL, *Hk. fil,* is adulterated, the latter is a Central Asian plant.

FIBRES—

The only plant cultivated to yield fibre in these districts is GOSSYPIUM HERBACEUM. The indigenous plants yielding fibre are ASTRAGALUS, several species, APOCYNUM VENETUM, and ERIANTHUS RAVENNÆ.

Cotton is very extensively cultivated as a field crop; the quality of the fibre, however, is poor, and is far surpassed by the produce of Turkistan. The soil in Western Afghanistan and in Eastern Khorasan is not favourable for the production of a good fibre, owing to the want of loam. Almost the whole of the cotton grown is expended in the manufacture of home-made material for local use. Flax, LINUM USITATISSIMUM, is rarely grown, and when it is, as in Turkistan, it is for its seed alone for oil, and not for fibre. In Turkistan a fibre, for rope, is made by steeping in water the refuse stems of CANNABIS SATIVA. From APOCYNUM VENETUM is collected a fine fibre which in these parts is chiefly manufactured into rope or twine, but in Turkistan a kind of linen is made from it. Here no use is made of the fibre of ERIANTHUS RAVENNÆ, but in Turkistan they make rope from it, and cultivate the plant along the margins of their fields for this purpose. The people here, when requiring a piece of twine, and certain of the ASTRAGALI are handy, pull up their roots, and from the bast and bark of the roots make what twine they may require, or employ the bark from the young shoots of an Elm, as they do in Kashmir and Southern Afghanistan.

Ficus Carica, *Linn.* URTICACEÆ.

The Fig. The cultivated fig, *anjīr;* the indigenous fig, *anjīr-i-kohī.* The fig is cultivated in all the better class of orchards, and the fruit is eaten in a fresh state. I do not remember ever seeing any dried figs in any of the village shops. The indigenous shrub I first met with at Tirpul, on the face of some sandstone rocks, growing amongst the clefts, where a very little water percolated. It was in great luxuriance on the southern exposure of Sim-koh, forming a good-sized shrub from eight to ten feet high, growing very characteristically on, as it were, projecting mounds of soil, and each bush was made up of numerous close-set shoots from one general great root-stock. At Kush-ao, in Khorasan, on the 20th August I saw several bushes, which were more spreading and woody than those at Sim-koh. Near Kush-ao the bushes were said to be very numerous, both on the plains in the open and in the clefts of rocks; where they exist in the plains water is considered to be close to the surface. In some localities the bushes are so numerous that they form a copse, and with them the flocks of goats and sheep play terrible havoc. At Sangun I found round the gardens great hedges of figs; these I was told were the wild figs in cultivation. Dried figs, strung on strings like beads, are imported in small quantities into north-west India from Afghanistan.

FIELD-BEAN—VICIA FABA.

FIG—FICUS CARICA.

Fīlfīl—فلفل—*pīlpīl*—Pepper, in these parts the name is applied to red pepper, CAPSICUM species.

Fīlfīl-i-surkh—فلفلسرخ—[red pepper], CAPSICUM species.

FIR—the only fir tree of the seregions is the cultivated PINUS HALEPENSIS.

Fīroza—فیروزه—a Turquoise, azure, blue, rare, noted.

FLAX—the fibre of LINUM USITATISSIMUM.

FLINT—*sang-ātish, sang-chakhmākh, sang-chakmāk;* called by the Turkomans *chakh-māk-dāshe,* and by the Baluchis *khal.*

In the hills to the north of Kalla-nao, near Kalander-abad, black flints are plentiful, and are largely worked for there. As pieces of pottery were met with amongst the ruins on the Helmand, so throughout the Badghis all sorts of odd bits of flint that had apparently been used and thrown away were picked up. Flint locks for weapons are now quite out of use in these regions.

FLOUR—*ārd, aurd.*

The common flour of the country is that of imported Indian corn, the lesser millets, wheat, occasionally barley; in the districts of Bala-morghab and Maimana the flour in ordinary use consists chiefly of Maize with Sorghum, and that of the spiked Millet. In the Badghis, the fruit of the wild pear, PYRUS species, as well as that of CELTIS CAUCASICA, and of dried Mulberries, the fruit of MORUS ALBA, are all converted into flour and mixed with ordinary flour to be made into bread; so also are the seeds of LUFFA and some other of the CUCURBITACEÆ.

FLOWER—*gul.*

FODDER, herbage—*kā, ka, giā, giāgh, ālaf, wāsh, khāsh, gaz.*

I. Indigenous herbs and shrubs noted for yielding good fodder.

a. That are browsed upon whilst growing.

CAPPARIS SPINOSA.	HALOXYLON AMMODENDRON.
TAMARIX, several species.	SALSOLA, several.
ASTRAGALUS, all the species.	ANABASIS, species.
ALHAGI CAMELORUM.	CALLIGONUM COMOSUM.
PROSOPIS STEPHANIANA.	POPULUS EUPHRATICA.
CRATÆGUS OXYACANTHA.	CAREX PHYSODES.
PRANGOS PABULARIA.	CAREX STENOPHYLLA.
FERULA OVINA.	PENNISETUM DICHOTOMUM.
FERULA GALBANIFLUA.	POLYPOGON LITTORALE.
CODONOCEPHALUM PEACOCKIANUM.	ARISTIDA PLUMOSA.
ARTEMISIA MARITIMA.	ERAGROSTIS CYNOSUROIDES.
ARTEMISIA CAMPESTRIS.	POA BULBOSA.
PERIPLOCA APHYLLA.	AGROPYRUM CRISTATUM.
STACHYS TRINERVIS.	HORDEUM ITHABURENSE.
PTEROPYRUM AUCHERI.	HORDEUM CAPUT-MEDUSÆ.

b. Collected for immediate use.

CAPPARIS SPINOSA.	UNGERNIA TRISPHÆRA.
CYNANCHUM (?), sp.	PENNISETUM DICHOTOMUM.
OROBANCHE, species.	ARUNDO DONAX.
BALANOPHORA, species.	PHRAGMITES COMMUNIS.

c. Stored for winter consumption.

CRAMBE CORDIFOLIA.	GUNDELIA TOURNEFORTII.

II. Cultivated.

a. As fodder.

TRIGONELLA FŒNUM-GRÆCUM.	TRIFOLIUM RESUPINATUM.
MEDICAGO SATIVA.	HORDEUM VULGARE.

b. The refuse of cultivated plants employed as fodder.

The straws of the Cereals and Pulses, and the refuse from the various seeds after the extraction of their oil; the unripe cotton pod; the branches of the cultivated willows, and of the Jujube, Zizyphus vulgaris, in early spring whilst other green fodder is scarce.

III. The following plants are hurtful, if not actually poisonous, as fodder.

Nerium odorum.
Stellera Lessertii.
Nitraria Schoberi.
Zygophyllum, species.

IV. Animals will not eat—

Sophora pachycarpa.
Ammothamnus Lehmanni.
Cercis Siliquastrum.

Trigonella Fœnum-græcum, Medicago sativa, and Trifolium resupinatum are cultivated as fodder, chiefly for the use of horses and mules. These are usually grown in orchards under the shade of trees; they are given either in the green state freshly cut or as hay. Owing to the rapidity of drying in this climate this hay retains its green colour, and is much relished by all cattle. It is sold in the bazaars twisted in the form of ropes, and made up into small bundles convenient for both buyer and seller. During early summer barley in a young green state is much employed as fodder. In winter the crushed straw of wheat and barley, and of the various pulses are the usual fodder supply of the country, to which occasionally the refuse from the various oil seeds, after the oil has been extracted, is added. The most important of the indigenous plants collected for fodder is a large thistle-like herb, Gundelia Tournefortii; this, as already stated, covers vast tracts of country to the exclusion of all other plants; from its general fierce spinous condition it appears whilst growing as quite unfit for fodder; this, however, is not the case. In autumn the whole plant rapidly dries, and in this condition easily breaks up, when it is collected and housed, or stacked, and employed as winter fodder for sheep and goats. It is so abundant that except the carriage there is little difficulty in collecting any quantity of it. In Persian territory I saw it being stacked in the localities where it grew for future transport to the villages. The turnip-like roots of Crambe cordifolia are largely collected in the Badghis, at the nomad encampments, and are stored as turnips are in Scotland, for the use of camels during the most severe part of the winter. These roots are ordinarily very woody, and are far beyond the masticating power of any animal except the camel.

Nerium odorum is very poisonous to camels and donkeys —the donkey by experience keeps from it, camels never learn to do so. Where the shrub is found occurring amongst Tamarix thickets, near water, as in Baluchistan, it proves very destructive to camels. It is as well to note that there are two natural orders that contain plants that are poisonous to camels, and which they themselves will not touch unless pressed by hunger, these are Zygophylleæ and Thymelæaceæ. The plants in Zygophylleæ are Nitraria Schoberi, Miltianthus portulacoides, Zygophyllum Fabago, and Zygophyllum atriplicoides; in Thymelæaceæ—Stellera Lessertii and Daphne oleoides. Of the last plant, in my first paper on the Kuram Valley of Afghanistan (*Linn. Soc. Journal of Botany*, vol. xviii. page 90), I say, "Camels will not eat this shrub except when very hungry; it is poisonous, producing violent diarrhœa. I feel certain that much of the mortality of camels in the Kuram division was due to the prevalence of this shrub. It was noticeable when camels were grazing that the Daphne was not touched until all the other shrubs had been eaten."

There are three of the Leguminosæ that I would also be careful of, viz., Cercis Siliquastrum, Ammothamnus Lehmanni, and Sophora pachycarpa, for the simple reason that if camels are watched it will be noticed that they never browse on these wilfully.

Lycium barbarum is certainly not hurtful to camels, although at the encampment at Zaru it looked as if this shrub had been the cause of several deaths.

Fōlād, faulād—فولاد—steel.

Foods—see Beverages, Bread, Cereals, Condiments, Fruits, Milk and its products, Oils, Pulse, Vegetables. Other substances (employed either as foods, condiments, or as medicines).

Other substances employed as foods. There are certain substances which it is very difficult to classify under any special head, as, though used as food—say Mannas by the

Persians and Afghans—at the localities where they are collected owing to their cheapness there, once these begin to be exported their value rises, and they come either under the head of condiments or medicines; again, Orchis tubers are treated as medicines by the natives of Afghanistan and Persia, for even in those localities they are difficult to obtain, high priced, and not within the reach of the natives as a food. Exported say to India, Salep is looked upon as a superior class of food for babies and the sickly, and therefore may be classified as a highly nutritious food or as a medicine. The rhizomes of POLYGONATUM VERTICILLATUM are employed as a strength-giving food in the Kuram Valley, where it was obtainable in quantity, but is in the trade treated rather as a medicine. Sarcocolla is considered a food by the wealthier classes of Persia; in India, and out of Persia, it is treated in the light of a drug.

Produced locally—MANNAS, ORCHIS tubers, POLYGONATUM rhizomes, SARCOCOLLA; and all these are exported either as medicines or condiments.

FORESTS—*darakht-i-stān.*

True forests of POPULUS EUPHRATICA, with several species of TAMARIX, exist on the islands and banks of the Helmand and Hari-rud rivers. On the Hari-rud, at its most northern point, where I travelled, near Kumani, HALOXYLON formed a great part of the forest; a country covered with a forest of HALOXYLON is called Tagh-i-stan by the Persians. On the great sand-dunes of Baluchistan this HALOXYLON formed rather a copse than a forest. On the Helmand TAMARIX ARTICULATA occurred, forming thin forests of very large bulky trees, in certain special localities. PISTACIA VERA exists in large forests in the Badghis, at an altitude of from 2000 to nearly 4000 feet above the sea-level; where these forests occurred the districts were called *pistalik,* in the same way as places noted for the profusion of the Elæagnus in Eastern Afghanistan are called *jigdalik* or Jagdalak; one of the celebrated passes into Afghanistan is so named, although even in Griffith's time there was no sign of the tree then there. JUNIPERUS EXCELSA was in abundance as very large, though not lofty, trees along the ridges of the hills above 3000 feet altitude both in the Badghis and Khorasan.

Lonicera nummularifolia was still more restricted in its localities. The most extensive forest that I saw of this tree was in Khorasan, to the south-west of Bezd, where it is distributed thinly over a good extent of country on the south-western slopes of the hills, giving a very park-like feature to the grassy uplands.

Fox—*rōba, sālab.*

Fox-tail—Apocynum venetum.

Fraxinus oxyphylla, *Bieb.* Oleaceæ; and another species.

The Ash, *banaush, binaush, benaush.* The seeds, *tukhm-i-banaush.* A large tree, cultivated in orchards, near houses, and surrounding shrines. The wood is much valued for ploughs and other agricultural implements; next to the Elm it is considered the best wood for oil-mills. The seeds are held in esteem as a valuable medicine, and are imported into Persia from Herat, where these trees are said to be numerous.

Frankincense—Olibanum, the gum-resin of Boswellia species.

French-bean—Phaseolus vulgaris.

Fruits.

a. Cultivated fruits.

The Afghans, Persians, and Turkomans live largely on fruit, which, either fresh or dried, in one form or other, is usually added to their ordinary diet; when travelling they always carry with them a small supply of dried fruits to be eaten as they proceed upon their journeys. The portion of the Hari-rud Valley that I visited produces little fruit, but around Herat itself, and eastwards from it, the country is said to be prolific in fruit, as is Khorasan. There is at present none grown in the Badghis, yet Maimana is famed for its fruits, especially its walnuts. The gardens of Herat are celebrated for the fine and numerous varieties of grapes produced in them, Turbat-i-haidri and Meshad in Khorasan are equally so. Melons are grown everywhere; the variety *sardā,* collected late in the season, is a fruit very largely exported to India from Herat; and the Water-melon, cultivated in the open fields, may be looked upon as one of the chief food crops of the country. Apples are chiefly grown in Persia, and thence imported into Herat for further exportation. The town of Anar-dara, fully a degree and a half south of Herat, is famous for its Pomegranates, which are largely exported to India; those produced in Herat itself are few and, comparatively speaking, poor in quality. The Peach, Nectarine, and Almond are said to attain their greatest perfection in Persia; certainly those I saw and ate at Meshad were of very superior quality. Owing to the great abundance of all kinds of fruit, and the climate being one suitable for it, most of these are dried for consumption locally during the rest of the year, or for exportation. Hence in all bazaars Raisins, Prunes, dried Apricots, dried Mulberries, dried Cherries, Jujubes (ZIZYPHUS), ELÆAGNUS, and the dried flesh of Melons, are ordinarily met with on sale, less frequently dried Peaches and dried Apples. Currants, or Corinths (*ziriskh-shīrīn*), are a product of Kafiristan and of Eastern Afghanistan.

Maimana, as already stated, is famed for its Walnuts, which it exports largely; at Herat they are said to be plentiful, but the only place where I saw the tree growing in perfection was at Bezd, where the trees quite equalled the grand groves of Shalizan in the Kuram Valley.

Cultivated for their fruits—

ZIZYPHUS VULGARIS. Jujube.
VITIS VINIFERA. Vine.
PISTACIO VERA. Pistacio.
PRUNUS species. Plum.
PRUNUS CERASUS. Sweet cherry.
PRUNUS CERASUS. Bitter cherry.
PRUNUS ARMENIACA. Apricot.
PRUNUS AMYGDALUS. Almond.
PRUNUS PERSICA. Peach.
PRUNUS PERSICA. Nectarine.
PYRUS CYDONIA. Quince.
PYRUS COMMUNIS. Pear.
PYRUS MALUS. Apple.
PUNICA GRANATUM. Pomegranate.
CUCUMIS MELO. Melon.
CITRULLUS VULGARIS. The Water-melon.
ELÆAGNUS HORTENSIS. The Elæagnus.
MORUS ALBA. Mulberry.
MORUS NIGRA. Royal mulberry.
FICUS CARICA. Fig.
JUGLANS REGIA. Walnut.

b. Fruits yielded by indigenous plants.

The nuts collected from the indigenous forests of PISTACIA VERA are of great commercial importance, both as an article of diet amongst the people, and also for exportation, being obtained in immense quantities from the forests in the Badghis, whence they are carried all over the country, besides being exported to Persia, Afghanistan proper, and India. Barberries are considered rather in the light of a condiment; preserved as a pickle they are greatly used in the diet of the better classes, and for similar reasons much exported to India. The fruit of the indigenous ELÆAGNUS and of the Jujube cannot be distinguished from the cultivated forms except by size; these are chiefly carried and eaten on journeys, hence one of the names for the fruit of the Elæagnus, "Caravan-dates." The fruit of CELTIS CAUCASICA is much eaten and highly extolled, but it is chiefly used as a flour, to be made into bread with ordinary flour. The wild fig is much smaller than the cultivated fruit, but I was told that it was excellent eating. I had not an opportunity of collecting it when it was actually ripe.

Indigenous plants yielding fruits that are of importance—

BERBERIS VULGARIS. Barberry.
ZIZYPHUS VULGARIS. Jujube.
PISTACIA VERA. Pistacio.
PYRUS, species. Wild pear.
ELÆAGNUS HORTENSIS. Elæagnus.
CELTIS CAUCASICA. Celtis.
FICUS CARICA. Fig.

Fruits exported—

The greatest exportation occurs in Raisins, Pistacio nuts, Walnuts, the dried flesh of Apricots, Prunes, and Almonds; the next, in fresh Grapes packed between layers of cotton, in small light circular boxes, made of poplar or willow wood, much resembling the boxes figs used to be packed in called "drums," Quinces, Pears, Apples, Pomegranates, *sardā* Melons, and BERBERIS fruit.

Fruits imported—

The Date is largely imported from Southern Persia, and said to be from Arabia through Persia to Afghanistan and to Turkistan. The trade with Arabia is done chiefly by pilgrims to Meshad, or return pilgrims from Mecca, who depend upon the exchange or sale of some such commodity to pay their way whilst travelling. Limes, Lemons, and Oranges in a fresh state are extensively imported into Afghanistan and Turkistan from the Caspian provinces of Persia, where the trees grow in great luxuriance.

FUEL—*hīma, kōnda.*

In the vicinity of all villages fuel is extremely difficult to be got, and is always an expensive item in one's daily bill. The inhabitants have long ago consumed the little that existed in the land surrounding the village, and when the village is a large one, people are seen going long distances to collect a sufficiency for their daily requirements. As a rule much fuel is not consumed by the people of these regions, as most of their food and bread is cooked at public resorts, and the luxury of a fire lighted to keep them warm is rarely adopted. Their houses are all built of sun-dried bricks owing to this great scarcity of fuel, and it is only the houses of the great and rich that are to be seen built with burnt bricks. By travellers the stems and twigs of the ARTEMISIÆ are generally most sought for as fuel, for this purpose being excellent, always apparently being dry and ready to burn, as well as being easily handled in making a fire; next to these the smaller branches of the Tamarisks.

Our camp followers, once they had struck upon the roots of the Liquorice plant, steadily searched for it, but this was more to make a good hot fire to keep themselves warm than to cook with. Whilst resident at Bala-morghab, those who had chimneys built into their tents found the dry wood of PISTACIA VERA by far the best fuel the country could produce, owing to the amount of resin present in the wood, and next to it that of CELTIS. The wood of HALOXYLON AMMODENDRON was highly extolled by the natives as giving a valuable slow-burning fire, producing great heat, and that a log once lighted would burn slowly for days, no trouble being required to keep the fire in. Notwithstanding the difficulty of obtaining fuel, cow-dung is rarely used for this purpose.

FUNGUS—*samārukh, gharī-kun.*

Gab—گب—*gap*—گپ—thick, large, gross, dense.

Gab-chīr, gap-chīr, gab-shīr, gap-shīr—[thickened milk]. Manna, and the plant producing it, COTONEASTER NUMMULARIA.

Ga-bīna—[the grass gum]. A form of the gum Tragacanth, or the shrub yielding it, ASTRAGALUS HERATENSIS, and other species. *Gabīna* and *bagīna* in the Kuram Valley meant honey.

Gach—گچ—Gypsum; Plaster of Paris.

Gāl—گال—a red variety of the Millet, PANICUM MILIACEUM.

GALBANUM—the gum-resin of FERULA GALBANIFLUA.

GALLS—

The galls that form on the leaves of PISTACIA VERA, *boz-ganj*; these are employed in dyeing silks, for which purpose they are largely exported from the Badghis to Persia, Afghanistan proper, and in smaller quantities to India; some even to Turkistan. *Heehī, keehī, jing-jing-bānu* are the galled pods of PROSOPIS STEPHANIANA; they are employed as a dye stuff, as well as being used in dyeing and tanning, chiefly locally, but are also exported through Persia to India. *Māju, māzu,* are either the galls of TAMARIX GALLICA, which are scarcely used, and not exported, or are the galls of a species of Oak, QUERCUS, that is said to grow in Persia; these are largely imported from Persia for dyeing and tanning. *Kīsa* is a very prominent gall that occurs on the leaves of an Elm, ULMUS species, but which is not employed. The presence of a flat gall following the curve of the leaves of PISTACIA TEREBINTHUS, var. MUTICA, obtains for that leaf its name *gōshwāra* [like the ear].

Gand—گند—anything fœtid, a bad smell, a testicle.

Ganda—گنده—fœtid, stinking, a ball of anything.

Ganda-fīroza—گنده‌فیروزه—[the rare scented]. The gum-resin Olibanum, BOSWELLIA species; or Turpentine.

Gandam—گندم—*ganam*—Wheat, TRITICUM VULGARE.

Gandamak—گندمک—[Wheatling], ARENARIA HOLOSTEOIDES; the name of a locality on the Khyber-Cabul route.

Gandam-dār—[Wheat-like]. Rye, SECALE CEREALE, a common weed in all wheat fields.

Ganj—گنج—or *ghanj*—غنج—a store, a granary.

Gāo—گاو—a cow, a bull, an ox.

Gāo-gōsh—[Cow's ear], APOCYNUM VENETUM.

Gāo-sāla or *gō-sāla*—گوساله—a calf.

Gāo-shīr—[Cow's milk]. Galbanum, the gum-resin of FERULA GALBANIFLUA.

Gāo-targanak—[Cow herb], EUPHORBIA CÆLADENIA.

Gāo-zabān—[Cow's tongue]. This word might well stand for our technical term Boraginaceous, as it is applied to several plants of that order, CACCINIA GLAUCA, ANCHUSA ITALICA, MACROTOMIA PERENNIS, and MACROTOMIA BENTHAMI.

Gaodar—گودر—*gao-dār*—the wild Oat, AVENA FATUA.

Gāoras—گاورس—the grain of the Italian Millet, PENNISETUM ITALICUM.

Gap—گپ—*gab*—thick, large, gross, dense.

Gard—گرد—to revolve, turn round, the sun; dust, applied technically to the resinous dust that falls off the CANNABIS SATIVA plant after it has been hung up to dry; this dust when collected is *chars, charas.*

GARDEN—*bāgh, bāghīcha, chaman.*

GARLIC—ALLIUM SATIVUM.

Garm—گرم—hot, warm.

Garma—گرمه—Melons that ripen early, first fruits.

Gash—گش—elegant, pretty.

Gash-gōshī—[elegant-eared], TRAGOPOGON COLORATUM.

Gāz—گاز—pasturage.

Gaz—گز—TAMARIX species.

Gaz-angabīn—گزانگبین—also pronounced *gaz-anjabīn* —[Tamarisk Honey]. The manna of TAMARIX GALLICA, var.

Gaz-māzu—گزمازو—[the gall (yielding) Tamarisk], TAMARIX GALLICA.

Gaz-kera—[the Tamarisk (employed to make) baskets], TAMARIX GALLICA, var.

Gaz-shakar—گزشکر—[Sugar-Tamarisk]. The Manna yielding Tamarisk, TAMARIX GALLICA, var.

Gaz-shōra—گزشوره—[bitter, or saline, Tamarisk], TAMARIX TETRAGYNA.

Gaz-surkh—گزسرخ—[Red-Tamarisk], applied to TAMARIX MACROCARPA, and also to TAMARIX GALLICA.

Gazak—گزک—a devil, a bird trap.

Gazella subgutturosa, *Güld.*

The Gazelle, the male *āhu* or *taka-i-āhu,* the female *bōz-i-āhu* or *burz-i-āhu.*

Gazu—گزو—*gaju*—a Tamarisk.

Gentiana Olivieri, *Griseb.* GENTIANACEÆ.

This by Boissier is considered the hot country Gentian, which it most certainly is, *gul-khale.*

Get—Baluchi for a Willow, SALIX species.

Ghanj—غنج—a store.

Ghārī-kun—غاریقون—Arabic for AGARICUS. Is the Arabic word from the Greek *agarikon?* or is it a word taken from the East by the Greeks? It is curious to note that species of Fungi in Central Asia are employed for stopping hæmorrhage in wounds, and the word is said to mean "blood-stopper" in Persia—غاری—*ghārī,* is a sponge, and the—قون—*kun,* may be for *khun*—خون—blood.

Ghī—گهي—Hindustani for clarified butter, *rōghan-i-zard.*

Ghīs—غيس—abundance.

Ghōja, ghuja—غوژه—*ghōza, ghuza*—غوزه—a nut, a cotton pod, a cardamom.

Ghulām—غلام—a boy, a servant, a slave.

Gīā—گياه—گيا—green herbage, grass, hay, fodder.

Gīā-shīr—گياه‌شير—[milk-herb]. Any milky plant, EUPHORBIA species.

Gīā-shutar—گياه شتر—[Camel-shrub]. An ASTRAGALUS, the Tragacanth plant.

Gīā-sares—گياه‌سريس—or *gīā-sarīshim*—گياه‌سريشم—*gīā-sirīsh, gīā-sirīshim*—a plant whose roots are very viscous, EREMURUS AUCHERIANUS.

Gīāgh—گياغ—grass, herbage.

Gil—گل—clay.

Gil-i-barang—گل‌برنگ—a coloured clay from Burang or Fara.

Gil-i-surkh—گل‌سرخ—a red clay.

Gīlās—a corruption of *Kīrās*—كيراس—from the Greek *kerasion.*

A cherry, the fruit of PRUNUS CERASUS, var.; *gīlās* is the term in Persia, in the Kuram Valley, and Kashmir for the sweet white-heart cherry met with in cultivation.

GIN, the cotton gin, *halājī.*

The wood considered the best for the manufacture of these, is that of the wild Pear, PYRUS species; and of the Hawthorn, CRATÆGUS OXYACANTHA.

GINGER—the rhizomes of ZINGIBER OFFICINALE.

Girez—گريز—the end of a beam of wood; *grez, gurez,* the Elm, ULMUS MONTANA, and another species.

Gīshar—probably a corruption for *gīā-shīr*, EUPHORBIA OSYRIDEA.

GLASS—*shīsha.*

Glass is now manufactured at Herat, for which the natives employ the Barilla of the country. Signs of the past manufacture of glass were very prevalent in the Helmand Valley, amongst the debris of the many massive ruins of that country.

GLASS-WORT—CALLIGONUM COMOSUM.

GLUE—

The Persians have two substances almost identical with each other, both are equally commonly used for the same purposes; in speaking generally of either they use a term commonly applied to both. Glue made from the refuse of animal matter, our ordinary glue; and a glue-like gum made from the roots and leaves of an EREMURUS, quite unknown to us. When speaking of either generally they call them *charīsh, chirīsh, chīresh, sares, sires, siris, sirīsh, sirish,* so that to distinguish what substance it is that they are alluding to they find it necessary to add some discriminating word—thus for animal glue, *charīsh-charm*, the glue made from skins of animals, or *charīsh-shōm,* black glue; for the vegetable glue they say *gīā-sares, sarīsh-i-kāhī,* grass or herb glue. In all probability *sīrinj,* "a gum-like substance obtained in Yarkand by boiling the root of a shrub" (*Trade Products of Leh,* p. 246), will prove to be the latter.

Glycyrrhiza glabra, *Linn.* LEGUMINOSÆ.

The liquorice plant, *mahk, māhk, sus, asus, ālsus;* the underground root-stock, *bekh-mahk, bekh-sus;* the extract liquorice, *mahk, rob-asus, asus, ālsus, asal-ālsus, malhatī.*

A characteristic and extremely common shrub in the Badghis and Khorasan, at an altitude of above 2000 feet, and most luxuriant in loamy soil, where there is moisture. In the latter localities the annual shoots grow to four feet, with enormous underground root-stocks. The underground root-stocks are collected by the nomads, from which they prepare the extract liquorice. Those of our camp followers who had been to Kandahar with our army, demonstrated to us what excellent fuel the root-stocks made; ever after the discovery of the profusion of this plant in our encampments, or the vicinity, our men were to be seen daily collecting the roots for fuel.

The extract is not prepared at any of the large towns, but at the places where the nomads encamp, and by them is traded with in the towns, and thus exported to Persia proper and India. This plant, or a variety of it, is indigenous in the Kuram Valley, and might easily be cultivated at Quetta, Kohat, Peshawur, Abottabad, and many other localities on our north-western frontier. A preparation of liquorice made with the whey of Oxygal is called by the Turkomans *āo-karut;* this is employed as a household remedy.

GOAT—

Goats in general, or the female goat in particular, *buz, bōz, baz, bād, burz;* by the Baluchis *heth.* The male goat, or the leader of the flock, *taka,* hence applied to the male Ibex, and to the male Gazelle. *See* Sheep.

GOAT'S FIG—the castor-oil plant, RICINUS COMMUNIS.

GOAT'S HAIR—*pat, kurk, kurg.*

GOAT'S STORE—the galls of PISTACIA VERA.

GOAT'S THORN—ALHAGI CAMELORUM.

Gōgird—گوگرد—sulphur.

Gōgird-i-farangī—[European sulphur]. Lucifer matches.

Gōhar—گوهر—a jewel.

Gōhja, kōhja, kōhcha—the Hawthorn, CRATÆGUS OXYACANTHA.

Gol, gul—گل—a ball, a bulb, a flower.

Gōla—گوله—a ball, a cotton pod, a cocoon, the seed vessel of the poppy.

Gōlī, gulī—گولي—a ball, a bullet, a bulb.

Gōlī-lāle, gōlī-lāla—گولي لاله—[the bulbs of the red (flower)]. The bulbs of TULIPA MONTANA, these are rather nice to eat; they are commonly collected and eaten by the people.

Gōlī-sarnagun—[the bulbs of the topsy-turvy].

The tubers of a plant, the flowers of which, according to the natives, hang upside down, considered rare in Afghanistan, and highly valued as a medicine. From inquiries I believe it to be a Liliaceous plant near FRITILLARIA.

Gōr—گور—a tomb, a grave, the wild ass.
Gōra—گوره—the wild ass, EQUUS HEMIONUS.
Gōra-khar—گوره خر—the wild ass.
Gōr-kan—گورکن—[the grave-digger], name applied to the Badger, MELES species.
Gōsāla—گوساله—a calf.
Gōsfand, gōspand—گوسفند—a sheep.
Gōsh—گوش—the ear, the external fleshy appendage.
Gōsh-wāra—گوشواره—[like the ear].

The name applied to the leaves of PISTACIA TEREBINTHUS, var. MUTICA, from the appearance given to the leaves by the flat, flesh-coloured galls that form round the margin of the leaf.

Gōsht—گوشت—meat.
Gōsht-ruba, gosht-roba—گوشت ربا—[carrier off of meat]. A kite, a crow.

Gossypium herbaceum, *Linn.* MALVACEÆ.

The cultivated cotton plant, *pamba-chōb, pumba-chōb, pamba-chub, pumba-chub, pamba-chu, pakhta-chōb, chōb-i-ghōza, kapās;* the flower, *gul-i-ghōza;* the pod, *gōza, guza, ghōza, ghōja, ghuja, kōza, kōza-pamba, khurāk, kōkalak, umba;* the shell of the pod, *kawa;* the seed, *pamba-dāna, phun-dāna;* the oil, *rōghan-i-tāza;* the oilcake, *kunjāra;* the fibre cotton, *pamba, pumba, pakhta, gōza, kōza, guza, kalak;* the raw thread, *nakh-i-pamba khāmak.*

Cotton is generally cultivated over the whole of this country, but wherever it is grown successfully there must be a free supply of water for its irrigation. The shrub does not average three feet in height; the seed is sown in beds about the middle of May, and the seedlings are planted out in from five to six weeks' time; the cotton is fit for collecting from October on to the middle of winter. Cotton in a raw state is not exported, although we did see a good deal passing up the Helmand Valley, from Persia, at the end of October 1884. It is usually locally converted into thread, or woven into cloth; the thread and fabrics are traded with in the surrounding country. The fibre of the Turkistan cotton is very much superior to the product of these parts. Animals are fed on the unripe cotton pods; the ripe shells of the pods are employed in the manufacture of gunpowder, and from the seeds an oil is extracted; the refuse of the seeds after the extraction of the oil are used to feed cattle on. The prosperity of any village can be well estimated from the number of cotton-gins, spinning-wheels, and reels for winding silk that are seen exposed on the house-tops.

GOURDS, or Pumpkins, the fruit of LAGENARIA VULGARIS, BENINCASIA CERIFERA, CUCURBITA PEPO—*kadu, thambal, sabcha.*

Gōz—گوز—a nut, a walnut, the fruit of JUGLANS REGIA.

Gōz-i-kanā—گوزکنا—[the hard nut]. The Thorn-apple, DATURA STRAMONIUM.

Gōza—گوزه—*guza, kōza*—the fibre cotton, yielded by the plant GOSSYPIUM HERBACEUM; also the cotton pod; the cocoon of the silk-worm; the capsule of the poppy; the Cardamom fruit; a nut.

GRAFT—a graft, *kalam;* to graft, *pewand-kardan;* grafted, *pewandī.*

The gardener's art of grafting is well known, and all the better class of fruits are raised by grafting, as the Peach, the Pear, the Apricot, the Quince, the Cherry, and the Mulberry.

GRAIN—a grain, a seed, a berry—*chām, dāna, hab.*

Gram—an Anglo-Indian term in the Punjab for the pulse of CICER ARIETINUM; in other parts of India for the pulse of some other plant.

GRAPES—the fruit of VITIS VINIFERA.

GRAPE-BOXES—

These are for the export of fresh grapes to India; they are usually made of the wood of POPULUS NIGRA or of a SALIX; they are circular boxes, about 12 inches across, and from 4 to 5 inches deep.

GRAPE-SUGAR—*kand-a-shīra-ghī.*

Ordinarily only a syrup is obtained from grapes, very like that form of treacle in England that goes by the name of golden syrup, but I was informed that a sugar also is obtained; and I was given some small loaves, the crystalline particles of which did not correspond with that of ordinary loaf-sugar, and this may have been sugar made from grapes.

GRASS, or grass-like herbs—*ālaf, gīā, gīāgh, ka, kā, khāsh, kīāgh, kirta, kīrtag, sīāl, kāhī;* Turkomani, *tarnak, tar-ganak.*

GRAVE, *gōr.*

GRAVE-DIGGER, *gōr-kan*—a Badger, MELES species.

Grez, gurez—the Elm, ULMUS species; *girez,* the end of a beam of wood.

Gugal—گوگل—the gum-resin of BALSAMODENDRON MUKUL.

Guj—گوژ—a button, the Hawthorn.

Guj-i-kōhcha—گوژکوهچه—*guj-i-kōhja*—[the Hawthorn of the hillocks]. The Hawthorn, CRATÆGUS OXYACANTHA.

Gul—گل—*gol*—a flower, a bulb, a ball of clay.

Gul-āb—گلاب—[flower-water]. A rose; the flowers of ROSA DAMASCENA; rose-water.

Gul-i-abās—گلعباس—the flowers of MIRABILIS JALAPA.

Gul-i-dukhtar—گلدختر—[the daughter's flower]. The Poppies, PAPAVER DUBIUM, PAPAVER PAVONINUM, and RŒMERIA species.

Gul-i-gāo-zabān—گلگاوزبان—[the flower of the cow's tongue]. The flowers of CACCINIA GLAUCA and ANCHUSA ITALICA.

Gul-i-ghōza—گلغوزه—[the flowers of the cotton], GOSSYPIUM HERBACEUM.

Gul-i-khatmī—گلخطمي—[the flowers of MALVA] and ALTHÆA species.

Gul-i-kājīra—گلکاجیره—[the flowers of CARTHAMUS TINCTORIUS].

Gul-i-khaira—گلخیره—or *gul-i-kheru*—گلخیرو—[flowers of ALTHÆA species].

Gul-i-nīlī—گل نیلی—[the flower of the Nile, or the blue flower]. The flowers of a rare plant collected on Koh-i-simcha, and used in medicine.

Gul-i-rānān-zebā, or *gul-i-rānā* — گل رعنا —[the beautiful lovely flower], Rosa lutea.

Gul-kalura—[the flower (got during) gleaning], Rosa berberifolia.

Gul-khale—the flower, Gentiana Olivieri.

Gul-lāl-abāsī—گل لال عباسی—[the red flowers of Mirabilis Jalapa].

Gul-māī—Anabasis species, and Salsola auricula.

Gul-nār—گل نار—[the flower of the Pomegranate], Punica Granatum.

Gul-nastran—گل نسترن—[the flower of Rosa moschata].

Gul-pār—an Umbelliferous plant, the fruit of which is also called *anjadān*.

Gul-zalīl, *gul-i-julīl*—[the flowers of (Delphinum) Zalil].

Gul-zard—[yellow flowered], Brassica species.

Gulām—Turkomani for the wild Ass, Equus hemionus.

Gulām-maidanī—[the plains of the wild Ass].

Gum—*jad, gabīna, katīra, kawaj, charīsh, sakbīna, sares, shilim, tul, samagh.*

Several forms of gum seem to be of valuable commercial importance throughout the country. The highest in importance is that of Astragalus Heratensis, and another species, a kind of Tragacanth called *katīra*, nextly that obtained from the roots and leaves of Eremurus Aucherianus, by boiling, viz., *gūā-sares* or *charīsh-i-kāhī*, and lastly the gums collected in orchards from the trees of plums, apricots, peaches, and almonds, usually termed *shilim*. I was quite astonished at the quantities of gum I saw being collected in the various gardens from these trees, and the huge balls of it, made up into half-camel loads, that were lying for sale in the bazaars at Meshad, mostly all for exportation to Turkistan.

The seeds of Pyrus Cydonia, the Quince, yield a gum that is employed by the women and dandies in dressing their hair.

Gum Arabic—*sakbīna.*

Gum Tragacanth—*gabīna, katīra.*

Gum-resins.

The gum-resins for which this part of the world is most famous are Asafœtida, Galbanum, and Ammoniacum. These are collected from indigenous plants, and exported through Persia or Afghanistan and India to all parts of the world. Their value would be greatly increased if any trouble were taken, or system adopted, for their collection, improvements being made as regards cleanliness in collecting and exporting devoid of adulteration. I am of the opinion that the plants yielding these might be cultivated with success, both as regards the quality of the drugs produced and as a profitable investment, if an experiment were attempted, in the vicinity of Quetta.

A Mastich is collected, for household use, exuding from the stems of Pistacia vera and Pistacia Terebinthus, var. mutica. A kind of Bdellium is obtained in Baluchistan from Balsamodendron Mukul, called *gugal,* and at Meshad I purchased a highly-scented gum-resin, I myself collecting a similar piece at Sha-Ishmail, to which was given the same names as to an imported Bdellium, viz., *mulk-i-azrak, mukal-i-azrak, bōī-kōhī, buī-kuhī,* probably the gum of a Balsamodendron. Rhus coriaria is cultivated for its leaves, it exudes a gum which is called *sumāgh;* this is collected, but in what way employed I know not.

Imported into Meshad through Persia, for further transit *viâ* Afghanistan to Turkistan and India, are Myrrh, the gum-resin of Balsamodendron Myrrha, *mur, bōl.* Bdellium, yielded also by a species of Balsamodendron, *mulk-i-azrak, mukal-i-azrak, bōī-kōhī, buī-kōhī.* Olibanum or Frankincense, yielded by a species of Boswellia, *ālk, īlk, ālk-ul-labān.* True Mastich from the west, the gum-resin of Pistacia Lentiscus, *kandur-i-rumī;* and Lac, the gum-lac of commerce, *lāk,* imported from India and Bokhara.

Gun — گون — *guna* — گونه — colour, species, kinds, sorts.

Gundelia Tournefortii, *Linn.* COMPOSITÆ.

Kangar. This is a large thistle-like shrub, growing in gregarious masses, and covering immense tracts of country. In a general way it much resembles the Artichoke, CYNARA SCOLYMUS, and hence I believe that the latter, a cultivated plant in gardens, has received its name from this. The young leaves and shoots in early spring are eaten as a vegetable, very much in the same way as we use the Cardoon, CYNARA CARDUNCULUS, and is much relished by the Persians. A red dye is said to be obtained from the stems. The whole plant makes excellent fodder, and is largely collected and stacked for winter use, chiefly to feed goats and sheep upon. It is one of those shrubs that in autumn is to be seen being blown hither and thither by the winds across the vast open plains.

GUNPOWDER—*barud.*

Is manufactured for individual or local use by the inhabitants. This is a coarse slowly exploding compound, which is better fitted for the very ordinary weapons of this country than that manufactured in Europe. It is usually made from the charcoal of the shell of the cotton pod, or from that of the wood of a SALIX. Almost every native seems to know how to make gunpowder, and each man has his own special receipt for doing so.

Gur—گر—this is a Hindustani word for solid molasses, which is imported in large quantities from India.

Gurās—ARTEMISIA SCOPARIA.

Gurba—گربه—a cat; *gurba-dala*—a MARTEN or wild cat.

Gur-bālchōr-ak—a trade name for the root-stocks of VALERIANA WALLICHIANA.

I am of opinion that this name is a contraction for *gurba-bālchōr-ak* [the cat VALERIANA]. *Bālchōr* is the root of NARDOSTACHYS JATAMANSI, *bālchōr-ak* is the little *bālchōr*, or VALERIANA; the word *gur*, a contraction for *gurba*, a cat, no doubt applied to the root from the extraordinary effect it produces upon this animal. " A Kabul trader at Leh told me that it was the same as *gur-bālchōr-ak* in the Peshawur trade, and owing to a load of which he was once nearly driven mad in conveying it from Kabul to Peshawur, by all the cats of the country surrounding him at night, wherever he halted" (*Trade Products of Leh*, p. 13).

Gurda—گرده—a kidney, anything round, a pillow.

Gurda-ālu—گرده‌الو—[the kidney plum], the same as *gurja-ālu*, the fruit of PRUNUS species; a kind of plum.

Gurez, grez—the Elm, ULMUS species; this is probably the same word as *girez*, a part of a beam.

Gurja, gurda—a plum, the fruit of PRUNUS species when in a ripe fresh state, when dried *ālu-bokhāra*; the cherry-tree, PRUNUS CERASUS, is also called *gurja*.

Gypsophila paniculata, *Linn.* CARYOPHYLLEÆ.

The plant, *sāo-safed*; the root-stock, *bekh*. The root-stock of this plant is extensively sold in the bazaars to be employed as soap in the washing of clothes.

GYPSUM—*gach*.

A common mineral product of the country, employed as cement and to give a white polished plaster for the interior of buildings.

Hab—حب—a grain, a seed, a berry, a pill, a pulse.

Hab-ālmalūk— حب الملوک —[cherry-stones], CROTON seeds.

Hab-āl-salātīn— حب السلاطین —[the royal berry]. The seeds of CROTON TIGLIUM.

Hab-dilmaluk—probably for *hab-ālmaluk*. The seeds of CROTON TIGLIUM.

Hab-i-hīl—حب هیل—or *hab-i-hāl*—حب هال—Cardamoms, ELETTARIA CARDAMOMUM.

Hab-i-khīār—حب خیار—the seeds of the Cucumber, CUCUMIS SATIVUS.

HAIR—Goat's hair, *pat*; the cloth, *patu*, *kurk*, and *kurg*. Camel's hair, and the fabric CAMLET, *barak*.

Halājī—(pronounced *alājī*)—حلاجي—a cotton gin.

Hāl—هال—or *hīl*—هيل—the fruit of ELETTARIA CARDAMOMUM.

Halīla—هليله—*halīle*—the fruit of TERMINALIA CHEBULA, Chebulic Myrobalans.

Haloxylon Ammodendron, *Bunge*. CHENOPODIACEÆ.

Called the white Tamarisk by Europeans. *Tā, tar, tār, tā-gaz, tārgaz, tāgh, tākh, tāk, tugh*; *saxaol* by the Turkomans, and *zak** by the Mongols. A common tree of no great size, found from the dry sandy deserts of Baluchistan to the valley of the Hari-rud and Khorasan. One tree that I measured at Tomanagha, and with the largest wood of its kind that I had come across, measured at two feet from the ground twelve feet in circumference. They average in height about twelve feet, few ever reach eighteen feet. The wood is very heavy, it is difficult to cut, but makes splendid fuel. From the green wood in Herat the natives prepare a dye, (*rang-i-*)*shākha-i-tāgh*, much employed to give a green colour. The wood is often burnt to yield Barilla, but the plant is held in greatest value for the fodder its fresh shoots yield, especially to camels in the desert tracts, where they can live upon it alone for months without suffering; this is not the case when they have to feed on the TAMARIX.

Hamām—حمام—a place for bathing within a building, the term is usually applied to a Turkish bath.

Hāmun—هامون—a plain, a piece of level ground. On the Helmand it means an expanse of water in which a jungle grows.

Haoma—EPHEDRA PACHYCLADA.

Har—هر—every, all. A noxious grain amongst corn.

Har-bang—هربنگ—[the intoxicating grain]. Darnel grass, LOLIUM TEMULENTUM.

* *London to Bokhara*, by Col. A. Le Messurier, R.E., 1889, p. 133.

HARE—*khar-gōsh*—LEPUS species.
HARICOT BEAN—PHASEOLUS VULGARIS.
Harmal—حرمل—the wild Rue, PEGANUM HARMALA.
Haoz—حوض—

A reservoir for storing water in; it is usually covered over with a domed roof, to keep the water cool in summer, and to prevent its freezing in winter. The water in these tanks is filthy in the extreme, owing to the amount of organic water introduced by the people in taking their daily supply, as well as in carrying out their ablutions over the margin of the reservoir.

HAWTHORN—CRATÆGUS OXYACANTHA.
HAY—*beda, khāsh, ka, kā.*

Is prepared from the cultivated plants TRIGONELLA FŒNUM-GRÆCUM, MEDICAGO SATIVA, and TRIFOLIUM RESUPINATUM; although in some parts of the country grasses are in profusion, no attempt to make hay from them is ever made, whereas the entire shrub GUNDELIA TOURNEFORTII is collected and stored, this after being stored becomes more like the crushed straws of wheat and barley, than our idea of what hay ought to be.

Hechī—the galled fruit of PROSOPIS STEPHANIANA.
HEDGEHOG—ERINACEUS species.

Helianthus tuberosus, *Linn.* COMPOSITÆ.

The Jerusalem-artichoke, the tubers are called *seb-i-zamīnī-angrez.* This is cultivated in gardens both at Herat and Meshad.

Helicophyllum crassifolium, *Engl.* AROIDEÆ.

Phanār. This Aroid was very common in the stony clayey soil round Tirpul. Its deep purple-coloured spathe was extremely handsome.

HEMLOCK—CONIUM MACULATUM.
HERBS, Herbage—*ālaf, samār, giā, giāgh.* Turkomani, *tarnak, targanak.*
HERMODACTYL—

The corms of MERENDERA PERSICA are collected and imported into Meshad, called *shambalīt*; these may be one of the forms of the Hermodactyl of the ancients.

Heth—Baluchi for a goat.

Hīl—هيل—or *hāl*—هال—the fruit of ELETTARIA CARDAMOMUM.

Hīl-i-kōza, or *hīl-i-gōza*—هيل گوزه—the skins of the Cardomum fruits.

HILL—*ko*, *kōh*; hillock—*kōhcha*.

HILL-CARROTS—ZOZIMIA ABSINTHIFOLIA.

HILL-PEACH—STOCKSIA BRAHUICA and LYCIUM BARBARUM.

Hīma—هيمه—firewood, fuel.

Hinduāna—هندوانه—*hinduānī*—the water-melon, CITRULLUS VULGARIS.

Hīng—هينگ—Hindustani for the gum-resin Asafœtida, FERULA FŒTIDA.

HOLLYHOCK—the flowers of the indigenous ALTHÆA HOHENACKERI and of the cultivated ALTHÆA LAVATERIÆFLORA resemble those of our garden cultivated plants extremely.

HONEY—*asāl*, *angabīn*, *anjabīn*, *mazj*; Kuram Valley, *gabīna*, *bagīna*.

Was a rare commodity over the most of the country I traversed; it is said to be imported into Herat from the forest districts, and that bees were common in the forests of the tree Honeysuckle, LONICERA NUMMULARIFOLIA.

HONEY-GRASS—ARISTIDA PLUMOSA.

HONEY-SUCKLE—LONICERA NUMMULARIFOLIA.

HOP—the aggregate fruits of HUMULUS LUPULUS.

Hordeum Caput-Medusæ, *Benth. et Hook. fil.* GRAMINEÆ.

Considered a valuable fodder grass.

Hordeum hexastichum, *Linn.* GRAMINEÆ

Barley, *jao-shīrīn*, or *jow-shīrīn*. This species of barley, with the huskless variety, are alone used as food by the people. As this takes fully four months to ripen, it never can be grown as a second crop. It is usually considered as too valuable to be ordinarily cut down and given as a green fodder to cattle. The crushed straw after the removal of the grain is stacked as a winter fodder.

Near Maimana the huskless variety is cultivated, called *jao-makaī*, or the barley from Mecca ; it is, however, not a very common grain.

Hordeum ithaburense, *Boiss.* GRAMINEÆ.

The barley of the desert. This grass by the nomads is looked upon as wild barley, and goes by the name *jao-dashtī;* it resembles in its habit the growth of barley so closely, that the natives believe it to be so. It is found occurring throughout the Badghis, forming a portion of the vegetation on the rolling downs, usually growing in isolated clumps to a height of nearly three feet, these clumps look as if patches of the country had come under cultivation.

Hordeum vulgare, *Linn.* GRAMINEÆ.

The harsh or bitter barley, *jao-tursh.* This barley is considered too harsh to the taste and too heating for the blood to allow of its being employed in food. It is therefore cultivated solely to be given to cattle; usually the crop is cut green, and this mixed with the crushed straws makes the latter more palatable. All green-cut fodder, whether of wheat or any barley, is ordinarily called *tursh* or *trush*, the name for this barley having spread to any corn cut in a green state. This is one of the few grains that can be looked upon as ever being grown as a second crop, as it ripens in three months ; except as a fodder for cattle this barley is always spoken of with great contempt.

HORSE—*asp.*

In Afghanistan the horse is primarily employed for the conveyance of man, and nextly for all field work, such as ploughing, and conveying in the harvest. For carrying heavy loads for long distances camels are employed. At Karaolkhana, Marachak, and Ab-i-goshan in February 1885 we saw numerous pairs of horses ploughing and preparing the land for a wheat crop. For conveying goods in these parts they have a long-bodied stumpy horse, not quite a pony, which is called a *yābu;* these are excellent animals for riding a sort of jog-trot on long journeys, and it is wonderful what a weight they will carry in addition to the rider. At Kushk we saw several herds of ordinary ponies, which we were told were bred there for sale to traders.

House—*khāna, dān.*

With scarcely an exception all the houses of this part of the country are built of sun-dried bricks, and the roofs are domed with the same material. This is solely due to the want of fuel for burning bricks, and the absence of timber for the purposes of roofing. To see a house with a flat roof is exceptional, and the natives say that they are always dangerous to live in owing to the havoc that white ants play with any timber that may be employed in the roofing. These domed houses have no windows, only an opening on one side in the top of the roof for the exit of smoke, and a small narrow door. They are very comfortable to live in during winter, but quite unbearable in summer. The houses for cattle are all built of basket work—wattle—dabbed over with clay.

Huka—حقه—the technical term for that portion of the pipe which holds the water through which the smoke is drawn; ordinarily a pipe for smoking tobacco.

Hulu—حلو—the Teheran term for the peach, the fruit of Prunus persica; Arabic for sweet, pleasant to the eye or taste.

Hum—هوم—*huma, um, uma*—Ephedra pachyclada and other species. The same name is also applied in Baluchistan to Periploca aphylla, where both plants are common.

Hum-i-bandak—[the knotted or jointed Ephedra], Ephedra foliata.

Humulus Lupulus, *Linn.* Urticaceæ.

The Hop, grows in enormous quantities in Mazanderan, the Caspian province of Persia, in apparently an indigenous condition. I believe it would flourish if cared for in the Kohistan range and to the east of Herat, also round

Kandahar, certainly in the Kuram Valley in the deep gorges of those high mountains, where there is a sufficiency of moisture without an excess as in Kashmir. The indigenous Hop of Mazanderan even now might be made a very valuable article of commerce from Herat to India, and its cultivation a source of great profit to that country. Round Quetta I feel sure that there are localities where the cultivation of the Hop might be looked forward to with success.

Hyssopus, *species.* LABIATÆ.

A Hyssop, called *zufa.*

Hystrix, *species.*

The Porcupine, *khār-a-kash, khār-a-kosh, khār-pusht, khār-pōsht, khāl-pōsh, shōgle, sīkh-aōl.* A good specimen of this from that country would be valued.

IBEX—CAPRA SIBIRICA. The male *taka,* the female *bōz-i-kōhī* or *burz-i-kōhī.*

Īblīs—ابلیس—the devil.

Ībrān—the extract obtained from the root of BERBERIS species, employed as a dye stuff and medicine.

Ībrang—يبرنگ—root, origin of anything.

ICE—*yakh.*

In Persia ice is collected during winter by spreading out water during the night in a shallow trench, between a couple of high walls; these places where the ice is thus collected are called *chādar-shab* [night-sheet]; in the morning the ice is lifted and stored in pits.

Igir—اگر—the rhizomes of ACORUS CALAMUS.

Ilk—الك—*alk*—علك—a gum-resin as of BOSWELLIA species. The true resin of a Pine or Juniper.

INCENSE—

The following substances are employed in Persia as incense, or are exported to be so employed:—Galbanum, the gum-resin of FERULA GALBANIFLUA; the root of the true Sumbul, FERULA SUMBUL, imported from Central Asia; and as a substitute, the root of Ferula suaveolens; the leaves of the tree Juniper, Juniperus excelsa, *ārcha, orsa;* the twigs of Ephedra pachyclada, *hum;* and a substance called *zuft,* said to be obtained from a cultivated tree.

Indar-latīb, a corruption for *andar-ultīb,* the root-stock of Valeriana wallichiana.

Indian corn—Maize, Zea Mays.

Indian hemp—Cannabis sativa.

Indigo—the dye stuff obtained from Indigofera tinctoria.

Indigofera tinctoria, *Linn.* Leguminosæ.

Yields the dye stuff Indigo, *nīl,* which is largely imported from India, either overland or by the Persian Gulf.

Ipomæa, *species* (?).

A cultivated Convolvulus is called *nīla-fār,* and the seeds *tukhm-i-gul;* the latter are employed in medicine.

Iris, *species.* Irideæ.

The rhizome of an Iris is called *ōrisā, ōrisīā,* brought from Bijnort to Meshad, is used as a scent and employed in medicine. *Susan* is a name for either a Lily or an Iris. The Orris root of commerce is derived from several species of Iris; according to Flückiger and Hanbury, that of Iris florentina, *Linn.,* being the rarest.

Iron—*āhan, āhun*—is imported very largely through Persia into this district.

Irrigation—

The water for irrigating fields, orchards, &c., in the Hari-rud Valley was all got by cutting channels from the river; in Khorasan by underground channels leading from spring heads. These underground channels were called *kārez* or *kharez.* I never saw water being raised from wells for irrigation, nor did I ever see a Persian wheel, or any other mechanism for raising water.

Isbarg, isbarag—the flowers of Delphinium Zalil.

Isfand—اسفند—the wild Rue, Peganum Harmala.

Ishkam—اشکم—the belly, abdomen.

Ishkhār—اشخار—*khār*—خار—Barilla; an impure carbonate of potash and soda.

Ishkī—اشکی—vinegar, acid, sour.

Ishkīn—the Turkoman term for RHEUM TATARICUM.

Ishkhun—اشخون—a dock, RUMEX species.

Ishlan, ishlun, ishlun-i-bandak—ANABASIS ERIOPODA.

Ishnan—اشنان—Arabic for potash.

Ispaghul—اسپغول—the seed of a PLANTAGO species.

Ispand—اسپند—*ispanthan*, PEGANUM HARMALA.

Isparak—اسپرک—the flowers of DELPHINIUM ZALIL.

Ispārza—the seeds of a species of PLANTAGO employed in medicine.

Isthag—the Baluchi for steel, for striking a light with.

ITALIAN-MILLET — SETARIA ITALICA (PENNISETUM ITALICUM).

Jad—جد—or *jid*—gum, resin, the exudation of a juice from a plant.

JAGDALAK, *jigdalik*.

A pass in Eastern Afghanistan half-way between Jelalabad and Cabul, so named from the ELÆAGNUS, or *jigda*, having once been numerous there.

Jāgī-shāk—[earth roots], the tubers that form on the roots of CARUM BULBOCASTANUM.

Jāīphal—جايپهل—Hindustani for the Nutmeg, the kernal of MYRISTICA FRAGRANS.

Jalīl—DELPHINIUM ZALIL.

Jangal—جنگل—a desert place; a country overrun with wood, or with thickets; a jungle.

Jao, or *jow*—جو—barley, HORDEUM species.

Jao-dāna—جودانه—barley pickles; the term applied to small nodes on a stick, after the removal of the bark.

A shrub in the Badghis celebrated for yielding such sticks; they are much sought after.

Jao-dashtī—[wild barley], HORDEUM ITHABURENSE.

Jao-makaī—جومكي—[Mecca barley]. A form of barley, HORDEUM, that produces huskless grain.

Jao-shīrīn — جوشيرين — [sweet barley], HORDEUM HEXASTICHUM.

Jao-tak-tak—rye, SECALE CEREALE.

Jao-tursh—جوترش—[bitter or harsh tasted barley], HORDEUM VULGARE.

Jaoār— جوار —*jowār*—Hindustani for SORGHUM VULGARE.

Jaohar—جوهر—a jewel, Aniline dyes in crystals.

Jaondar, gaodar—گودر—the wild oat, AVENA FATUA.

Jaor, jaorī, jaoārī, jāoras—

Names equally applied to ZEA MAYS and SORGHUM VULGARE. To distinguish these the former is spoken of as *jaorī-khurdanī*, and the latter as *jaorī-turkomanī.*

Jāo-shīr—جاوشير—the gum-resin Galbanum, yielded by FERULA GALBANIFLUA.

Jaōz, jouz—جوز—a nut; the walnut.

Jaur—a corruption for *zahr*, poison; Baluchi for the Oleander, NERIUM ODORUM.

Jāwars, jāwaras— جاورس —*jāoras*—the greater millet, SORGHUM VULGARE.

JERUSALEM ARTICHOKE—HELIANTHUS TUBEROSUS.

Jhāg—the tubers on the root of SCORZONERA species.

Jidwār—جدوار—*jizwār*, the tubers of Zedoary, CURCUMA ZEDOARIA.

Jigda—the ELÆAGNUS and its fruit.

Jing-jing-bānu, jinjak—the galled pods of PROSOPIS STEPHANIANA.

Jīr, jīr-khār—the barberry, BERBERIS VULGARIS.

Jīra—زيره—Cumin, CUMINUM CYMANUM.

Jīra-shāk, jīrī-shāk—[Carum-roots], the tubers of CARUM BULBOCASTANUM.

Jizwār—Zedoary, the tubers of CURCUMA ZEDOARIA.

Joanī—جواني—CARUM COPTICUM.

Jouz—جوز—a nut; the marrow or centre of anything; a walnut, the fruit of JUGLANS REGIA.

Jouz-i-bōīa—جوزبويه—the Nutmeg, the kernel of MYRISTICA FRAGRANS. Also pronounced *jouz-i-bīā.*

Jowain—the fruit of CARUM COPTICUM.

Jowār—Punjabi for SORGHUM VULGARE.

JUDAS TREE—CERCIS SILIQUASTRUM.

Jughal—ژغال—*jughāl,* charcoal.

Juglans regia, *Linn.* JUGLANDEÆ.

The Walnut, the fruit of the cultivated tree, *jouz, jaōz, gōz, chār-maghz.* This tree is extensively cultivated at Maimana, from whence most of the walnuts that come to these parts are imported. There are a few trees at Herat, and at Bezd are some large groves of very fine trees, with the orchards full of numerous smaller ones. The tree is said to be indigenous in the Kohistan range; it was so in the Kuram Valley of Afghanistan, where the indigenous tree and its fruits were called *matākh, metākh, whāgar,* the cultivated tree and its fruit having the ordinary Persian names; specimens of the fruit of the indigenous tree were collected and forwarded to the museum at Kew. The *Flora of British India,* by an oversight I suppose, does not include Afghanistan in the extent of the distribution of this tree. The chief value of the cultivated tree lies in its fruit, which, in addition to its being locally consumed, is largely exported to India and Turkistan. Except for medicinal use the oil is not extracted from the nut. The wood is highly valued for the manufacture of the large wooden dishes and platters so commonly in use amongst the people. From the indigenous tree in Kohistan are imported large quantities of the bark for dyeing with, for which purpose the rind of the nuts is also used. The bark, *pōst-i-jouz;* the dye, *rang-i-pōst-i-jouz;* the oil, *rōghan-i-jouz.*

JUICE—*shīra, rob, rōb, rub.*

JUJUBE—*ūnāb,* the fruit of ZIZYPHUS VULGARIS.

Juncus maritimus, *Linn.* JUNCACEÆ.

The rush, *chāb.*

JUNGLE, *jungal*—a thicket; a country overrun with wood, reeds, or long grass.

Juniperus excelsa, *Bieb.* CONIFERÆ.

The tree juniper—*ārcha, ors, ōrs, orsa, āoras, ardij.* A large tree, not tall, but massive in bulk; occurring on the ridges and the northern slopes of the Paropamisus range, and in Khorasan, at an altitude of 3000 feet and upwards. The ordinary large specimens measured from 15 to 20 feet in circumference, branching close to the ground, and did not exceed from 20 to 25 feet in height; the lowest branches spreading out almost at right angles, and nearly as large in circumference as the tree itself. Usually the stem of the tree was much larger at the point of throwing off its branches than below it. The wood is employed for beams for roofing, it being considered as proof against the inroads of white ants. At Kala-Naratu there are beams still to the fore, in excellent preservation, which are supposed to have been put up with the building some 200 years ago. The best charcoal for iron and goldsmiths' work is made from this wood, and it is employed in the manufacture of many farm implements, as harrows and such like. The leaves are used as incense in Khorasan.

K—ک. The letter *k* added to a word in Persian gives the diminutive.

Ka—كه—*kā*—كاه—straw, hay, grass, the crushed straw of the various cereals; *bhusa* of Hindustan.

Kabitka—

The houses, huts, or tents of the nomads of Turkistan, made of a wooden frame-work covered with felt. The whole of the woodwork is usually of willow, except the axle on the top of the hut which receives the roof supports; this is, if of hard wood, usually of Mulberry.

Kabuda—كبوده—the Lombardy Poplar, POPULUS NIGRA.

Kachola—کچوله—*kachula*—a term applied to the seeds of STRYCHNOS NUX-VOMICA, and to the shrub and fruit of DATURA STRAMONIUM.

Kachur—کچور—Zedoary, the tubers of Curcuma Zedoaria.

The long tubers are called *nar-kachur*, and the round ones *māda-kachur.*

Kadu—کدو—a pumpkin, a gourd, the fruit of a Cucurbitaceous plant.

Kaf—کف—foam, froth.

Kaf-i-dariā—کف دریا—[The foam of the waters]. Cuttle-bone, the internal calcareous skeleton of Sepia species.

Kāfila—قافله—a caravan.

Kāhī—کاهي—greenness, grassy.

Kāh-reiva, kāh-ruba—کاهربا—[siezer of straw]. Amber.

Kāh-wan [bush-straw], *kāh-warg, kow-warg, kā-warg* [leaf-straw]. The Caper plant, Capparis spinosa.

Kāhu—کاهو—Lettuce, Lactuca sativa.

Kaimāg—Cream.

Kajak—کژک—any kind of hook.

Kajāk—a small, but very troublesome horse-fly, Tachina species.

Kajāoa—کجاوه—*kadjaoa*—a pannier made of wood, employed with camels, mules, or ponies.

Kājīra— کاجیره —*kājura*—Safflower, Carthamus tinctorius.

Kāk—کاک—anything dried, as meat, biscuit, bread; the dried flesh of melons, Cucumis Melo.

Kākrī-lōg—[the Kakar-people]. A nomad tribe of merchants belonging to the vicinity of Herat.

Kākutī—کاکوتي—the herb Ziziphora tenuior.

Kalak—کلک—a Cabul term for the fibre of cotton, Gossypium herbaceum.

Kalam, or *kalm*—قلم—a pen, a graft, an annual shoot, a slip.

Kalamī, or *kalmī*—قلمي—pen-like, applied technically to a crystalline Nitre and Borax. The name for an ERIANTHUS species, from which pens are made.

Kalamfur, for *karanful*—Turkomani for cloves, the flower buds of EUGENIA CARYOPHYLLATA.

Kalampur, kalanfur—Turkomani for red-pepper, CAPSICUM species.

Kalaī—قلعي—tin.

Kalān—كلان—great, large, expanded.

Kalāt—كلات—a fort.

Kalkilī—the cup-bearing Ferula, FERULA OOPODA.

Kalpa—the honeysuckle, LONICERA NUMMULARIX-FOLIA.

Kalpura—STACHYS TRINERVIS.

Kalur—كلور—gleanings of corn.

Kalura—ROSA BERBERIFOLIA.

Kām—كام—desire, wish.

Kāma—كامه—a fragrant herb; generic term for the Ferulæ.

Kamāī—كمائي—a general term for the Ferulæ, and large Umbelliferæ; name of a stinking herb.

Kamān—كمان—a bow, a cotton cleaner.

Kamānī—كماني—bowed, bent.

Kamar—كمر—the loins, the waist.

Kambul—tubers of SCORZONERA species.

Kan—كن—a tree, a place full of trees. To dig, tear out, in composition a digger, as *gōr-kan*, the Badger, or [grave-digger.]

Kān—كان– a mine, a quarry, a shaft, a dry well.

Kanā—كنا—hardness.

Kānī—كاني—a mineral.

Kanāt—كنات—the sides of a tent, or of a *kabitka*.

Kanawez—a country-made cotton cloth.

Kand—كند—*kānd*—كاند—loaf sugar, the testicle, a tuberous root.

Kand-a-shīra-ghī—[sugar from syrup]. Loaf sugar, made from grapes.

Kandal—the gum-resin Ammoniacum, or the plant yielding it. Dorema Ammoniacum.

Kandalāsh—کندلاش—*kandal-lāsh* [a putrid carcase]. A stinking kind of herb.

Kandar—(Baluchī) the grass Æluropus littoralis.

Kandīr—a cloth made of fibre.

Kandur—the grass Erianthus Ravennæ.

Kandur—کندر—(Arabic) the gum-resin Olibanum, Frankincense, yielded by Boswellia species. Mastich, the gum-resin of Pistacia species.

Kandur-i-rumī—کندر رومی—*kundar-i-rumī*, the true Mastich, yielded by Pistacia Lentiscus.

Kangar—کنگر—the shrub Gundelia Tournefortii; the Artichoke, Cynara Scolymus.

Kangnī—کنگنی—Hindustani for Setaria italica.

Kanjak—کنجک—in these parts is Pistacia Terebinthus var. mutica; is also a name applied to an Elm, Ulmus species.

Kanjīd—کنجید—*kanjīt*—Sesamum indicum.

Kanoucha—*kanouncha*. The seeds of a Labiate, probably of a Salvia, employed in medicine.

Kao, kow—Punjabi for Olea europea the indigenous Olive.

Kapās—کپاس—the Cotton plant, Gossypium herbaceum.

Kap-o-chīst—the Turnsole, Crozophora tinctoria, so called on the Helmand.

Kār—کار—work, labor.

Kār-o-zera—the fruit of a tree said to be cultivated at Meshad and Teheran, employed as a purgative.

Kār—قار—pitch, tar.

Karakulī—

Belonging to a district of Bokhara; the name for a fine kind of kid-skin that comes from that country, the fur of which is highly valued.

Karam—کرم—the Cabbage, BRASSICA OLERACEA.

Karanful—قرنفل—Cloves, the flower-buds of EUGENIA CARYOPHYLLATA.

By the Turkomans corrupted to *kalamfur*, and by them *karanful* is understood to mean red pepper, the fruit of CAPSICUM species.

Karbās—كرباس—in Arabic means fine linen, in these parts a very ordinary country-woven cotton material.

Kardan—کردن—to do, to act.

Kārez—كاريز—and *kharez*—کهریز—an underground conduit for water.

Karmāk—PRUNUS CALYCOSUS.

Karmak—کرمک—a herb with which they wash.

Karmīz—کرمز—[the produce of an insect], COCHINEAL.

Karuna—SOPHORA PACHYCARPA.

Karut—قروت—*kurut*, *māstwā*, *māstāwa*.

Is dried Oxygal, the dried curd from sour buttermilk. Buttermilk is made sour by adding to it some *karut*, or the dregs of some sour buttermilk; it is then placed over the fire until half the liquid has evaporated, and then strained and compressed with the hands, or placed under a weight, until the whole of the whey is pressed out; the whey so removed is called *āo-karut*, and the compressed curd, which is now exposed in pieces to the heat of the sun to be dried, is called *karut*. It is usually to be seen in pieces of an irregular shape, the size of the fist, of a grey brown colour, and of an apparently sandy consistency, covered with finger marks, the impressions left on it in trying to squeeze out the last drops of whey; in consistency it is much harder than any ordinary cheese. Amongst the nomads, and in all households wherever butter is made, there *karut* is largely prepared, and by them traded with throughout the whole country. It is excessively acid, and tastes as if it were made of very acid vinegar. It is largely used in the diet of the people. A piece of it is broken into a basin of milk, and the milk is drunk when it has become sour, which it does in a few minutes; or a small piece is mixed in water, and this acidulated water is drunk with the food; most of the meat stews have *karut* thrown into them to aid in softening the usually tough meat of these parts; or it is eaten as a condiment along with bread, as we do cheese among the very poor. My first experience of *karut* was in the Kuram Valley, where I found the nomads cutting out great slabs of bark from the Deodar trees. The *karut* was placed between two slabs of bark and a large stone on the top to press out the whey. It was a long time before I could find out who cut these slabs of bark out of the trees, disfiguring the splendid trees so dreadfully, or for what purpose the bark could be used. Dried Oxygal, or *karut*, is imported into India from Afghanistan, and is usually considered cheese by Europeans, but that is in all probability because they have never used, or eaten it. Had they ever tried to eat a piece of it the experiment would at once have shown to them how very different it is from cheese. The term dried Oxygal, for *karut*. will be found in Richardson's *Persian Dictionary*, revised by Francis Johnson, 1829, and in my opinion is the correct meaning, for certainly *karut* is not cheese under the ordinary acceptation of that term in Great Britain.

Kās—کاس—a large flat dish or platter.

Kās-i-chob—کاس‌چوب—a wooden platter, usually made of willow or walnut.

Kash—کش—in composition means drawing, bearing, carrying, as *khār-a-kash*, the bearer of thorns, the Porcupine.

Kashaf—کشف—*kashif*—a tortoise, TESTUDO species.

Kashafa—کشفه—a flat wooden dish.

Kāshghar—کاشغر—*kāshkar*, a variety of LAGENARIA VULGARIS. A town of Central Asia.

Kashnī, kashnīj—کشنیج—*kāsnī, kashnīz*—کشنیز—the Endive, CICHORIUM ENDIVIA, and Chicory, CICHORIUM INTYBUS.

Kashnīz—کشنیز—this is also the name for the fruit of CORIANDRUM SATIVUM, Coriander.

Kashta—کشته—*kishta*—dried fruit; usually applied to the dried flesh of the Apricot, PRUNUS ARMENI-

ACACIA; and the same term is applied whether the fruit was dried in a ripe, or unripe state.

Kashta-seb-i-tursh—[dried sour apples], fruit of PYRUS MALUS.

Kashta-shīrīn—the sweet almonds of the Nectarine, variety of PRUNUS PERSICA.

Kāshuk—قاشق—*kāshik*—a spoon.

Kāsnī—كاسني—CICHORIUM ENDIVIA and CICHORIUM INTYBUS.

Kāt-a-gulābī—كات گلابي—Catechu, obtained from ACACIA CATECHU and ARECA CATECHU.

Katān—كتان—*katun*—linen cloth made from the fibre of LINUM USITATISSIMUM; also applied to the cloth made from the fibre of APOCYNUM VENETUM.

Kātar—قاطر—a mule.

Katīra—كتيره—a kind of gum Tragacanth, obtained from the shrub ASTRAGALUS HERATENSIS and other species.

Kāt-karounja—(Hindustanī)—كات كرنجه—the seeds of CÆSALPINIA BONDUCELLA.

Kawa—كوه—*kuwa*—the shell of the cotton pod, the seed vessel of any plant, the cocoon of the silk-worm, the capsules of cotton employed to make charcoal.

Kawaj—كوج—gum.

Kawar—كور—a place full of rubbish, and deserted by its inhabitants; or, in other words, where the Caper plant, CAPPARIS SPINOSA is found in luxuriance, a name for the Caper plant.

Kāwarg, kāwar-gīā—كورگيا—[leaf-fodder] *kawark*—كورك—*kawarz*—كورز—*kawarza*—كورزه—the Caper plant, CAPPARIS SPINOSA.

Kawhai—a plant employed in medicine.

Kazb—كزب—the refuse of the seed after expressing the oil, Oil-cake.

Kech, kich, kīch, the shrub ZYGOPHYLLUM ATRIPLICIOIDES.

Kechī—the galled fruit of PROSOPIS STEPHANIANA.

Kema, kāma—کامه—*kamāī*—کمای—the general term for the several large Ferulæ, and Umbelliferæ.

Kema-kōhī, FERULA OVINA.
Kema-i-asp, or *asp-i-kema,* DOREMA GLABRUM.
Angōza-kema, FERULA FŒTIDA.
Bādra-kema, FERULA GALBANIFLUA.
Kāndal-kema, DOREMA AMMONIACUM.
Kema-bīrzad, FERULA GALBANIFLUA.

Kep—the bars of wood that act as levers in bending the poles to the proper curves required for the roof of the *kabitka.*

KERNEL—*maghz, jouz.*

Khadmī, khatmī—the plants ALTHÆA HOHENACKERI, ALTHÆA LAVATERÆFLORA, ALTHÆA OFFICINALIS, and MALVA SYLVESTRIS.

Khāīa—خایه—an egg.

Khāīa-i-īblīs—خایهابلیس—[Devil's-eggs]. The seeds of CÆSALPINIA BONDUCELLA.

Khair—ALTHÆA LAVATERÆFLORA.

Khāk—خاک—earth, soil, mould.

Khāk-shī—خاکشي—*khāk-shīr*—the seeds of SISYMBRIUM SOPHIA, and of some other CRUCIFERÆ employed in medicine.

Khal (Baluchī)—flint.

Khāl-pōsh, a corruption for *khār-pōsh,* [thorny-back]. The Porcupine, HYSTRIX species.

Khāl-pōsht-ak [the small thorny-backed one]. The Hedgehog, ERINACEUS species.

Khām — خام — *khāmak* — خامک — raw, unworked, applied to the thread of cotton, silk, or wool when not finished.

Khāna—خانه—a house, a dwelling, a tent, a place for putting things.

Khanzīr—خنزیر—a pig, SUS SCROFA.

Khar—خر—a donkey, the domestic ass.

Khar-ās—خراس—[a mill worked by a donkey], has come to be applied to an oil-mill.

Khar-buz —خربز— *kharbuza*— خربوزه —*kharbuze*— [donkey's snout]. The Melon, the fruit of CUCUMIS MELO.

Kharez—کهریز—an underground conduit for water.

Khar-gōsh—خرگوش—[donkey-eared]. A hare, LEPUS species.

Khar-khushta—[donkey's-delight]. The Colocynth, CITRULLUS COLOCYNTHIS.

Khar-whang-khush—[the shrub sweet to the donkey] PTEROPYRUM AUCHERI.

Kkar-zahra—خرزهره—[donkey's poison]. NERIUM ODORUM, the Oleander.

Khār— خار—a thorn, a prickle, applied to ALHAGI CAMELORUM and PROSOPIS STEPHANIANA as *the* thorn.

Khār-a-bīa, or *khar-a-bōīa*—خاربویا—[the scented thorn], PSAMMOGETON SETIFOLIUM.

Khār-a-kash or *khār-a-kosh* [the thorn-bearer]. Porcupine, HYSTRIX species.

Khār-a-zīr, or *khār-a-zīl*—[the thorn under]. This is the name of LYCIUM BARBARUM, but it is equally applicable as far as the meaning goes to BERBERIS VULGARIS, the Barberry.

Khār-i-buz—جاربز—[the goat's thorn], ALHAGI CAMELORUM.

Khār-i-jinjak—[the thorny *jinjak*], PROSOPIS STEPHANIANA.

Khār-pōsht, *khār-pusht*—خارپشت—[thorny-backed]. The Porcupine, HYSTRIX species.

Khār-pusht-ak, *khār-pōsht-ak* — [the little thorny-backed one]. The Hedgehog, ERINACEUS species.

Khār—خار—*ishkhār*—اشخار—Barilla, a coarse carbonate of potash and soda.

Kharez—کهريز—and *kārez*—کاريز—a conduit for water, the greater part of which is usually under ground.

Kharus—خروس—a cock, the male of the domestic fowl.

Khāsh—خاش—a bundle of hay, the grass ERIANTHUS RAVENNÆ.

Khāshāk—خاشاک—a wand, a stick, chips, leaves.

Khāshk—the grass ERIANTHUS RAVENNÆ.

Khash-khāsh — خشخاش — the seeds of the Opium Poppy, PAPAVER SOMNIFERUM.

Khatmī — خطمي — *khadmī* — the plants ALTHÆA HOHENACKERI, ALTHÆA LAVATERÆFLORA, ALTHÆA OFFICINALIS, and MALVA SYLVESTRIS.

Kheru—ALTHÆA LAVATERÆFLORA.

Khesht, or *khisht* — خشت — *kīsht* — کيشت — a brick, a sweetmeat, curdled milk, anything that has become hardened, Manna.

Khīār—خيار—a Cucumber, CUCUMIS SATIVUS.

Khīr—(Baluchistan), the milky juice of EUPHORBIA CHEIROLEPIS.

Khirs—خرس—a bear—*khirsa*—a red bear, URSUS species.

Khīz, or *khez*—خيز—a spring of water.

Khōbānī, khubānī—خوباني—in Persia fried apricots; in the Peshawur trade the dried flesh of apricots as imported into India. In Persia and Afghanistan the term *kashta* is employed to mean the dried flesh of apricots.

Khōl—خول—an enlarged gland.

Khōl-a-kōknār—the seed-vessel of the Opium Poppy, PAPAVER SOMNIFERUM.

Khōra, khura—خره—خوره—

A white ant, TERMES species; a disease, a mound, a dome, a domed covering that is placed over the exposed cut root-stock of the Asafœtida plant to protect it from the sun's heat whilst exuding the gum-resin; fruit stones.

Khōra-gaz—[The mound Tamarix].

TAMARIX ARTICULATA in the valley of the Helmand was usually to be noticed growing on mounds or hillocks, as if the ground between the trees had been washed away, only leaving that immediately surrounding each tree.

Khōra-kema — [the dome (covered) Asafœtida], FERULA FŒTIDA.

Khōrāk, khurāk—خوراک—food; the pods of GOSSYPIUM HERBACEUM, the cotton plant, before they are ripe, given as fodder to cattle.

Khōrd, khurd—خورد—meat, victuals, eating.

Khōrdan, khurdan—خوردن—to eat.

Khōrdanī, khurdanī — خوردني — edible; *jaorī-khurdanī*, Indian Corn, ZEA MAYS.

Khormā, khurmā—خرما—Dates, the fruit of PHŒNIX DACTYLIFERA.

Khōrne, khurne—[edible], as *khurne-kema* [the edible Ferula], so called owing to the rachis of the flowering stem of FERULA FŒTIDA being eaten and considered a delicacy.

Khoresh, koresh—EPHEDRA PACHYCLADA.

Khourī—the local name in Kohistan for Alum.

Khūk—خوک—a pig, SUS SCROFA.

Khul—کحل—dark, black; the black bear, URSUS species.

Khun—خون—Blood.

Khun-jada—خون جده—[blood-gum]. The gum resin, a sort of Mastich, of PISTACIA TEREBINTHUS, var. MUTICA, and of PISTACIA VERA.

Khurd—خورد—little, minute, short; also meat, victuals, eating.

Khurda-farōsh—خرده فروش—[a seller of smallwares], a pedlar, a druggist.

Khush—خوش—good, sweet, nice, happy, pleasant.

Khushta—delight, pleasure.

Khushk—خشک—dry, withered.

Khushk-targ—[the dry shrub]. The name at Koin for EPHEDRA PACHYCLADA, and other species.

Kīāgh—کیاغ—grass, herbs.

Kīāgh-dāna-dār—کیاغ دانه دار—[the grain-bearing grass]. The wild Oat, AVENA FATUA.

Kīāk—Darnel-grass, LOLIUM TEMULENTUM, also POLYPOGON LITTORALE.

Kīch, kech—ZYGOPHYLLUM ATRIPLICIOIDES.

Kilkī, kalkilī—the cup-bearing FERULA, FERULA OOPODA.

Kīmāk—کیماک—*kaimāg*—cream.

Kinjad, kinjada—کنجده—*khunjada*—خونجده—[blood-gum]. A gum employed in dressing wounds, the Mastich of PISTACIA VERA, and of PISTACIA TEREBINTHUS, var. MUTICA.

Kinjak—کنجک—the tree PISTACIA TEREBINTHUS, var. MUTICA.

Kīōs—کیوس—curved, a crooked stick.

Kīōs-a-gī—[bent-grass]. The greater Millet, SORGHUM VULGARE. This is certainly the best name as yet for this Millet, seeing it is an introduced plant.

Kīrās—کیراس—

This is an Arabic name for the sweet white-heart cherry, from the Greek; hence comes the Persian term, carried through Afghanistan on to Kashmir *gīlās,* PRUNUS CERASUS, var.

Kirī—A general term for the TAMARIX, in Baluchistan, and on the Helmand.

Kirm—کرم—a worm, a caterpillar.

Kirm-pela—کرم پیله—the caterpillar of the silk-worm moth.

Kirta—کرته—the grass ERIANTHUS RAVENNÆ; the bog-rush; a shrub brooms are made of.

Kīrtag, kīrthag—the grass Eragrostis cynosuroides.

Kīsa, kesa—کیسه—*kīse*—a purse, a pocket; applied to the enormous, soft, hollow, flabby galls of the Elm, Ulmus species.

Kishmish—کشمش—raisins, the dried fruit of Vitis vinifera. There are two well-marked kinds in the trade identified by their colour, the red *surkh*, and the green *sabz*.

Kishnīj—کشنیج—Cichorium Endivia and Cichorium Intybus; a blue flower.

Kīsht—کیشت—Sweet milk curdled, the curds of milk, a brick, anything hard, Manna.

Koār—کوار—*koāra*—کواره—a basket.

Ko—که—*kōh*—کوه—a hill, a mountain.

Kōha—کوهه—a hillock, a knoll; the Hawthorn, Cratægus Oxyacantha.

Kohar-barar—the shrub and nodes of Eremostachys labiosa, and Eremostachys Regaliana.

Kōhcha—کوهچه—*kōhja* — a hill, a hillock; the Hawthorn, Cratægus Oxyacantha.

Kōh-tōr—[the beloved of the mountain], the hill peach, the Baluchistan and Helmand name for Stocksia brahuica and Lycium barbarum.

Kōkalak—کوکلک—the pod which contains the cotton before it is ripe.

Kōkh—کوخ—a house without a window, a small hut of reeds.

Kōkh-i-pela—the cocoon of the silk-worm.

Kōknār—کوکنار—the Opium Poppy, Papaver somniferum.

Kōlak—کولک—a dish in which women keep their cotton that is prepared ready for spinning.

Kōm, kum—کم—*kōn*—the shrub Astragalus heratensis, and another species, that yield a form of gum Tragacanth.

Kōnda—fuel; more correctly fuel consisting of dry cow-dung.

Kōr—کور—blind.

Kōr-mār—کورمار—[blind-snake]. Applied to the Lizard, OPHISAURUS APUS, and to others.

Kōresh—EPHEDRA PACHYCLADA.

Kors—قرص—a round ball of paste, or medicine; the sun's orb; the moon at full.

Kors-i-gurba, or *kos-i-gurba*—[cat-nuts]. Tubers of CARUM species.

Kors-i-kamar—[nuts for the loins]. The great orbicular seeds of ENTADA species.

Kow-warg—the Caper plant, CAPPARIS SPINOSA.

Kōza—کوزه—*gōza*—cotton as collected from the shrub.

Kōza-panba—کوزه پنبه—or *kōza-pamba*—cotton-pods, the pods of GOSSYPIUM HERBACEUM.

Kulcha—the roasted grain of CICER ARIETINUM, carried by travellers as food on their journeys.

Kulfa, *kalpa*—the Honeysuckle, LONICERA NUMMULARIFOLIA.

Kundār—Turki for the shrub APOCYNUM VENETUM.

Kundar—کندر—*kandur*—Mastich, or the gum-resins of the PISTACIAS.

Kundar-i-rumī, *kandur-i-rumī* — [Mastich from Turkey] true Mastich, imported from the West, yielded by PISTACIA LENTISCUS.

Kundarud—کندرود—Mastich, of PISTACIA LENTISCUS.

Kunderu—کندرو—in all probability a contraction and corruption for *khun-dārū*—خون دارو—[remedy for bleeding]. The Mastich, or gum-resin of PISTACIA VERA, and PISTACIA TEREBINTHUS, var. MUTICA.

Kunhalk—SMYRNIUM CORDIFOLIUM.

Kunjad, *kunjada* — کنجده — and *khun-jādā* — خونجده—[resin, for bleeding]. A gum-resin, a Mastich, the trees PISTACIA VERA, and PISTACIA TEREBINTHUS, var. MUTICA.

Kunjāra—کنجاره—the oil-cake, from cotton seed.

Kunjid — کنجد — *kunjit* — the Sesamum plant, Sesamum indicum, and its seed.

Kurg—کرك—*kurk*—the fine hairs of the goat's fleece combed out from the coarser hairs; and a fabric made of it.

Kurut — قروت — *karut* — the dried curd of sour butter-milk, dried Oxygal.

Kuschakewiczia turkestanica, *Regal et Smirnow.* Boragineæ.

Bajindāk.

Kuwa—کوه—*kawa*—the shell of the cotton pod, the seed-vessel of any plant, the cocoon of the silk-worm.

Laban—لبن—(Arabic) drinking; milk, gum, or any juice that exudes from a tree; *liban*, a brick, a tile.

Labān—لبان—*lubān* (Arabic). The breast, bosom, milk, Frankincense, Olibanum.

Labiatæ.

Bād-ranj-bōīa, or *bād-rang-bōīa* [the scented (remedy) for flatulent colic], the seeds of a labiate employed in medicine; *sātar*, a labiate strongly scented of Peppermint, employed in medicine; *ustakadus*, a labiate employed medicinally.

Lab-labu—لبلبو—*labu*—Beet, the root and herb of Beta vulgaris.

Labu—an Orobanche, collected for fodder in Baluchistan is so called, also a Balanophora.

Lac—Gum-lac, *lāk*.

Lāch—لاچ—a deception, a trick, a jest.

Lāch-pusht—may be for *lāk-pusht*, [hard-backed one]. The Tortoise, Testudo species.

Lactuca sativa, *Linn.* Compositæ.

The cultivated Lettuce, *kāhu*; commonly cultivated in gardens, much eaten as a pot-herb.

Lagenaria vulgaris, *Seringe.* Cucurbitaceæ.

The bottle gourd; this is commonly cultivated to be used as a vegetable. The larger fruits are employed to be made into water-holders *chilimī*, for the *huka*, and the smaller *nashwārī* are converted into bottles for holding snuff. The finest specimens of the last are said to be brought from Samarkand. A well-known variety comes from Central Asia, hence its name *kāshghar, kāshkar.*

Lahsan — لهسن — (Hindustanī) Garlic, Allium sativum.

Lājward—لاجورد—Lapis-lazuli.

Lak—لك—*lāk*—لاك—Lac, gum-lac, sealing-wax.

Lākh—لاخ—hard, a rock, a stone.

Lāk-pusht— لاكپشت —[hard-backed]. A Tortoise, Testudo species.

Lāl—لعل—a gem, a ruby, blood, red.

Lāla—لعله—a tulip, a poppy. By the Afghans the name for the Poppy only.

Lāla-dukhtar, *lāla-dakhtar* — لالەدختر — [the red daughter].

The poppies, Papaver dubium, Papaver pavoninum, also Rœmeria rhœdiflora. These are greatly admired by the Afghans and Persians, with Tulipa montana, for their bright-coloured flowers, which are certainly most attractive, in early spring, spread in great masses all over the plains.

Lāle—لالي—the Tulip, Tulipa montana; the bulbs, *gōlī-lāle.* The Afghans were very particular in the pronunciation of the words *lāla*, a poppy, and *lāle*, a tulip.

Landār—Codonocephalum Peacockianum.

Lang—لنگ—Lame, maimed, paralytic; *ling*, the leg, the lower limb from the thigh downwards.

Lang-ash — [producing paralysis]. Darnel - grass, Lolium temulentum. A kind of pea, though Lathyrus sativus was not so called.

Lapis-lazuli—*lājward.*

Lārag—a species of ANABASIS.
LARKSPUR (yellow)—DELPHINIUM ZALIL.
Lāsh—لاش—a dead body, a corpse.
Lasī—لسي—Hindustani for butter-milk.
Latīb, ūltīb, āltīb—musk-scented.

Lathyrus sativus, *Linn.* LEGUMINOSÆ.

The chickling vetch, *ādas* (?). Cultivated in fields above 3000 feet altitude, and not uncommon as a field weed at similar altitudes. It is said not to be injurious as a diet, but at the same time there seemed to be a general idea that some pea *langash* was injurious.

Latīm—لطيم—Musk, or any odour with which temples are perfumed.
LEAD—*surb*—is said to be collected at a place called Robinj, in the hills to the north of Kala-nao; white-lead — *murda-sang*; red-lead — *sīndur, sundur.*
LEAF—*barg, barag, warg, warag, wark, warak, balag, balak.*

Lens esculenta, *Mœnch.* LEGUMINOSÆ. (ERVUM LENS, *Linn.*)

The Lentil, *ādas, āda.* Is cultivated as a field crop at an altitude above 3000 feet, usually without irrigation, but then its success depends greatly upon the fall of dew.

Lepidium Draba, *Linn.* CRUCIFERÆ.

Hoary-cress, *bajindāk, bijindāk,* extremely common amongst corn, collected largely as a pot-herb.

Lepus tibetanus, *Waterhouse.* The Hare, *khargōsh.*

LETTUCE—LACTUCA SATIVA.
LIME—the fruit of CITRUS MEDICA, var.
LIME—*āhak,* made from limestone—*sang-āhak.*

At the north base of Mount Do Shakh, on the 5th August, I saw several lime-kilns. The ordinary mountain limestone was not being employed to make the lime from, although this range consists almost entirely of that formation, but it was being made from tufaceous limestone, of which there was any quantity in the stream-beds. This is the locality where all the lime required for Herat is obtained; as in addition to the presence of the tufaceous limestone there is an abundance of fuel for burning it.

Līmon—ليمون—the Lime, CITRUS MEDICA, var.

LINEN—the fabric made from the fibre of LINUM USITATISSIMUM.

Ling—لنگ—the lower limb, the leg from the thigh downwards.

Linum usitatissimum, *Linn.* LINEÆ.

Flax. The plant and seed, *zagher;* the fibre and cloth linen, *katan, katān, katun;* the oil of the seed, *rōghan-i-zagher.* This plant is not cultivated in any part of the country I traversed. It is cultivated in Turkistan for its seed for oil. The seeds are largely eaten in sweetmeats, and the oil employed both as a burning oil and in diet. The fibre is not collected. Much linen material is said to be imported from Russian territory.

LIQUORICE—the extract prepared from GLYCYRRHIZA GLABRA.

LITTLE—small, minute; *khurd, āj, chaka,* and the syllables *ak* and *cha* added to a word give the diminutive.

LIZARD—*sag-mār, kōr-mār.*

Lōbīa, lubīa—لوبيا—the French kidney, or haricot-bean, PHASEOLUS VULGARIS; under the name *lubia* may be looked for the bean of DOLICHOS LUBIA, also a cultivated plant.

Lōg—لوگ—(Hindustani) people, a race.

Lolium temulentum, *Linn.* GRAMINEÆ.

Darnel-grass. Scotch, Doits (imbecile); *kīāk, langash, mastakī, musung-dewāna, tak, harbang, zīwān.* A very common grass in wheat fields, the seed of which, when in quantity amongst wheat, is well known, as seen by the meanings to the above native names, to be productive of dizziness, stupor, inebriety, and vomiting. The flour of the wheat grown in the vicinity of Herat has the character of producing these ill-effects, from the great prevalence of this weed in the fields. When encamped at Tirpul, in May 1885, we had several cases of this poisoning amongst our camp followers. The best treatment to pursue under the circumstances is to relieve the stomach of all the food by a good hot-water emetic, and then clean the intestines by a larger dose of castor oil. In most of the cases vomiting always came on naturally. As far as I can judge, the poison only seems to affect some people. I treated several cases of the same poisoning in the Kuram Valley.

Lonicera nummularifolia, *Jaub. et Spach.* CAPRIFOLIACEÆ.

The Honeysuckle, *kalpa, kulfa;* the fruit, *dāna-chaka.* A common shrub in all the hilly districts, at an altitude above 3000 feet; in certain localities it forms forests on the mountain sides, and slopes that are free of rocks. The trees are few and distant from each other, like the trees in an English park; they do not average much above 20 feet in height, and the boll of the largest I measured was 5 feet in circumference at 6 feet from the ground. Considering the plant is usually a shrub, I believe such a tree as that I measured must have been of a very great age. The wood is highly valued for the manufacture of gun-rests *pāe,* being very light, and yet elastic and tough. The points of these rests are often mounted with the points of the horns of the Gazelle, or with steel. The timber seems to run hollow, as bees are said to commonly hive in this tree. Children are very fond of eating the berries.

LUBIA-BEAN—the bean of PHASEOLUS VULGARIS in these parts, and of DOLICHOS LUBIA in Egypt.

Lubia—لوبيا—the French or Haricot Bean, PHASEOLUS VULGARIS.

LUCERNE—Medick, MEDICAGO SATIVA.

Luf—a cloth made from the fibre of a plant in Yarkand, probably the fibre of APOCYNUM VENETUM.

LUFFA ACUTANGULA, *Roxb.* CUCURBITACEÆ.

The plant, *turī;* the seeds, *tukhm-i-turī.* Commonly cultivated in gardens for the fruit, which is used as a vegetable. The kernels of the seeds are ground into a flour, and eaten as a relish with oil; the seeds are given entire as a purgative.

Lukh—لوخ—the Bulrush, TYPHA ANGUSTATA.

Luling—on the Helmand, a name for ARTEMISIA SCOPARIA.

Lutra, species.

The Otter—*sag-ābī*—is said to exist in the Hari-rud, and in the Bala-morghab rivers; this requires confirmation.

Lycium barbarum, *Linn.* SOLANACEÆ.

Khār-a-zīl, khār-a-zīr; in Baluchistan, *kōh-tōr;* the fruit, *zīl.* A large trailing shrub, remarkable in early spring for the brilliancy of its young grass-green foliage, which it loses in early autumn, and then the shrub is seen to be covered with spines, and its general colouring is an ugly grey; but at this time, if laden with berries, which is often the case, the bright scarlet of its berries causes it to become an object of attraction in the landscape, causing it to vie with STOCKSIA BRAHUICA, as to which shall be applied the name *kōh-tor,* [the beloved of the mountain] the hill peach. Children eat the fruit, and apparently relish it. At the encampment of Zaru we lost fifteen camels and a goat, said to have been poisoned from eating the berries of this bush; their deaths must have been due to some other cause, as I subsequently frequently saw camels and goats browsing on this shrub, and eating the fruit without any after bad effects.

Mā—ماه—the moon.

MACE—the aril of the Nutmeg, MYRISTICA FRAGRANS.

Mach, māch—the Baluchi name for the date palm, PHŒNIX DACTILIFERA.

Māda—ماده—the female.

Māda-kachur—ماده کچور—*māda-kachul,* the round tubers of CURCUMA ZEDOARIA.

MADDER—the plant and dye stuff of RUBIA TINCTORUM.

Maghz—مغز—the brain, fat, marrow, kernel, pith;

chār-maghz, the walnut; *tut-i-maghz,* dried mulberries.

Maghz-i-jouz—the kernel of the walnut, JUGLANS REGIA.

Maghz-i-pista—Pistacio kernels, the kernels of PISTACIA VERA.

MAGNESIAN-LIMESTONE—Gypsum, *gach.*

Mahk—مهک—*māhk,* a root; the plant GLYCYRRHIZA GLABRA, its roots; also the extract prepared from its roots, Liquorice.

Māhk-ak—[the small root]. The root stocks of VALERIANA WALLICHIANA. A Kuram Valley name, where this Valerian root is collected for exportation to Cabul.

Māīa—مايه—Ferment, Leaven, Rennet; *panīr-māīa,* [cheese-producer] Rennet; *gul-māī* [the flower that produces (Barilla)] a species of SALSOLA, and ANABASIS.

Māīa-mesh—[sheep-leaven]. The plant CENTAUREA MOSCHATA.

Māīa-shīr —مايه‌شير—[milk-leaven]. A mixture of sour milk and herbs to coagulate milk with.

Maidān—ميدان—a plain, a desert.

MAIZE. Indian corn, ZEA MAYS.

Majīt, majīth—مجيته—(Hindustanī) RUBIA TINCTORUM, Madder.

Majnu, majnun—مجنون—a willow, SALIX species, cultivated at Herat.

Māju—ماجو—*māzu*—مازو—the galls of an Oak, QUERCUS species, or of a Tamarisk, TAMARIX species.

Majun—معجون—an intoxicant prepared from the oil of CANNABIS SATIVA. Indian hemp.

Makaī—مكي—*mekaī.* Of, or belonging to Mecca.

Malhatī—ملهتي—Liquorice, the extract prepared from the roots of GLYCYRRHIZA GLABRA.

MALLOW—MALVA SYLVESTRIS.
Malmal, for *marmar*—Marble.
Malourī—the Bramble, RUBUS species.
Maluk—a sort of candle, or taper.

Malva sylvestris, *Linn.* MALVACEÆ.

The Mallow *khatmī, khadmī*, the flowers *gul-i-khatmī*. Employed in medicine, for which the flowers are collected and exported.

Manakī—منقی—*manaka*, Raisins when dried of a red colour, and possessing usually a fine bloom; these contain stones, and resemble our ordinary raisins.

Mandalāk—SCORZONERA species.

Mandāo—the plant ERUCA SATIVA.

Manjīth—منجيتة—*majīth*, Madder, the dye-stuff and shrub RUBIA TINCTORUM.

MANNA—

Several shrubs yield a sweet exudation, which is treated either as a condiment or drug. The product yielded by the plant COTONEASTER NUMMULARIA, *sīa-chob*, is called in these districts *shīr-khisht, shīr-khesht*, and *gap-chīr*, or *gap-shīr*. That yielded by ALHAGI CAMELORUM, *shutar-khār*, is called *tar-anjabīn*, or *tar-angabīn*. I also collected from the leaves of SALSOLA FŒTIDA a manna, which was well known to the camel men in Baluchistan, and by them called *shakar*. In Khairan, is said to be collected from a variety of TAMARIX GALLICA, a manna called *gaz-shakar* and *gaz-angabīn*; this in certain seasons is to to be had in great abundance.

These mannas, viz. of COTONEASTER, ALHAGI, and TAMARIX are eaten by the natives as we do sugar or jam with our food, and usually are not treated in the light of medicines. They are largely exported in all directions, and by the natives of India and Europeans are looked upon as drugs.

MANURE—see dung, cattle, fuel, pitch.

Māo—the name amongst the Khyber Afridis for EPHEDRA PACHYCLADA.

MAPLE, ACER species.

Mār—مار—a snake, sick, unwell.

Marble—*sang-i-marmar.*

March—مرچ—pepper; black pepper, Piper nigrum.

March-i-surkh — مرچسرخ — [red pepper], Capsicum species.

Marg—مرگ—death.

Marg-ī-mush—مرگ موش—[the lamentation of death]. White Arsenic.

Margh—مرغ—a pleasant grassy spot; plateaux covered with grasses and flowering herbs.

Marmar—مرمر—(supposed to be derived from the Latin, *marmor*) Marble.

Marmar-i-safed—مرمرسفيد—Alabaster.

Mār-pech—مارپيچ—twisting round, as a climber round a tree, or as a snake twists about; when applied to Cynanchum acutum it means the poisonous climber, or the climber (that causes) sickness.

Marten, Mustela species; *dala, gurba-dala.*

Marvel of Peru, Mirabilis Jalapa.

Māsh—ماش—the cultivated field pea, Pisum sativum. The same name is sometimes applied to some of the Vicias.

Mashing, mushing—مشنگ—Vicia Ervilia.

Mashk—مشک—*mashak*—a prepared leather bag for holding water, or for churning milk in.

Maska—مسکه—butter; this is the usual name in these parts for butter.

Mās or *māst*—ماست—sour coagulated milk, or sour butter-milk, oxygal.

Māstāwa—ماستاوه—*māstwā*—ماستوا—sour butter-milk coagulated, strained, and the curd dried; this is dried Oxygal.

Mast—مست—drunk, intoxicated, hurtful.

Mast-akī—[slightly intoxicating]. The Darnel-grass, Lolium temulentum.

Mastakā-i-rumī — مصطکارومي — [Turkish Mastich], yielded by PISTACIA LENTISCUS.

Matākh, metākh—the indigenous walnut tree, JUGLANS REGIA, and its fruit in the Kuram Valley is so called. Raverty, in his *Pashtu Dictionary*, gives "*mattāka'h*—متاکه—as a kind of walnut with a hard skin."

MASTICH—the true Mastich is yielded by PISTACIA LENTISCUS; forms of Mastich by other species of PISTACIA and RHUS. See gum-resins.

Mazj—مزج—Honey. The Baluchistan name for the grass ARISTIDA PLUMOSA; and for fodder.

Māzu—مازو—*māju*—the galls of an oak, QUERCUS species, or of a Tamarisk, TAMARIX species.

MECCA—مکه—the holy city of the Arabs.

Medicago sativa, *Linn.* LEGUMINOSÆ.

Lucerne, Medick, *sebist, sepist, sipist, tebit*; the hay, *beda*. Cultivated in every orchard or garden, as a fodder chiefly for horses, and may be found in a state fit for cutting almost the whole year round. In a green state during winter it is cut up and mixed with the dry fodders of the country to make these more nutritive and more acceptable to the cattle. It appears to be an indigenous plant throughout the Badghis, found in extensive patches wherever there is permanent moisture and good soil.

MEDICINE—*dāru, dawā, ādwīa*, or *ādwīat*, (plural of *dawā*).

MEDICK—the clover, MEDICAGO SATIVA.

Megūn—میگون—*megān*—wine or ruby coloured.

Mekaī—مکي—or *makaī*—of or belonging to Mecca. The huskless variety of Barley, HORDEUM HEXASTICHUM, var., and Senna, CASSIA OBOVATA, are so called, as it is supposed that these originally came from that locality.

Mekh—میخ—a nail.

Mekh-ak—میخک—a small nail, a clove, the flower bud of EUGENIA CARYOPHYLLATA.

Meles species. The Badger, *gōrkan.*

MELON—the fruit of CUCUMIS MELO.

MERCURY—*sīmāb.*

Merendera persica, *Boiss.* LILIACEÆ.

The corms, which may be one of the forms of the HERMODACTYLUS of the ancients. *Shambalīt, shānbalīt, surinjān.* This plant is very common all over the Badghis and Khorasan; the corms are largely collected and exported from Meshad to be employed in medicine, through Persia to India, *via* the Persian Gulf. It occurs in abundance on the Shutargardan Pass in the Kuram district, and extends as far south as the Salt-range in the Punjab, and east to Gugarkhan, in the form of MERENDERA AITCHISONI, *Hook. fil.* It was collected on the encamping ground at Gugarkhan in the Punjab by General F. Stubbs, R.A., and subsequently at the same place by myself; this, I suppose, is its most southern and eastern limit.

Mesh—میش—a sheep.

MESHAD—the holy city of the Persians; *Mash-had* —مشهد—a burying-place, especially for those who have been killed fighting for their religion.

METALS, and their salts; see arsenic, copper, gold, iron, lead, silver, zinc, tin.

Meth—Baluchi for a sheep.

MICA—*ābrak, talk.* Is imported as a medicine, and also to be crushed and employed as a facing to plaster of Paris.

Microrhynchus spinosus, *Benth. et Hooker.* COMPOSITÆ.

The plant, *charkha, chīrkha, sīā-kā;* the glue-like gum, *shilim-i-chīrkha.* This is a very common shrub, yielding a gelatinous strongly-scented glue-like substance. It appears at first as a milky juice exuding from different parts of the stem and branches, which as it dries resembles little chips of glue, and which when fresh gives forth a most nauseating odour like that of decomposed meat. It is collected and employed to adulterate the true *anzarut,* or the SARCOCOLLA drug.

MILK—*shīr;* Arabic, *laban, labān, lubān;* see cream, curdled-milk, cheese, whey, butter, butter-milk, oxygal.

MILK-HERB, or any plant that exudes a milky juice, *ashar, ashīr, gīā-shīr, shīr-ag, shīr-gīā, shīr-go.*

MILL—flour-mill, *āsīā;* hand-mill, *dast-āsīā;* donkey-mill, *khar-ās* (oil-mill); water-mill, *āb-āsīā;* wind-mill, *āsīā-bād;* mill-stone, *sang-i-āsīā.*

MILLET—the great, or greater Millet, SORGHUM VULGARE. The spiked Millet, PENNISETUM SPICATUM; Italian Millet, SETARIA ITALICA; Common Millet, PANICUM MILIACEUM.

MINERALS—*kānī.* See SALTS; see METALS; see ALABASTER, CLAY, GYPSUM, FLINT, LIMESTONE, LAPIS-LAZULI, MARBLE, MICA, SANDSTONE.

MINERAL PITCH, or Oil—*mumīāī, momlāī*—a natural production obtained from the Kohistan range.

Mirabilis Jalapa, *Linn.* NYCTAGINEÆ.

The Marvel of Peru. The plant, *abās;* the flowers, *gul-lāl-abāsī, gul-i-abās;* the root, *bekh-i-gul-i-abās, resha-i-gul.* An extremely common flower cultivated in all gardens, much admired for the rose colour of its flowers; the roots, leaves, and seeds are employed in medicine. The rose-red colour of the flowers, *abāsī* (*rang*).

Mis—مس—copper.

Misar—مصر—Egypt.

Misrī, misarī—مصری—Egyptian.

Applied to certain products that are supposed to come from Egypt; as, for instance, *sālab-misrī,* the tubers of an Orchis (*sālab*) that are imported from Egypt. In India the term *misrī* is correctly applied to a sugar-candy which originally was imported into Bombay from Egypt, and I believe the Parsees still import it from thence. Amongst Europeans, sugar that is not candied often goes by the name *misrī,* and the meaning attached to the name now is sugar, and sweetness, rather than that it is the produce of a certain country from whence it has been imported.

MOLASSES (solid), *sīa-kand; gur* (Hind). Is very largely imported from India and Southern Persia.

Mōm, for *mum*—bees-wax.

Mōmlāī, a corruption of *mumīāī*, a natural pitch.

Morus alba, *Linn.* URTICACEÆ.

The Mulberry, *tut;* often pronounced *tuth*. A universally cultivated tree found in all gardens, orchards, and in the vicinity of dwellings; it is cultivated, in the first place, for its leaves for feeding silkworms upon; secondly, for the shade and protection it gives to an orchard generally; and lastly, its fruit comes in for use. It is a common and apparently indigenous tree throughout the Badghis and Khorasan, at an altitude of 3000 feet, in a rocky limestone country in the vicinity of streams. The fruit of the indigenous tree is usually white, of the cultivated tree black, but of the latter I have seen trees having some of the branches bearing white fruit, whereas the fruit on the rest of the tree was black. In the Tirband range a Mulberry is a common, well-known, indigenous tree, but I have no authority as regards the species, but in all probability it is *Morus alba*. From the hill of Malikdan, near Galicha, in Baluchistan, I got specimens of an indigenous Mulberry.

The commencement of all orchards seems to be a low wall, of some 4 feet in height, enclosing a space of ground capable of being irrigated. On the inner side of this wall is planted out a row of ungrafted mulberry trees, and for the first year or two the enclosed space is grown with Lucerne, Barley, and a few vegetables. As the trees grow up, and begin to give shelter and shade, the rest of the ground is planted out with fruit trees, such as Apricots, Plums, and Elæagnus, which usually are the earlier ones to be introduced into an orchard. As long as the mulberries are young, they are valued for feeding silkworms on, with their leaves; as they get old they are not considered good for this purpose, and other young trees are successively reared, the older trees becoming more valuable for the greater amount of shelter and shade they give the orchards.

The fruit of these ungrafted trees is not considered worth eating in a fresh state, but it is collected in immense quantities to be dried. The dried fruit, *tut-i-maghz,* is met with in every household, for eating as a relish with their ordinary bread diet, or it is made into flour, *talkhan,* to be mixed with corn-flour and baked into bread, or the dried fruit is allowed to steep in water for a night; this infusion, called *shīr-a-tut,* is drunk as an accompaniment with food. From what I have seen of the collecting and drying of mulberries in Afghanistan I certainly would refrain under any circumstances from partaking of them. These are exported in some quantity to India. The fruit of the grafted varieties is only eaten fresh, and is occasionally to be seen for sale in the Bazaars.

At Karobagh there was a circle of very fine old Mulberry trees, varying from 12 to 16 feet in circumference, but much stunted and gnarled in their growth; the largest trees of the sort, however, that I met with in my travels were at Bezd, in Khorasan, where there were many of a very great age. The timber is much valued for building purposes, the wood for fuel, and the darker pieces of the wood, the colour of which is deepened by burying in the ground for a time, for the manufacture of combs; this darkened wood is employed as a substitute for Ebony.

Morus nigra, *Linn.* URTICACEÆ.

The Black Mulberry, *shā-tut.* I met with an occasional tree of this in orchards, cultivated by grafts for its fruit; and on one or two occasions saw the fruit on sale in the Bazaars.

Mōsh—موش—*mush*—grief, sorrow, lamentation.

Moschus moschiferus, *Linn.*

The Musk Deer, from which is obtained the gland technically called the Musk-pod, that contains the Musk, *tibit mushk.* This is imported from Central Asia to be employed as a scent, or in medicine.

MOTH—*shaprak, shauprak.*

Mukal—مقل—is Bdellium, a gum-resin yielded by a BALSAMODENDRON species. The gum-resin *gugal* of Baluchistan is yielded by BALSAMODENDRON MUKUL.

Mukal-i-azrak—مقل ازرق—*mulk-i-azrak*, [pure Bdellium], yielded by BALSAMODENDRON species.

MULBERRY—the tree and fruit of MORUS species.

MULE—*āstar, āstār, kātar*.

The religious prejudices of the Afghans object to mules, hence they are uncommon in Afghanistan. In Persia it is by mules that all the rapid travelling and quick conveyance of goods takes place; they convey heavy loads rapidly by long marches, and exist upon miserable fare. When mules are well cared for, it is marvellous what an amount of work they will do.

Mulī—مولي—(Hind). A Radish, RAPHANUS SATIVUS.

Mulk—ملک—a country.

Mum—موم—*mōm*—Bees-wax.

Mumīāī—موميائي—*mōmīāī*—a natural mineral pitch, or mineral oil collected in the Kohistan range.

Munj—مونج—Turkomani and Punjabi for the grass ERIANTHUS RAVENNÆ.

Mur — مر — Myrrh, the gum-resin of BALSAMODENDRON MYRRHA.

Murda—مرده—dead, a dead body, a corpse.

Murda-sang—مرده سنگ—[death-stone]. The Oxide of Lead, white-lead.

Murgh—مرغ—a bird, the domestic fowl, or its male.

Mush, mōsh—موش—grief, sorrow, lamentation.

Mush, probably for *māsh*—ماش—PHASEOLUS MUNGO, var. RADIATUS.

Mushing, mashing—مشنگ—VICIA ERVILIA.

Mushing-dewāna, mashing-dewāna, or *musung-dewāna* [(the grain) *mushing* that produces foolishness], Darnel-grass, LOLIUM TEMULENTUM.

Mushk—مشک—the MUSK-POD from Tibet, the gland of the Musk-deer, MOSCHUS MOSCHIFERUS.

Mushk-ak—[the little Musk-scented one]. A Kuram

Valley name for the roots of VALERIANA WALLICHIANA.

MUSK—the musk-pod, *mushk, tibit*—Musk-scented, Arabic *latīm, ultīb, latīb, āltīb*.

Mustakī-rumī — مصطکی رومی — [Turkish Mastich]. Gum-mastich, the gum-resin of PISTACIA LENTISCUS.

Mustela, species. WEASEL, MARTEN.

Musung-dewana—Darnel-grass, LOLIUM TEMULENTUM.

Myristica fragrans, *Houtt.* MYRISTICEÆ.

The kernel of the fruit of this plant is the Nutmeg of commerce, *jouz-i-bōīa*, and *jouz-a-bīa*. It is imported either as a condiment or medicine, as is also the aril of the seed Mace, *baz-bāz;* the latter is, however, little known in these parts.

MYROBALANS—the fruit of TERMINALIA species.

MYRRH — the gum - resin of BALSAMODENDRON MYRRHA.

Nabāt—نبات—Sugar-candy.

Nagun—نگون—misplaced, inverted, topsy-turvy.

Nahar—نهر—a canal.

Nāī—نای—a reed. This name is usually applied to reeds of PHRAGMITES and ERIANTHUS, of which the reeds are much smaller than those of ARUNDO, the last usually going under the name *nāl*, though occasionally called *nāī*.

Nāju—نازو—or *naoju*. The tree PINUS HALEPENSIS, and its cones.

Nāk—ناک—a fine grafted variety of the pear; the fruit is large, and sometimes very good. PYRUS COMMUNIS.

Nakh—نخ—thread of any material.

Nakhud — نخود — the plant and grain of CICER ARIETINUM.

Nāl—نال—the reeds of ARUNDO DONAX.

Namak — نمک — pronounced also *namik, nemak.* Salt.

Namak-sār—نمکسار—salt-fields, or salt-mines.

Nān—نان—bread.

Nannorrhops Ritchieana, *Wendl.* PALMEÆ.

Is the common dwarf palm of Baluchistan, called *pīsh, pesh.* I did not observe it after passing Nushki.

Nao—نو—*nu, no.* New, fresh.

Naosh-ādar, nōsh-ādar — نوشادر — Sal-ammoniac, CHLORIDE OF AMMONIUM.

Nar—نر—the male.

Nar-kachur—[male-kachur]. The long tubers of CURCUMA ZEDOARIA.

Nār—نار—the fruit of the Pomegranate ; fire.

Narcissus Tazetta, *Linn.* var. AMARYLLIDEÆ.

The Narcissus, *nastar, nargis.* The bulbs of this plant were obtained by me at Bala-morghab in the winter of 1884, and sent to Kew on the 18th January 1885. They flowered at Kew during 1887, producing a double crown ; this is worthy of notice, as the bulbs were those of indigenous plants, and not collected anywhere near where they could have been from cultivation. During the summer I did not meet with the plant, and therefore had no specimens of it in my herbarium.

NARCOTICS, not employed as drugs. The resin and dried leaves of Indian Hemp, CANNABIS SATIVA ; Tobacco, the prepared leaves of NICOTIANA TABACUM and NICOTIANA RUSTICA.

Nardostachys Jatamansi, *D'C.*, VALERIANEÆ.

Spikenard, *bālchīr, bālchōr, sambal-ultīb, sanbal-ultīb, alak.*

Nargis—نرگس—NARCISSUS species.

Narm—نرم—soft, mild, gentle.

Naruk—نروک—*narak.* A shrub, SALSOLA species.

Nāshpātī — ناشپاتي — *nāspātī* — the common pear, the fruit of Pyrus communis, of ordinary quality.

Nashuk-kardan — نشوقکردن — to snuff, to inhale snuff.

Nashwār — نشوار — *naswār* — in Arabic means the food which a ruminating animal keeps in its mouth to chew. Snuff.

Nashwārī, *naswārī* — the name for the small specimens of the Bottle-gourd, Lagenaria vulgaris, fruit, employed as bottles to hold snuff.

Nāspāl—ناسپال—the rind of the Pomegranate, Punica Granatum.

Nastar—نستر—*nastaran*—نسترن—a Narcissus, or the white rose of India, Rosa moschata.

Nāurinj, for *āurinj*, *āuranj*, the Orange, Citrus Aurantium.

Nectarine, a form of the Peach, Prunus persica, var.

Needles, *sanesh*

These are fixed in wax, and are employed in scratching the surface of the seed-vessels of the Opium Poppy, Papaver somniferum, to permit of the escape of the milky juice, which upon becoming inspissated is Opium.

Nerium odorum, *Soland.* Apocynaceæ.

The Oleander, *khar-zahra*; in Baluchistan, *jaur*. By no means an uncommon shrub in the Tamarix thickets of Baluchistan, near water. Is extremely poisonous to camels, as also to donkeys; the former never learn to avoid it, the latter do. It is not employed as fuel, as the natives assert the smoke from the fuel to be poisonous to those sitting round the fire. Except the form cultivated in gardens, I did not collect or see the shrub north of Baluchistan.

New—*Nao*, *no*, *nu*, *tāza*.

Nicotiana Tabacum, *Linn.* SOLANACEÆ, and
Nicotiana rustica, *Linn.* SOLANACEÆ.

Tobacco, *tambāku, tumāku, tamāku;* and *N. rustica* is especially identified as *turkomānī.* The tobacco plant is largely cultivated for local consumption, as well as to be employed in local trade. It is an expensive crop to raise, as the fields are very heavily manured, and they require a great deal of irrigation to give anything of a fair crop; these fields of tobacco are terribly infested by the parasite OROBANCHE EGYPTIACA, so much so that on its being in flower the blossoms give the land a general blue hue. In addition to the leaf being smoked it is much used either as an errhine as snuff, or is applied to the gum under the upper lip, above the incisor teeth, where the morsel lies like a plug of tobacco, and I suppose acts much in the same way on the constitution as chewing. A somewhat similar habit of applying snuff to the gums was called in the southern states of America "snuff-dipping" (Webster's *Dictionary*, 1880.) The ordinary term for snuff is *nashwār;* now it is curious that this should be the term applied by the Arabs for the cud that is kept in the mouth and chewed by ruminants, which would exactly apply to the use of the word in either chewing tobacco or placing it between the lip and gum, allowing it to lie in the mouth. Snuff is mixed with the powdered stems or ashes of EPHEDRA PACHYCLADA; this is said to improve its errhine action, making it more pungent.

Nigella, species. RANUNCULACEÆ.

The seeds of a species of NIGELLA are imported from Afghanistan into India as a drug, under the names *shaōdāru, shavadāru, shaonīz.*

Nīl—نیل—*nīla*—نیله—Indigo, the dye-stuff obtained from INDIGOFERA TINCTORUM. Blue colour.
Nīlī—نیلي—belonging to the Nile; blue, livid.
Nīl-a-far, nīlfar—نیلفر—*nīlpar*—نیلپر—

A water lily; here the name of a species of IPOMŒA, the flowers of which are of a lovely blue colour; this is cultivated for the beauty of its flowers, as well as for its seed, to be employed in medicine.

Nīl-tutīā—نیل‌توتیا—Sulphate of Copper.

Nitraria Schoberi, *Linn.* ZYGOPHYLLACEÆ.

One of the few shrubs not grazed on by camels.

Nitrate of Potash.

Nitre, Saltpetre, *shōra.* This, I was told, was obtained over the whole country, by any one who chose to take the trouble of collecting the soil from the vicinity of ruins and the *debris* of old houses, but that experts alone collected the soil of certain localities in the open country, which contained a greater amount of the salt. The soil collected is mixed with water; the water is then removed and evaporated, the residue is again dissolved in water, and the water treated as before; on the second evaporation, sometimes requiring a third, are obtained fine crystals of saltpetre; these crystals are called *shōre-kalmī.* It is chiefly employed in the manufacture of gunpowder, which almost any one in this country seems to know how to prepare.

Nosh—نوش—an antidote.

Nosh-ādar—نوشادر—[the antidote to fire]. CHLORIDE OF AMMONIUM, Sal-ammoniac.

NUT—*jaōz, jouz, gōz, gōza, ghōza, ghōja, kōza*; fruit stones, *khura.*

Walnuts, the nuts of JUGLANS REGIA, *gōz, jaōz, chār-magz.*

Pistacio Nuts, the nuts of PISTACIA VERA, *pista.*

Almonds, the nuts of PRUNUS AMYGDALUS, *bādām.*

The Sweet Almonds, or kernels of PRUNUS PERSICA, var. *kashta-shīrīn.*

Pine Nuts, the seeds of the Pine, PINUS GERARDIANA, *chīl-ghōza.*

Pistacio Nuts, Walnuts, and Almonds are articles of great importance in the export trade of the country.

NUTMEG—the kernel of MYRISTICA FRAGRANS.

NUX-VOMICA—the plant and seed of STRYCHNOS NUX-VOMICA.

OAK—QUERCUS species.

OAK-GALLS—*māju.* The galls of a species of QUERCUS.

OATS, WILD. AVENA FATUA.

OIL—*rōghan.*

The oils produced in these districts may be classed under (1) those chiefly restricted to lighting; (2) food oils; (3) medicinal oils.

1. OILS RESTRICTED TO LIGHTING PURPOSES.

The chief plant grown to yield an oil for burning is RICINUS COMMUNIS, the Castor Oil plant, which may be seen growing in strips round the margin of cotton and melon fields. This yields by far the greatest proportion of the oil that is consumed in the country for lighting purposes. From the seed of the cotton plant, GOSSYPIUM HERBACEUM, is extracted an oil which is only used in lighting. Poppy, Rape, and Eruca-seed oils are used as lighting oils, but are also employed in dietary.

In Turkistan the oil of CANNABIS SATIVA is extensively used in lighting, and that of Linseed both for lighting and as a food oil; these are almost unknown in these districts, as the plants are not grown here, and the oils are rarely imported. Apricot-seed oil is equally used for burning and in diet in that country.

II. FOOD OILS.

SESAMUM and ELÆAGNUS oils are almost entirely used for food purposes, along with a little of the Poppy, Rape, and Eruca-seed oils. The oil of the seeds of several of the CUCURBITACEÆ are used on rare occasions in the diet. The oil of the seed of PISTACIA TEREBINTHUS, var. MUTICA, is much used along with food in those localities where the tree grows, eaten mixed with oxygal as a flavouring to bread.

III. MEDICINAL OILS.

That of the Walnut, the Pistacio Nut, and Apricot are used here in medicine alone, as also is the imported Castor Oil. On one occasion alone did I hear that the oil of the locally grown plant RICINUS COMMUNIS was useful in medicine. A natural mineral oil, or pitch, is collected in the Kohistan range, and an artificially prepared tar, or pitch, made by the destructive distillation of sheep and goat manure, are both employed in local medicine.

POPPY-SEED OIL. The oil of the seed of PAPAVER SOMNIFERUM, *rōghan-i-khash-khāsh.*

RAPE-SEED OIL. The oil of the seed of BRASSICA CAMPESTRIS, *rōghan-i-shersham*, or *sarshaf.*

ERUCA-SEED OIL. The oil of the seed of ERUCA SATIVA, *rōghan-i-til.* The plant and seed *mandāo.*

COTTON-SEED OIL. The oil of the seed of GOSSYPIUM HERBACEUM, *rōghan-i-tāza*, *rōghan-i-pamba-dāna.*

LINSEED OIL. The oil of the seed of LINUM USITATISSIMUM, *rōghan-i-zagher.*

PISTACIO OIL. The oil from the fruit of PISTACIA TEREBINTHUS, var. MUTICA, *rōghan-i-kanjak.*

PISTACIO-NUT OIL. The oil from the kernel of PISTACIA VERA, *rōghan-i-pista.*

APRICOT OIL. The oil of the almond of the Apricot, PRUNUS ARMENIACA, *rōghan-i-zard-ālu.*

MELON-SEED OIL. The oil of the seed of CUCUMIS MELO, *rōghan-i-tukhm ;* but the oil of any of the CUCURBITACEÆ, is also so named.

SESAMUM-SEED OIL. The oil of the seed of SESAMUM INDICUM, *rōghan-i-kanjūd.*

ELÆAGNUS-SEED OIL. The oil of the seed of ELÆAGNUS HORTENSIS, *rōghan-i-sinjit.*

CASTOR OIL. The oil of the seed of RICINUS COMMUNIS, *rōghan-i-baz-anjīr.*

INDIAN HEMP-SEED OIL. The oil of the seed of CANNABIS SATIVA, *rōghan-i-chars.* An intoxicating preparation from the same, *majun.*

WALNUT OIL. The oil from the kernel of the Walnut, JUGLANS REGIA, *rōghan-i-jauz.*

MINERAL OIL, or PITCH, a natural production exuding from the soil, *mumīāī ;* an artificial, chemically-prepared oil, or pitch, *rōgan-i-sīa*, or *sīa-rōghan.*

CLARIFIED BUTTER, *rōghan-i-zard*, [yellow oil] ; or *rōghan-i-gao*, [cow-oil] ; Hindustani, *ghī.*

OIL-CAKE—the refuse from the oil-seeds, *kunjāra*, *kazb.*

OIL MINERAL—a natural exudation from the soil, *mumīāī.*

OIL-VESSELS—*daba.*

These are great vessels made of the prepared skins and intestines of animals ; or, in Persia and Central Asia, equally as often of the viscous glue-like gum of an EREMURUS species. The two kinds of vessels are identified from each other, in speaking of them, by adding the words *charm,* or *sarīsh,* the former meaning a vessel prepared from skins, the latter meaning from vegetable glue.

Ok—

The wooden supports of the roof of the *kabitka,* usually made of willow, SALIX species, and bent by means of fixed levers, or by the heat of fire, to the peculiar form required.

Olea europæa, *Linn.* var. OLEACEÆ.

The Olive, *zetun; kao* (Punjabi). After leaving Baluchistan I did not see this shrub or tree. In Baluchistan, and in part of the Kuram Valley of Afghanistan, it is an indigenous tree, but is often cultivated round shrines.

OLEANDER—NERIUM ODORUM.

OLEASTER—

According to Lindley and Moore is an ELÆAGNUS; according to De Candolle (*Origin of Cultivated Plants*) is the indigenous Olive, OLEA EUROPÆA.

OLIBANUM—the gum-resin of a BOSWELLIA species.

OLIVE—OLEA EUROPÆA.

OMUM SEED—the fruit of CARUM COPTICUM.

ONION—the cultivated ALLIUM CEPA.

OPIUM—the inspissated juice of PAPAVER SOMNIFERUM.

ORANGE—the fruit of CITRUS AURANTIUM.

Orchis latifolia, *Linn.* ORCHIDEÆ, and
Orchis laxiflora, *Linn.* ORCHIDEÆ.

SALEP, our dictionary name for the tubers of ORCHIS LATIFOLIA, which are palmately divided, and those of ORCHIS LAXIFLORA, which are simple tubers; both are collected under the name *sālab,* or *sālap,* and form an export article of very ancient repute to India, where amongst the natives they have been long highly valued as a medicine for strengthening a weakened constitution. The tubers, as met with in the trade, are usually strung as beads on pieces of string; in this way they are more easily dried and preserved for transportation. I only collected the above two species, and they are by no means common, owing to the localities on which they thrive being limited, as well as the fact that the tubers have been collected from these localities for centuries, and hence the wonder is that these plants have not been altogether eradicated. One cause in favour of their being still present in these parts is that sheep and goats do not browse on them, as where every blade of grass and other herbs had been closely cropped the flowers of the above species of Orchids were standing out in great beauty.

The value of Orchis tubers in the trade has created a continuous attempt to substitute in their place the bulbs or tubers of other plants. In the museum at Kew I found bulbs of what I believe to be the bulbs of TULIPA MONTANA with the external coatings removed, marked as having been originally sent to Kew as *sālap*, and, as seen by my paper in the *Annals of Botany*, the bulbs of ALLIUM M'LEANII and other species of ALLIUM are sold as *bādsha-sālap* or as *ambar-kand.* At Meshad, I was informed that *sālap-misrī* was an import from Egypt, and that it differed from the *sālab* of the country. I was unable to obtain any of it. EULOPHIA CAMPESTRIS is found in quantity in special localities in the Punjab, Baluchistan, and Afghanistan. The tubers of this plant are simple, but on the whole larger than those of ORCHIS LAXIFLORA. They are collected in the vicinity of Lahore, and I do not see why they should not also form part of the tubers exported from Afghanistan and Baluchistan into India.

Ōrisā, ōrisīā—اوریسا—the scented rhizome of an IRIS species.

Orobanche, species. OROBANCHACEÆ.

Several species of Orobanche are extremely common throughout the country, growing as parasites on LABIATÆ, CHENOPODEÆ, PYCNOCYCLA, COUSINIA, ARTEMISIA, NICOTIANA, CUCUMIS, and TAMARIX. One species, growing to over 2 feet in height, with a splendid spike of purplish flowers, occurs profusely in TAMARIX thickets, in such abundance that it is collected by camel drivers in Baluchistan as fodder for their camels. This is called *labu ;* other species, called *pīr-injīr* and *samārukh*, are eaten as vegetables by the natives. OROBANCHE ÆGYPTIACA colours, with the luxuriance of its flowers, melon and tobacco fields, from the profusion in which it grows amongst these crops.

ORPIMENT—yellow arsenic, *zarnīkh.*

ORRIS ROOT—the rhizomes of IRIS species.

Ors — ارس — *ōrs* — اورس — *orsa, ārcha* — the tree Juniper, JUNIPERUS EXCELSA.

Oryza sativa, *Linn.* GRAMINEÆ.

Rice. The plant, *shālī* ; the grain, *beranj, berinj.* I only saw rice once being cultivated in these travels, and that was in Khorasan, where its cultivation at any time is most exceptional. It is grown in quantity at Panjdeh and Maimana, from whence the greater part of the rice consumed in Khorasan and Herat is obtained. The rest is grown to the east of Herat, or brought from the Cabul Valley. The Caspian provinces of Persia are said to yield an abundant supply of rice. In these regions new rice is preferred as food to old, which is quite the reverse in Bengal.

OTTER—LUTRA species ; *sag-ābī.*

OXEN—

Of these there are very few, either in the Herat district or in Khorasan. I never saw any being employed for agricultural purposes. On the Hamun of the Helmand we saw large droves, and on the Helmand we met droves conveying raw cotton up the river.

OXYGAL—

An old English technical term applied to sour milk, from the Greek words *oxus,* and *gala.* Richardson, in his *Persian Dictionary,* edited by Francis Johnson, 1829, uses this term, and speaks of *māst,* which is very sour coagulated milk, as oxygal, and *māstāwa, māstwā,* and *karut,* the dried curds of sour butter-milk, as dried oxygal.

Pāchak—پاچک—dried cow-dung, used as fuel.

Pada—پده—*padak*—Populus euphratica.

Pāe—پاي—the foot, footstep; a rest for a gun, or rifle.

Pāe-bandukī—a gun-rest.

Pakhta — پخته — the fibre of cotton, Gossypium herbaceum.

Pakhta-chōb, or *chub*, or *chu*—the cotton plant, or shrub.

Palīta — پليته — the wick of a candle or lamp, splinters of wood, *palīta*, *phalīta*, in Baluchistan the plant Stellera Lessertii.

Palīta-gogird—

A piece of stick on the end of which cotton has been wrapped, and then dipped in a mixture of sulphur and water and dried. These are the spunks of Afghanistan, and were always in use before the days of lucifer matches; they are still in common use.

Palm—Phœnix dactylifera, the Date Palm; Nannorrhops Ritchieana, the dwarf palm of Baluchistan.

Palti—Euphorbia cheirolepis.

Pamba—*panba*—پنبه—*pumba*—the fibre cotton, raw cotton, Gossypium herbaceum.

Pamba-chōb, or *chub*, or *chu*—the cotton plant, or shrub.

Pamba-dāna—cotton seed.

Panicum miliaceum, *Linn.* Gramineæ.

Common Millet, *arzan;* the *chīnī* of the Punjab. Is freely cultivated all over the country; much eaten as bread, and also cooked somewhat like rice. There is a red variety of grain called *gāl.*

Panīr—پنير—cheese.

Panīr-māīa—پنيرمايه—[cheese-leaven], rennet.

Papaver dubium, var. lævigatum, *Elk.* Papaveraceæ.

Papaver pavoninum, *C. A. Mey.* PAPAVERACEÆ, and RŒMERIA species.

Owing to the brilliancy and similarity of their flowers are called *gul-i-dukhtar*, and *lāla-dukhtar*.

Papaver somniferum, *Linn.* PAPAVERACEÆ.

The Opium Poppy. The plant, *kōknār;* the capsule, *gōza, khōl-a-kōknār, pōst-a-kōknār;* the seed, *tukhm-i-khash-khāsh;* the milky juice, *shīra;* the needles, set in wax for scratching the capsules, *sanesh;* the inspissated juice Opium, *afīun, tarīāk;* the oil of the seed, *rōghan-i-khash-khāsh.* In Persia, where there is a liberal supply of water for irrigation, and in the close vicinity of the village, are to be seen the fields of the opium poppy, more especially since the failure in the silk crop, as wherever the villages have suffered from the disease amongst the silkworms the inhabitants have taken to the culture of opium, resulting in a complete demoralization of the villagers, who almost as a whole—men, women, and children—have adopted the pernicious practice of eating, besides many of smoking, the drug. In Afghanistan there is little opium grown, and the wholesale demoralization is absent. At Bezd, and other villages in Persia children came to me asking for some means of getting rid of the habit, and out of every small crowd of children who used to surround my tent, coming to see the stranger, one or two could be picked out from amongst the number, from their haggard looks and peculiar pasty complexion, as being addicted to smoking the poison. The eaters looked upon the habit of smoking as an enormity that they would never adopt. Large quantities of opium are traded in between the villages and towns, but what became of it after that I could never find out. The people were very reticent in talking about the trade in opium, I suppose owing to the heavy Government tax upon its cultivation and sale. The oil of the seeds is much used for burning, as also for food, and the seeds are eaten in sweetmeats.

Par—پر—a wing, a feather, a leaf, flying, one who flies.

Pār—پار—rain, a bit, a piece.

Pāra—پاره—a piece, a portion.

Pashm—پشم—wool, feather, down.
Pashmīn—پشمین—*pashmīna*—پشمینه—woollen.

In Kashmir and India means the fine hair removed from the coarser parts of the fleece of the goat. In Persia simply wool, woollen.

Pat—plains of clay; land almost of a dead level, the surface covered with a layer of clay deposited by water.
Pat—پت—fine goat's hair, separated from the ordinary hair of the goat; a fabric made from it, *patu*—پتو—also called *kurg* and *kurk;* but *patu* is also applied to a fabric made of sheep's wool.
PEA—PISUM species.
PEACH—the fruit of PRUNUS PERSICA.
PEAR—the tree and fruit of PYRUS COMMUNIS.
Pech—پیچ—twisted, folded, intertwined.
Pechak—پیچک—[the small climber]. In Baluchistan applied to a species of CYNANCHUM (?); a climber.

Peganum Harmala, *Linn.* RUTACEÆ.

The wild rue, *harmal, ispanthan, ispand, isfand, spand, spandan, spanj, spangaoli, spingulī.* This shrub was common over the whole country traversed up to an altitude of 4000 feet. The natives employ it in medicine, as it is supposed to be efficacious in many diseases. On the occurrence of an epidemic, as cholera, they collect it in heaps and burn it through the villages; they consider it drives away evil spirits. In Persia it was a common thing to see a bush of this hung up in doorways to protect the inmates from evil spirits. One of our encampments at Quetta was called *spangaoli* from the profusion of this shrub at that locality.

Pela, pīla—پیله—the cocoon of the silkworm, a button, a knot, the core of a boil, a seed, a root, the smallwares of a pedlar.

PEN—*kalm.*

Pens are imported into Afghanistan, Northern India, and Kashmir from Persia. These are made of reeds, and are highly valued by the writers of manuscripts. At Sangun, in Persia, I found in the gardens a grass called *kalmī*, an ERIANTHUS (?), being cultivated for its reeds. The ordinary pens are made from the reeds of the local grasses, ERIANTHUS RAVENNÆ and PHRAGMITES COMMUNIS.

Pennisetum dichotomum, *Del.* GRAMINEÆ.

Bamboo-grass, *bārshonk.* At the skirts of the low hills, on stony ground, in the Baluchistan Desert, this grass grew in great luxuriance, producing long, woody, jointed, bamboo-like, trailing stems, very different in habit to the same grass in the Punjab. The stems in autumn were devoid of leaves, and when collected in heaps for fodder looked like so many twisted cuttings from the small bamboo. At first sight no one expected that horses would eat these sticks as fodder, but they did, and seemed to appreciate them.

PENNISETUM ITALICUM, *R. Br.*, is a synonym for SETARIA ITALICA, *Beauv.* Italian millet.

Pennisetum spicatum, *Del.* GRAMINEÆ.

Spiked Millet—the *bājrā* of Hindustan. Common in Baluchistan and on the Helmand, as a field crop. In the rest of the country through which I passed it only occurred as single plants here and there, through tobacco, cotton, and melon fields.

PEPPER—Black Pepper, PIPER NIGRUM; Red Pepper, CAPSICUM species.

PEPPERMINT-SCENTED—ZIZIPHORA TENUIOR.

Periploca aphylla, *Dcne.* ASCLEPIADACEÆ.

Hum, huma, um, uma; bata (Punjabi). A common shrub in the rocky parts of Baluchistan. Owing to its leafless habit and rod-like stems it is somewhat similar in appearance to EPHEDRA PACHYCLADA; they both go by the same names in that district.

Pesh—پیش—before, in front, beyond.
Pewand—پیوند—bound, fastened.
Pewandī—پیوندی—grafted.
Pewand-kardan—پیوندکردن—to graft.
Phan—پهن—(Sanscrit) the hood, or expanded head of a Cobra.
Phandhār—پهندهار—*phanār* (Sanscrit).

A Cobra. *Phanār* is the name for Arum Griffithii and for Heliocophyllum crassifolium in these parts, owing no doubt to the resemblance that their spathes have to the expanded wood of a Cobra.

Phaseolus Mungo, *Linn.*, var. radiatus, *Baker* (*Hook. Fl. Ind.*). Leguminosæ.
Phaseolus radiatus, *Linn.*

Māsh, mush; the *mung*, or *urd* of Hindustan. Cultivated in Baluchistan, and on the Helmand. The pulse used as food, and the refuse straw and leaves crushed and given as dry fodder to cattle mixed with that of wheat and barley.

Phaseolus vulgaris, *Savi.* Leguminosæ.

The Kidney-bean, common Haricot-bean, or French-bean, *lobīa, lubīa.* Cultivated freely on the margins of melon and tobacco fields, where profuse irrigation is being carried out. The beans are much eaten as food, and are found for sale in all bazaars.

Phœnix dactylifera, *Linn.* Palmeæ.

The Date Palm. The Baluchistan name for the palm-tree is *māch;* the fruit, Dates, *khorma, khurmā.* This palm is cultivated in Baluchistan and Southern Persia; the most northern locality where it was met with by us was at Zagin. The river Helmand may be considered its northern limit. The fruit is imported from Southern Persia and Siestan to Meshad and Herat, from whence it is exported to Turkistan and Western Afghanistan. It is much relished by the people, who have a superstitious regard for it as coming from Mecca. It is partaken of at some of their holiest feasts. This is one of the staple articles that the pilgrims from Mecca carry with them for exchange, and payment of small debts. Of course, according to the pilgrim, the store they carry with them has always come from Mecca, or Arabia at least, and not been purchased at the last bazaar they passed through.

Phog, *pog*—the glasswort tree, CALLIGONUM COMOSUM.

Phragmites communis, *Trin.* GRAMINEÆ.

The common Reed, *nāī*. Is abundant, growing in localities where there is shallow slow-running water, on the sides of irrigation channels, and similar localities where there is plenty of moisture. In the young state it is cut and employed as fodder. The stems are used in various ways—for the roofing of huts, basket-work, mats, screens, and sometimes for local pens.

Phun-dāna—the seeds of GOSSYPIUM HERBACEUM; cotton.

Piāz—پیاز—the common Onion, ALLIUM CEPA.

Piāz-khūkī—[pig-onion], UNGERNIA TRISPHÆRA.

PIG—*khūk*, *khanzīr*—SUS SCROFA.

PIG-NUTS—tubers of CARUM species.

PIG-ONION—UNGERNIA TRISPHÆRA.

Pīla, *pela*—پیله—the cocoon of the silkworm, a button, a knot, the core of a boil, a seed, a root, the smallwares of a pedlar.

PILGRIM — of Mecca, *hājī*; of Meshad, *mashdī*. Pilgrims carry with them for exchange, or sale, Senna, Saffron, Dates, Cuttle-bone.

Pilpil—پلپل—or *filfil*, *pīlpīl*, *fīlfīl*—Red Pepper, CAPSICUM species.

Pimpinella Anisum, *Linn.* UMBELLIFERÆ.

Anise. The fruit, Aniseed, *badīān*. Cultivated in gardens for its seed, to be employed as a condiment and in medicine.

PINE CONE—*Nāju*, *naoju*; *guta* (Kuram Valley).

Pinus Gerardiana, *Wall.* CONIFERÆ.

Gerard's Pine. The tree, *chīr*, *chīl*; the seeds, or nuts, *chīl-*

ghōza. The seed of this pine is one of the great trade products exported from the district of Kost and the Kuram Valley to India, where the tree is called *zan-ghōza,* the seeds *zan-ghōz,* and the cones *guta.* The tree does not exist, as far as I could learn, anywhere near Herat, and I did not come across the seeds in any of the bazaars, so if they are to be got at Herat their occurrence in the trade must be rare; they are quite replaced here by the kernels of the Pistacio Nut.

This pine occurs on the Suliman range, with PINUS EXCELSA, at and above 7000 feet; it is there called *chīr, chīl.* As far as I could learn from hearsay, and from specimens brought to me of the pines that occur on this range, no PINUS LONGIFOLIA exists on it. The nearest locality to the plains of the Punjab where Gerard's Pine grows, is on the Suliman range opposite Dehra-Ismail-khan, from which it would be possible to get fresh seeds to England in a fit state to germinate. All the seed that I was ever able to send from other localities were usually reported upon "as dead as door nails." The difficulty of transporting these in a healthy condition for germinating consists in their oleaginous nature, and it must be also remembered that in extracting the seeds from the cones, the natives place the cones on hot stones, or even partially burn them; this causes the hard scales of the cone to expand, and then the seeds are easily shaken out, so that this method of extracting the seeds may have been also one of the reasons why all that I sent to England were unable to germinate. I think there would be a greater chance of success if the entire cones were forwarded. This pine, it seems to me, ought to do well on the Riviera.

Pinus longifolia, *Roxb.* CONIFERÆ.

The Long-leafed pine, *chīr, chīl.* Is a north-west, outer Himalayan pine, extending from the Indus river eastwards, and not to the west of that river. It is however cultivated at Peshawur, Kohat, and at most of our frontier stations. The *Flora of British India* gives Afghanistan as the distribution of this pine. To this I cannot agree (see "On the Flora of the Kuram Valley," *Linn. Soc. Jour.*, vol. xix. pt. ii. p. 142).

Pinus halepensis, *Mill.* CONIFERÆ.

A very fine cultivated tree, *nāju, nāoju.* In Afghanistan it is usually met with planted in the vicinity of shrines—Kandahar, (No. 714, Griffith); Jelalabad (Dr Cattell); Kuram Valley, Zeran (Aitchison); on Persian territory planted in long rows to give protection to orchards and gardens. At Turbat-i-shaikh-jami there were some fine trees, but most of them were in a dying condition from the effects of a heavy fall of snow which had occurred a few years ago; the snow lay for some days, and this apparently ringed the trees, thoroughly killing the bark round them, and thus causing the destruction of nearly all. Here I was informed that there was a forest of the tree at Rui-khauf. On visiting that town I found some splendid rows of cultivated trees, but as to a natural forest there was not even a semblance of one. The nearest thing to a natural forest of this pine is at a shrine at Karokh, two nights' march from Herat, on the road to Kala-nao, and where the tree has spread naturally round the shrine, the original trees being well cared for, and the locality where they grow being suited to the tree. The wood is highly valued as timber for roofing, for doors, and lintels. It is known to yield a resin, but the trees are too much valued to permit of any being collected. The cones are carried away from the shrines by the ladies of the nomad tribes to be placed in their work-bags to be kept there to bring luck.

Piper nigrum, *Linn.* PIPERACEÆ.

The fruit Black-pepper, *dāru-garm, daur-garm, march.* Imported through India or through Southern Persia, as a medicine or condiment; it forms part of the well-known aromatic powder of Persia, *aduīa-deg.*

Pīr—پیر—an old man.

Pīr-injīr—OROBANCHE species.

Pīr-wathī—a climber, CYNANCHUM species.

Pīsh, pesh—پیش—the dwarf palm of Baluchistan NANNORRHOPS RITCHIEANA.

Pishak—پشک—*pushak*—پوشک—a cat.

Pistā—پستا—*pista*—پسته—the Pistacio-nut, the nut of PISTACIA VERA.

Pistacia Lentiscus, *Linn.* ANACARDIACEÆ.

Yields Mastich, *kandur-i-rumī, kundar-i-rumī, mastakā-i-*

rumī. This is imported from Turkey into Meshad, most of it for exportation.

Pistacia Terebinthus, *Linn.*, var. MUTICA, *Aitch. et Hemsley.* ANACARDIACEÆ.

This includes PISTACIA MUTICA, *Fisch. et Mey;* PISTACIA KHINJUK, *Stocks;* PISTACIA CABULICA, *Stocks; ban, wan, wana, gwan, gwana, kanjak, kinjak, kunjad;* the resin, which cannot be ordinarily distinguished from that of PISTACIA VERA, goes by the same names as those of the latter tree, *kunjad, kunjada, khunjad, khunjada, kinjad, kinjada, wanjad, wanizad, kandur, kundar, kundarud, kunderu, shilm;* the leaves, *goshwāra, barg-a-bana;* the oil, *rōghan-i-kanjak.* This is the South and East Persian, Southern Afghan, and the Baluchistan PISTACIA; it extends eastwards to the Kuram Valley, and as far North-east as Gilgit. It has been described under several species, all of which may be united as a variety of PISTACIA TEREBINTHUS. It is *the* tree of Baluchistan, and hence its name, *ban, wan, gwan*; on Persian territory, and near Herat, its name is altered to *kinjad, kunjad.* It is usually a small tree about 18 feet in height, and with a bole of from 3 to 5 feet in circumference, occurring occasionally in clusters, but usually scattered singly at long distances, on limestone formation. In the districts where it is to be met with trees are so scarce that to cut down one would be almost a sacrilege, hence I can say nothing regarding its value as timber, but its dry branches make excellent fuel. The only locality where I saw what could be called a thicket, or small forest of this tree, was on my march between Robat-i-turk and Cha-surkh, on the 19th August 1885, and this thicket had been a few days before set on fire by some nomads who had encamped with their flocks in the vicinity. The nuts are much sought after, to be crushed for their oil, which is eaten as a relish with *karut* (dried oxygal) and bread. The leaves almost without exception are affected by a flat horse-shoe shaped gall, that extends round the margin of the leaf; this gall is so very distinct in form, much resembling the lobe of the ear, that the leaves get their name *gōshwāra*, meaning ear-like, owing to this resemblance; by these galls alone the leaves of this species may be identified from those of PISTACIA VERA. These galls the natives say are of no use, but the leaves are valued for dyeing and tanning with. May not the presence of the galls on the leaves be the reason why these leaves are employed, and that the galls are really the active part of the leaf? The Mastich, or gum-resin of this tree, with that of Pistacia vera, is considered as one, both going by the same names, and being employed in medicine for similar purposes, viz., for dressing wounds and sores, for which uses they are highly valued; the names mean "the resin for stopping blood," "the remedy for stopping blood," or "for dressing wounds," "the tree-resin." A turpentine is said to be occasionally obtained from the resin, but only by any one specially making it for themselves. The gum-resin is not usually to be found for sale, but it is to be met with in all households, as it is looked upon as an everyday remedy for cuts and bruises.

Pistacia vera, *Linn.* Anacardiaceæ.

The indigenous Pistacio tree, that yields the Pistacio Nut, traded with to India. The tree and nut, *pista, pistā*; the country where the tree abounds, *pistalik*; the galls, *bōz-ghanj*; the mastich, or gum-resin, *kunjud, kunjada, khunjad, khunjada, kinjad, kinjada, wanjad, wanizad, ḳundar, kunda-rud, kunderu, shilm-i-pista*, has the same names as the mastich of Pistacia Terebinthus, var. mutica. It is a small tree, or a large shrub approaching the habit of a tree, with little or no main stem, throwing up numerous branches almost from the root, and averaging in height from 12 to 20 feet, and forming when in full foliage symmetrical clumps like great bushes. Early in autumn it begins to loose its leaves, and by November the tree stands naked, devoid of all foliage. The bark is now seen to have a remarkable grey colouring, so much so that at a little distance portions of a forest give the appearance of smoke passing through it, when what is seen is nothing more than the grey colouring of the bark affected by certain beams of light. This tree is found on sandstone formation at an altitude of 3000 feet. In suitable localities it forms large forests. The most celebrated of these occur in the Badghis, near Kala-nao, and at Zulfikar. There are forests in the hills of Khorasan, to the north of Turbat-shaikh-jami. I myself found the tree occurring in small clumps to the south of Bezd, although the natives affirmed that the indigenous Pistacio was unknown in those parts. In Persia the cultivated form of PISTACIA VERA is grown in the orchards; this I saw on several occasions, but I did not meet with it in the gardens in Afghanistan, and as far as I could learn it is not cultivated round Herat. It is, however, a common thing to see trees of the indigenous Pistacio growing round shrines, where they are carefully protected. The cultivated tree of orchards has usually a good stem, showing a fair amount of wood, and growing altogether more luxuriantly and more like a tree than the wild form. The value of the forests of the indigenous Pistacio lies in their yield of nuts, but the harvest is a precarious one, greatly due to the tree being diœcious, and to fertilization being frequently unaccomplished. The appearance of the staminate flowers on these trees are the first signs of spring, and as they appear long before there is any sign of leaves, they are unprotected and easily injured by frost, and I have no doubt but that a late recurrence of frost is one of the most frequent causes of a bad nut harvest. The natives say that there is only a good nut harvest every second year, and that when the nuts fail the galls on the leaves are more numerous. The nuts on some of the trees are partially dehiscent, whereas in others they are quite indehiscent. So well is this known to the people of the country, that in collecting nuts for eating, should they chance to come upon a tree of which the nuts are indehiscent, they just move on until they come to a tree bearing dehiscing nuts. In the latter case a slight crushing of the nut with the fingers gives exit to the kernels, whereas in the former each nut has to be broken up, as we would a hazel, before the kernel can be got at. On many trees the female flowers are found not to have been fertilized; these develop into a nut-like form, and when these unfertilized ovaries are examined they are found to be quite hollow, the walls being apparently analogous to the covering of the fertilized nut. These hollow nut-like sacks hang on the trees like bunches of grapes all through the winter (while the fertilized nuts fall off along with the leaves); they are at once recognised by their semi-translucent appearance and larger size than the ordinary fruit; these along with the external covering of the nuts are collected to be employed in dyeing and tanning, and when dried they rapidly break up, parts of them appearing like portions of the covering of the nut. The leaves of this tree become affected with galls, which are valued in the trade for dyeing silk. These galls are irregular-shaped spheroids, from the size of a cherry to that of a large gooseberry, borne on a short stalk, and usually growing from the upper surface of the blade of the leaf. From the great trade value of the nuts, and of the galls, there is much jealousy as to the forest rights, as to whom they may belong, and in what proportion to each tribe. Half the blood feuds of the nomads originate in their quarrels over the rights of produce in these forests. All persons concerned in the rights to the forest produce unitedly collect the nuts, and the general harvest is subsequently divided in the allotted proportions to those to whom they may belong. In the meanwhile the Amir's tax collectors are at hand ready to carry off the usual tax imposed on produce before it is permitted to leave the ground. The nuts are exported in immense quantities to Afghanistan proper and India, where they are highly appreciated by all classes, as well as to Persia and Turkistan. The galls are exported chiefly to Persia and Turkistan, a very small proportion to India. The gum-resin is a kind of mastich, and is identical with that obtained from PISTACIA TEREBINTHUS, var. MUTICA, similarly employed as a household remedy to be applied to cuts, wounds, and sores, and goes by the same names. From this resin a turpentine can be obtained. The fresh gum-resin, as collected from the trees, has a most pleasant fruity odour; at first it is very liquid, and then gradually hardens on exposure to a very brittle, almost transparent, rather resin-like consistency. The oil is rarely extracted from the nuts, and then only to be employed in medicine. The wood is highly valued for the manufacture of agricultural instruments, especially ploughs, also to make spoons; it certainly makes the best firewood of any in the country. Sheep, camels, and goats feed greedily on the foliage, hence the name applied to the galls, "the goat's store." The galls are, as already stated, employed in dyeing and tanning, but the leaves are not.

At Rawulpindi, in the Punjab, there were, a few years ago, some large bushes of PISTACIA VERA grown from the seeds of the Afghan indigenous tree, by Colonel Miller, the Inspector-General of Police, in his garden to the front of his house; and in Kashmir I saw one immense tree at Serinagar, this was covered with fine fruit, showing that other trees must also have been in the vicinity. This tree, from the size of its fruit and the method of its growth, I believe to have been raised from the seed of the cultivated form of the PISTACIA VERA. I do not see why, with a very little trouble, the cultivation of the Pistacio should not be carried out with success along the whole of our north-west frontier, from Abbotabad to Quetta.

PISTACIO—the tree and nut of PISTACIA VERA.
Pistalik—

The term applied to those parts of the country that are covered with natural forests of the PISTACIA VERA, as the term Jagdalak or *Jigdalik* is applied to the celebrated pass into Eastern Afghanistan from India, owing to the presence there once of a forest of the Elæagnus.

Pisum sativum, *Linn.* LEGUMINOSÆ.

The common Field-pea, *māsh.* Is cultivated here and there, but not extensively, and not in any quantity in one place. A pea, called *chish-khām,* was also cultivated in fields at Meshad.

PITCH, or Tar, *kār*, *rōghan-i-sīa*—

Is artificially prepared by the destructive distillation of goat and sheep dung; this is in great request as a remedy to be applied to sheep and other cattle that may suffer from sores or ulcers. A natural mineral product found in the Kohistan range goes by the name of *mōmlāī*, or *mumīāī*; this is highly valued as an internal remedy for many complaints.

PLAIN—a flat expanse of land, *maidān, hamun, dasht;* of clay, *pat.*

PLANE—the Oriental Plane, PLATANUS ORIENTALIS,

Plantago, species. PLANTAGINEÆ.

The grass-like herb Plantain. The seeds, *bārtang, bārang, ispaghul, ispārza, sebush, sepush, shīkam-pāra.* The seeds of several species are employed in medicine for their mucilaginous properties, especially in affections of the bowels. PLANTAGO MARITIMA covers the surface of the sand that has been deposited by high winds on the banks of the Hari-rud.

Platanus orientalis, *Linn.* PLATANACEÆ.

The Oriental Plane, *chanār, chinār, chunār.* To the east of Meshad, over the country I traversed, this was a cultivated tree. I noticed a few cultivated in Afghanistan; they were more common in Khorasan. At Maimana I was informed there are numerous and superb trees, but all from cultivation, and from whence most of the wood required for this district is imported. To the west of Meshad I found it an indigenous tree, occurring on the banks of streams, forming dense groves. The wood is considered by far the best for the construction of the large gates which are fixed at the entrances to villages. I measured the planks that made up one gateway, and found they were 18 feet long, 18 inches broad, and 4 inches thick. This wood, owing to its being easily worked and fairly tough, is more generally employed than any other for doors, lintels, and sometimes for roofing.

PLATTER, or Wooden Dish—*kās, kās-i-chōbī, kashafa.*
PLUM—the fruit of PRUNUS species.

Poa bulbosa, *Linn.* GRAMINEÆ.

One of the most common and characteristic grasses of the country, called *sīāl-i-we,* a splendid fodder grass, especially profuse on the plains near the Kambao Pass; at the proper season this could be collected to an unlimited amount for storage as hay.

POISON—*zahr, zahra, zahar, riz.*
POISONOUS—

I. THE INDIGENOUS PLANTS THAT ARE CONSIDERED TO BE POISONOUS.

CONIUM MACULATUM, CYNANCHUM ACUTUM, NERIUM ODORUM' the grain of LOLIUM TEMULENTUM, the Ergot on Rye SECALE CEREALE. Goats and sheep grazed on HYOSCYAMUS PUSILLUS and HYOSCYAMUS RETICULATUS without apparent bad effects, and the shepherds did not look upon these herbs as poisonous. DATURA STRAMONIUM was known to be poisonous, but owing to the localities in which it was only found, and its having no local name of its own, I came to form the opinion that here it has been introduced, and is not an indigenous plant.

II. Poisons imported.

The seeds of Strychnos Nux-vòmica, and Arsenic, are imported for the purpose of poisoning dogs and wolves.

Pole-cat—Putorius species.

Polygonatum verticillatum, *All.* Liliaceæ.

The fleshy rhizomes of this plant were collected in the Kuram Valley of Afghanistan under the name *shakākal,* sent to Cabul, and thence exported to India, *via* Peshawur, as *shakākal misrī,* valued by the natives in the same way as Orchis tubers, as a sort of strength-giving food. I did not collect this here, but was informed that it was a common root, collected in the Koh-i-baba range.

Polypogan littorale, *Sm.* Gramineæ.

Kīāk. A grass common on the banks of irrigation channels considered a good fodder grass.

Pomegranate—the fruit of Punica Granatum.

Poplar—the black or Lombardy Poplar, Populus nigra; the Euphratic Poplar, Populus euphratica.

Poppy—the Opium Poppy, Papaver somniferum; wild poppies, Papaver dubium, Papaver pavoninum; and Rœmeria species.

Populus euphratica, *Oliv.* Salicineæ.

The Euphratic Poplar, *pada, padak.* This is an indigenous tree over most of the country traversed; it forms forests on the islands and banks of the Helmand and Harí-rud, showing good-sized timber, but the tree does not average over 20 feet in height; at higher altitudes, say 3000 feet, as at Gulran in the Badghis, it was more of a shrub. In a climate with a severe winter, such as Khusan, it loses all its leaves at once; in Sind, on the Indus, these fall off irregularly throughout the winter. Under protection, and in a suitable locality, it grows to a great size in bulk, but never to any height, as at Nushki, where I measured several trees, which at 6 feet from the ground were 9 feet 6 inches in girth. At Maidiabad I saw two superb trees on the 1st September 1885, giving splendid shade, and under one of these a large school was being conducted. The wood is considered useless except for fuel; owing to its extreme lightness it makes excellent rafts. The leaves are good fodder for camels and goats, which browse on them whenever they have the opportunity. In the desert country of Baluchistan it was cultivated at some of the shrines.

Populus nigra, *Linn.*, var. PYRAMIDALIS. SALICINEÆ.

The Lombardy, or Black Poplar, *safeda, safedār, kabuda.* I only met with this tree cultivated in orchards and near houses. At Nasarabad, on the 4th September 1885, I saw a garden laid out with these trees exactly as are the great *bāghs* in Kashmir, only this was a small garden making a great attempt at something fine and historical. The wood is considered good for beams for roofing purposes, and is employed in the manufacture of boxes for packing fruit in, especially for those used in transmitting fresh grapes to India.

PORCUPINE—HYSTRIX species.

Pōsh—پوش—a covering, a mantle, a garment, the bark of a tree.

Pōshāk—پوشاک—clothes, garments.

Pōsh-e-khām, or *pash-e-khām.*

This is said to be a tree cultivated at Kala-nao, Maimana, and Panjdeh. On breaking up the fruit a gum is obtained called *zuft*; this is used in medicine, being spread on paper like a plaster, and applied over the part of the body where the patient suffers pain. On burning, the *zuft* gives out a strong pleasant odour. The above is all the information I could obtain regarding this tree. *Zuft*, of course, is a resin, and the tree may be a Pine, but my informant would not have it so, and as he was usually very accurate in his information I merely note his statements. As the tree is a cultivated one, and is said not to grow wild in these regions, a specimen should not be difficult to get. The same native names are applied to an Elm, ULMUS species, but of course its fruit does not yield a gummy substance of any sort; it is, however, a cultivated tree in the regions above mentioned.

Pōsh-e-kār—[the bark (used) in work], *posh-e-kham;* the Elm, ULMUS species.

Pōst—پوست—an external covering; the skin, bark, shell.

Pōst-i-ānār — the rind of the fruit of PUNICA GRANATUM.

Pōst-i-gurba-dala—the skin of the MARTEN.

Pōst-i-jouz—the rind, or bark, of the Walnut fruit, or of the tree JUGLANS REGIA.

Pōst-i-kōknār—Poppyheads, PAPAVER SOMNIFERUM.

Pōst-i-līmon—the dried skins of Lemons, CITRUS MEDICA, var.

Pōst-i-naurinj—the dried skins of Oranges, CITRUS AURANTIUM.

Pōst-i-pishak—cat-skins.

Pōst-i-rōba—fox-skins.

Pōst-i-sīa-ling—the root bark of PRUNUS CALYCOSUS.

Pōst-i-shākh—the root bark of the Maple, ACER species.

Pōst-i-gī—cream.

Pōstīn—پوستین—

A fur garment. A coat made of the skin of a sheep, the skin being tanned with the wool on. An immense trade is done between Afghanistan and the surrounding countries, especially with the frontier of India, in these furs. The great centres of their manufacture and preparation are Kabul, Kandahar, and Herat.

POTASH—*īshnān* (Arabic).

Prangos pabularia, *Lindl.* UMBELLIFERÆ.

The Prangos of Ladakh, *bādīan-kohī.* A very common plant in the Badghis, growing in great clusters on the northern slopes of the hills, at an altitude of 3000 feet and above, considered excellent fodder for goats and sheep.

Prosopis Stephaniana, *Spreng.* LEGUMINOSÆ.

Chigak, chogak, khār, khār-i-jinjak ; the fruit, or galled fruit, *kechī, kechī, jinjak, jing-jing-banu ;* the seeds, *tukhm-i-jīnjak ;* the dye, *zang-o-wach.* A somewhat woody shrub, usually about 4 feet in height, occasionally up to 12 feet (I never saw it more), forms a more or less dense scrub, and is extremely common from Quetta to Bala-Morghab, over the whole district traversed to an altitude of a little over 2000 feet. Is a nasty weed in cultivation. It gives excellent browsing to camels, goats, and sheep, who all feed greedily on it. The pods are commonly affected by a gall, which distorts them greatly, making them bloated and irregular in form, and causing them to take on a red copper colour. These are collected both for local use and for exportation to be employed in dyeing and tanning; they yield a light yellow dye. The seeds are employed in local medicine.

PRUNE—Dried Plums, the dried fruit of PRUNUS species.

Prunus Amygdalus, *Baill.* ROSACEÆ.

The Almond, *bādām, bedām.* At Meshad the Almond was cultivated freely in the gardens, but nowhere else did I meet with more than one or two bushes at a time. The great place whence almonds are imported into these parts, to be further exported, is Shakh-i-shai-mardan, and from Anar-dara. Around Herat, the shrub is cultivated, but not in sufficiency for the large export of fruit that takes place. The sweet kernels of a variety of the Nectarine are often employed as a substitute for the Sweet Almond. Throughout Afghanistan, not so noticeable in Persia, the priests carry a rod or staff of the almond as a sort of emblem ; these rods, with those of the Tamarisk, are made into handles or hafts for whips, as a protection against snakes.

Prunus Armeniaca, *Linn.* ROSACEÆ.

The Apricot, *zard-ālu ;* the dried flesh, *astak, ashtak, kishta, kashta, khōbanī, khubanī ;* dried unripe apricots, *ākhkuk ;* grafted, *zard-ālu-pewandī ;* the gum, *shilim-i-zard-ālu ;* the oil, *rōghan-i-zard-ālu.* This tree, with the Mulberry Plum and Elæagnus, is one of the commonest to be met with in all gardens and orchards, usually self-sown, rarely raised by grafts. The fruit is small and very poor in quality; it is eaten in a dried state, and the dried fruit is often cooked along with other food. It is generally collected when ripe, the stone removed, and the flesh dried in the sun; sometimes the almonds are made to replace the stones, or sweet almonds put in their place. An immense export trade is done towards India and to Southern Persia in the dried flesh of the apricot, which in Persia is usually called *kashta,* and *ashtak,* in India *khubanī;* by the latter word in Persia is understood a cooked apricot. Sometimes they are collected in an unripe state; these are also eaten, but usually these are exported for the use of silversmiths, who clean silver by boiling it amongst a decoction of the unripe fruit. The tree yields a gum in some quantity; this is collected, and along with that of the plum and almond is employed in the arts. The wood is considered hard, and when procurable is employed in the manufacture of farm implements.

It is not an Apricot that has a sweet kernel, as stated in error by me in *Linn. Soc. Trans.*, vol. iii. part i. p. 61, but a Nectarine.

Prunus avium, see variety *a* of PRUNUS CERASUS, *Linn.*

Prunus brahuicus, *Aitch. et Hemsley.* ROSACEÆ, and
Prunus eburnea, *Aitch. et Hemsley.* ROSACEÆ.

These two shrubs, *āol, āul, āwal,* are very similar in appearance and habit; they grow from 4 to 12 feet in height, forming copses; over the dry, arid, stony districts, at an altitude above 2000 feet, are recognized for the excellent quality of their wood for fuel, and for its manufacture into charcoal. The name *āol,* means a spine, or spinous, and is well applied to these shrubs.

Prunus calycosus, *Aitch. et Hemsley.* ROSACEÆ.

Sīa-ling, karmāk. A shrub, or small tree, common in the Badghis at an elevation of 3000 feet altitude. The bark is very like that of a cherry, but naturally much darker in colour, hence the name *sīa-ling* [black-limb]. Owing to this deep colouring of the bark the stems are much sought after for staves. The bark of the root is employed as a dye-stuff, being crushed, and boiled in water. It is employed to colour leather a dark, or maroon red. Some say the fruit when ripe resembles a cherry, others that it is like a small plum. I did not collect ripe specimens.

Prunus Cerasus, *Linn.* ROSACEÆ.

Variety *a* (*Brandis. For. Flora,* p. 193), PRUNUS AVIUM, *Linn.* The sweet-cherry, *gīlās;* Arabic, *kīrās.* A small cultivated tree, not so common as the next, raised by grafts only, yielding a fruit resembling our sweet white-heart cherry, quite as fine, and very similar to the fruit of the same name cultivated in Kashmir. There can be no doubt, I think, that the name *gīlās* is a corruption for the Arabic *kīrās,* from the Greek *kerasion,* which would point to this cultivated form having been carried east, from Greece, to Arabia, Persia, Afghanistan, and Kashmir.

Variety *b* (*Brandis. For. Flora,* p. 193), PRUNUS CERASUS, *Linn.* The sour, or bitter cherry. The tree, *gurja*; the fruit, *ālu-bālu.* A small cultivated tree, common in all orchards, said to be raised from the seed only, not grafted. It has a bitter harsh fruit, which when ripe becomes almost black in colour, and is as large as our largest cherries. The fruit is not much eaten whilst fresh, but is dried, the stones being removed, when it is rather nice, though astringent; this dried fruit is largely exported into Persia, a very little to Afghanistan. I never met with it as an import into India. The dried fruit is considered an excellent remedy to wounds.

Prunus divaricata, *Ledeb.* ROSACEÆ.
And other species.

A Plum, *ālu, ālucha, gurja, gurda*; the dried fruit or Prune, *ālu-bokhāra;* this last name is also, but not commonly applied to the fresh fruit. The plum is cultivated in all orchards, usually by scions or self-sown seed, and not ordinarily from grafts, hence the ordinary fruit is very poor, and austere to the taste. The better sorts of fruit raised by grafting are called *gurja, gurda;* there are many varieties of these, and some very fine, one especially, a very deeply-coloured almost black variety, called *ālu-sīa.* Meshad is now as much celebrated as Bokhara used to be for its plums, and there is here an immense trade done in dried plums or prunes, called *ālu-bokhāra,* exported to Southern Persia, Afghanistan, and India, some even to Turkistan by the way of Maimana. These are used in the ordinary diet of the better classes, usually mixed amongst the flesh of dried apricots.

Prunus eburnea, *Aitch. et Hemsley.* ROSACEÆ.
See PRUNUS BRAHUICUS, *āol, āul, āwal.*

Prunus persica, *Benth. et Hook. fil.* ROSACEÆ.

The Peach, *shaft-ālu, tō, tōr;* Teheran, *hulu.* The Nectarine, as far as I can remember or noted, came under the same names, but a nectarine with a sweet kernel was called *shaftarang,* and the kernels *kashta-shīrīn,* this I have no doubt was the same fruit as in Ladakh is called *raktha-karpo* (*Trade Products of Leh,* p. 61). A small tree, cultivated extensively at Herat and Meshad for its fruit, not in any quantity in the gardens of the other towns through which I passed; of course, of Herat I can only speak from hearsay. The finer varieties of the fruit are raised from grafts, and these were very fine at Meshad; to this is given the name *shaft-ālu,* meaning the beautiful plum. There is a very ordinary fruit, in external appearance resembling in form and colouring the fruit of PRUNUS AMYGDALUS, the almond, only almost as large as the ordinary peach; this originates from self-sown seeds, and is not grafted; it is called *tō,* or *tōr,* which means a sweetheart, beloved. In Teheran, the fine Peach is called *hulu,* which is an Arabic word meaning sweet, pleasant to the taste or eye. The name *āru* is a Hindustani corruption for *ālu.* I never heard it, nor did any one know of it in these districts as a name for the peach.

The fruit of the peach, when ripe, cannot be conveyed, so that it is not an export article; the unripe fruit—both peaches and nectarines—are dried for exportation, but even this is said not to carry well. De Candolle (*Origin of Cultivated Plants,* p. 223, Eng. trans., 1884), in speaking of the indigenous peach says: "Pallas saw several on the banks of the Terek, where the inhabitants give it a name which he calls Persian *scheptata.*" This name is no doubt *shafta-ta,* the beautiful luscious one (*shafta,* beautiful; *ta* or *tar,* green, moist, luscious). And again, at page 223, he gives *tao* as a Chinese name, which may be from the Persian *ta,* *tar*, or from *tō*, *tōr*, the latter meaning sweetheart, beloved, a peach; as *kōh-tōr* the name for Stocksia, and for Lycium, translated by the natives as "Hill-peach," whereas the translation should more literally be the "Beloved of the Mountains." This, I think, ought to lead us back from China towards Persia or Central Asia, if language will help to do it, as to the locality of the origin of the Peach. Royle gives *āru* as the general name for Peach in Persia; this, as I have already stated, is a Hindustani corruption for *ālu*, and in North-West India the Peach is known as *āru*, and the Nectarine as *mundla-āru* [the shaven or shorn Peach]. At Peshawur, the Peach is as often called by the Persian name *shaft-ālu*. The *kulloo* of Royle is in all likelihood a misprint for *hulu*, the Teheran name.

Psammogeton setifolium, *Boiss.* Umbelliferæ.

Khār-a-bōīa, khār-a-bīa. A very common herb all over the country, well known for its fruit, which is much gathered as an aromatic flavouring, and employed in medicine. It is said to be common at Koin, and Birjand. It obtains its name, "the thorny scented," from the stiff sharp hairs that cover the aromatic fruit.

Pteropyrum Aucheri, *Jaub. et Spach.* Polygonaceæ.

Khar-whang-khush. A common shrub, in the arid tracts, easily noticed from the brilliancy of its almost scarlet fruit. Is considered a favourite fodder with the donkey; hence its name.

Pul—پول—a bridge.

Pulley—*chambāra*, *charkh*.

Pieces of the stems of various shrubs are bent into a loop, and attached by carriers to their ropes; these wooden loops act as pullies in tightening the ropes whilst lading beasts of burden. They are of immense assistance for the purpose to which they are applied, and are therefore to be found for sale in all bazaars. The best are considered to be made from the stems of Cotoneaster nummularia, or of the roots of Zizyphus vulgaris.

Pulse—

The seeds of several species of the Leguminosæ are found for sale in the bazaars of all the villages, being much used in the diet of the natives mixed with other food-stuffs. The following plants are cultivated throughout the country to yield the various kinds of pulse:—The Field-bean, VICIA FABA; the Haricot or French bean, PHASEOLUS VULGARIS; PHASEOLUS MUNGO; and the field-pea, PISUM SATIVUM. It was only in Khorasan, and at an elevation of 3000 feet and upwards, that I met with the following being cultivated:—The Gram of the Punjab, CICER ARIETINUM; the Lentil, LENS ESCULENTA; the Vetch, VICIA ERVILIA; and the Chickling-Vetch, LATHYRUS SATIVUS. In most cases these were grown without irrigation, but a good crop was dependant upon the sufficiency of the dew-fall.

The Field-bean was conspicuous wherever it was grown, from being cultivated in strips round the margins of fields of cotton. These beans are usually eaten by the Afghans cooked with meat; the flour is never used for bread, being considered as too heating a diet, but goats and sheep are fed on it. The pulse of LATHYRUS SATIVUS was not known to be productive of injury to health, but I was told that a pea, called *langash*, which I did not meet with, was conducive to sickness.

Pulūsh—COUSINIA species. The leaves are employed in making tinder.

PUMPKIN—CUCURBITA PEPO (?).

Punica Granatum, *Linn.* LYTHRARIEÆ.

The Pomegranate, and fruit, *ānār;* the flower, *gul-nār;* the rind of the fruit, *pōst-ānār, nāspāl;* the dye, *rang-i-pōst-ānār;* the Punjabi for the indigenous shrub, *dāru, dārim;* Salt-range, *durunī;* Kuram Valley, *wāngar.* On this journey I only met with the cultivated shrub, which was common in the orchards. The natives told me that the indigenous plant existed in the hills near Anar-dara; it is well known in Baluchistan, and passes eastwards along the Suliman range to the Kuram Valley, where I collected it. In the lower outer hills it is met with along the whole of our frontier, from Kohat to Abbotabad, the Salt-range, Rawulpindi into Kashmir, along the banks of the Jhelum river, Jamu, in the arid outer hills below Simla, whence it extends into Kamaon. De Candolle, in his *Origin of Cultivated Plants,* p. 238, Eng.

edition, 1884, doubts its being indigenous in Baluchistan where Stocks found it, and also states that "Anglo-Indian botanists do not allow it to be indigenous east of the Indus." He must have overlooked the *Forest Flora of North-west and Central India*, p. 241, 1874, and probably was misled by the account of its distribution as given in *Flora Indica*, pt. v. p. 581, 1879. Thomson considered it indigenous as far east as Kamaon. In the trade the small Pomegranates are *ānār-dāna*, whereas the cultivated fruit is always *ānār*.

The gardens of Anar-dara are celebrated for the very fine pomegranates they yield; the finest are as large as a child's head, with a very thin papery rind, and an almost seedless grain. These are exported in immense quantities to Afghanistan, India, and Persia. The rind of the fruit is employed in dyeing and tanning leather, for which purpose the poor unripe cultivated fruit, or much more largely the fruit of the indigenous shrub, is collected.

Pur—پور—steel.
Purze—tinder.
Pusht—پشت—the back.
Puz—پوز—or *buz*—the snout of an animal.
Puza—پوزه—wool; the pile of cloth; the down upon leaves.

Pyrus communis, *Linn.* ROSACEÆ.

The Pear, or its fruit *,āmrud;* a grafted variety of the fruit, *nāspatī, nāshpātī, nāk.* The pear is commonly cultivated in all orchards for its fruit; this is usually poor in quality, owing to the tree being raised either from scions, or self-sown. The grafted trees, which are met with in the better class of orchards, bear a large variety of the fruit; this is said to be much more common to the east of Herat, from whence great quantities of the fruit are exported. At Meshad some of the pears were very fine, and well worth the notice of our gardeners.

Pyrus, species. ROSACEÆ.

An indigenous pear, is called *āmrucha,* from its yielding a smaller fruit than the cultivated garden tree does. This small fruit is collected, dried, and made into flour to be mixed with ordinary flour for making bread. In the Badghis, on December 6, 1884, between Palounda and Karezdara, I saw a clump of pear trees growing apparently as if indigenous; amongst those hills in similar localities they are said to be common. The wood of the indigenous tree is valued for the construction of cotton-gins.

Pyrus Cydonia, *Linn.* Rosaceæ.

The Quince, *bhī, bhiī;* the seeds, *bhī-dāna, bhiī-dāna.* Cultivated in all gardens, usually the fruit was poor, but in exceptional cases very fine and large; the latter were said to have been grown from grafts. At Meshad the Quince is grown in great profusion and of very fine quality. It is a fruit that stands carriage well, and hence is largely exported to India and Southern Persia. The seeds are commonly employed for yielding a gum for dressing the hair.

Pyrus Malus, *Linn.* Rosaceæ.

The Apple, *seb, sib;* dried sour apples, *kashta-seb-i-tursh.* Is a cultivated tree in the better class of orchards. Immense quantities of apples are raised in Persia, from whence they are exported to Herat for further exportation. The district round Herat does not produce such fine apples, or in the quantities that they are grown in Persia. There are two marked kinds, the sweet and the sour, the former are eaten fresh, the latter are usually dried and are cooked to be eaten with various foods; these are largely exported to Southern Persia, in smaller quantities to Afghanistan. The natives say that in the hills of the Paropamissus range, at its eastern extremity, a wild apple is common.

Quercus, species. Cupuliferæ.

The Oak, *balut.* The galls of an Oak, called *māju,* are imported from other districts of Persia for dyeing and tanning with. Over the country I traversed I did not come across any oaks, nor did I hear of any existing in those parts.

Quince—the fruit of Pyrus Cydonia.

Radish—the root of Raphanus sativus.

Raisins—the dried fruit of the Vine, Vitis vinifera.

There are several kinds: *kishmish,* these are small and seedless usually green in colour, sometimes red; when green they are known as *sabz*, and when red as *surkh*. *Manaka* are like our ordinary raisins, of a red colour, and contain seeds. *Zīriskh* are like currants or corinths, they require to be distinguished from the dried fruit of BERBERIS, and hence are called *shīrīn*, in contradistinction to the BERBERIS fruit, which is called *zīrishk-tursh*. Herat and its vicinity yield immense quantities of raisins, which are exported to India, some to Turkistan. From raisins the natives prepare a strong spirit, *arak*; this is locally consumed.

Rānā—رعنا—beautiful.

Randu, *randuk* — the name in Baluchistan for SALSOLA ARBUSCULA.

Rang—رنگ—colour, dye-stuff.

RAPE — BRASSICA CAMPESTRIS, *Linn.*, sub-species NAPUS.

Ranj—رنج—colic, twisting of the bowels, grief.

Raphanus sativus, *Linn.* CRUCIFERÆ.

The Radish, *turb, thurb*; Hindustani, *mulī*. A very large white-rooted variety is commonly cultivated in all gardens, and is much valued as a vegetable when cooked. This, when boiled (the usual way of cooking this vegetable by the Pathans and Afghans), gives forth the most horrid and unbearable stench to a European nostril, but these people seem to appreciate it.

Rasan—رسن—*rasmān*—رسمان—*razmān*, *rīsmān*—rope, cord, string, thread.

Rasmān-ālafī—rope made from the grass, ERIANTHUS RAVENNÆ.

Rawīsh—رويش—a sprout, a shoot.

Raz—رز—*riz*—grapes, poison.

Re, *rī*—ريه—a salt that effloresces from the soil.

RED—*surkh*, *lāl*.

RED-PEPPER—CAPSICUM species.

REEDS — *nāl*, *nāī*—ARUNDO DONAX, PHRAGMITES COMMUNIS, ERIANTHUS RAVENNÆ, and ERIANTHUS species.

RENNET—*panīr-māīa;* a substitute for rennet, *māīa-shīr.*

Resh, rīsh—ریش—the beard, applied to the roots of a plant.

Resha, rīsha—ریشه—a fringe, fibres, the roots of a tree.

Resha-khatmī—roots of ALTHÆA LAVATERÆFLORA employed in medicine.

Resha-i-gul—roots of MIRABILIS JALIPA.

Resham—ریشم—silk.

Resham-i-khāmak—raw-silk.

Reshmī—ریشمی—silken.

RESIN—*zaft, zift, zuft.*

No pine-resin is a product of the country I travelled over, but under the name *anzrud* is imported into Herat and Meshad a true pine-resin from other parts of Afghanistan and India. A substance called *zuft* is said to be obtained from a cultivated tree called *pōsh-i-khām,* which grows at Maimana, Kalanao, and Panjdeh. The resinous dust of CANNABIS SATIVA is *chars, charas,* and is imported as an intoxicant.

Rewand—ریوند—Rhubarb, RHEUM species.

Rewand-i-chīnī—ریوند چینی—the medicinal Rhubarb root from China, RHEUM species.

Rewand-chukrī—the edible indigenous Rhubarb, RHEUM RIBES.

Rewand-i-dewāna—[Fools'-Rhubarb], RHEUM TATARICUM.

Rewand-i-megān — [the ruby-coloured Rhubarb] RHEUM TATARICUM.

Rewās, rīwās—ریواس—the edible Rhubarb, RHEUM RIBES.

Rewāsh, rewāshk—[from *rawīsh,* a sprout, a shoot]; the edible Rhubarb, RHEUM RIBES.

Rewāsh-i-dewāna—[Fools'-Rhubarb], RHEUM TATARICUM.

Rheum Ribes, *Gronov.* POLYGONACEÆ.

The edible rhubarb, *rewand, rewand-chukrī, chukrī, rewās, rīwās, rewāsh, rewāshk.* Indigenous all over the moister localities from 3000 feet and upwards, occurring in great expanses, over wet clay soil, on a northern exposure, on the Paropamissus range and the higher hills in Khorasan, marking the country most characteristically in the autumn with the brilliancy of its almost scarlet foliage. The natives are very fond of collecting and eating raw the young shoots of the flowering stems, not the leaf-stalks; they surround the sprouting stems with stones, to blanch them as well as to protect them from the goats and sheep, until they have grown large enough to be worth collecting to eat. The root-stock is employed in dyeing leather of a red colour.

Rheum, *species.* POLYGONACEÆ.

The medicinal rhubarb, *rewand-i-chīnī,* is imported in some quantity from China through Turkistan.

Rheum tataricum, *Linn.* POLYGONACEÆ.

Fools'-rhubarb, *rewand-i-dewāna, rewāsh-i-dewāna, rewand-i-megān; ishkīn* (Turkomani). This grows on the great alluvial plains of the valley of the Hari-rud to the north of Tir-pul, at an altitude of 2000 feet. From the great size of its two or three base leaves, which lie expanded flat against the ground, somewhat resembling VICTORIA REGIA leaves without the up-curled margin, it forms a marked object on the plain, more especially when its fruiting-stem is covered with the most brilliant ruby-coloured fruit, from which it receives one of its names. The fruit and the root-stock are both collected to be employed in medicine; the decoction of the fruit is considered a more powerful purgative than that of the root-stock.

RHUBARB, CHINESE—RHEUM species.
RHUBARB, EDIBLE—RHEUM RIBES.
RHUBARB, FOOLS'—RHEUM TATARICUM.

Rhus Coriaria, *Linn.* ANACARDIACEÆ.

The Sumach, *samagh, samāghk, sumāghk, sumagh.* A cultivated tree in Khorasan and Western Afghanistan orchards, and said to be cultivated throughout Central Asia for its leaves, which are greatly used in dyeing, especially in dyeing silks. The leaves as sold in the bazaars are called *barg-a-sumāghk.* Can it be this tree that is called *posh-i-khām,* and yields *zuft* at Maimana?

RICE—the plant ORYZA SATIVA, and its grain.

Ricinus communis, *Linn.* EUPHORBIACEÆ.

The Castor Oil plant, *bed-anjīr, baz-anjīr.* Cultivated throughout the country, round the margin of cotton, tobacco, or melon fields, for its seed, from which the chief oil for burning is obtained, *rōghan-i-baz-anjīr.* Imported "cold drawn" castor oil is well known as a medicine, and so are the seeds of a Croton, but neither the local oil nor the seeds of this plant are employed as medicine. Indeed, the people would never admit that the oil could be of use as a drug except at Hosenabad. Household tapers, *maluk,* are made by crushing the seeds along with raw cotton wool until the oil is expressed, and then rolling the cotton laden with oil into the form of tapers; these are made, as required, for household use.

Rīsmān—ريسمان—*rasman*—رسمن—*razmān*—a rope, twine, and string.

RIVER—*rud, darīa.*

Rīwās—ريواس—RHEUM RIBES, the edible rhubarb.

Riz, raz—رز—grapes, poison.

Rob — رب — *rōb, rub* — juice, syrup, inspissated juice.

Rob-al-sus—رب السوس—*rob-a-sus*—[the syrup of the root], liquorice, the extract made from the roots of GLYCYRRHIZA GLABRA.

Roba, ruba—ربا—robbing, stealing, carrying off.

Rōbā—روبا—*rōba*—روبه—a fox, VULPES species.

Rōdan—رودن—*rōdang*—رودنگ—madder, the plant and dye-stuff of RUBIA TINCTORUM.

Rœmeria hybrida, *D'C.* PAPAVERACEÆ.

Lāla-dukhtar, shatīra. The seeds of this poppy are employed in medicine.

Rōghan—روغن—oil, butter, grease, pitch.

Rōghan-i-gāo—[cow-oil], *rōghan-i-zard* — [yellow-oil], clarified butter, the *ghī* of Hindustan.

Rōghan-sīa — [black-oil], pitch, tar — artificially prepared.

Rōj-gard, for *rōz-gard*—[the day turning], EUPHORBIA CHEIROLEPIS.

ROOT—*āgar, asal, bekh, ban, bun, golī, ībrang, mahk, resh, resha, sus, shāk, shākh;* of the teeth, *ārī.*

ROPE—*rasmān, razmān, rīsmān, rassan.*

The ordinary rope or twine of the country is made of goats' or camels' hair, that made of sheep's wool is less common. These materials, although they do not make as strong ropes as vegetable fibres, are on the whole much more suitable in this climate for tying on loads to animals. The Turkomans manufacture rope from the fibres of APOCYNUM VENETUM, CANNABIS SATIVA, and ERIANTHUS RAVENNÆ. Where we would employ twine for tying up small bundles, and other such small requirements, the people of these parts employ the root bark of several species of ASTRAGALUS for the purposes required, as also the bark from the annual shoots of the Elm, ULMUS species.

Rosa Beggeriana, *Schrenk.* ROSACEÆ.

Sag-zahr, [the dog-rose].

Rosa berberifolia, *Dumont.* ROSACEÆ.

Kalura, so called in all probability from its becoming exposed to the notice of the gleaners when the crop is being collected, as it is a common weed in corn-fields.

Rosa damascena, *Mill.* ROSACEÆ.

The Damask Rose, *gul, gulāb.* This is the ordinary rose that is found cultivated in all gardens, generally one or two large bushes in each. It is grown in great quantity at Meshad, and Turbat-i-Haidri, and wherever there is a large town with abundance of water for liberal irrigation. In Persia this is the flower of all flowers in beauty and scent, it however lasts too short a time, owing to the hot winds, as they at once put an end to all its beauty. Wherever it is grown, or in however small a quantity, the flowers are daily collected by the owners of each garden, and handed over to the distiller, who manufactures from them rose-water, *gulāb*. Rose-water is a luxury which the very poorest of the Persian ladies and dandies cannot do without; in almost the smallest village it is to be procured.

Rosa lutea, *Mill.* ROSACEÆ.

The single-flowered Yellow Rose, the Persian Yellow Rose of our gardens, *gul-i-rānā, gul-i-rānān-zebā.* A cultivated shrub in gardens.

Rosa moschata, *Mill.* ROSACEÆ.

Gul-nastaran, or *gul-nastran.* The climbing White Rose of the Punjab Himalaya, so well known to the dwellers at Muree and Simla. On this journey, I only met with it as a cultivated plant in the vicinity of shrines.

ROSE—the flower and shrub of ROSA species, *gul, gulāb, zahr, sag-zahr, kalura, gul-i-rānā, gul-nastran.*

ROSE-WATER—*gulāb.*

Manufactured in every hamlet from the flowers of ROSA DAMASCENA, the Damask Rose. From the larger towns, as Meshad and Herat, there may be some trade in the commodity.

Rōz—روز—the day.

Rōz-gard—روزگرد—*roj-gard*—[the day turning], the sun; turning of the day; applied to certain flowers; EUPHORBIA CHEIROLEPIS.

Ruba, roba—ربا—robbing, stealing, carrying off.

RUBEFACIENT—the tubers of the roots of EREMOSTACHYS LABIOSA, and other species, and the tubers of CURCUMA LONGA are so employed.

Rubia tinctorum, *Linn.* RUBIACEÆ.

Madder, *rōdan, rōdang*; the Peshawur and Indian trade terms, *manjīth, majīth, majīt.* This valuable dye-stuff is cultivated throughout this country in orchards, under the shade of trees, and where irrigation is plentiful; the plant takes three years before it can yield the proper size of root to be considered a good marketable commodity. The cultivating of the plant in orchards is said rather to improve the bearing of the trees than cause them injury; the fact is, to get a good crop of madder the soil requires to be well manured and most liberally irrigated, thus the fruit trees benefit as well as the madder. The finest is said to be cultivated at Anar-dara, Koin, and Yezd, from whence the roots are imported in immense quantities to Herat. At Herat a good deal is also produced, but not of such a fine quality. From Herat it is re-exported in all directions, a great deal to Afghan proper and India, besides in some bulk to Turkistan.

Rubus discolor, *Weike. et Nees.* ROSACEÆ, and
Rubus cæsius, *Linn.* ROSACEÆ.

These two species of Bramble, *balourī, malourī, zīl-khār,* are very common shrubs at an altitude of 3000 feet, in rocky country, by the sides of streams. Their roots are collected to be employed in producing a brown dye for wool, and the fruit is much sought after.

Rud—رود—a river.

RUE, WILD—PEGANUM HARMALA.

Rukh—روخ—the name of a plant.

Rumex, species. POLYGONACEÆ.

The Dock, or Docken, *ishkhun, turshak.* The stems of this plant are employed in making tinder; these are browned over a fire, the browned coating is scraped off, and this makes the tinder. I found a RUMEX similarly employed in Ladak and Kashmir.

Rumī—رومی—Turkish.

RUSH—JUNCUS MARITIMUS.

RYE—SECALE CEREALE.

Sabad—سبد—*sabat*—a strainer made of basket-work, a basket.

Sabcha—the gourd of BENINCASIA CERIFERA, much eaten as a vegetable.

Sābun—صابون—soap.

Sabz—سبز—green.

Sabza—سبزه—pot-herbs, vegetables.

Sabzī—سبزي—verdure, green, Turki for the carrot, Daucus carota.

Safed—سفيد—white.

Safeda—سفيده—and *safedār*—سفيدار—the Lombardy or Black Poplar, Populus nigra.

Safflower—Carthamus tinctorius.

Saffron—the stigmata of Crocus sativa.

Safī—a sieve or strainer made of basket-work, the shape of a large spoon or ladle.

Sag—سگ—a dog.

Sag-ābī—سگ آبي—[water-dog], an Otter, Lutra species.

Sag-mār—[dog-snake], a Lizard.

Sag-zahr—[dog-rose], Rosa Beggeriana.

Saīad—صيد—game, prey. In Baluchistan the Gazelle.

Sāk—ساق—Arabic, the trunk of a tree. In Hindustani the name for the bark of the Acacia Arabica.

Sak-bīna—سكبينه—[the gum of the (tree) trunk]. Gum-arabic.

Sāla—ساله—age, years.

Sālab—ثعلب—*sālub*, *sālap*, or *sālup*—a fox, the tubers of an Orchis species, Salep (Anglo-Arabic).

Sālab-misrī—ثعلب مصري—[Egyptian Salep].

Sal-ammoniac—Chloride of ammonium.

Salātīn—سلاطين—kings, princes.

Salep—Anglo-Arabic from *sālab* or *sālap*, the tubers of an Orchis.

Salix, *species*. Salicineæ.

The Willow, *bed*, *bīd*, *majnu*, *majnun*, by the Baluchis *get*. Salix pycnostachya, *Anders.*, and Salix acmophylla, *Boiss.*, occur only as indigenous shrubs or small trees at an elevation of 3000 feet and upwards near running water.

Salix Babylonica, *Linn.*, is a large indigenous and cultivated tree. Salix Daviesii, *Boiss.*, is a cultivated tree. Salix alba, *Linn.*, is a large tall tree cultivated near villages, called *bed-i-sīa*, owing to the dark colouring of its bark. Salix songarica, *Ands.*, is also a cultivated tree near villages called *bed-i-surkh*, owing to the red colouring of its bark. The cultivated trees attain great girth; although whilst young they may be tall, they soon loose their stature owing to the high winds, and their boughs easily breaking off, besides whilst young most of them are kept in a continuous state of pollard, from cattle being fed in early spring upon their young branches and shoots. They are all cultivated, if water is at hand, for the rapidity of their growth, which gives early shelter and shade, besides for the value of their wood, which, though not much thought of for roofing purposes, as it is easily destroyed by white ants, comes largely into use for doors, lintels, spinning wheels, making dishes, platters, lids for the large iron cooking pots which are so much in vogue in this country, for spoons, for the manufacture of charcoal, for gunpowder, and as fuel, and divides the honour of being used in making the boxes for packing grapes for exportation to India with Populus nigra. The stems of young trees are employed to make the handles of their chief agricultural weapon, a kind of spade-shovel, the handle of which has to be fully 5 feet in length, requiring lightness and strength; or these are bent into shape to make the wooden supports employed in the roofing of the *kabitka*, or nomad hut. The branches and annual shoots are used in the manufacture of basket-work, whether for the construction of the walls of houses, supporting irrigation channels, or for basket-work in general, and in early spring cattle are fed on the young blossoming shoots.

Salix Caprea, Linn. (?) (at least I suppose it is this plant), is cultivated at Herat, for the scent distilled from its flowers; it is called *majnu*, and *bed-mushk*.

Salsafy—

That cultivated as a vegetable in England is Tragopogon

PORRIFOLIUS. The indigenous TRAGOPOGON COLORATUM is used as a vegetable here.

Salsola arbuscula, *Pall.* CHENOPODIACEÆ.

The Brahui name for this shrub is *narak, naruk;* the Baluchi, *randu, randuk.* A very common shrub in the Baluchistan desert country, often 4 feet in height, at once distinguished by its peculiarly striped bark, marked with longitudinal stripes of white, the darker outer layer of bark splitting, showing the inner lighter coloured tissues, as if the outer bark was too tight for the growing shrub. It is considered excellent camel fodder, and is employed in the tanning and preparing of skin bottles for holding water, which are a great necessity in this desert country; it is also used for the manufacture of Barilla.

Salsola Auricula, *Moq.* CHENOPODIACEÆ.

Gulmaī, yields Barilla.

Salsola fœtida, *Del.* CHENOPODIACEÆ.

Saltwort, *shōra, shōrag, shōre.* This is a common shrub over the saline plains of the desert country from Quetta to the Hari-rud. It is burnt to obtain Barilla, *khār, ishkhār.* At Sha-ishmail, on the 28th October 1884, I obtained from the surface of its leaves a quantity of manna, which presented the appearance of drops of milk that had hardened on its foliage; this seemed to be well known to the Baluchi camel drivers, who collected and ate it. The only name they had for the substance was *shakar* (sugar).

SALT, common salt, CHLORIDE OF SODIUM.

SALT-MINE, or salt-pits, or salt-fields, *kan, kanī, namak-sār.*

SALTPETRE—NITRE, NITRATE OF POTASH.

Salts.

of ARSENIC; of COPPER; of LEAD; of ZINC.
ALUM.
BIBORATE OF SODA, Borax.
CHLORIDE OF AMMONIUM, Sal-ammoniac.
CHLORIDE OF SODIUM, common salt.
NITRATE OF POTASH, Nitre, Saltpetre.

SALTWORT—species of Salsola.

Salvia ceratophylla, *Linn.* LABIATÆ.

Is said to be employed in medicine; the leaves are strongly lemon scented.

Salvia (?) *species.*

The seeds employed in medicine called *kanoucha, kanouncha.*

Samagh — صمغ — *samāghk* — the Sumach, RHUS CORIARIA.

Samār—سمار—a herb.

Samārākh, samārukh—سماروخ—[*samār-rukh*].

An OROBANCHE, that springs from the roots of the Umbellifer PYCNOCYCLA AUCHERIANA. The term is applied to other species of OROBANCHE, and to a large FUNGUS that breaks open the soil in the same fashion as the Orobanche flowering head does.

Sambal—سمبل—*sanbal*—سنبل—*sumbal*—

Is a scented root-stock, and these names should, correctly speaking, be applied to that of FERULA SUMBUL; in this country it is applied to that of FERULA SUAVEOLENS, which is merely a substitute for the former, as it loses its scent on drying.

Sambal-ultīb—*sanbal-ultīb*—سنبل الطيب—*sanbal-al-latīb*—سنبل الطيب—[the musk-scented *sambal*].

In these localities, and in this trade, this term is applied to the root-stock of VALERIANA WALLICHIANA; but to speak more exactly it should be the root of NARDOSTACHYS JATAMANSI of Hindustan.

Sanā—سنا—*sanā-ī-makaī*—سنامكي—*sanoī-makaī*—

Senna, the leaves of CASSIA OBOVATA (?) and other species employed in medicine; supposed to be brought from Mecca.

SANDSTONE—

The country in the vicinity of Salami produces some very fine high-coloured slabs of sandstone. These are placed at the heads of graves uncut, and just as if lifted from the quarries. I measured one 13 feet long, 2 feet wide, and 2 feet thick.

Sanesh—

A needle, the technical term applied to needles fixed in a piece of wax employed to scratch the surface of the Opium Poppy head to allow of the exit of the milky juice.

Sang—سنگ—a stone, anything hard.
Sang-āhak—سنگ آهک—[limestone].
Sang-ātish—سنگ آتش—[fire-stone], flint.
Sang-chakhmākh—سنگ چکهماخ—[flint-stone].
Sang-i-āsīa—سنگ آسیا—*sang-āsā*, [mill-stone].
Sang-i-marmar — سنگ مرمر — *sang-i-malmal*, [marble], alabaster, or chrysolite.
Sang-i-nivishta—سنگ نوشته—[inscribed stone].

A name applied to a large stone covered with inscriptions in the Nehal-shani pass.

Sang-pusht—سنگ پشت—[stony-back], the tortoise.
Sang-tōtī—[stone-covered], a tortoise.
Sang-tutia—سنگ توتیا—[the stone Tutty]. Here a common term for sulphate of copper. Tutty is a natural salt of zinc, found in Persia.
Sanī—سنی—steel—*Sanesh*—a needle.
Sanjid — سنجد — *sanjit, sinjad, sinjit, sinjid*, Elæagnus hortensis, so called whether indigenous or cultivated.
Sankhīa—سنکهیا—the ordinary dirty grey Arsenic of the bazaars.
Sāo-safed—[the white polisher], the herb Gypsophila paniculata, the root-stocks of which are *bekh*, and employed as soap. *Sāvīdan*—ساویدن—to polish.
Sapad, sabad—a basket.
Sapistān—سپستان—Sebestens, the fruit of Cordia Myxa.
Sa,—سر—the head, the top.

Sar-i-khāna—سرخانه—[the top of the room].

The ring of wood or nave at the top of the roof of the *kabitka*, into which all the ends of the pieces of wood that form the roof are fixed, usually made of Mulberry wood.

Sar-pōsh—سرپوش—[head-cover], the lid, or wooden cover for a pot.

Sar-shīr, sir-shīr—سرشير—[top of the milk], cream.

Sār — سار — placed after a noun means plenty, magnitude, as *sangsār*, stony ground; *nemak-sār*, salt fields.

Sarcocolla—[from the Greek, meaning flesh-glue] the manna-like substance, or drug yielded by Astragalus Sarcocolla.

Sarda—سرده—*sardā*, [cold].

A variety of the Melon, Cucumis Melo, collected late in the season, and largely exported from Afghanistan to India.

Sardī—سردي—cold, coldness.

Sares, sarīsh—سريش—*siresh, sirīsh*—

These terms are applied equally to the viscid glue-like gum obtained from the roots and leaves of Eremurus Aucherianus as well as to the glue made from animal refuse.

Sarīsh-i-kāhī — سريش كاهي — [vegetable-glue], made from the roots of Eremurus Aucherianus.

Sarīsh-i-narm—the flour made by grinding down the dried roots and leaves of Eremurus Aucherianus, preparatory to converting it into glue.

Sargīn—سرگين—*sarkīn*—dung, manure.

Sarnagūn — سرنگون — [topsyturvy], the head turned upside down, as in the flowers of a Fritillaria.

Saro—سرو—*saur, sawn, sarun*—سرون—the Cypress, Cupressus sempervirens.

Sarshaf—سرشف—Rape, BRASSICA CAMPESTRIS.

Sarson — سرسون — Hindustani for Rape, BRASSICA CAMPESTRIS.

Sātar—سعتر—a labiate, with a strong odour of Peppermint.

Saxaol — the Turkomani name for HALOXYLON AMMODENDRON, the White Tamarisk of Europeans.

SCENTS—

Rose-water, *gul-āb*, is prepared from the flowers of the Damask rose, ROSA DAMASCENA. A willow, SALIX species, is cultivated in Herat, for a scent that is obtained fiom its flowers by distillation. The shrub is called *majnu*, the shrub and scent *bed-mushk;* this may prove to be SALIX CAPREA, which is cultivated in the Punjab also for this purpose, but I have no other authority for considering it so. The rhizomes of an Iris, *ōrisā ōrisīā*, are imported from Western Persia for their scent, as well as to be employed in medicine. The Musk-pod, *mushk, tibit*, is imported from Tibet; from Central Asia the true *sambal*, FERULA SUMBUL, and as a substitute for the last, the root-stock of FERULA SUAVEOLENS. The root-stocks of VALERIANA WALLICHIANA, called in these parts *sambal-ultīb*, are imported from Afghanistan proper to Meshad.

The following gum-resins and herbs are strongly scented: —Galbanum, the gum-resin of FERULA GALBANIFLUA, especially when burnt: the grass ANDROPOGON LANIGER; the gum-resin of a species of BALSAMODENDRON; the fresh root-stock of FERULA SUAVEOLENS; ZIZIPHORA TENUIOR, the whole plant, is strongly pregnant with an odour of Peppermint; TEUCRIUM SERRATUM upon being crushed gave forth the odour of Asafœtida. The tubers on the roots of EREMOSTACHYS species, when crushed, yield an aroma usually associated with the CRUCIFERÆ.

Scorzonera mollis, *Bieb.* COMPOSITÆ, and

Scorzonera tuberosa, *Pall.* COMPOSITÆ.

The tuberous roots of these and other species are called *jhāg, kambul, mandalāk*; they are collected and eaten, either raw or cooked; when cooked they make a rather nice vegetable, losing their extreme bitterness. The Scorzonera or Vipers-grass, cultivated as a vegetable in our gardens in England, is SCORZONERA HISPANICA.

SEALING-WAX—*lāk*—chiefly comes from Bokhara, a little from Persia; it is mostly used by the jewellers in their trade.

Seb—سيب—*sib*—the Apple, PYRUS MALUS.

Seb-i-zamīnī—[earth-apple], the Potato, SOLANUM TUBEROSUM.

Seb-i-zamīnī-angrez — [English-earth-apple]; the Jerusalem Artichoke, the tubers of HELIANTHUS TUBEROSUS.

SEBESTENS—the fruit of CORDIA MYXA.

Sebist, sepist, sipist — سپيست — Lucerne, Medick, MEDICAGO SATIVA.

Secale cereale, *Linn.* GRAMINEÆ.

Rye, *gandam-dār, jao-tak-tak.* As a weed very largely affecting the wheat fields of the country; in some instances the fields appeared more rye than wheat, it is very rarely found to occur amongst barley, though I did find it in a field of barley at Bezd. The grain is not considered as injurious to those eating it when so largely mixing with wheat, but when diseased by the presence of Ergot, *sīa-khāk,* the grain is known to be injurious to the health. I am of the opinion that rye here, as in the Kuram Valley, is an indigenous weed of the wheat fields.

SEED—*dāna, dāne, cham, hab, pīla, tukhm*; a small seed, *dānak.*

SEEDLESS—*be-dāna, bī-dāna.*

SEED-VESSEL—capsule, *kawa.*

SENNA—the leaves of CASSIA OBOVATA, and other species employed in medicine.

Sepāru, supārī—سوپاري—the Areca nut, the nut of the AREA CATECHU Palm.

Sepia, *species.*

The Cuttle-fish: the internal calcareous skeleton, or cuttle-bone, is called *kaf-i-darīā*, or foam of the waters, and is usually brought to these regions by return pilgrims from Mecca, and hence is looked upon as a most important and valuable medicine.

Sepush—سپش—the seeds of a species of PLANTAGO employed in medicine; their resemblance to the bodies of lice has no doubt given rise to the name.

Sesamum indicum, *Linn.* PEDALINEÆ.

The Sesamum, *kanjīd, hanjīt, kunjid, kunjit;* Hindustani *til.* Cultivated for its seed for oil, *rōghan-i-kanjīd;* usually grown in fields associated with melons and tobacco, as it is a crop that requires free irrigation. The oil is employed both as a burning oil, and in dietary. The seeds, *tukm-i-kanjīd*, are much used in confectionery.

Setaria italica, *Beauv.* GRAMINEÆ.
Syn. PENNISETUM ITALICUM, *R. Br.*
„ PANICUM ITALICUM, *Linn.*

Italian Millet. The plant, *tōgī, tugī, thugī;* the seed, *gāoras; kangnī* of the Punjab. Is cultivated largely, and employed in the food of the people.

Sha—شه—or *Shā*—شاه—a king, a prince, great, excellent. A term of excellence as applied to the Spanish chestnut, CASTANEA VULGARIS, *shā-balut;* to the Mulberry, MORUS NIGRA, *shā-tut.*

Shab—شب—night, darkness.

Shab-pāra—شبپاره—[night-flyer], a bat; *shaprak* — شپرك — *shabparak*, *shauprak* [the little night-flyer]; a small bat, the silkworm moth, any moth, a butterfly.

Shafta—شفته—thin, delicate, beautiful.

Shaftarang—شفترنگ—[the beautiful coloured one]. A nectarine with a sweet kernel.

Shaft-ālu — شفتالو — [the beautiful plum]. The Peach, PRUNUS PERSICA.

Shaftal — شفتل — *shautal* — the Clover, TRIFOLIUM RESUPINATUM.

Shagh—شغ—a branch, a horn, an antler.

Shaghs, shaghz—the Maple, ACER species.

Shakar—شكر—sugar; also applied to manna.

Shāk—شاك—a shoot, a twig, a tendril, a root.

Shak-ākal—شقاقل—

Several plants go by this name. If it means [the root of wisdom], being a corruption for *shāk-akal,* then it would be the name for TRACHYDIUM LEHMANNI, eating the roots of which are supposed to increase the memory, and give knowledge; if the word means the [root yielding provisions], and is a corruption for *shāk-ākal,* it is applicable to the Carrot, DAUCUS CAROTA and to POLYGONATUM VERTICILLATUM: the rhizomes of the latter are considered a valuable food for the sickly.

Shakh—شخ—hard ground, the summit of a mountain, a branch.

Shākh—شاخ—*shagh*—شغ—a branch, a bough, a horn, a shoot, a peak. The Maple, ACER species.

Shākha-i-tāgh—

The dye-stuff obtained from the wood of HALOXYLON AMMODENDRON. The word is a technical one; it only means [the wood of the Haloxylon], and "dye" is left to be understood.

Shalgham—شلغم—the Turnip, BRASSICA CAMPESTRIS.

Shālī—شالي—the rice plant, ORYZA SATIVA.

Shām, shom—شام—black, a black spot, a mole.

Sham—شمع—a candle.

Shamal—شمل—the north; applied to a wind from the north that blows across the Hari-rud in autumn, bearing great quantities of sand along with it, very injurious to the crops.

Shambalīt, shanbalīt — شنبليت — the corms of MERENDERA PERSICA. The Hermodactyl of the ancients (?).

Shāmlī, shamlīd — شمليد — *shamlīt* — شمليت — the Clover, Fœnu-greek, TRIGONELLA FŒNUM-GRÆCUM.

Shamshād — شمشاد — *shamshāt* — Boxwood, BUXUS SEMPERVIRENS.

Shamshātu—a tortoise.

Shāna—شانه—a comb.

Shangār—شنگار—MELILOTUS species; the fruit of *pīrwathī*, CYNANCHUM species.

Shaō-dāru, shava-dāru, shaōnīz—شونيز—the seeds of a species of NIGELLA.

Shaprak — شپرك — a small bat, a moth, the silk-worm moth, a butterfly.

Sharāb, shrāb — شراب — wine prepared from the juice of the grape.

Shāsh—the Elm, ULMUS species.

Shatīra—the Poppy, RŒMERIA HYBRIDA.

Shā-tut—شهتوت—the grafted Mulberry, MORUS NIGRA.

Shaufī—

A tribe of people who live near Teheran, who eat such animals as porcupines, hedgehogs, and lizards, which are usually looked upon as unclean.

Shaupara—شوپره—[a night flyer], a bat.

Shauparak, shauprak — a small bat, a moth, a butterfly.

Shautal, shaftal—the clover, TRIFOLIUM RESUPINATUM.

SHEEP—*mesh, gōspand, gōsfand*; Baluchi, *meth*.

The nomad tribes possess immense flocks of sheep and goats. With these they wander during summer over the great pasture-lands of the country; they collect the milk of the sheep and goats together, and from this mixed milk manufacture large quantities of butter and dried oxygal. The butter is at once clarified to permit of its keeping, and is put into prepared goat-skins for transport; it is usually thus conveyed to the nearest market-town, and there is repacked in huge jars for further transport. Upon the return of these nomads late in autumn there is a great trade done by them, as they pass through or in the vicinity of any large town, in sheep and goats; lamb, kid, and goat skins; clarified butter, and dried oxygal; in some manufactured woollen goods, as blanketing, carpets, felts, and clothing, the result of the industry of the women whilst in their summer encampments. The trade in sheep wool and the fine hair of the goat is mostly done during early summer with middlemen, who go to the great nomad encampments to collect the produce, a very different state of things to what it was in Ferrier's time, as the country is now overrun with middlemen purchasing up products, especially for the purchase of fine wools and manufactured goods, as carpets. The coarse goats' hair and coarser wools are wholly used up by the nomads themselves in their various necessities, as in clothing materials, blanketing for tents, felts, ropes, and such like.

Shersham, *sharsham*—Rape, BRASSICA CAMPESTRIS, var. NAPUS.

Shikam—شكم—the abdomen.

Shīkam-pāra—[a portion (medicine) for the abdomen]; the seeds of PLANTAGO species, a well-known remedy in dysenteric affections.

Shikār—شكار—prey, game.

Shikārī—شكاري—a hunter.

Shilim—شلم—*shilm*—resin, gum-resin, gum, mastich.

Shilim-bārzat, and *shilim-i-bādra-kema*, the gum-resin of FERULA GALBANIFLUA.

Shilim-i-chīrkha—the gum-resin of MICRORHYNCHUS SPINOSUS.

Shilim-i-pista—the resin, or mastich of PISTACIA species.

Shilim-i-zard-ālu—the gum of the Apricot, PRUNUS ARMENIACA.

Shīr—شير—milk, the milky juice of a plant.

Shīr-ag—milk-herb.

Shīr-giā — شيرگياه — *shīr-giā* — شيرگيا —any [milk-herb].

Shīr-go—a species of EUPHORBIA.

Shīr-khisht—شيرخشت—[hardened milk], the manna yielded by COTONEASTER NUMMULARIA.

Shīra—شيره—juice of fruit, syrup, treacle; the milky juice of the Poppy, PAPAVER SOMNIFERUM.

Shīra-ghī—syrup made from grape juice.

Shīra-tut—[Mulberry-syrup]; the infusion made from dried mulberries.

Shīrīn—شيرين—sweet, pleasant, gentle.

Shīsha—شيشه—glass.

Shōgle—Herati for a Porcupine, HYSTRIX species.

Shom, shām—شام—Arabic, black, a black spot.

Shōr—شور—saline, brackish; the name of a SALSOLA.

Shōra—شوره—salt-petre, a salt marsh, saline; the name applied to SUÆDA FRUTICOSA and SALSOLA FŒTIDA.

Shōra-gaz — شوره‌گز — or *gaz-shōra* — TAMARIX TETRAGYNA.

Shōra-kalmī — شوره‌قلمي — *shore-kalmī*, Crystalline Saltpetre.

Shōrag—SALSOLA FŒTIDA and SUÆDA FRUTICOSA.

Shōre—شوري—the plants HALOXYLON AMMODENDRON, and SALSOLA FŒTIDA.

SHOT—the nuts of PISTACIA TEREBINTHUS, var. MUTICA, are employed in lieu of small shot, by local sportsmen.

SHOVEL—a spade-like shovel, with an extremely long handle of willow wood, is called *bīl*. Any agricultural instrument, as an axe, a shovel, a spade, is *tabar*.

Shughāl—charcoal.

Shusha—شوشه—*shushad*—شوشد—chips, rubbish.

Shushag—pieces of broken pottery (Helmand).

Shutar—شتر—*shuthar*—a camel.

Shutar-khār —شترخار— [the camel-thorn], ALHAGI CAMELORUM.

Shutar-mār—[camel-snake], VIPERA OBTUSA, and the Cobra, NAIA OXIANA.

Sīa—سيه—*sīā*—سياه—black.

Sīa-chōb — سيه‌چوب — [black-stick], the shrub COTONEASTER NUMMULARIA.

Sīa-kā—سيه‌كاه—[the herb (yielding) black]; the shrub MICRORHYNCHUS SPINOSUS.

Sīa-kand—سيه‌قند—[black-sugar], Molasses.

Sīa-khāk—سيه‌خاك—[black-earth]; the Ergot on Rye, SECALE CEREALE.

Sīa-khāna—سيه‌خانه—[black tents].

Sīa-kōh—سيه‌كوه—[black mountain].

Sīa-ling—سيه‌لنگ—[black limb]; the name for PRUNUS CALYCOSUS, owing to the extremely dark colouring the bark takes on when employed as a staff.

Sīa-pōsh—سيه‌پوش—[clad in black]; the name of a tribe.

Sīa-rōghan—manufactured tar, pitch.

Sīahk—the Marten, or Pole-cat.

Sīāl—سيال—a weed, grass.

Sīāl-i-we—the grass POA BULBOSA.

Sib, *seb*—سب—an apple, PYRUS MALUS.

Sīch—سيچ—trouble.

Sich, *sīch*—EREMURUS AURANTIACUS and EREMURUS OLGÆ.

Sīkh—سيخ—a wooden skewer, a spit.

Sīkhaōl—سيخول—[bearing skewers]; a Porcupine, HYSTRIX species.

SILK—*resham*; raw-silk, *resham-i-khāmak*—

Sericulture in this country has of late years become terribly depressed, owing to sickness and disease amongst the worms, so much so that the natives have turned their attention to other products likely to prove remunerative, chiefly to the raising of opium.

SILK-WORM—the caterpillar of the silk-worm moth, *kirm-pela*; the eggs, *tukhm-i-pela*; the cocoon, *pela*, *pīla*; the moth, *shauprak*.

SILVER—*sīm*, *nokra*.

Sīm—سیم—silver.

Sīm-āb—سیم اب—[silver water], mercury.

Sīmang—ZYGOPHYLLUM FABAGO.

Sīm-kōh—[silver-hill]; these low hills to the extreme north-west of the Badghis still show traces of the old workings for silver and lead.

Sīndur—سیندور—*sundur*—red-lead.

Sinjad — سنجد — *sinjid*, *sinjit*; the Elæagnus, ELÆAGNUS HORTENSIS.

Sipist—سپست—*sebist*—Lucerne, MEDICAGO SATIVA.

Sipusha—سپشه—a nit, a louse.

Sīr—سیر—garlic, ALLIUM SATIVUM.

Sīr-piāz-ak — [the little onion garlic], ALLIUM XIPHOPETALUM.

Sīr—corruption for *zīr*, meaning under, beneath.

Sīr-balak — [(the thorn) under the leaf]; the Barberry, BERBERIS VULGARIS.

Sires, *siresh*, *siris*, *sirīsh*—سریش—*sarīsh*, *saresh*, *sirish*—سرش—

These terms are applied equally to a vegetable glue-like gum, the product of EREMURUS species, or to the glue obtained from animal refuse.

Sīrinj—

"A gum-like substance" (*Trade Products of Leh*, p. 95). "The Turkomans obtain a very superior gum from the root of a plant that grows in Kokan, which they extract by boiling, and call *sīrinj*." This in all probability will prove to be the product obtained from an EREMURUS species.

Sirishk—سرشک—the Barberry, BERBERIS VULGARIS.
Sirka—سرکه—*sirkā*—سرکا—vinegar.
Sir-shīr—*sarshīr*—[top of the milk], cream.

Sisymbrium Sophia, *Linn.* CRUCIFERÆ.

The seeds of this plant, *khāk-shī*, *khāk-shīr*, are employed in medicine.

SKIN—*pōst*.

Sheep-skins are prepared in very great numbers, tanned with the wool attached, to be made into robes called *pōstīn*. These are generally used throughout Afghanistan and Persia; during winter, they are largely exported to Central Asia, and to the north-western frontier of India, used by the natives, but the best trade is with the British frontier regiments. For winter use the men of these regiments are each supplied with one such coat, but specially made to suit their requirements by certain large firms in Cabul. There is a great trade in prepared kid and lamb skins. The finer quality of kid-skins are always called *Karakuli*, as if from that country, although prepared in Afghanistan or Persian territory. Goat-skins are tanned with the hair removed; the finest and most carefully prepared are those made to hold water in the Baluchistan desert country; they are, however, generally used to hold water, oil, clarified butter, also to contain the milk whilst being churned; but the chief use to which goat-skins are applied in these parts is for the manufacture of leather for shoes and saddlery, being dyed various colours to suit the wants of the people. Ox, horse, and donkey hides are proportionately little used, and are chiefly employed in the soling of shoes, and such like coarser uses.

SLATE—

Slate-formation was very common in the M^t Do-shakh ranges, amongst the limestone of those hills; and could be easily worked if required.

SMALL—*aj*, *chaka*—the syllables *ak*, and *cha*, added to a word, give the diminutive.

Smilax China, *Linn.* Liliaceæ.

China-root, *chōb-chīnī.* What is supposed to be the root of this species is imported from China through Central Asia, and valued as a drug.

Smyrnium cordifolium, *Boiss.* Umbelliferæ.

Kunhālk, eaten as a vegetable raw and cooked.

Snake—*mār*—

Snakes were very numerous throughout the country we traversed. In the dry desert country of Baluchistan, the Helmand, and similar parts of Persia, the small viper Echis arenicola, was very common; in the sandstone country of the Badghis, Vipera obtusa was specially characteristic, but it is not uncommon in the Hari-rud Valley, and I got a specimen of it in the Do-shakh range of hills, which is all limestone, so that it does not confine itself to sandstone, which I once thought it did. The Cobra, Naia oxiana, was met with occasionally, but owing to its great size and difficulty of preserving, only one adult specimen was kept; a good set of specimens of this species would be a valuable acquisition to any museum. Several species of Zamenis, with numerous specimens, were obtained; but bush-snakes, such as Psammophis leithii, require to be carefully looked for with their curious habit of living among the upper branches of shrubs. The formation of the soil of the Badghis seems to be a paradise for snakes, and for numerous small rodents.

Snuff — *naswār, nashwār* — to snuff — *nashuk-kardan.*

Is prepared from the leaves of Nicotiana species, its errhine action is supposed to be increased by adding to it the powder of the stems, or the ashes of Ephedra pachyclada. The natives, both men and old women, employ snuff to a great extent in these countries.

Soap—*sābun*—

Is at all times an expensive article in these regions. It is made in villages when particularly required, but is usually imported from Turkistan and Maimana; the former produces a very superior article to that locally manufactured, as at Herat, or Meshad. The finest is of course that imported from Europe, through Persia or *via* India. In lieu of soap the great root-stocks of an ACANTHOPHYLLUM, and of GYPSOPHILA are sold in the bazaars. Barilla and lime are also employed in the washing of wools and clothes.

SODA—an impure carbonate of soda and potash, is called *khār*, *ishkhār;* see Barilla.

Sōkhta—سوخته—tinder.

Solanum Lycopersicum, *Linn.* SOLANACEÆ.

The Tomato, cultivated in gardens for its fruit, which is employed as a vegetable.

Solanum Melongena, *Linn.* SOLANACEÆ.

The Brinjal, Aubergine, Egg plant, *banjān, bādinjān;* Hindustani, *baingan.* Extensively cultivated in all gardens for its fruit, which is much relished by the people as a vegetable, and is, I think, with beet-root and carrots the most commonly used vegetable.

Solanum nigrum, *Linn.* SOLANACEÆ.

The Black Solanum, *tāj-i-rizī.* A common weed, the plant used as a vegetable, and the fruit, which is black, is dried to be used as a medicine. The same species, in the hills of India, has the fruit of a ripe apricot colour, and not black. It is curious to note that *tāj-i-rizī* may mean either a crown of grapes, which the fruit resembles, or a crown of poison, as the word *riz* has both meanings.

Solanum tuberosum, *Linn.* SOLANACEÆ.

The Potato, *seb-i-zamīnī;* Hindustani *ālu.* Cultivated for its tubers in Khorasan to a large extent, but not so much in Afghanistan.

Soma—

The ancient name for a plant, which by late authorities is considered as likely to have been an EPHEDRA, and is supposed to be another form of the words *hum, huma.*

Sombala—FERULA SUAVEOLENS.

Sophora pachycarpa, *C. A. Mey.* LEGUMINOSÆ.

Karuna, talkh. This is a very common roadside shrub, which no animals will graze upon owing to its extreme bitterness.

Sorghum vulgare, *Linn.* GRAMINEÆ.

The greater, or great Millet, *jaor, jaorī, jaoār, jaoārī, jāoras, jāwars, jāwaras, jaorī-turkomanī, kīos-agī ;* the *jowār* of the Punjab.

This Millet is cultivated largely at Panjdeh, Bala-morghab, Maimana, on the Helmand, and in Baluchistan. In the district between Herat and Meshad it is only cultivated as single plants, here and there amongst crops, such as tobacco and melons which are freely irrigated. This Millet and ZEA-MAYS go by almost the same names, so that unless one inquires what the natives are speaking about it is impossible for us, and I believe even for themselves, to know which of these two they are alluding to, unless they use some distinctive term. The best name, and one which identifies the plant, but which is rarely used, is *kīos-a-gī,* meaning "the bent-grass," from the way the flower-heads are bent down. The stems here are not crushed but given entire to cattle.

SOUR, acid, harsh-tasted—*trush, tursh, turush, ishkīn.*

Spānāj—سپاناج—*spānākh*—سپاناخ—and *spināj*—the pot-herb Spinage.

SPINAGE—SPINACIA OLERACEA.

Spand — سپند — *spandān* — سپندان — *spanj* — the herb, PEGANUM HARMALA.

Spangaolī, spangulī, spingulī—the herb PEGANUM HARMALA ; and the name of a locality where the herb was common.

Sparak — سپرک — *sparīg* — سپریگ—DELPHINIUM ZALIL, and its flowers.

SPECIES, kind, sort—*gun, guna.*

SPIKENARD—NARDOSTACHYS JATAMANSI.

Spinacia oleracea, *Linn.* CHENOPODIACEÆ.

Spinage, *spinach, spānāj, spānākh, spināj.* I feel quite sure that M. De Candolle is correct in assuming this to be the cultivated form of SPINACIA TETRANDRA (*Stev.*). The indigenous plant has the same native names applied to it, and it is put to the same uses as a pot-herb. Spinage is cultivated commonly in all gardens, and where I collected SPINACIA TETRANDRA the natives pointed it out to me as *spināj*.

SPIRITS—*arak*—

A strong spirit, very like a bad brandy, is prepared from raisins, also from the fruit of the ELÆAGNUS. The preparation of spirits and wine is said to be carried on by Jews alone; once prepared the Afghans have no objection to make use of the liquor, but the manufacture is considered a heinous sin, and it is said that under this excuse alone are Jews permitted to remain in Cabul.

SPOON—*kāshuk*—the best are made from the wood of CELTIS, PISTACIA, and SALIX.
SPRING (of water)—*chashma*, *āb-khez*, *khez*.
SPUNK—*palīta*, *palīta-gōgird*.

Stachys trinervis, *Aitch. et Hemsley*. LABIATÆ.

Kalpura. A very characteristic shrub of the gravel plains of the Hari-rud. This is closely cropt by goats and sheep, and seems to make an excellent fodder.

STAFF—*chōb*, *chōb-i-dast*.
Stān—ستان—a place, a station.
STEEL—*folād*, *faulād*, *sanī*.

The steel employed in connection with flint to strike a light, *atish-bark*; Baluchi, *isthag*. It is remarkable how seldom flint and steel are now employed, even by the nomads, to strike a light: lucifer matches are always at hand.

Stellera Lessertii, *C. A. Mey*. THYMELÆACEÆ.

The myrtle-like bush of Baluchistan, *palīta*, *phalīta*. Very characteristic of the arid stony regions; it is not grazed on by camels, being injurious to them.

Stocksia brahuica, *Benth*. SAPINDACEÆ.

The hill-peach, *kōh-tōr*, [the beloved of the hills]. This is a large shrub, or small tree to 18 feet in height, characteristic of the high desert flora of Baluchistan, extending north and west to the Harut Valley as far as Karez-dasht and Sangbar. The inflated fruit hangs in clusters on this shrub well into winter, when it is quite devoid of leaves; the brilliant autumnal colouring of the fruit gives the shrubs a most gorgeous and attractive appearance,—to this is due its name.

STONE—*sang, takar, zuma, khal, lākh.*

Stourga—FERULA OVINA, the hill, or sheep Ferula.

STRAW—*ka, kā, ālaf;* Hindustani, *bhusā.*

The straws of barley and wheat are usually crushed, and in this condition are given as fodder to cattle, along with the straws of the various cultivated legumes. On the Helmand we found the straw of wheat left standing in the fields, the grain alone having been collected. The cattle were let loose and allowed to feed on the standing straw.

Strychnos Nux-vomica, *Linn.* LOGANIACEÆ.

The seed of the Nux-vomica, *kachola*, is imported freely into these parts as a valuable tonic, but it is chiefly employed by the nomad tribes for poisoning wolves and dogs, these animals frequently proving very destructive to their flocks.

Suæda fruticosa, *Forsk.* CHENOPODIACEÆ.

Shōrag. Employed in the manufacture of Barilla.

SUGAR—

Shakar, is any sugar, ordinarily brown soft sugar; *kand, kānd*, is loaf sugar; *kand-a-shīra-ghi*, is loaf sugar made from the syrup of grapes; *nabāt*, is sugar-candy: *sīa-kand* (Hindustani *gur*), is solid molasses; *shīra*, is treacle; *shīra-ghī*, is a treacle or syrup made from grape-juice: *misrī*, is Egyptian sugar-candy; and *chīnī*, a sugar-candy from Central Asia and China. In India *chīnī* is a crystalline sugar, but not sugar-candy.

With the exception of a treacle or syrup made from the juice of the grape, some say also from water-melons (Colonel Le Mesurier, in *From London to Bokhara*, p. 133, mentions that "in Merv there is a refinery to make sugar from melons"), all the sugar used in this country is imported from

Southern Persia, India, or Russia. It is imported not only for local consumption but for exportation to Turkistan. The most of the *gur* or solid molasses comes from India, a little from Southern Persia. Yezd sends a well-known loaf sugar, which is a through article, but is sold in the bazaars as *kand-i-yezdī*, as if manufactured there, which cannot be the case. A fine sugar-candy comes from Bandar-Abbas, well known as *nabāt-i-bandar-abbas.* Most of the loaf-sugar comes from India, some from Russia, called *kand-i-rusī.* A great deal of the coarse imported sugar is converted at Herat into a fine sugar-candy. I possessed specimens of sugar that were said to have been made at Herat from the juice of the grape: I regret these were lost, or rather stolen. They resembled small cakes of loaf sugar, but the crystalline structure was more like fine sand, and very gritty. The syrup or treacle made from grape-juice resembles our golden syrup treacle, and is consumed generally all over the country eaten with the diet. It is a capital addition to one's food, and not to be despised.

SULPHATE OF COPPER—*nīl-tutīā.*

SULPHUR—*gōgird*—is an importation from Persia and India.

SUMACH—RHUS CORIARIA.

Sumāgh, samagh—صمغ—*sumaghk*—the Sumach, RHUS CORIARIA.

Sumbal, sambal—سمبل—*sunbal, sanbal*—سنبل—the root of FERULA SUMBUL, or of FERULA SUAVEOLENS.

Sundur, sīndur—سیندور—red-lead.

Supārī—سوپاري—*sepāru*—the Areca nut; the nut of the ARECA CATECHU Palm.

SUPERSTITIOUS PREJUDICES—

The natives have certain superstitions relative to the following:—The Amaranth, AMARANTUS PANICULATUS, which is grown in ones and twos through the fields, to act as amulets, and thus protect the crops through which they grow. CELTIS CAUCASICA, PINUS HALEPENSIS, and PISTACIA VERA are usually found planted round their holy places or Ziarats, with an occasional Rosa moschata climbing up one of these trees. The stems of Tamarix, and the Almond, Prunus Amygdalus, are valued as hafts to whips, as a protection against snakes; a rod of the Almond carried in the hand indicates the priestly office. Peganum Harmala and Ferula galbaniflua are supposed to be preventatives of sickness; the former is collected and burnt in heaps to drive away sickness, or hung up in doorways; the latter is hung up in and around dwellings to drive off evil influences, especially during parturition. Amber, and the seeds of Cæsalpinia Bonducella, with pieces of the wood of Celtis, are worn as amulets to keep off evil spirits. The cone of Pinus halepensis is kept by the ladies in their workbags in order to give luck. It is propitious to eat of the fruit of the Date-Palm at certain holy feasts. Afghans have a religious prejudice against mules and donkeys.

Surb—سرب—lead.

Surinjān—سورنجان—the corms of Merendera persica.

Surkh—سرخ—*surkha*—سرخه—red.

Sus scrofa, *Linn.*

The wild boar, the pig, *khuk, khanzīr.*

Sus—سوس—in Arabic, a root; the Liquorice plant, Glycyrrhiza glabra.

Susan—سوسن—a Lily, an Iris.

Susanak—سوسنك—the herb Erodium cicutarium.

Syrup—*shīra, rob, rub.*

Tā, for *tar*—تر—*tār*—wet, moist, green.

Tā-gaz, for *tār-gaz*—[the green or sapid Tamarisk], Haloxylon Ammodendron.

Tabak—طبق—a wooden platter or dish, usually made of willow, Celtis, or walnut wood.

Tābāk—تاباك—the pith or heart of a tree.

Tabar—تبر—*tabār*—تبار—an axe, hatchet, shovel, spade; any agricultural tool, as a mallet for breaking clods.

Tabar-khun—تبرخون—[the blood (coloured) implement], the Jujube, ZIZYPHUS VULGARIS.

The young stems are valued as handles to implements, and when the wood is stripped of its bark it becomes blood-red, accounting for the name.

Tachina, *species.*

A small but very troublesome fly, *kajāk.*

Tāgh—تاغ—the White Tamarisk, HALOXYLON AMMODENDRON.

Tāghīstān—تاغیستان—a place abounding in trees of HALOXYLON AMMODENDRON.

Tāghūn—the tree CELTIS CAUCASICA.

TAIL—*dum, dumb.*

Tāj—تاج—a crown, a crest, a wreath, a cock's comb.

Tāj-i-kharus—تاج خروس—[cock's comb]; the Amaranth, AMARANTUS PANICULATUS.

Tāj-i-rizī — [a crown of grapes, or a crown of poison.]

The herb and dried fruit of SOLANUM NIGRUM. The fruit of this is very like a bunch of grapes, and as the fruit is of the black variety it may be known to be sometimes poisonous. The apricot-coloured fruit, of the variety in India, is eaten by children in India, and is not poisonous.

Tak—تک—a grass that grows amongst wheat.

Tak-tak—the wild Oat, AVENA FATUA; *jao-tak-tak*, Rye, SECALE CEREALE.

Tāk—تاک—the plant of the Vine, VITIS VINIFERA.

Tāk — تاق—and *tākh* — تاخ — the White Tamarisk, HALOXYLON AMMODENDRON.

Taka—تکه—the male goat that leads the flock; applied to the male of the Ibex, and to the male of the Gazelle.

Takar—a stone.

Tākh — تاخ — the White Tamarisk, HALOXYLON AMMODENDRON.

TALK—طلك—Mica.

Talkh—تلخ—*talakh*—bitter; a name applied to SOPHORA PACHYCARPA.

Talkh-ak—تلخك—bitterish; the name applied to AMMOTHAMNUS LEHMANNI; and to the Colocynth, CITRULLUS COLOCYNTHIS.

Talkhā—تلخا—parched grain, pulverized, and mixed with water into a paste; a prepared food for travelling with.

Talkhan—the flour prepared from dried Mulberries.

Tamāku, tambāku, tanbāku — تنباكو — *tumāku*— tobacco, the plant and preparation of the leaves of NICOTIANA species.

TAMARISK, TAMARIX species.

The various species of TAMARIX are the commonest shrubs and low trees found to occur from Quetta to Balamorghab, and from Herat to Meshad, up to an altitude of 3000 feet. None of the wood, even though large enough, is considered as good for timber. It is used for fuel, and the smaller branches whilst still green are largely employed in basket-work, coarse or fine, as occasion may necessitate. These shrubs are all freely browsed upon by most animals, and form part of the daily food of camels, which, however, upon being restricted to a diet alone of Tamarisk, soon become ill. On the young shoots of these shrubs is deposited much saline matter, and in the south of Persia on the species TAMARIX GALLICA, VAR. MANIFERA, is deposited a manna called *gaz-i-shakar.* In Baluchistan and Afghanistan *gaz* is the usual term for any Tamarisk, on the Helmand *kirī.* The White Tamarisk of Europeans, the *tā-gaz,* more properly *tār-gaz* of Baluchistan, is not a Tamarisk at all, but is a Chenopodiaceous plant, HALOXYLON AMMODENDRON, which, owing to its habit of growth being like that of Tamarisks generally, is considered as such by the natives, and the Europeans have taken up their name.

Tamarix articulata, *Vahl.* TAMARISCINEÆ.

The mound Tamarisk, *khōra-gaz;* Baluchi, *kirī.* This forms an apparently indigenous forest on the Helmand river;

the trees average 6 to 9 feet in circumference (I measured one 15 feet), and about 40 feet in height.

Tamarix gallica, *Linn.* TAMARISCINEÆ.

The common Tamarisk, *gaz-māzu, gaz-kera, gaz-surkh.* Is a common shrub over the whole country, well known to yield a gall, but this is not collected in these parts; it is chiefly employed for fuel and in basket-work of all sorts, from the coarse material required to build houses, on the wattle and dab principle, or in the construction of dams across rivers, to the ordinary baskets required in household use. There is a superstitious regard for having the handles of whips made from this species, owing to the bright red colouring of the bark, which much resembles, but is higher in colour, than that of the Almond, PRUNUS AMYGDALUS.

Tamarix gallica, var. **Mannifera,** *Ehrenb.* TAMARISCINEÆ.

This plant yields a manna, and hence its name *gaz-shakar.* The manna it yields is called *shakar, gaz-angabīn, gaz-anjabīn.* I collected the specimens in the Badghis, from their having been pointed out to me by a native as the plant which yielded the manna. I myself could not distinguish between this variety and TAMARIX GALLICA, but the native certainly did, as the specimens subsequently proved to be the variety MANNIFERA at the Herbarium at Kew. The manna from this plant is said only to be collected in South-Eastern Persia, in the district of Kerman, where it is obtained in large quantities and exported in all directions.

Tamarix macrocarpa, *Bunge.* TAMARISCINEÆ.

The red Tamarisk, *gaz-surkh.* A common shrub, sometimes occurring as a good-sized tree, with the young bark very red.

Tamarix tetragyna, *Ehrenb.* TAMARISCINEÆ.

The saline Tamarisk, *shōra-gaz, gaz-shōra.* So named either for its having an unusually large amount of saline deposit on its leaves, or from being employed in the manufacture of Barilla.

Tambāku, tanbāku—تنباکو—Tobacco, the plant, and preparation from the leaves of NICOTIANA species.

Tanakār, tunakār, tinkār—تنکار—*tanakāl, tinkāl*—تنکال—Borax, Biborate of soda.

TANNING—

I. The indigenous plants and substances procurable in the country that are employed in the processes of tanning are :—

TAMARIX GALLICA, as shown by one of its names *gaz-māzu*, is known to yield a gall that is employed, but it is not made use of here.

ZIZYPHUS VULGARIS. The bark of the root of the indigenous shrub.

PISTACIA TEREBINTHUS, var. MUTICA. The leaves are turned to account.

PISTACIA VERA. The galls of the leaves are an important commercial product, both for dyeing and tanning, and are largely used here as well as exported, as is the external covering of the nut, and the unfertilized ovaries.

PUNICA GRANATUM. The fruit of the indigenous shrub, and the poor fruit of the cultivated one, yield their rind for colouring and tanning leather.

PROSOPIS STEPHANIANA. The galled pods of this plant are resorted to in tanning; these are exported for the same purpose.

APOCYNUM VENETUM. The bark of the creeping underground stem is considered a valuable substance for tanning skins to be employed as water bottles.

SALSOLA ARBUSCULA. The leaves and small branches are much used in preparing skins, in the desert country of Baluchistan, to be used as water holders.

LIME and BARILLA are both freely manufactured throughout the country. These are both employed in the process of tanning.

II. Cultivated to yield tanning material :—

RHUS CORIARIA is cultivated in orchards for its leaves, which are used both in dyeing and tanning.

III. Substances imported into the country to be employed in tanning :—

CATECHU. The extract of ACACIA CATECHU.

OAK-GALLS. The galls of QUERCUS species.

ARECA NUTS. The seed of ARECA CATECHU.

TURMERIC. The rhizomes of CURCUMA LONGA; this is much used in finishing the sheep skins that are manufactured into *Pōstīns*.

The town of Turbat-i-Haidri, in Khorasan, produces an immense amount of leather, and here shoes of all sorts are manufactured very largely; these are traded with in every direction, and have a great reputation for quality.

TAR — Pitch — (manufactured), *kār*, *sīa-rōghan*; (natural), *mumīāī*, *mōmlāī*.

Tar—تر—*tār*, *tā*—wet, moist, green, juicy, luscious, fresh, young.

Tar-angabīn—ترانگبین—*tar-anjabīn*—ترانجبین—[green-honey]; in these parts the manna collected from the shrub ALHAGI CAMELORUM.

I at first thought that the reason why the name *tar-angabīn* was applied to this manna was that it was "the manna from the green bush, this name probably originating from the shrub remaining vividly green over the country long after all other plants have dried up and disappeared" (*Pharm. Jour.*, Dec. 11, 1886). Since then I have seen Layard's *Early Adventures in Persia*, vol. i. p. 349, where he says —"The mountainous country beyond Fellaut, in which we now entered, was thickly wooded with the '*beloot*' or oak. I observed several different species, one in particular bearing a very large and handsome acorn. But these trees are chiefly valuable for the white substance, called by the Bakhtyari '*gaz*' or '*gazu*,' a kind of manna. It is an article of export to all parts of Persia, and is everywhere sold in the bazaars, and employed in the manufacture of a sweetmeat called '*Gaz-enjubeen*,' which is much relished and considered very wholesome. When boiled with the leaves and allowed to harden it forms a kind of greenish cake not disagreeable to the taste; but prepared for the use of the ladies of the *enderun*, and to be offered to guests, it is carefully skimmed and separated from the leaves, when it becomes a sort of white paste of very delicate flavour." The name *tar-āngabin* would apply correctly to Layard's "greenish-cake," and this name has in all probability been merely transferred to the produce of Alhagi camelorum in this district, without any reference to colour.

Tarīāk—تریاک—the drug Opium; the inspissated juice of Papaver somniferum; medicinal treacle.

Tarkārī—ترکاری—vegetables, pot-herbs.

Tarnak, targanak—Turkomani for herbs, grass.

Tāterān, tātrān, tātrāng, tāturān, tetrān — the great roots, "Camel-turnips" yielded by Crambe cordifolia.

Tāwa—تاوه—a clay employed in the adulteration of the drug Asafœtida; red clay.

Tāza—تازه—new, fresh, green.

Tea—the prepared leaves of Camellia theifera.

Tebit, for *sebist*—Lucerne, Medick, Medicago sativa.

Tent—*khāna*—black tents of the nomads, *sīa-khāna*; the felt tents of the Turkomans, *kabitkha*.

Terek-mastar, trakmastar — hill-carrots, Zozimia absinthifolia.

Termes, *species*.

White ants, *khora, khōra, khura*. These pests are very common over the whole country, and are to be detected everywhere by their numerous clay mounds. These mounds are also called *khōra*, and apparently from them the same name has come to be applied to the domed coverings the natives build over the exposed end of the cut-over stem of the Asafœtida plant, Ferula fœtida. The destruction that white ants cause to all timber, besides its scarcity, is one of the reasons why so few houses have roofs supported by beams in this country.

Terminalia belerica, *Roxb.* Combretaceæ.

Yields the Beleric Myrobalans, the *balīla* or *balīle* of the Persians.

Terminalia Chebula, *Retz.* Combretaceæ.

Yields the Chebulic Myrobalans, the *halīla* or *halīle* of the Persians.

These two kinds of Myrobalans are largely imported to be employed as a drug, and are exported in quantity to Turkistan; in the bazaars I usually met with both species mixed together.

Testudo horsfieldii, *Grey.*

The Tortoise, *kashaf, kashif, lāk-pusht, lāch-pusht, sang-pusht, sang-tōtī, shamshātu, tōsh-bake.* This species was very common from the Helmand to the Hari-rud, and in the country to the east of the Hari-rud; I do not think that I met with a single specimen, or even the remains of one, in Khorasan.

Tetrān—the Camel-turnip, Crambe cordifolia.

Teucrium serratum, *Benth.* Labiatæ.

This herb was very strongly scented of Asafœtida.

Thambal—the Pumpkin, Cucurbita Pepo (?).

Thorn—*khār.*

Thorn-bearer—*khār-āor*—خارآور—changed to *khār-āol*, as in *khār-āol-khāna*, [the abode of the porcupine], the name of a locality; shortened to *āol*, the name for Prunus brahuicus and Prunus eburnea, both of which are noted for their numerous spines. *Sīkh-aōl* for *sīkh-āol*, [the bearer of skewers], a porcupine.

Thorn-apple—Datura Stramonium.

Thuz—the Turkoman term for salt; the name of a grass in Baluchistan.

Tibat—تبت—*tibit.*

The country Tibet; the fine soft hair, forming the under fleece of the goat, of which shawls are made, and which is called *pashmīna* in Kashmir; the Musk-pod of the Musk Deer Moschus moschiferus.

Tibatī—تبتی—*tibitī*—anything of, or belonging to, Tibet; the musk-pod; fine goats' hair.

Til—تل—Hindustani for Sesamum indicum.

TIMBER—

In Baluchistan, over the district I traversed, there are no trees to yield timber; the largest that could be obtained would be from the few scattered specimens of PISTACIA TEREBINTHUS, var. MUTICA, or from a few cultivated trees of POPULUS EUPHRATICA, TAMARIX ARTICULATA, and TAMARIX MACROCARPA. The Helmand Valley is not quite so devoid of trees; a little timber is procurable from a natural forest of TAMARIX ARTICULATA and from the forests of POPULUS EUPHRATICA on the banks and islands of the river.

In the Badghis, Hari-rud Valley, and Khorasan, a very little good timber could be derived from a few cultivated trees of the Elm, ULMUS species; the Ash, FRAXINUS species; the Oriental plane, PLATANUS ORIENTALIS; the Walnut, JUGLANS REGIA; some Willows, SALIX species; and the Lombardy Poplar, POPULUS NIGRA. The indigenous trees which might be depended upon for a very limited supply would be the Juniper, JUNIPERUS EXCELSA; some Willows; POPULUS EUPHRATICA; and the Honeysuckle, LONICERA NUMMULARIFOLIA.

The Tir-band range was by the natives said to contain timber of sorts. To my regret I was not permitted to visit the locality, which could easily have been done, whilst the mission was encamped at Balamorghab. The moment I saw the superb lofty trees of PINUS HALEPENSIS, at Turbat-i-shaik-jami, at Rui-khauf, and Sangan, I grieved in my heart as in my mind's eye I saw them being ruthlessly hacked down for material for bridges and rafts for crossing the Hari-rud, for certainly that is their fate, if not now, in a very short time.

TIN—the metal, *kalaī*, imported by coppersmiths with which to tin pots and pans.

TINDER—*fandak, purze, sōkhta*—

Is prepared from cotton-wool; also from a RUMEX called *turush-ak*, in exactly the same way as is done in Ladak, by charring the stems and scraping off the browned surface, the scrapings forming the tinder; and from the leaves of a COUSINIA, to which a good deal of woolly tomentum is attached.

TINDER-BOX—*ātish-barg*.

Tingār — تنگار — *tinkār* — تنکار —*tinkāl*—تنکال— Borax, Biborate of soda.

Tīr—تیر—an arrow.

Tō, for *tōr*—تور—a sweetheart, beloved, cream, a peach.

TOBACCO —the prepared leaves of NICOTIANA TABACUM, and NICOTIANA RUSTICA.

Tōgī, *thugī*, *tugī*—Italian Millet, SETARIA ITALICA.

Tokhm, probably the same word as *tukhm*—تخم—a seed; the name for CELTIS CAUCASICA.

TOMATO—the fruit of SOLANUM LYCOPERSICUM.

Tōr—تور — *tō* — a sweetheart, beloved, cream, a peach.

TORTOISE—TESTUDO HORSFIELDII.

Tōsh—توش —power, strength.

Tōsh-bake—[the strong box], a Tortoise.

Tōtī—a covering.

Tōtō—توتو—covering each other as the layers of an onion.

Trachydium Lehmanni, *Benth. et Hooker.* UMBELLIFERÆ.

Skakākal. The roots of this plant are collected and exported as a medicine; they are the thickness of an ordinary pencil at the top of the root, and are about 4 inches in length, tapering very rapidly to a point. These are considered very valuable as a diet for improving the memory and increasing brain-power.

TRADE—

After consideration of the various products of the country, it is but natural to note what of this local produce does the country export, and lastly what products does it import for its own requirements.

Herat and Meshad are the two great centres of trade in this country—the one lying to the east, the other to the west,—through which all the trade of these parts passes both for exportation and importation. The chief exportation consists of sheep and goats; wools—sheep's wool, and fine camel and goats' hair; woollen goods, carpets, cloths, felts, camlets; prepared skins, with the wool and hair attached, of sheep and kids; goats' skins, raw and tanned; clarified butter; dried oxygal (*karut*); wheat; fresh fruits—pomegranates, grapes, melons, apples, quinces, pears; dried fruits—apricots, prunes, raisins; nuts—pistacio nuts, almonds, walnuts; drugs—opium, asafœtida; dye-stuffs—madder, DELPHINIUM (*zalīl*), the rind of pomegranates, pistacio galls; gums of sorts; silken materials—the cocoons of the silkworm, raw and manufactured silk; a very few horses, some ponies and cattle.

The imports, applied to the uses of this country, are iron, and iron utensils of all sorts, both for agricultural and domestic use; copper-sheeting; tin; cotton and woollen goods, both of European manufacture and the local produce of the surrounding countries; rice; Indian corn; various sugars; molasses; salt; tea; condiments of sorts; drugs; dye-stuffs—indigo, aniline, cochineal, walnut bark, turmeric; tanning material—catechu, areca nuts, oak-galls, alum; sulphur; sal-ammoniac.

Raw cotton, tobacco, and barilla seem rather to act as local coinage; they are produced in the country, traded with by the people amongst themselves, and ordinarily do not go beyond the locality, these local products being consumed in the country itself.

TRAGACANTH—

The gum yielded by ASTRAGALUS HERATENSIS and other species is closely allied to the Tragacanth of European commerce, and is largely exported to Afghanistan, India, Persia, and Turkistan, under the name *katīra*.

Tragopogon coloratum, *C. A. Mey.* COMPOSITÆ.

A species of Salsafy, *gash-gōshī*, of which the natives eat the leaves and roots as a vegetable.

Trak-mastar, *terek-mastar*—Hill-carrots, ZOZIMIA ABSINTHIFOLIA.

TREACLE (liquid molasses)—*shīra*, a medicinal treacle—*tariāk* (opium).

TREE—*dār*, *darakht*, *ban*, *bān*, *bana*, *wan*, *wana*, *gwan*, *gwana*, *kan*, *zan*.

Trek—ARTEMISIA CAMPESTRIS, and ARTEMISIA MARITIMA.

Trifolium resupinatum, *Linn.* Leguminosæ.

This clover, *shaftal*, *shautal*, is cultivated to some extent as fodder for cattle, but not to the amount, or nearly so commonly as Medicago sativa.

Trigonella Fœnum-græcum, *Linn.* Leguminosæ.

This clover, Fœnu-greek, *shāmlī*, *shāmlīd*, *shāmlīt*. Is cultivated universally in gardens as a pot-herb, and occasionally, especially at Herat, for fodder for cattle. The leaves are commonly used for poultices.

Trīthk—an Anabasis, was so called on the Helmand.

Triticum vulgare, *Linn.* Gramineæ.

Wheat, *gandam*, *ganam*. This is the chief cereal crop in these regions, and upon which the agriculturist largely depends for his exchange in trade; he scarcely consumes any of it himself, living almost entirely upon other grains, even if they have to be imported, as rice or maize. The greater amount of this produce is exported, much of it to Baluchistan, Cabul, and Turkistan.

Trush, *tursh*—ترش—sour, acid, tart, harsh-tasted.

Tubers—*agar*, *agar-magar*, *gol*, *kachur*, *kors-i-gurba*, *sālab*, *yāgī-shāk*.

Tufaceous Limestone—

Was very common at the base of Mount Do Shakh, and was employed to manufacture lime from in preference to the ordinary mountain limestone, owing to the former being much more easily turned into lime, and at less cost of fuel and time.

Tugh — توغ — the White Tamarisk of Europeans. Haloxylon Ammodendron.

Tugī, *tōgī*, *thugī*—the plant Setaria italica.

Tukhm—تخم—*tokhm*—a seed.

Tukhm-i-banaush—the seed of Fraxinus species.

Tukhm-i-bhāng—the seed of Cannabis sativa.

Tukhm-i-gul—the seed of Ipomœa species.

Tukhm-i-jinjak—the seed of Prosopis Stephaniana.

Tukhm-i-kanjīt—the seed of Sesamum indicum.

Tukhm-i-khash-khāsh—the seed of Papaver somniferum.

Tukhm-i-khair, *Tukhm-i-khaira* *Tukhm-i-kheru,* } the seed of Althæa lavateræflora, and of other species.

Tukhm-i-hhatmī—the seed of Althæa Hohenackeri.

Tukhm-i-nīla-far—the seed of Ipomœa species.

Tukhm-i-rehan—the seed of Ocymum pilosum.

Tukhm-i-turī—the seed of Luffa, and Cucumis (?).

Tukhm-i-murgh—an egg, the egg of the domestic fowl.

Tukhm-i-pīla—silkworm eggs.

Tul—تول—gum, glue, cement.

Tulipa montana, *Lindl.* Liliaceæ.

The Tulip, *lāle, lāla.* This is the more common tulip of these districts, which in spring characterises the stony arid plains by the brilliancy of its inflorescence, varying in colour from a deep red to pure yellow. The bulbs, *gōl-i-lāle,* are collected and eaten, and what I believe to be these bulbs, from a specimen lot at present in the Kew Museum, when deprived of their external coats, are passed off for, and sold under the name of, *sālap,* at Bombay. Tulipa humulis, which is not uncommon, occurs in great beds, resembling in appearance our English wood Anemone, and was considered as such by several of those who accompanied the mission.

Tumāku, tamāku—the plant, and prepared leaves of tobacco, Nicotiana species.

Turb—ترب—*thurb*—the radish, the plant and root of Raphanus sativus.

Turī—تری—(Hindustani) Luffa acutangula, and sometimes this name is applied by the Persians to Cucumis sativus, but in the latter case it is probably a misnomer.

Turkamānī—ترکمانی—*turkimānī, turkomanī*—of or belonging to the Turkomans, the word is employed to identify certain products.

TURMERIC—the rhizomes of CURCUMA LONGA.

TURNIP—the plant, and root of BRASSICA CAMPESTRIS, var. RAPA.

TURNSOLE—CROZOPHORA TINCTORIA.

Tursh, turush, trush—ترش—sour, acid, tart, harsh-tasted; the grass of the Barley, HORDEUM VULGARE, or of any other cereal, given in a green state as fodder.

Turshak—ترشک—*turushak*—[sourish], a little acid; the name of a RUMEX, the stems of which are employed to make tinder.

Tut—توت—*tuth*—the Mulberry, MORUS ALBA; also a species of CAREX.

Tut-i-maghz—dried Mulberry fruit.

Tutia—توتیا—a grey Oxide of Zinc, Tutty, said to be found in a natural condition in Persia.

Typha angustata, *Borry et Chaub.* TYPHACEÆ.

The Bulrush, *lukh.* Employed in the roofing of huts, in the manufacture of matting, screens, and light basket-work.

TWISTED—*pech, ranj.*

Uch—the Baluchi for a camel.

Udish—ASTRAGALUS HYRCANUS.

Ul, al—ال—the Arabic form for our English word "the."

Ul-latīm—اللطیم—[the scent]; musk, or any odour with which they perfume the temples.

Ultīb, altīb—الطیب—[this I believe to be a contraction, and corruption for الطیب, then اللطیم], scent, musk.

Ulmus campestris, *Linn.* URTICACEÆ, and

Ulmus montana, *Stokes.* URTICACEÆ.

These two species of Elm go under the same native names, *asal-pōshāk, asal-pishāk, grez, gurez, kanjak, pōsh-e-kām, pōsh-e-kār, shāsh.* These are cultivated trees at Maimana, Kala-nao, Panjdeh, the Hari-rud Valley, and in Khorasan. Highly valued for their timber, which is considered specially well adapted for making their rice-mills. The bark of the young shoots is employed in the raw state as twine or rope. The galls *kīsa, kīsc, kesa,* are not employed.

Um—uma, hum, huma. The usual names for EPHEDRA PACHYCLADA.

In Baluchistan these are equally applied to PERIPLOCA APHYLLA. I never heard this name applied to a Tamarisk, though the Tamarisks when young are much more like the EPHEDRA than is the PERIPLOCA.

Umba—cotton pods, the fruiting pods of GOSSYPIUM HERBACEUM.

UNDER—*zīr*, frequently corrupted to *sīr*, or *zīl.*

Ungernia trisphæra, *Bunge.* AMARYLLIDEÆ.

The so-called black skinned or pig onion, *piāz-khukī,* is a very characteristic bulbous plant, but not an onion at all. The large flask-shaped bulb consists of innumerable layers of thin, black, membranaceous coverings surrounding a very small growing axis. These bulbs are collected for feeding camels with. There are two species, this one with salmon-coloured flowers, the other with yellow flowers which I did not see.

UNRIPE FRUIT—*ākhkush, ākhkuk.*

Urd—ارد—Hindustani for the Pulse, PHASEOLUS RADIATUS.

Ursus *species.*

The Bear. The natives said that between Bala-morghab and Maimana in the hills, both a red and black bear were known, but I could not get any skins, nor did I ever come across a skin in the Bazaars. The Persians on all occasions made much fun out of my enquiries relative to the *locale* of these animals; they always ended by saying, "do not be the least anxious, you will soon know as much about them as we do," alluding of course to the Russians. The black bear, *khul,* the red bear, *khirs, khirsa.*

Ushak—وشق—Dorema Ammoniacum.
Ustukhudus—اسطوخودوس—*ustakhadus.*

A labiate, employed in medicine, the name is supposed to be taken from the Greek.

Utranj—اترج—an orange, Citrus Aurantium.

Valeriana Wallichiana, *D'C.* Valerianeæ.

The root-stocks of this Valerian are called in Meshad *sanbal-ultīb, sambal-ultīb,* and are imported from Afghanistan. I collected this plant from the lofty rocks in the deep gorges of the Kuram Valley, Afghanistan, where the roots were collected and exported to Cabul under the names *māhk-ak, mushk-ak,* whence they were exported to India as *sambal-ultīb, indar-latīb, indar-ultīb, andar-ultīb, andar-latīb, gur-bālchōr-ak.* Employed as a scent and in medicine.

Vegetables—

Both the Persians and Afghans partake largely of vegetables cooked or in the raw state as part of their usual diet. Those cultivated in their gardens, and of which they usually make use, are beetroot, brinjals, carrots, radishes, turnips, cabbages, onions, cucumbers, gourds, pumpkins, endive, and lettuce, besides several pot-herbs; potatoes are in common use amongst the Persians, but these the Afghans do not seem to take to. In the better class gardens of the Persians, the artichoke, cardoons, and Jerusalem artichoke, with tomatoes and peas of a fair quality, are to be found.

The most remarkable of the indigenous plants which the people employ as a vegetable is the Gundelia Tournefortii, the young leaves and shoots of which are used in the same way as we do the leaf-stems of the cardoon, and from the great resemblance it bears in general characters, as well as in uses, to the artichoke and cardoon, its name has apparently been adopted to name the two latter, viz., *kangar;* the shoots of the flowering-stems of the edible rhubarb are much eaten raw, as well as converted into a pot-herb; the leaves of Eremurus aurantiacus and Eremurus Olgæ are used throughout the spring as the ordinary vegetable in the localities where they are common; the flowering-stem and young leaves of the Asafœtida are used by the nomads who may be encamped in the vicinity of the great Asafœtida-producing plains.

The ordinary vegetables met with cultivated are:—

Brassica oleracea.	Cynara Scolymus.
Brassica campestris, var. rapa.	Cynara Cardunculus.
Raphanus sativus.	Cichorium Endivia.
Trigonella Fœnumgræcum.	Lactuca sativa.
Lagenaria vulgaris.	Solanum Lycopersicum.
Luffa acutangula.	Solanum Melongena.
Benincasia cerifera.	Solanum tuberosum.
Cucumis sativus.	Amarantus paniculatus.
Cucurbita Pepo.	Beta vulgaris.
Daucus carota.	Spinacia oleracea.
Helianthus tuberosus.	Allium Cepa.
	Allium sativum.

Indigenous plants employed as vegetables:—

Lepidium Draba.	Solanum nigrum.
Cucumis trigonus.	Orobanche species.
Carum species.	Chenopodium Botrys.
Smyrnium cordifolium.	Spinacea oleracea.
Ferula fœtida.	Atriplex Moneta.
Zozimia absinthifolia.	Atriplex Flabellum.
Gundelia Tournefortii.	Rheum Ribes.
Centaurea moschata.	Eremurus aurantiacus
Tragopogon coloratum.	Eremurus Olgæ.
Scorzonera mollis.	Allium xiphopetalum.
Scorzonera tuberosa.	Tulipa montana.
Caccinia glauca.	Fungi species.

Vessels—

For holding oil, clarified butter, &c., made from the prepared skins and intestines of animals, are called *daba-i-charm;* made of vegetable glue, the glue-like substance obtained from the roots of an Eremurus are *daba-i-siresh;* a large iron pot or mortar is called *deg.*

Vicia Ervilia, *Willd.* Leguminosæ.

Mashing, mushing, māsh, ādas; māsh, however, is more properly a Pisum, and *ādas,* Lens esculenta. Cultivated as a field crop above 3000 feet.

Vicia Faba, *Linn.* LEGUMINOSÆ.

The Field-bean, *bakhla, bakhlī, baglī,boglī.* Cultivated over the whole country as a field crop, usually as a margin to other crops, especially cotton. Beans are eaten cooked with meat; the flour is not used as bread. Animals are fed on the flour made from beans.

VINE—VITIS VINIFERA.

VINEGAR—*ishkī, sirka, sirkā.*

VIPER—

In the Hari-rud Valley and Badghis the huge VIPERA OBTUSA is very common, ECHIS ARENICOLA is more common in the dryer and hotter desert country; both are called *dusha.*

Vitis vinifera, *Linn.* AMPELIDEÆ.

The vine, *tāk;* the fruit grapes, *angur;* raisins, *kishmish;* currants or corinths, *zīrishk-shīrīn;* wine, *sharāb;* spirits made from raisins, *arak;* vinegar, *sirka;* syrup of grape-juice, *shīra;* sugar made from grape-juice, *kand-i-shīra-ghī.* The vine is cultivated wherever there is a garden. At Herat and Meshad large gardens contain ground laid out in vines alone; usually these are all trained as climbers, but at Bezd I saw some gardens in which were cultivated standard vines. The fruit is very variable in quality. The grapes of Herat are considered to be the finest. In Herat and its vicinity the largest amount of raisins are preserved, and much of both wine and spirits prepared. Throughout the country generally a syrup or very thin treacle is made from the juice of the grape; this is much eaten by the people along with their food, and is a great improvement when added to their usual coarse bread. Grapes and raisins, more particularly the latter, form a great export trade to India. The grapes collected when on the point of ripening are packed between layers of cotton-wool, in round flat boxes, much resembling the *drums* in which figs used to be imported into England some years ago; each box contains three layers of individual grapes closely packed together, each layer of grapes lying on a layer of cotton-wool, and thus they are exported to India, arriving there about Christmas time. These form a great addition to the table at that season, and are eagerly bought by both Europeans and natives. The grapes contained in these boxes are usually a long green grape, but I have occasionally seen boxes containing red grapes. This part of the country does not produce corinths or currants, they are said to be imported into Cabul from Kafirstan, and then exported occasionally to India *via* Peshawur. An excellent vinegar is prepared from grape-juice in Herat; this is an article much exported.

Vulpes *species.*

A Fox, *rōba, rōbā, sālab, sālub.* Fox-skins, *pōst-i-rōba,* of which there is some trade in these parts.

Wach, waj—وج—the sweet-flag, Acorus calamus.

Walnut—the tree and fruit of Juglans regia.

Wan—ون—*wana*—a tree; the Pistacia vera and Pistacia Terebinthus, var. mutica.

Wanīzad—ونيزد—*wanjad*—ونجد—[the tree-resin], the gum-resin or mastich of Pistacia species.

Wāngar — the Kuram name for the indigenous Punica Granatum.

Wāra—وارة—like, resembling.

Warag, warg, warak, wark—ورق—a leaf.

Wāsh—واش—fodder, herbage.

Washing.

The roots of Gypsophila paniculata and of Acanthophyllum macrodon, barilla, lime, and last of all soap, are employed in washing woollens, cottons, and clothes.

Water—*āb, āo*; a well or shaft, *chā*; a reservoir, that is usually covered over, *hauz*; a spring, *chasma, āb-khez*; an underground conduit, *kharez, kārez*; a canal, *nahar*; a weir, embankment, or dam, *band*; a river, *rud, darīā*; a piece of water, the depth permitting of the growth of bushes, *hamun* (this originally means a level plain); the sea, or a river, *darīā*.

Water-bottle—*mashk*.

These are usually made of goat or kid skins. In Baluchistan, where every man carries one, some are beautifully prepared, the skin being very carefully tanned, and as soft as the leather of a glove.

WATER-MELON—the fruit of CITRULLUS VULGARIS.

WAX—*mum*—in this country there is little or none; it is imported into Herat from the great forest districts.

WELL—*chā.*

The wells in this country are mere shallow shafts, from 9 to 12 feet. I never came across a thoroughly constructed well in which the shaft was built of masonry as in India, nor did I meet with any well having an apparatus attached to it for drawing up or raising water.

Whāgar—the indigenous Walnut, JUGLANS REGIA, a Kuram Valley name.

WHEAT—TRITICUM VULGARE.

WHEATLING—ARENARIA HOLOSTEOIDES.

WHEEL—*charkh, charkha*; a spinning-wheel, *charkhī.*

WHEY—obtained during the manufacture of cheese, *āb-i-panīr*; during the manufacture of dried oxygal, *āo-karut.*

WHIP—*chabuk, kamchīn*—

The handles of these are usually made from the wands of TAMARIX GALLICA, or of the Almond, PRUNUS AMYGDALUS, owing to the superstitious belief that a snake will fly from these woods if the whip is thrown at them.

WHITE ANTS—TERMES species.

WHITE TAMARISK—the tree or shrub so called by Europeans is not a Tamarisk at all, but is of the natural order CHENOPODIACEÆ, HALOXYLON AMMODENDRON; it is the *tā*, or *tār-gaz*, the green or juicy Tamarisk, of the natives.

WILD—indigenous, *dashtī.*

WILLOW—SALIX species.

WIND—*bād.*

WIND-MILL, *asīā-bād.*

WINE—*sharāb, shrāb*—

The wine of the country is manufactured in the large towns. I have no information as to whether there is any trade in it with the surrounding districts. Foreign wines and brandies are most certainly imported for the use of the wealthy.

Wood—*chōb.*

Wool—

Ordinary sheep's-wool, *pashm,* and a woollen material, *pashmīna ;* in Kashmir, and India these terms are applied to the fine soft hair of the under fleece of the goat, which is here called *pat, tibat,* and the material made from it *patu* and *kurk.* There is an enormous exportation of wool in the raw state from this country through Persia to the Caspian, and also *via* Tabriz to the Black Sea, very little going towards Southern Persia, a good deal to India, besides manufactured woollen goods in the shape of carpets, and of late an immense trade has been struck up in carpets with Turkistan.

Worm—*kirm.*

Yābu—يابو—a long backed, short legged, sturdy horse, made as if it were for carrying loads, from Central Asia ; a pony.

Yāghī—ياغي—the earth, the ground.

Yāghī-shāk — [earth-root], earth-nuts, tubers of Carum species.

Yehma—Ephedra pachyclada.

Yellow—*zard.*

Zabān—زبان—the tongue.

Zafrān—زعفران—saffron, the stigmata of Crocus sativus.

Zaft, zift, zuft—زفت—pitch, tar, resin.

Zagāl—زگال—charcoal.

Zaghīr, zagher — زغير — the flax plant, Linum usitatissimum.

Zahr, zahar—زهر—Arabic, a flower, a yellow flower, a rose.

Zahr, zahar—زهر—*zahra*—زهره—poison, venom.

Zak—Haloxylon Ammodendron.

Zalīl—the plant and dye-stuff Delphinium Zalil.

Zama—زمه—*zuma, zamch*—زمچ—a white stone, alum.

Zambur, zanbur—زنبور—the honey-bee, a hornet, a wasp.

Zamīn—زمین—the earth, ground, land, soil.

Zan, for *wan*, a tree.

Zang—زنگ—the rays of the sun; rust.

Zan-ghōza—[nut (bearing) tree]; Pinus Gerardiana; *zan-ghōz*, [tree-nuts], the seeds.

Zangāl, zangār—زنگار—sulphate of copper.

Zang-o-wach — the yellow dye of Prosopis Stephaniana.

Zanj—زنج—crying, weeping.

Zanjabīl — زنجبيل — *zanjafīl*—زنجفيل—*zangabīl* — ginger, the rhizomes of Zingiber officinalis.

Zar—زر—*zer*—Gold.

Zar-chōba—زرچوبه—turmeric, Curcuma longa.

Zard—زرد—yellow.

Zardak — زردك — yellowish; the Carrot, Daucus carota.

Zardak-kōhi—hill-carrots, Zozimia absinthifolia.

Zard-ālu—زردالو—[yellow-plum], the Apricot, Prunus Armeniaca.

Zard-ālu-pewandī—technically applied to the sweet-stoned Nectarine, var. of the Peach, Prunus persica.

Zard-chōb—زردچوب—[yellow stick], the rhizomes of Curcuma longa.

Zarda-chōb—زردهچوب—yellow wood; this may be the Turmeric, Curcuma longa; the Barberry, Berberis vulgaris; or Delphinium Zalil.

Zarishk — زرشك — *zīriskh, sīrishk;* the dried or preserved fruit of the Barberry, Berberis vulgaris.

Zarna—زرنه—arsenic.

Zarnīkh—زرنیخ—yellow arsenic, orpiment.

Zea Mays, *Linn.* GRAMINEÆ.

Maize, *jaorī, jaoārī, jaorī-khurdanī.* I never could make out whether the natives were speaking of this plant or of SORGHUM VULGARE, as the ordinary terms *jaorī*, and *jaoārī*, are equally applicable to both. To those who may have the opportunity it would be as well to make a more careful examination into these names. In Baluchistan, and on the Helmand, maize is grown, but over the rest of the country I traversed it could not be considered a field crop, as if grown at all it was only grown as an occasional plant, at distances from each other, through fields of cotton, melons, and tobacco, in the same way as SORGHUM VULGARE, or PENNISETUM SPICATUM. Raised as a luxury only, for the cobs to be eaten roasted over the fire. The climate in these parts was not considered suitable for it without continuous irrigation, which could not be supplied. It is cultivated largely to the east of Herat, near Bala-morghab, Panjdeh, and in Turkistan, whence it is extensively imported into these districts; and its flour is in ordinary use here for bread.

Zebā, zība—زیبا—beautiful, elegant.
ZEDOARY—the rhizomes of CURCUMA ZEDOARIA.
Zer, zar—زر—the metal Gold.
Zer-bār, zīrbār—زیربار—impoverished ; the Barberry, Berberis vulgaris.
Zer-khār, zīr-khār—[the thorn under (the leaf)], the Barberry, BERBERIS VULGARIS.
Zetun—زیتون—the Olive, OLEA EUROPEA.
Zīārat—زیارت—a shrine, a holy place.
Zift—زفت—*zuft*—pitch, resin.
Zīl, zīr—زیر—the fruit of LYCIUM BARBARUM.
Zīl-khār—the Bramble, RUBUS species.
ZINC—a natural oxide of zinc is said to be found in Persia, called Tutty ; *sang-tutia.*

Zingiber officinale, *Roscoe.* SCITAMINEÆ.

Ginger, *zanjabīl, zanjafīl, zangafīl.* The dried rhizomes are imported from India and Southern Persia, chiefly for exportation to Turkistan.

Zīr—زير—*sīr, zīl.* Under, below, beneath.
Zīr-balak—[(the thorn) under the leaf]; the Barberry, Berberis vulgaris.
Zīr-barg—[(the thorn) under the leaf]; the Barberry, Berberis vulgaris.
Zīr-bār, zer-bār—زيربار—impoverished; the Barberry, Berberis vulgaris.
Zīrishk, sīrishk, zarishk—زرشك—the preserved or dried fruit of Berberis vulgaris.
Zīrishk-shīrīn—[sweet *zīrishk.*], corinths, or currants, the dried fruit of Vitis vinifera.
Zīrishk-tursh—[acid *zīrishk*]; the dried Barberry, Berberis vulgaris.
Zīr-khār—[the thorn under (the leaf)]; the Barberry, Berberis vulgaris.
Zīra— زيره —*jīra*— ژيره — an umbelliferous fruit, sometimes that of Cuminum Cymanum.
Zīra-sīa—an umbelliferous fruit that is almost black.
Zīwān—زيوان—darnel, Lolium temulentum; a weed growing amongst wheat, the seed of which causes inebriety and madness.

Ziziphora tenuior, *Linn.* Labiatæ.

Kākuti. Employed much in medicine, owing to its strong aroma of peppermint.

Zizyphus vulgaris, *Lam.* Rhamnaceæ.

The Jujube, *ānāb, tabar-khun;* the fruit, *ānāb.* The indigenous form is a shrub, rarely a tree; it grows in the deeper valleys of the Badghis, forming a dense low scrub, almost inpenetrable owing to the huge thorns it bears. It occurs in the same form in Kashmir, on the slopes of the hills to the north-east of the lake, at from 5000 to 6000 feet altitude, characterising the landscape in autumn by the brilliant colouring of its leaves. On the banks of the Jhelum river, entering into Kashmir, where I believe it also to be indigenous, it is more of a tree, and there forms a thicket that wild pigs cannot pass through. It is cultivated in all orchards (where its character is that of a good sized tree, but with few or no thorns) for its fruit, which is largely eaten by the natives, especially on journeys, in the same way as the fruit of the ELÆAGNUS, and this may account for the spread of the tree throughout the whole of Asia, wherever caravan journeys were made; but at the same time I am of the opinion that within the hills from the Badghis eastwards it is an indigenous shrub. I have seen it but very rarely cultivated in the Punjab plains, and in the Kuram Valley I found it being grown as a hedge, and cultivated at a shrine. Between Kuram and Thal it was certainly indigenous, but resembled ZIZYPHUS NUMMULARIA more in its method of growth.

The wood is valued as handles for farm implements. On the removal of the bark, the wood takes on a red colouring, hence its name *tabar-khun*. The branches of the cultivated tree are much cut off to be given as fodder to goats and sheep, and the bark of the branches of the cultivated tree, or of the roots of the indigenous shrub, is employed in the process of tanning.

Zoghāl, zughāl—زغال—*zagāl*—زگال—charcoal.

Zozimia absinthifolia, *Vent.* UMBELLIFERÆ.

Hill-carrots, *zardak-kōhī*. A common herb, much eaten as a vegetable.

Zufa—زوفا—HYSSOPUS (?) species.

Zuft, zaft, zift—زفت—pitch, resin, tar; the gum or resin of a cultivated tree, *pōsh-e-khām*.

Zuma, zama—زمه—a white stone, alum.

Zurat—the name on the Helmand for SORGHUM VULGARE.

Zygophyllum atriplicioides, *Fisch. et Mey.* ZYGOPHYLLEÆ.

Kech, kīch, kich. This is one of the commonest shrubs from Nushki to the Hari-rud, and is one of the few plants animals will not eat; it is very characteristic in late autumn, when covered with its large, deeply winged, straw-coloured fruit.

Zygophyllum Fabago, *Linn.* ZYGOPHYLLEÆ.

Sīmang. A very common weed, especially in the debris of old buildings. The root, when beaten into a pulp, is applied as a poultice to clean foul sores and ulcers.

Since reading the above paper, and during its publication, the first parts of two valuable works bearing on many of the same subjects have been issued from the press, viz., *The Pharmacographia Indica*, by the authors, William Dymock, C. J. H. Warden, and David Hooper, published in London by Trübner & Co., and in Bombay by the Education Society's Press, Byculla; and *A Dictionary of the Economic Products of India*, by George Watt, C.I.E., M.D., Calcutta, 1889.

LIST OF PAPERS published by J. E. T. AITCHISON, C.I.E., M.D., in connection with the Vegetation and Products of North-Western India, Ladak, and Afghanistan.

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ERRATA.

Page 2, line 36, for HASSAIN read HASSAN.

Page 7, under ALABASTER, CHRYSOLITE is mentioned. The specimens of this mineral have, however, been identified for me at the Museum of Science and Art, Edinburgh, and prove not to be CHRYSOLITE but ARAGONITE, a native carbonate of lime, in this instance (as it frequently does) containing traces of STRONTIA.

Page 8, line 23, for CEPA read CEPA.

Page 12, line 1, for ITALICA read ITALICA.

Page 12, line 6, for *Indarlutīb* read *indarlatīb*.

Page 14, line 29, for ARMENAIACA read ARMENIACA.

Page 25, line 2, for BEKH read *Bekh.*
Page 27, line 2 from foot, *for* medecine *read* medicine.
Page 38, line 5 from foot, for *Char-maghz* read *Chār-maghz.*
Page 40, line 13 from foot, for *Chob* read *Chōb.* The same in its compounds.
Page 45, line 3, for CARDAMOMUM read CARDAMOMUM.
Page 58, line 26, *for* roots-stocks *read* root-stocks.
Page 94, line 18, for DELPHINUM read DELPHINIUM.
Page 100, line 19, for LAVATERIÆFLORA read LAVATERÆFLORA.
Page 110, line 12, for NUMMULARIXFOLIA read NUMMULARIFOLIA.
Page 120, line 18, for REGALIANA read REGELIANA.
Page 122, line 9, for *Regal* read *Regel.*
Page 127, line 7 from foot, for DACTILIFERA read DACTYLIFERA.
Page 151, line 10, *for* wood *read* hood.
Page 161, line 17, for **Polypogan** read **Polypogon**.
Page 173, line 9, for JALIPA read JALAPA.
Page 179, line 10, for SATIVA read SATIVUS.
Page 186, last line, for AREA CATECHU read ARECA CATECHU.
Page 188, line 13, *for* which are *read* which is.
Page 197, line 14, for ZEA-MAYS read ZEA MAYS.

Opening Address of Session 1889-90. By Mr Robert Lindsay, President of the Society.

On the Genus Nepenthes. (With Plate I.)

The subject on which I venture to make a few remarks, viz., the genus *Nepenthes*, is one that was suggested to me as being somewhat appropriate from the fact that it is exactly a century since the first species was introduced into cultivation. I the more willingly agree to this suggestion, since the practical cultivation of these interesting plants has engaged my attention for many years. A good deal has been written of late years about the species of this genus *Nepenthes* from a physiological point of view, beginning with Sir J. D. Hooker's Address on Carnivorous Plants, delivered to the British Association in 1874. The work of the late Professor Dickson on their minute structure is familiar to you all,—work which, I am glad to say, is still being elaborated and extended by Dr Macfarlane. But in addition to the scientific interest which attaches to these highly specialised plants, their suitability for garden decorative purposes, as well as the ease with which they can be cultivated, renders them peculiarly attractive. Their singularity of form and beauty of colour are not exceeded by any other group of plants.

The order Nepenthaceæ is limited to the single genus *Nepenthes*, which consists of thirty-four species and nine varieties, as defined by Sir J. D. Hooker.* In 1847, when Dr Lindley published the second edition of his 'Vegetable Kingdom' six species only were known. The plants are shrubby, climbing, and diœcious. The greater number are natives of Borneo and the Malay Archipelago ; but one, *N. khasiana*, is a native of India, another, *N. distillatoria*, grows in Ceylon, *N. Pervillei* is a native of the Seychelles, and *N. madagascariensis* is endemic in Madagascar, whilst from tropical Australia comes *N. Kennedyana.* Since the publication of Sir J. D. Hooker's monograph in De Candolle's 'Prodromus,' four new species have been discovered and introduced into cultivation by the

* De Candolle, *Prodromus*, vol. xvii., 1873.

enterprise of Messrs Veitch & Sons, Chelsea; these are *N. Northiana, N. cincta, N. Curtisii*, and quite recently *N. Burkei.* There are at present in cultivation twenty species and ten distinct and well-marked varieties that have been introduced from abroad, and at least thirty-nine named garden hybrids, raised in this country and in America

The first species of *Nepenthes* introduced into this country was *N. distillatoria,* brought from Ceylon in 1789 by Sir Joseph Banks.* My earliest recollection of pitcher-plants at the Edinburgh Botanic Garden is of two huge bushes trained in balloon fashion; one was *N. Phyllamphora,* the other *N. lævis*, but they rarely produced pitchers. Indeed, at one time it was reckoned very fortunate when a pitcher could be had to illustrate the lectures of the late Professor Balfour. But with improved means of raising young plants from cuttings, and the advent of the earlier raised hybrids, pitchers could be had at all times,—the hybrids *N. Dominii, N. hybrida,* and particularly *N. Sedenii,* being extremely free-growing, and always having some pitchers developed. *Nepenthes distillatoria,* figured in the 'Botanical Magazine,' t. 2798, from a male plant which grew in the Royal Botanic Garden, and described by Professor Graham in 1828, had long disappeared before my association with the garden, but I recollect seeing a contemporary of the figured plant growing in Messrs Dickson & Sons' Nursery at Inverleith Row. This plant was a female, and had ripened seeds from which the first seedlings raised in this country were produced. The pollen to fertilise this *Nepenthes* was supplied by Dr Neill, who had plants of both sexes of *N. distillatoria* at Canonmills Lodge Garden. Dr Neill himself also raised numerous seedlings of this species in 1835.† I shall very briefly mention the species at present in cultivation, as well as those not in cultivation, in order that those interested, who may be located or sojourning near to where these plants are indigenous, may know which are likely to be of value to cultivators. The simplest and easiest way of introducing new kinds is by seeds. They

* Aiton's *Hortus Kewensis.*
† London, *Gardener's Magazine,* 1836.

soon, however, lose their germinating power, and should, therefore, be sent home without much delay.

1. NEPENTHES ALBO-MARGINATA, Lindl., a native of Singapore and Sumatra, is a free-growing species, with peculiar rigid leaves, which are covered with a white tomentum. The pitcher is about 6 inches long, beautifully marked with purple spots, and has a peculiar and characteristic white band running round the neck of the pitcher.

2. N. AMPULLARIA, Jack,* from Singapore and Bintang, is a strong-growing species, which, when kept well in check, produces more pitchers than any other kind. The pitchers are small, 1 to 2 inches in length, having a deeply inverted rim. The lid projects backwards from the mouth of the pitcher, which is also distinguished by the absence of a conducting surface. The presence or absence of the conducting surface, and its relative length in the former case, is a character of sufficient constancy in the different species to afford a useful diagnostic mark.

N. ampullaria, var. *vittata*, and its form *major*, have highly coloured pitchers.

3. N. ANGUSTIFOLIA, Mast., from Sarawak, is a small green pitchered species resembling the form grown as *N. lævis.*

4. N. BICALCARATA is a native of Borneo and Sarawak; it is a very strong-growing species, having a stem an inch or more in thickness, and leathery leaves, each 2 to 3 feet long and 4 to 5 inches broad, produced into a long rigid tendril-like mid-rib, terminating in a stout bag-shaped pitcher. The rim of the pitcher is peculiar in having two sharp spurs developed from it which point towards the mouth of the pitcher. This species was first sent home alive by Mr. F. W. Burbidge to Messrs Veitch & Sons in 1879.

5. N. CINCTA, Mast.,† endemic in Borneo, was raised from seed collected by Mr Burke for Messrs Veitch, and is supposed to be a natural hybrid between *N. Northiana* and *N. albo-marginata.* In cultivation it grows freely and produces extremely handsome pitchers about 7 inches in length, dark green with irregular purple blotches. The mouth of the pitcher is wide and the rim is finely ribbed, and has projecting lobes, somewhat resembling those in the pitchers of *N.*

* Figured in *Bot. Mag.*, t. 5109.
† *Gard. Chron.*, vol. xxi., N.S., p. 576.

Northiana, while a white band runs round the base of the rim as in *N. albo-marginata.*

6. N. Curtisii, Mast.,* a new species introduced by Messrs Veitch, is very distinct, and one of the best yet sent home. The leaves are broad, light green in colour, and have wavy margins. The tendril-like mid-rib is prolonged from the under surface of the leaf, leaving a peltation at the apex as in *N. Rajah.* The pitchers, which are freely produced, are large and trumpet-shaped, dark green in colour, thickly mottled with purplish brown.

N. Curtisii superba is a variety considered to be an improvement on the original species. Our plant in the Botanic Garden is as yet too small to allow of my expressing an opinion regarding it.

7. N. distillatoria, L., from Ceylon, is a very elegant species, with light-green pitchers about 5 inches long, and with a conducting surface equalling two-thirds of its length. It bulges out at the part where the digestive glands make their appearance. This species requires a little more heat to grow it well than does the form often grown in gardens under the name of *N. distillatoria,* which is really *N. khasiana.*

N. distillatoria, var. *rubra,* is a very pretty form with reddish coloured pitchers.

8. N. gracilis, Korthals, from Sumatra, and elsewhere in the East, is a comparatively hardy and easily grown species. The pitchers are somewhat variable in size and colour. Those produced low down on the stem are purple coloured, those higher up almost green, with a few purple spots dotted over the inside of the pitcher.

N. gracilis major is a form of this.

9. N. Hookeriana, Low, introduced from Sarawak in 1847, is one of the best species for general culture. It has two forms of pitcher. Those at the base of the stem are round and spotted with red, while the upper ones are more elongated. The conducting surface is absent; the rim is inverted and set close round the mouth of the pitcher, and the lid stands erect, free from the mouth characters in which the species agrees with *N. ampullaria* more than with any other. *N. Hookeriana* is generally supposed to be a variety of *N.*

* *Gard. Chron.*, vol. ii. (3rd series), p. 681.

Rafflesiana, with which it agrees in size and colour only, while it differs so much in other features that I am inclined to regard it as a natural hybrid between *N. ampullaria* and *N. Rafflesiana*. I hope to have an opportunity some day by crossing these two species of ascertaining whether this conjecture is correct or not.

N. Hookeriana elongata is a variety, which we have in cultivation in Edinburgh, differing slightly in habit and in shape of pitcher from the type.

10. N. KENNEDYANA, F. Mueller, a native of York Peninsula, Australia, comes very near to *N. Phyllamphora*, but does not grow so freely as that species. The pitchers differ in being slightly tinged with red, and have less conducting surface.

11. N. KHASIANA is found in Eastern Bengal at 3000 feet altitude. This, the *N. distillatoria* of gardens, and as such figured in the 'Botanical Magazine,' is one of the best known in cultivation. It has narrow funnel-shaped pitchers, 8 to 10 inches long when fully developed. The conducting surface extends to about half the length of the pitcher, and has a purplish glaucous appearance. Nearly every pitcher is supported by a tendril, and the lamina of the leaf has a flaccid appearance. One of the oldest in cultivation, it is still one of the most ornamental species.

12. N. LÆVIS resembles *N. gracilis*, but differs in having narrower leaves. The rim and the wings of the pitchers are not so well developed as in *N. gracilis*.

13. N. NORTHIANA, Hook. fil., a native of Sarawak, altitude 1000 feet, is one of the largest and most magnificent of all the species. It was discovered by Miss North, whose drawing of the plant induced Mr Veitch to send out a collector, Mr Curtis, to search for it, and he succeeded in introducing it in 1881. When fully developed, the pitchers are 16 inches in length by 5 inches wide. The plant seems to be quite easily cultivated, and I have no doubt that in course of time these large mature pitchers will also be produced by cultivated plants. Our plant in Edinburgh (which is a young one) has pitchers 4½ inches long by 2 inches wide, and they are larger in size on every leaf that is made. The pitcher is peculiar in being highly coloured inside, and in having only faint blotches of purple

on the outside. The rim is very broad, undulating, everted, and beautifully ribbed; the lid is ovate-oblong, nearly covering the mouth of the pitcher.

14. N. Phyllamphora, Willd., from Cochin China, Borneo, &c., has long been known in cultivation, and is a rampant species with delicate light-green pitchers, which have a broad flattened rim. It is one of the easiest to cultivate.

15. N. Rafflesiana, Jack, comes from Singapore, Borneo, &c., and is one of the most effective species in cultivation. It forms two kinds of pitchers: those produced low down on the stem have broad ciliated wings, greenish-yellow in colour, with brown markings, and they are much handsomer than the upper pitchers, which are longer and more trumpet shaped. The rim of the pitcher is finely corrugated with strong teeth which run round the mouth of the pitcher, ending in an upright column which supports the lid, and a posterior gap is left owing to the edges of the rim not fitting closely together. This is a tall-growing species.

N. Rafflesiana nivea is a beautiful dwarf variety, not more than 10 to 12 inches in height. The leaves are narrow and shining; the stems are covered with a white tomentum; and the pitchers are darker coloured and even handsomer than those of the type.

16. N. Rajah, Hook. fil. This wonderful species was discovered by Sir Hugh Low in 1851 during his first ascent of Mount Kina Balou, Borneo, at an altitude of 5000 feet. He again ascended this mountain along with Mr Spencer St John in 1858, and I may quote what the latter traveller says regarding this famous pitcher-plant: * "The pitchers, as I have before observed, rest on the ground in a circle, and the young plants have cups of the same form as those of the old ones. This morning, while the men were cooking their rice, as we sat before the tent enjoying our chocolate, observing one of our followers carrying water in a splendid specimen of *Nepenthes Rajah*, we desired him to bring it to us, and found that it held exactly four pint bottles. It was 19 inches in circumference. We afterwards saw others apparently much larger, and Mr Low, while wandering in search of flowers, came upon one in which was a drowned rat." This magnificent species was sent home by Mr F. W. Burbidge in

* *Life in the Forests of the Far East*, vol. i. p. 327.

1878 to Messrs Veitch & Sons. Unfortunately, it has not proved very amenable to culture, but it is to be hoped that some one may find out its requirements, and succeed in growing it so as to produce those marvellous urns. Notwithstanding every care, our Edinburgh plant perished.

17. N. SANGUINEA, Lindl., a native of Malacca, is a rare and extremely handsome species having large crimson coloured pitchers. It grows freely enough, but is rather difficult to increase by cuttings.

18. N. VEITCHII, Hook. fil.,* grows in Borneo, at an altitude of from 1000 to 3000 feet. It is a remarkable species, having a peculiarly low spreading manner of growth, not upright like most of the species. The whole plant is densely covered with brown hairs. The pitchers are from 6 to 12 inches in length and yellowish-green in colour. The mouth is surrounded by a very broad everted margin of a light golden colour. The conducting surface is very small, covering scarcely an inch of the length of the back of the pitcher.

These are all the species at present in cultivation in the Royal Botanic Garden, Edinburgh. So far as I am aware, the only others in cultivation are *N. madagascariensis*, Poir, and *N. Burkei*. The latter, described by Dr Masters,† was introduced by Messrs Veitch & Son from the Philippine Islands, and named after their collector, Mr Burke.

‡ *Species of Nepenthes, not in Cultivation.*

1.	NEPENTHES	ALATA, Blanco, Philippine Islands.	
2.	,,	BOSCHIANA, Korth, Borneo, alt. 3000 to 5000 ft.	
	,,	,,	var. SUMATRANA.
	,,	,,	var. LOWII, Sarawak, alt. 3000 ft.
3.	,,	BONGSO, Korth, Sumatra.	
4.	,,	BLANCOI, Blume, Philippine Islands.	
5.	,,	EDWARDSIANA, Hook. f. Kina Balou, alt. 8000 to 9000 ft.	
6.	,,	ECHINOSTOMA, Beccari, Sarawak.	
7.	,,	CELEBICA, Meyer, Island of Celebes.	
8.	,,	EUSTACHYA, Miq., Sumatra.	
9.	,,	HIRSUTA, Borneo, alt. 2500 ft.	

* Figured in the *Bot. Mag.*, t. 5080, under the name of *N. villosa.*
† *Gard. Chron.*, vol. vi. (3rd series), p. 492.
‡ De Candolle, *Prodromus*, vol. xvii., 1873.

10.	NEPENTHES	LOWII, Hook. f., Kina Balou, alt. 6000 to 8000 ft.
11.	,,	MAXIMA, Reinw., Island of Celebes.
12.	,,	MELAMPHORA, Blume, Java, alt. 3000 to 5000 ft.
	,,	,, var. LUCIDA, Blume.
	,,	,, var. HÆMATAMPHORA, Miq.
13.	,,	PERVILLEI, Blume, Seychelles, alt. 2000 to 3000 ft.
	,,	PHYLLAMPHORA, var. macrantha, Beccari, Sarawak.
14.	,,	REINWARDTII, Miq., Sumatra, alt. 2000 to 4500 ft.
15.	,,	TENTACULATA, Sarawak, alt. 2000 to 5000 ft.
16.	,,	TEYSMANNIANA, Miq., Sumatra.
17.	,,	TRICHOCARPA, Miq., Sumatra.
	,,	,, var. ERYTHROSTICTA.
18.	,,	VEILLARDII, New Caledonia.
19.	,,	VILLOSA, Hook. f., Kina Balou, alt. 7000 to 9000 ft.
20.	,,	VENTRICOSA, Blanco, Philippine Islands.

Many of these species are most remarkable in structure and appearance, and in these days of quick transit it is to be hoped that some enterprising traveller may succeed in sending them home safely to enrich our collections. That they would receive a hearty welcome is beyond question.

A good deal has been accomplished by hybridising species of *Nepenthes*, but much more remains to be done. The great difficulty is in getting both sexes of the desired species in flower at the same time. As a general rule, the habit and form of the male parent predominate in the hybrid. *N. Rafflesiana*, *N. distillatoria*, and *N. Phyllamphora* have been frequently used in the production of hybrids, with the result that the offspring are too much alike.

As an example of real improvement effected by hybridising, *N. Mastersiana* may be cited. The female parent of this hybrid was the rather scarce *N. sanguinea*, the male being *N. khasiana*, a vigorous growing species. The resultant hybrid is a plant rivalling in beauty of form and colour any species in cultivation, with the additional recommendation that it is not excelled by any in vigour of constitution or in freedom of growth.

Another distinct hybrid is *N. Dicksoniana*, raised in the Edinburgh Botanic Garden in 1884 (see Plate I.) The female parent, *N. Rafflesiana*, was fertilised by pollen of *N. Veitchii*, supplied by Messrs Veitch from a plant in their nurseries at Chelsea. The result is a hybrid having the form and habit of *N. Veitchii*, with the vigour of

N. Rafflesiana infused into it. The pitchers have the colour of *N. Rafflesiana*, but possess a broader rim, approaching *N. Veitchii* in this respect. The conducting surface is intermediate between the two parents. I have drawn up a list of Nepenthes-hybrids with their parentage, so far as is known, and I would here express my obligations to the Messrs Veitch for information kindly supplied regarding the numerous hybrids raised by them. Unfortunately the parentage of the earlier raised hybrids is imperfectly known.

Name of Hybrid.	Female Parent.	Male Parent.
Nepenthes Dominii.	Rafflesiana.	species.
,, intermedia.	species.	Rafflesiana.
,, Rafflesiana pallida.	hybrida.	Rafflesiana.
,, edinensis.	Rafflesiana.	Chelsoni ×
,, Dicksoniana.	Rafflesiana.	Veitchii.
,, hybrida.	(distillatoria) khasiana.	species.
,, ,, maculata.	,,	,,
,, Sedenii.	,,	,,
,, Mastersiana.	sanguinea.	(distillatoria) khasiana.
,, Chelsonii.	Dominii ×	Hookeriana.
,, Stewartii.	Hookeriana.	Phyllamphora.
,, Ratcliffiana.	,,	,,
,, Wrigleyana.	,,	,,
,, Lawrenciana.	,,	,,
,, Outramiana.	,,	Sedenii ×
,, Williamsii.	,,	,,
,, Courtii.	species.	Dominii ×
,, maculata elongata.	,,	,,
,, rubro-maculata.	,,	hybrida ×
,, cylindrica.	hirsuta glabrescens.	Veitchii.
,, rufescens.	,, ,,	Courtii.

Names of hybrid Nepenthes grown in Gardens.

Nepenthes Amesiana.	Nepenthes Paradisiæ.
,, atrosanguinea.	,, picturata.
,, Broomeana.	,, lyrata.
,, coccinea.	,, Seemaniana.
,, Claytonii.	,, Siebrechtii.
,, Hamiltonii.	,, splendida.
,, Morganiæ.	,, Thorpiana.
,, Hookeræ.	,, washingtoniana.
,, Patersoni.	,, Dominii viridis.

It would be interesting as an experiment to try whether pollen, of the unintroduced species, would prove fertile when sent home. Seeing that male plants of *Nepenthes* are usually much more numerous than female, seeds might not be procurable, and it is just possible that if pollen were sent home quickly by post, some remarkable crosses might be effected. Such species as *N. Lowii, N. Rajah, N. echinostoma, N. Edwardsiana,* and others from very high altitudes, the conditions for the successful culture of which are so difficult to imitate, might in this way be brought into cultivation, and a great boon would thus be conferred on botanists and horticulturists.

Seeds of *Nepenthes* soon lose their germinating properties, and should, therefore, be sown as early as possible after ripening. This period may be known by the splitting of the capsules. A single capsule contains several hundred seeds. These are thin and light, about half an inch long, tapering at both ends, and invested with a loose coating of brown fibre. In raising seedlings, flat pots are filled one half with drainage, the other half with a compost of peat and sphagnum chopped very fine, to which is added a little silver sand and charcoal. This soil is then watered, and the seeds are sown on its surface, and the merest sprinkling of the finest portion of the soil put on the top. The pot is then covered with a bell glass, and placed in a close warm case until germination occurs. This usually takes place in about six weeks' time. When the young plants are fit to handle, they are put into small pots covered by a bell jar, which, in course of time, is removed, and the seedlings are gradually inured to the ordinary treatment given to older plants. The first leaves produced on plants of *Nepenthes,* after the cotyledons, are small winged pitchers, having a spur-like lid. A succession of these is produced before a lamina becomes apparent on the young leaves, and their development is most interesting. Regarding the cultivation of pitcher-plants generally, I may say a few words without entering very minutely into details. To produce good results, a very moist temperature is necessary. If it average 65° in winter and 75° in summer this will suit most of the species.

A free open compost is required for the roots, consisting of rough fibrous peat and sphagnum with a little silver sand and charcoal well mixed. Good drainage is needed, owing to the large amount of water required by the plants. Pots or baskets of small size in comparison with that of the plants are to be preferred. The plants should be placed near to the glass. Some shading will be necessary in summer, but it should not be very heavy. Constant attention to pinching or stopping the young growths is also essential. The most vigorous growing plants often fail to develop pitchers, on their leaves, which end in at endril only. The explanation I offer of this is that such plants are depending exclusively for their nourishment on their roots. For, when checked by being cut down, the young shoots then produced develop pitchers at the end of almost every leaf. This seems to be a return to the juvenile condition, for we have seen that seedlings at first produce pitchers only. Confining the roots in small pots or baskets has a similar effect, the more they are cramped at the roots the more pitchers are developed. That the pitchers play an important part in the economy of the plant, and that animal matter is absorbed by them, is beyond doubt. It sometimes happens, however, that the pitchers capture too much and decay sets in from excess of animal matter contained in them. This has given rise to the notion, somewhat prevalent among cultivators, that the capture of insects is injurious rather than beneficial to pitcher-plants. Such occurrences are exceptional and are simply cases of over-feeding. My experience in the matter is, that the capture of insects is of great value in the cultivation of pitcher-plants. It by no means follows that the plants would not grow if all insect or animal matter were excluded from the pitchers. I think, however, that it would be most unwise to treat them in this way seeing that they thrive so much better on a mixed diet. The fluid secreted by the pitchers should not be interfered with or emptied out, as the pitchers remain in good condition so much longer when this is attended to. Highly coloured pitchers are generally the largest, and the species producing these, in all likelihood, stand highest in the scale, probably from their being more attractive to insect life, and consequently better fed. Green-coloured pitchers, on the other hand, are usually small, and may be looked upon as the lowest in the scale. It is gratifying to find that the cultivation of species of *Nepenthes* is very much on the increase throughout the country, and that the beauty, singularity, and, above all, the wonderful adaptation in form which they manifest, are becoming more and more appreciated.

Description of Plate I.

(Illustrating Mr Lindsay's Address on the genus Nepenthes.)

NEPENTHES DICKSONIANA. HYBRID.

Fig. 1. The whole plant. From a photograph by Mr A. D. Richardson.

,, 2. The pitcher; natural size. From a coloured drawing by Mrs Bayley Balfour.

The plant figured here has not yet reached maturity, and the pitchers that may be produced when the plant is older will be larger in size.

Notes on the Regional Distribution of the Cape Flora. By G. F. Scott Elliot, M.A. Cantab., B.Sc. Edin.

(Read 14th November 1889.)

Mr H. Bolus, in the Cape of Good Hope Handbook, has given a very good division of the flora into five districts. I was able, during a recent visit of some twelve months' duration, to collect plants in all of his divisions; and although, unfortunately, the time I spent in each was very short, I noted some interesting points not generally known which may be worth putting on record.

Mr Bolus' divisions are based on certain definite climatic conditions. There is a range of mountains running interruptedly, and under different names, all round the southern corner of South Africa. These surround the great basin of the Karoo. Now, the predominant winds in South Africa are north-westerly or south-easterly. These mountains intercept the rains, and from the geography of the Continent it follows that the western flanks of the mountains receive their rain mainly from the north-westerly winds, which usually blow during the Cape winter from April to November, while the eastern flanks receive their rain by south-east winds, which blow chiefly during the Cape summer from October to March. Hence, the western and eastern districts have rainfalls, and therefore flowering seasons, at exactly opposite periods of the year,* and form, in consequence, two very natural botanical regions. The Karoo lying within these mountains is characterized by a very low rainfall, and so forms a third very natural region. The two remaining regions are characterized in part by a branch of the tropical flora of Africa which extends down the coast as far as Natal, and in part by a branch of the flora of Central Africa, which forms the northern boundary of the Karoo region.†

* A very interesting work by Mr D. E. Hutchins, "Cycles of Drought in South Africa," explains the difference in rainfall.

† The rainfall from October to March (inclusively) during the year 1888 was :—Cape Town, 4·62 in.; Table Mountain, 10·1 in.; Knyrna, 13·47 in.; Graaff Reinet, 8·94 in. From April to September inclusively it was :—Cape Town, 31·44 in.; Table Mountain, 47·82 in.; Knyrna, 20·95 in. Graaff Reinet, 7·90 in.

During June–July, 1888, 13·52 in. fell at Cape Town; 23·44 on Table Mountain; 3·85 at the Knyrna; 47 in. at Graaff Reinet; 89 inches at King Williamstown.

The extreme variety of the Cape flora, which embraces, according to Professor Maccowan, about 10,000 species, is mainly due to these well-marked climatic differences. In fact, the western (or properly south-western) district, the eastern district and Karoo form excellent examples of what Mr Romanes calls physiological islands. They are as thoroughly separated, so far as most of their plants are concerned by their different flowering seasons, as is an oceanic island from its neighbouring continent.

The geology of the country is of interest, too, in connection with the distribution of the plants. It is in the Transvaal that the oldest rocks of the country are to be found, while almost the whole of the country to the south of these rocks has been covered by a vast series of almost horizontal secondary strata. In the Stormberg these reach a height of some 8000 feet above the sea, while in the mountain ranges nearer the southern corner they are usually about 5000 feet. The whole of the Karoo is a basin of denudation worn out of these secondary strata. This structure of the mountains results in a peculiar and very characteristic scenery. The summit of every mountain in sight from any one point is as flat as a table, and all being at exactly the same level, nothing is more easy than to draw, in imagination, the original plateau, and to note the extraordinary amount of denudation that has taken place.

It follows, then, that the plants originally coming over this table-land have been divided into at least four main groups. The first party went down the sides of the mountains to the west and south-west, and their descendants form the south-western flora of to-day. A second group spread similarly over the eastern districts, mingling towards the north with the tropical coast flora of Africa (very probably they helped to form the tropical flora of the east coast). A third group, when the present dry, arid conditions of the Karoo began to prevail, became correspondingly modified, and form the present remarkable flora of the Karoo, while the fourth group remained on the summits.

Although the subdivision of Mr Bolus is quite good enough for all practical purposes, still it seemed to me during my short visit that this vegetation of the tops of the mountains should really be included in the flora of the interior of Africa, of which they are the southerly continuation.

The Perie mountain summits, the Grahamstown hills, the Boschberg, and even in a less degree Table Mountain, form a series of botanical outliers extending down to the southern corner of South Africa. It is almost impossible to represent this graphically, however, as the vegetation of these summits always approximates in character more or less to that of the districts which surround them.

These mountain summits are always good collecting-grounds, and many have even a large number of peculiar species. They are often separated from one another, not only in distance, but by a totally different climate—that of the Karoo. Hence it is not surprising to find, especially in the case of such genera as *Disa* and *Satyrium*, an enormous number of species, quite distinct, but only growing on some particular mountain. For instance, Table Mountain, Constantiaberg (7 miles off), and the Muizenberg (10 miles away) have peculiar species of these genera found nowhere else. The Cape peninsula, separated by a wide marshy strip (the Cape Flats) from the rest of the continent, possesses a number of indigenous forms (especially species of *Erica*), and some of them which are found on the mountains of the continent have apparently been developed since the formation of the Cape Flats, and have not been able to cross over to Table Mountain, *e.g.*, *Erica fascicularis*, one of the most beautiful of all the heaths.

The Cape flora becomes even more interesting when one studies the general facies of each of these regions. Most of the plants belonging to any one district have a sort of resemblance to one another. This is specially well seen in what one may call the flora of the mountain flanks in the south-western district. Collections of plants made wholly on the lower slopes of, say, Table Mountain, the Lion's Head, Devil's Peak, the Muizenberg, the Houwhœk Mountains near Caledon, or parts of the Tulbagh valley, show remarkable resemblance in the habit and appearance of the plants. They are all shrubby perennials. There is apparently not a single undoubtedly indigenous annual in the south-western flora. The leaves are small, hard, and frequently rolled at the edge, while the flowers are also small though numerous and crowded. This form of plant is exemplified in all sorts of orders, *e.g.*, by numerous species of *Heliophila* amongst Cruciferæ; by many species of *Polygala* and of *Muraltia*, of *Polycarpon*, of *Hermannia* and *Mahernia*, of *Pelargonium*, by the whole section Diosmeæ of Rutaceæ, by *Phylica* and *Noltea* in Rhamnaceæ; in Leguminosæ by *Amphithalea*, *Borbonia*, *Rafnia*, *Listia*, *Lebeckia*, and others, and most perfectly by the vast genus *Aspalathus;* in Rosaceæ, we find *Cliffortia;* the order Bruniaceæ also consists of such plants. The peculiar Umbellifer *Rhyticarpus* approximates to the type, while in Rubiaceæ *Spermacoce*, *Galium*, and others exemplify it; numerous Compositæ, specially *Pteronia* and species of *Helichrysum* and *Stæbe*, as well as almost all the tribe *Relhaniæ*, show the same tendency. Some Campanulaceæ, *e.g.*, *Lobelia* (*Parastranthus*) and *Lightfootia* are of this type, but the genus *Erica* supplies the best example of all; there are, I suppose 350 species of *Erica* in the south-west district of South Africa, and perhaps 23 in the eastern district, where the same conditions do not hold. In Scrophularineæ we have the whole tribe Manuleæ tending in the same direction. The order Selagineæ is practically composed of this type, and we again find it in *Serruria*, *Mimetes* and others of Proteaceæ, in *Gnidia* and *Lasiosiphon* amongst Thymelaceæ, in Penæaceæ, and in the large genus *Thesium* of Santalaceæ.

Even in monocotyledons, where we should not expect to find such a form, the tendency is clearly brought out in the shrubby small-leaved *Witsenia*, and in a species of *Ornithogalum* with much-branched peduncle and small flowers, in which the radical leaves are almost wanting, and the leaf-function is performed by the bracts of the peduncle.

These are, perhaps, enough examples, but the number could be greatly increased. It is not, I think, hard to see why this type should obtain so largely in the south-western district. There is, to begin with, no winter worthy the name, and therefore annuals would, when becoming acclimatised, probably cease dying at the end of the year, because there is no reason why they should. Certain European annuals of cultivation have, in fact, become perennial.

The climate is also characterised by a long and dry summer and by plenty of wind. Such conditions obviously favour transpiration. Vines* points out "that, *cæteris paribus*, the transpiration is proportional to the surface of a leaf, though, as might be expected, the activity of transpiration is very different in leaves of different structure; thin herbaceous leaves, for instance, transpire much more freely than do those which are fleshy or coriaceous." Hence the small, excessively coriaceous leaves of these plants without much spongy parenchyma are thoroughly suited to the climate. We may even, I think, go a step farther, and say that the physical conditions have produced this form.

The much-branched stunted condition seems to me only an intensified state of what we may see even in this country when we compare trees grown in open exposed places with those grown in woods. With regard to leaves, certain observations which are not yet extensive enough for publication, as to the variation in size and texture of the leaf in the same species in different habitats, strongly incline me to believe that the smallness, cuticularization, and want of spongy parenchyma in the leaf all follow directly from such conditions.†

The large number of flowers is probably in correlation with the greatly branched condition, while their small size has probably something to do with the small size of the leaf.

I must mention here, however, that there is in these districts an extraordinary number, both of species and individuals, of certain peculiar Coleoptera and Hymenoptera which are the main agents of fertilisation, and are distinguished by their very small size. These belong chiefly to the genera *Anisonyx* (specially *A. ursus* and *longipes*), *Dichilus* (*D. simplicipes* and *dentipes*) in Coleoptera, and the very small Hymenoptera *Ceratina, Odynerus,* and others. Still, however, the general similarity of these plants seems to me to give us data from which to gather the influence of physical conditions.

What speaks very strongly in favour of this view is the fact that such plants are only found in such situations as those mentioned above. Immediately one reaches, in an

* *Lectures on the Physiology of Plants*, Cambridge, 1886, p. 105.

† Here also *cf.* Vines, *loc. cit.*, p. 107, and *Höhnel Jährb. f. Wiss. Bot.*, xii. 1880, *Stahl Yena. Zeits.*, Bd. xvi. 1882, *Pick. Botan. Centralblatt*, Bds. xi. and xvi., various memoirs by Costantin, Grosglik, Wiesner, &c.

eastward direction, the region of summer rain, the characteristic Proteaceæ, Diosmeæ, &c., disappear, and the 350 species of *Erica* dwindle down to about 23 species. Moreover, grasses, instead of being few and far between, become abundant both in species and individuals.

Even if one ascends to the tops of the mountains the vegetation is quite different. Thus, while on the flanks of Table Mountain such conditions as I have described prevail, when one ascends to the top the general appearance of the plants changes. This follows from the fact that the climate on the top of the mountain is very different. A greater quantity of rain falls, and besides this, there are frequently at all seasons heavy mists which keep the plants from being dried up.*

I have often noticed that the commonest form of the plants growing on the summits is quite different from that found lower down. Perhaps it is best described as the *Hieracium* type. It is distinguished by crowded radical leaves and long branched peduncles. This type, however, is so common generally, even in England, that I should not speak of it as characteristic, were it not so strikingly absent on the lower slopes, except in moist places. Many species of *Senecio* and *Helichrysum* take on this form, and I found in both these genera so much variation with habitat in this respect (namely, the way in which the leaves varied from being all radical or more or less scattered along the peduncle) that it seemed to me culture-experiments would be necessary to make many of the species absolutely certain. Perhaps the Alepideas and the vast numbers of Orchids and Irids show the tendency to this form best.

The most marked feature of the summit flora is the quantity of bulbous plants. A new series of gorgeous liliaceous and iridaceous plants springs up every month during the flowering season. The theory of Mr Romanes again explains the extreme variety of these bulbs. The majority are marked by a very short flowering season indeed. Some particular spot will be covered by some species of *Morea* or *Geissorhiza* one day, and three days afterwards not one will be seen. Now, as bulbs appear to flower exactly after a definite amount of assimilation has been performed and moisture absorbed, it is easy

* See *ante*, p. 241, in note.

to see that if the descendants of a single species are distributed over spots varying even very slightly in physical conditions, this definite quantity of assimilation and moisture will not be exactly the same, and hence the flowers will not appear exactly at the same period. A difference of a fortnight, or even a few days, will however completely isolate such short-flowering bulbs, and variation will go on unchecked. The large number of such species is therefore quite what one would expect. On Table Mountain a new series of magnificent bulbs seems to spring up every fortnight during the flowering season.

In the Cape Flats, with marshy, peaty, or gravelly soil, and usually plenty of water, there are also many peculiar species as the conditions are again different.

In the Karoo, the plants are, as a rule, quite distinct. There are, however, two classes into which they may be divided. The first includes those which flower regularly, and continue in flower for pretty long periods; and the second, those which spring up and blossom for a very short period immediately after a shower of rain, and of which for months, or even for a year or two sometimes, no trace can be seen.

The first group falls into two divisions—the succulents and those which show the woody ericoid type in an intensified condition. Succulence is shown in the most extraordinary and unexpected places. *Sarcocaulon Patersoni* is a Geraniaceous plant which has done its best to become like a *Cactus*. There are many succulent species of *Euphorbia;* even in Compositæ there are numerous examples, *Othonna*, species of *Senecio*, &c., and in Asclepiadaceæ there is the whole series of Stapelieæ, while typically succulent genera, like *Crassula, Aloe,* and *Mesembryanthemum* abound both in species and individuals. The species of *Mesembryanthemum* particularly are so numerous that they have never been properly monographed.

The second group of excessively woody, densely branched tuft-like plants is best shown by *Aptosimum, Peliostomum,* and many Compositæ. As an instance of what I mean, I gathered on one dry, stony hillside on the banks of the Little Fish River the following, all close together, and showing the most remarkable similarity in habit—*Polygala hottentota,* *P. tenuifolia*, *Indigofera argyracea*, *Cluytia alaternoides*, *Phyllanthus verrucosus*, *Pharnaceum dichotomum*, and *Aptosimum depressum*. A habit so exactly similar in plants so widely different genetically seems certainly to prove the direct influence of physical conditions.

The second class mentioned above consists of those plants which suddenly spring up and flower for a very short time after a shower of rain. They are almost all bulbous or tuberous, and many orders have developed bulbs which usually show no trace of them. For example, the whole section *Hoareia* of the genus *Pelargonium* is bulbous. *Acanthosicyos* is a peculiar leafless and bulbous cucurbitaceous plant, while Lilies, Irids, and especially Amaryllids, are so numerous that one must not refer to them in detail. Perhaps the most striking plant of all is *Brunsvigia*, of which a single plant can be distinguished a mile away. The plants of this group, as seen in Herbaria, are utterly different from the usual type of desert plants. One must, however, remember that the physiognomy of a plant depends on the climate during the flowering and assimilating season only, not on that of the whole year. It is this fact which prevents one from noticing, as often as one might otherwise do, the direct influence of the climate.

In the Karoo another marked feature (chiefly observable, however, in the first class of plants mentioned) is the great number of thorny plants. Of course this is usually ascribed to the vast herds of antelopes formerly present, but it is so often to be seen in hot, dry, and rocky places that I have often doubted whether that is a sufficient explanation.*

In the eastern districts the plants are neither so numerous nor interesting. The forests, however, at the Knysna, the Perie Mountains, and Bedford are very distinctive. Practically, there are no forests at all in the western district.

It is hopeless to attempt a description of the beauty of these forests. The trees are far finer than usual in virgin forests, and not crowded. Graceful tree ferns spring up every here and there. The trunks and branches, as well as the twining creepers, as thick as one's wrist, which hang

* *Belt, Naturalist in Nicaragua*, p. 46. "This spiny character of vegetation seems to be characteristic of dry, rocky places and tracts of country liable to great drought."

from every tree in graceful convoluted folds, are covered with bright green moss. Sometimes one can see the bright red flowers of *Mystacidium* or other orchids spreading over a moss-covered branch. There is a dense undergrowth, chiefly of *Plectranthus fruticosus*, covered all over with its beautiful blue flowers, while other white species of *Plectranthus* and the Cape Balsam grow everywhere. The moss-covered boulders beside the streams are covered with the long leaves and graceful nodding flowers of *Streptocarpus Rexiæ*. The complete silence, broken only by the harsh notes of that beautiful bird the *loory*, or the hoarse cry of the baboon, also contribute to the impressive nature of the scene.

Some of the trees grow to a huge size—*Podocarpus elongatus* especially; one specimen, the "Eastern monarch," in the Amatola Mountains, being 90 feet in height and 34 feet in girth. *Podocarpus latifolius, Olea laurifolia, Curtisia faginea*, and others also grow to 70 or 80 feet.

A remarkable point about the forests is the number of evergreens. Mr D. E. Hutchins, the Head Conservator, informed me that only a very few are deciduous, and of these the Sneezewood, *Pteroxylon utile*, and *Hippobromus alatus, Celtis rhamnifolia, Erythrina Kaffra*, and *Rhus lævigata*, lose their leaves only on cold, exposed situations, in other places being always green.

Some of these trees give a timber which is as good or better than any other known, *e.g.* Sneezewood (*Pteroxylon utile*), *Olea verrucosa*, and *Oreodaphne bullata*. Most of the eastern district consists either of forest, or scrubby dense bush, 10 to 12 feet high (such as the Addobusch), mainly composed of *Portulacaria afra* and *Schotia latifolia*, or of wide grassy plains very valuable for agricultural purposes.

It is almost hopeless to give a satisfactory account of the Cape Flora, however, in such a paper as this. It is, in fact, not nearly well enough studied. Many places, notably Swaziland and the Waterberg, are not yet touched by collectors. In the work to which I gave most of my time, viz. observation of the fertilisation of flowers, I have found so little written that practically everything had to be begun from the beginning.

For that most interesting branch of botany which includes a study of the influence of physical conditions on the form of plant produced, there could not possibly be a better field.

The conditions are so much more sharply defined and so varied in every way that one is able to get a sort of glimpse of the way in which to work. I have tried to give some hints in this paper, which are pretty obvious and seem probable, but it would require years of residence and uninterrupted observation to obtain a really satisfactory notion of how evolution has progressed.

Taking the order Scrophularineæ, it was most interesting to me to watch the manner in which it took on the prevalent form of the vegetation round it. Thus in the Perie forest one finds a scrophularineous evergreen tree, *Halleria elliptica,* some 40 feet high, or even more. It has leaves just like most of those around it and berries, which the birds eat, and so distribute the seeds. In the smaller brushwood on the Boschberg, Somerset, I found *Phygelius capensis,* a shrub in foliage and appearance quite like its neighbours. On the flanks of Table Mountain and the dry hill-slopes in the south-western region there are several genera which take on the ericoid appearance. These are small shrubby perennials, with small hard leaves and small flowers, such as *Lyperia, Chænostoma* and others, or with sticky leaves which apparently answer the same purpose, *e.g. Sphenandra.* Although not in this order, the nearly allied Selagineæ consist wholly of this kind of plant. On the tops of the mountains, again, amongst the long grass and plants with chiefly radical leaves and long peduncles, one finds *Zaluzianskya, Buchnera,* &c., which have rosettes of long, slightly cut radical leaves exactly like their neighbours. In the Karoo one finds the depressed, moss-like tufts of *Aptosimum* and *Peliostomum.* The extraordinary parasitic *Hyobanche* has even become fleshy, so that in this one order the typically South African forms have taken on what seems to me the general type of the districts to which they belong.

Instances of this kind could be multiplied indefinitely. The Leguminosæ show the same modifications remarkably well. We have the typically ericoid forms in *Aspalathus* and the sub-tribe Crotalarieæ. Some Karroid *Aspalathi* even have succulent leaves which, I think, is very rare in Leguminosæ. They also grow into trees such as *Erythrina Calpurnia* and *Virgilia.* I have even noticed what seems to me similar tendencies in places where one would least expect it.

The order Umbelliferæ is perhaps one of those which, as a rule, have the most marked general resemblance. Yet in South Africa I found at Somerset East in the wooded kloofs an umbelliferous tree, *Heteromorpha arborescens*, whose leaves are usually ternate but often almost simple, while *Alepidea*, amongst the long grass and bulbous plants on the top of the mountain, has a rosette of entire ciliated leaves and a striking resemblance to what one may call the Hieracium type. On the other hand, near Seapoint, and in certain other places, I found a rosette of very broad, flat ciliated leaves which for a long time puzzled me; eventually I found the flowers, and made it out to be a diœcious umbellifer, *Arctopus echinatus;* while the nearest approach to the ericoid form is shown by a *Rhyticarpus* (*Bupleurum difforme*) which has only the petiole left, and rigid, almost woody, stems. In Orchids, *Disa grandiflora*, the Pride of Table Mountain, has very large flowers, but few in number, while a common species in the eastern districts, *Disa polygonoides*, has a very large number of excessively small flowers crowded together at the ends of the peduncle with exactly the same general appearance as the flowers of plants of the ericoid type. The Lilies, and in a less degree the Irids, also seem to me to show similar tendencies.

This may seem very speculative, but I have so often noticed the same thing, and in such different plants, that I think it will supply at least a good working hypothesis in studying the influence of physical conditions.

Notice of the Occurrence of Arenaria gothica, Fries, in Great Britain. By Arthur Bennett, F.L.S., &c.

(Read February 13, 1890.)

Last July Mr W. Whitwell of Balham brought to me two specimens of an Arenaria that he said had been referred to *A. norvegica*, Gunn. At first I was inclined to so consider them, but the habitat (Yorkshire) seemed so unlikely that I felt it was necessary to look to some other plant allied to *A. ciliata*, L.

On comparing the specimens with Fries' description of his *A. gothica*, it seemed to fit the plants very well; on further looking out some Gothland specimens kindly sent me by Dr Nilsson, it was at once evident that they were exactly similar.

The specimens had been gathered on the 12th of June at Ribblehead in West Yorkshire, by Mr Lister Rothesay of Shipton. On the 11th of September Dr F. Arnold Lees visited the station and found the plant growing amongst *Arenaria serpyllifolia*, *Sagina nodosa*, &c., with grasses and moss. In September also it was visited by Mr J. G. Baker of Kew, and his opinion, expressed in a letter to Mr W. Whitwell, was: "The locality is not satisfactory as regards nativeness. It is a road close to the railway station. But this is a plant not likely to have been introduced, and I expect it will be found on some of the neighbouring hills."

For some time I have had in my possession a fragment of a plant, that came to me attached to a *Potamogeton* that had been gathered at Grassmere Lake, Westmoreland, by Mr Roper of Eastbourne. While Mr Whitwell was at my house this specimen was thought of, examining it carefully I could come to no other conclusion than that it was *Arenaria gothica*.

The next day I wrote to Mr Martindale of Kendal, who has studied the county botany for many years; and told him of my suspicion and expectation that the plant might be found somewhere around the lake, on the rocks surrounding it. I regret to say that on visiting the locality with his son, he was unable to find any trace of it. He hopes to renew the search next summer.

It seems to me that the plant may yet be found elsewhere, and what should be looked for is a stouter plant than *A. serpyllifolia,* with flowers the size of *A. ciliata* and *A. norvegica*; any large-flowered form resembling *A. serpyllifolia* should be gathered and carefully examined.

In the Isle of Gothland, off the Swedish Coast, it grows on calcareous rocks, and among stones, with such plants as *Jasione montana, Scleranthus, Cerastium, Poa bulbosa, Sedum,* &c., in several situations on the island. On the mainland my good friend Dr Nordstedt of Lund tells me it occurs in Kinnekulle, in West Gothland, "on limestone about 250-400 feet above the sea-coast (very seldom on sandstone at 230 feet) where nearly nothing else grows, also where it will be depastured, nevertheless it has flowers from the middle of May to late in October. It is a more lively green than *A. serpyllifolia,* among which it grows."

It occurs on the borders of Lake Joux, Canton Vaud; Switzerland, and also from Reculet in the French Jura (Nyman in *Supp. Consp. Fl. Europ.,* 1889, p. 66) by Bonnet.

These are the only known localities, so that the plant is of interest from its remarkably restricted geographical distribution.

It is closely allied to *A. norvegica,* Gunner, *A. multicaulis,* Wulf, and *A. ciliata,* L.; probably its true place is with *A. norvegica,* either as a sub-species of *A. ciliata,* or as a variety. Mr J. G. Baker considers that *A. ciliata* includes the type, and *A. gothica, A. multicaulis* and *A. norvegica* as varieties.

I give a few references where information can be found respecting the plant.

Arenaria gothica, Fries, *Mant.* 2. pp. 33–34, 1839.
Rothesay in *The Naturalist,* 1889, pp. 335–336.
Baker, J. G., in do. pp. 337–339.
Whitwell in *Jour. of Bot.,* 1889, pp. 354–359.

A. gothica, Fr., Zetterstedt, *om vaxt pa Vestergotlands,* p. 44, 1876.

A. ciliata, L. β. Wahl., Nyman, *Bidr. Gottlands Fl.,* p. 141, 1842.

A. ciliata, L. β. *gothica,* Fr., *Eisen and Stuxberg Gotlands Faner-och Thall.* p. 29, 1869.

A. ciliata, L. *β*. (?) *fugax*, Gr. et Godr. *Fl. France*, vol. i. p. 259, 1848.

A. gothica, Fr. Hartm., *Hand. i. Skan. Fl.*, ed. 11, p. 243, 1879.

A. gothica, N. Nyman, *Consp. Fl. Europææ*, p. 115, 1878.

To those who seek for interesting observations on the forms of *A. ciliata*, L., I would refer them to Mr Baker's article "On the varieties of *Arenaria ciliata*" in "The Naturalist," which, like all that comes from his pen, is thoroughly well done.

I am glad to be able to send a specimen for the Herbarium.

Notes on the Records of Scottish Plants during 1889. By ARTHUR BENNETT, F.L.S., &c.

(Read May 8, 1890.)

In again noticing briefly the work that has been done in Scotland among flowering plants, I have to record a few new forms. In Shetland Mr Beeby has found *Rumex propinquus*, Aresch. (a probable hybrid between *R. crispus* and *R. domesticus*). It has occurred in Sweden, and will probably be found over the range of its two supposed parents. *Polygonum viviparum*, var. *alpinum*, Wahl. f., is also another of Mr Beeby's gatherings (and a very pretty form of the species); also two forms of *Rosa canina*, *Hieracium Schmidtii*, Tausch., *Hypochæris radicata*, *Oxyria reniformis*, and *Populus tremula*—a Potamogeton that is closely allied to *P. Wolfgangii*, Kihlman; but this has been previously named *P. gracilis* by Wolfgang. The Orkneys have only yielded one addition, *Potamogeton flabellatus*, Bab. From Caithness, *Subularia aquatica* (J. Henderson), *Lathyrus sylvestris* (W. R. Linton), *Carex paludosa* (W. F. Miller)—this extends the range of this species in Scotland fifty miles to the north; with four others.

The Outer Hebrides have had added to them nine species, with two species confirmed, *Equisetum pratense* and *E. arenarium* (W. S. Duncan) being the most interesting. W. Sutherland has produced fourteen or fifteen. Two of these are of particular interest, *Potentilla alpestris* from Beinn Laoghal, and *Valeriana dioica,* both reported by the Scottish Alpine Botanical Club. A record by the same of *Vicia lutea* is a very unlikely one, though the plant is by no means confined to the sea-shore on the continent, as it usually is with us. It is not a native of Scandinavia. Has some Scandinavian species been mistaken for it ? I have not seen a specimen. In E. Sutherland a record of *Melica nutans* by the Scottish Alpine Botanical Club is interesting, as Ross has been its hitherto ascertained limit.

East Ross has yielded my friend Mr Mennell sixteen additions; while in West Ross Messrs Druce and Sewell have sent nine species hitherto unrecorded. The group of the Inner Hebrides gives records for twenty-six additional species, one of *Rosa rubiginosa*—"among rocks a mile or more from any house, Jura," Mr P. Ewing—seems as likely to be an indigenous habitat as any recorded in Scotland.

Mr King sends seven additions to the Clyde Isles. In Dumbarton Messrs Ewing and L. Watt have sent me twenty-six additional records. Argyle supplies eighteen species, "*Holcus mollis,* at 1800 feet, near Kingshouse." Rev. Mr Marshall takes this plant 300 feet higher than hitherto recorded. In this county my friends Messrs Hanbury and Marshall gathered a series of the Backhousian Hawkweeds in splendid condition, and finer specimens than I have seen before.

From East Inverness comes a very interesting find by Mr Druce, "shores of the Beauly Firth," of *Carex salina,* var. *Kattegatensis* (Fr.), the same as the Caithness plant, with two others.

West Inverness, four species—notably *Cerastium arcticum,* Lange, and *Hieracium aggregatum.*

Forfar, five. East and Mid Perth, a few. *Poa palustris* (Dr B. White) of much interest.

West Perth, seventeen; but these are mainly from Glen Falloch (Rev. Mr Marshall), and some difference of opinion has been expressed as to their rightful vice-county; so far as Mr Watson's ideas go, they belong here.

To Stirling Dr R. M. Buchanan and Messrs Kidston, Watt, etc., have added nineteen.

A few are added to Berwick, Lanark, Renfrew, and Ayr. *Juncus tenuis,* Willd., in Renfrew in abundance.

Wigton still keeps up a good many new records by Sir H. Maxwell and Mr J. M'Andrew to the number of twenty-three; and to Dumfries Mr Johnstone and the Rev. E. F. Linton have added nine.

These are nearly all the records, except a series of Mr Druce's in the "Journal of Botany," which were too late for inclusion in my yearly paper in the "Scottish Naturalist."

I ventured last year (*Trans.*, p. 420) to predict that the records then given (584) would be found to fall off year by year. Those of 1889 fully bear out that idea, for they number only 259.

County.	Name.	No.	County.	Name.	No.
72	Dumfries	9		Brought forward	117
73	Kirkcudbright	1	99	Dumbarton	27
74	Wigton	23	100	Clyde Isles	7
75	Ayr	2	101	Cantire	1
76	Renfrew	3	102	S. Hebrides	20
77	Lanark	1	103	Mid. ,,	1
81	Berwick	2	104	N. ,,	5
86	Stirling	19	105	W. Ross	9
87	W. Perth	17	106	E. ,,	16
88	Mid ,,	4	107	E. Sutherland	12
89	E. ,,	6	108	W. ,,	16
90	Forfar	5	109	Caithness	8
96	E. Inverness	3	110	Outer Hebrides	9
97	W. ,,	4	111	Orkney Isles	1
98	Argyle	18	112	Shetland Isles	10
	Carry forward	117		Total	259

Additional Notes on Willows in the University Herbarium. By F. Buchanan White, M.D., F.L.S.

(Read 12th December 1889.)

In the notes on Willows in the University Herbarium, which I had the honour of submitting to the Society last session, I mentioned the existence of a specimen of *Salix Lapponum*, collected by Greville at Colinton near Edinburgh, which as it has ♀ catkins, dispelled the slight doubt, as to the species, suggested in the "Student's Flora." Since the notes in question were in type some additional specimens of willows have been found in the herbarium, and have been kindly submitted to me by Professor Bayley Balfour.

Amongst these are three more specimens of *Salix Lapponum* from the Edinburgh district, and three specimens of hybrids of that species. The collector's name is not mentioned, but the writing is, I think, that of the late Professor J. H. Balfour.

The examples of *S. Lapponum* include two from "near Craigcrook, 1832," and one from "Dalkeith Woods, 19 May, 1838."

The hybrids are with *S. aurita* and with *S. cinerea*. Of the first there is a specimen with a ♀ catkin from Colinton, and another (which, though it has no flowers, is from the structure of the leaves scarcely doubtful) from Craigcrook. The *S. cinerea* hybrid is labelled as from "Carlowrie, 1838."

We have thus proof that *Salix Lapponum* has been gathered in three localities near Edinburgh, namely, Colinton, Craigcrook, and Dalkeith Woods, whilst the occurrence of a hybrid of it at Carlowrie suggests that it also grew there.

Considering that this species very rarely occurs as a wild plant below an altitude of 2000 feet above sea-level, I fear that there can be little doubt but that it is only an introduced plant in these localities. Whether it is still to be found the investigations of local botanists must decide.

But though the nativity of the species must be regarded with suspicion, there is no good reason why the hybrids should not be of spontaneous origin. *S. aurita* and *S. cinerea* are both common willows, and probably grow or grew in all the localities. Indeed there are in the herbarium specimens of *S. aurita* from Colinton.

The hybrid *S. aurita-Lapponum,* Wimm. (*S. Læstadiana,* Hartm. *β opaca,* 2° *subaurita,* And.), has been found in both northern and central Europe. Its characters show a combination of those of its parents, but it much resembles the hybrid of *cinerea* with *Lapponum,* from which the rugosity, especially of the young leaves, best distinguishes it and indicates its affinity with *S. aurita.* Since its parents not unfrequently grow at no great distance from each other on many of the Highland hills, its occurrence in Scotland might be expected, but previous to these Edinburgh specimens I had seen one only which might possibly be it. This is a specimen of a willow—in Kew Herbarium—collected by Lightfoot, but without locality or date.

The hybrid with *S. cinerea, S. cinerea-limosa,* Læstad (*S. cinerea-Lapponum,* Wimm.; *S. Læstadiana,* Hartm. *β opaca,* 1°*subcinerea,* And.) is a much rarer form, and has been found in northern Europe only. The Carlowrie specimen, which I am inclined to refer to this, has numerous ♀ catkins, but the leaves are only quite young. It is very like *S. aurita-Lapponum,* but I think that from the densely black-pubescent twigs, the abundant rusty *cinerea*-like hairs on the under side of some of the leaves, and the absence of the rugosity of *S. aurita,* that the latter species has been replaced by *S. cinerea.* It is much to be wished that the plant could be rediscovered.

S. latifolia, Forbes.—Of this—which is a hybrid between *S. Caprea* and *S. nigricans*—there is a specimen labelled "S. W. corner of Duddingston Loch, a small tree 16 feet high," but without date or collector's name. This hybrid seems to be of rare occurrence. The majority of the few British specimens I have seen were collected in Perthshire.

S. Sadleri, Syme.—Having, during the past summer, found in Perthshire a hybrid between *S. lanata* and *S. reticulata* (or what seems almost certainly so), I have again made a study of *S. Sadleri.* *S. Sadleri* has been supposed to be a hybrid of *S. lanata* with *S. reticulata,* and for lack of a better explanation of its origin, I was content to temporarily accept it as such, though its affinity with *reticulata* is extremely obscure. I now think that it must be regarded as a variety of *S. lanata,* and not as a hybrid form. By a "variety" amongst willows I mean forms which other botanists might perhaps call "sub-species."

S. spuria, Willd.—To this—which is *S. Lapponum* × *S. Arbuscula*—I referred in my previous notes a willow (on sheet 330) from Glen Dole, Clova, and mentioned that the Rev. E. F. Linton had found it in Clova more recently. I have lately seen a series of similar specimens collected in Clova by Rev. W. R. Linton, and now perceive that Mr Linton's specimens are hybrids of *Lapponum* with *herbacea* (=*S. sobrina*, B.W.) and not with *Arbuscula*. I suspect therefore that the specimen on sheet 330, which has leaves only, is the same. In the meantime, at any rate, it must be considered as doubtful.

The History of Agropyrum (or Triticum) Donianum.

By F. Buchanan White, M.D., F.L.S.

(Read 12th December 1889.)

About the beginning of the century George Don found, on Ben Lawers, a grass of which he distributed specimens with (as regards a specimen now before me) this label—"*Triticum alpinum.* Nova species. Alpine wheat grass. Rocks on Ben Lawers." Since Don's time it seems not to have been gathered till Mr Cosmo Melvill rediscovered it on Ben Lawers in 1878, after which it remained undisturbed for ten years, when I found it again near the place where it had been collected by Mr Melvill.

In addition to, or perhaps on account of, its having escaped the observation of collectors, Don's grass was almost generally ignored by botanical writers till Mr Mitten (*Hooker's Journ. of Bot.*, vol. vii. p. 532) called attention to it as follows, referring it to *Triticum biflorum*, Brig.:—"The present is one of those plants gathered by the late Mr G. Don, which appears to have been overlooked by other botanists. His label in Mr Borrer's herbarium runs thus: '*Triticum alpinum.* Nova spec. It differs from *caninum* by its short arista and upright spikes, and from *repens* by not running at the roots.' No date is mentioned. It is thus clearly evident that he distinguished it as a new species. The only British species with which it can be confounded is *T. caninum*, from which it may be distinguished by its leaves, smooth on both sides, its usually two-flowered spikelets, and its want of the long awn; it also appears to be a more slender plant, with narrower leaves."

In Hooker and Arnott's *British Flora* (8th ed., 1860) it is given as var. β of *T. caninum*, with the synonym *T. biflorum*, Mitten (scarcely of Brignoli). In the *Student's Flora* (1st ed., 1870) it is mentioned as *T. caninum*, var. *biflorum*, Mitten (*T. alpinum*, Don MSS.), and is said to be "only *T. repens*"—a statement qualified in the 3rd edition by the addition of "judging from the specimen." Nyman (*Conspectus*) places it with a "?" under *T. violaceum*, Horn.

In the *Journal of Botany* (vol. xxv. p. 57, February 1887), Mr Cosmo Melvill writes on the subject under the heading "*Agropyrum* (*Triticum*) *violaceum*, Hornemann in Scotland." After mentioning that he had found a *Triticum* on Ben Lawers, he proceeds to say that when he came to examine the grass (some years after collecting it) he found it "to correspond exactly in every minutest particular with specimens of *Triticum violaceum*" from Norway and Lapland. He further adds that Mr A. Bennett had come to the same conclusion, with the addition that it was "identical with an original specimen of Don's *T. alpinum* in the Kew Herbarium." Mr Melvill also notices that "only a small piece of root was gathered with one of the specimens, but this, on a careful examination, would show that the plant was fibro-cæspitose, not creeping; and therefore, assuming this to be Don's original species, Sir J. D. Hooker's theory that *T. alpinum* is only a form of *repens* must fall to the ground. Indeed, it is nearer *caninum* than *repens;* but to my mind a true and very distinct species from any other: one of the chief characteristics by which it can in nearly every instance be told at a glance is the purple tinge of the spikelets, hence, doubtless, its trivial name."

Comparing one of Mr Melvill's specimens (which he kindly gave to me) with one of Don's (which Mr John Knox, of Forfar, had generously presented to the Perthshire Herbarium of the Perthshire Natural History Museum), I found that there was not the least doubt of their specific identity; and, moreover, that they were distinct from *A. repens.* Furthermore, I found that the plant which I gathered on Ben Lawers in 1888 was also the same. That the species was identical with *A. violaceum* seemed to me a little doubtful, but as I had no specimens of the latter with which to compare the Ben Lawers grass, I was content to accept Messrs Melvill and Bennett's determination. The plant I found on Ben Lawers grows on a rock ledge, where it forms a stout tuft. From it I took a small piece of the root, which has now made a good plant. In the course of its growth it developed a creeping stolon, and since N. J. Andersson describes (*Gramineæ Scandinaviæ,* p. 5) *T. violaceum* as altogether destitute of creeping stolons, I determined to compare for myself the Ben Lawers grass with *T. violaceum.* Andersson, whose descriptions are always careful, describes the inner pales of *T. violaceum* as acute, and those of *T. repens* as bifid. The Ben Lawers grass had, I found when examining Don's and Melvill's examples, acute inner pales, but had, in addition, the ribs of the pale produced into short lateral awns lying on each side of the acute apex. Numerous examples of *T. repens* showed without exception inner pales constructed as described by Andersson, therefore it seemed probable that the character was a reliable one. A specimen of *T. violaceum* was then examined, and no trace of the lateral awns could be detected. Under these circumstances, and having occasion to mention the rediscovery of Don's grass, I provisionally named it (*Proceedings of the Perthshire Soc. of Nat. Science*, vol. i. p. xli.) *Agropyrum Donianum*. This name was adopted in preference to Don's manuscript name of *Triticum alpinum*, since that has been attended with much confusion, and because, moreover, it seemed desirable to associate Don's name with a flowering plant of the Scottish hills.

As, however, the species of the genus *Agropyrum* are so variable, it appeared advisable that *the* specialist on grasses, Professor Hackel, should be consulted. The opinion which he very kindly gave is briefly this:—If the characteristic of the lateral awns of the inner pales is constant, the specific separation of *A. Donianum* from *A. violaceum* would be justified; but if not constant, or at least not obvious (and from the specimens he has seen he is doubtful as to the constancy), it can serve only to separate *A. Donianum* as a *variety*.

This, then, is the history of *A. Donianum* up to the present time. It remains to be considered whether there are sufficient grounds for believing that the distinction of the lateral awns of the inner pale is to be relied on as a constant character.

In search of this character I have examined numerous pales in—(1) Don's plant; (2) Mr Melvill's specimen; and (3) many spikes from my cultivated Ben Lawers plant. In all of these I have never failed to find it. If, however, the pales are examined before the fruit has developed, the awns may easily be overlooked, since at that time they appear to be in a rudimentary condition only. As the fruit matures the awns grow larger, till they become (as Professor Hackel remarks) "very obvious even for the naked eye." I am compelled, therefore, to think that this character is a constant one, and if constant, then *A. Donianum* is a good species.

Of the British species of *Agropyrum*, *A. Donianum* is most like *A. repens.* The leaves of *A. Donianum* are more rigid, and more scabrid on both surfaces; the spike (erect in both species) has comparatively shorter and broader glumes; the rachis is more strongly spinulose, not only on the edges, but on ribs within the edges; and the axes of the spikelets have longer internodes, which are hairy. The inner pale in *A. repens* is shortly bifid or emarginate at the apex.

From *A. violaceum* the chief distinction lies, as already mentioned, in the lateral awns of the inner pale, but there are other differences. The apex of the inner pale is more acute, and the spinulose pectination of the ribs is more dense, and not so long; the glumes and outer pale are proportionately longer and narrower; and the axis of the spikelet appears to be somewhat shorter and more longly spinulose. In colour the spike of *A. Donianum* is usually of a glaucous green, rarely slightly tinged here and there with violet, whilst *A. violaceum* derives its name from the violet colour of the spike. This colour character is probably, however, of comparatively little importance, since I have found both *A. repens* and *A. caninum* with violet-coloured spikes, and Swedish specimens of *A. caninum* with violet spikes have been distributed as *A. violaceum.* The spikelets of *A. Donianum* are three to four flowered.

Though *A. violaceum* is described as being altogether without stolons, this is, it seems, not quite the case, since Professor Hackel tells me that he has a specimen of the true *A. violaceum,* which shows short runners, but different from the long and scaly runners of *A. repens.* The stolon produced by my plant of *A. Donianum* is also short and scaleless.

As regards the specimen seen by Mr Mitten, and called by him *T. biflorum,* there is, judging from the description, some doubt, since our plant has not "leaves smooth on both sides," nor "usually two-flowered spikelets." *A. caninum* differs from *A. Donianum* by its often-nodding spike, softer leaves, longer and flexuose awn of the outer pale, and structure of the inner pale, which is truncate or scarcely acute at the apex, into which the ribs converge and vanish.

Though *A. Donianum* has as yet been detected on Ben Lawers only, it probably occurs elsewhere, and possibly may have been confounded with forms of *A. violaceum* in Northern Europe. In *Alopecurus alpinus*, Sm., we have an example of a grass which was found first in Scotland, and afterwards in the Arctic regions and in Fuegia.

Poa palustris, L., as a British Plant. By F. Buchanan White, M.D., F.L.S.

(Read 14th November 1889.)

Though the occurrence of *Poa palustris* in Britain was recorded several years ago (*Botanical Exchange Club Report* for 1879), the finder, Mr G. Nicholson, of Kew Gardens, was of opinion that in the locality where it was found—the banks of the Thames at Kew and Mortlake—it was only naturalised. Mr Nicholson adds the opinion that "it does not seem improbable that it may occur in a wild state in Britain," but does not give the reasons for supposing that it was naturalised only, and not native, on the banks of the Thames, nor does he indicate in what manner it may probably have been introduced.

In August last, my friend Mr William Barclay, who has set himself the task—a labour of love, however—of carefully exploring a portion of the banks of the Tay, found a grass which he could not at the moment identify. Within a day or two, however, we made it out to be *Poa palustris*, a determination which was confirmed by the eminent agrostologist, Professor Hackel.

On the banks of the Tay the grass is locally abundant, but so many aliens occur on these banks that the fact of its being abundant cannot in itself be accepted as a proof of the species being indigenous. On the other hand, the presence of the aliens in question is no proof that the *Poa* is also an alien, since many rare and local plants, whose nativity is undoubted, grow on the same parts of the banks of the Tay. The questions which presented themselves to us in discussing this point were these—"Supposing that the plant is an introduction, how could it have been introduced? and is there anything in its known distribution to militate against its nativity in Britain?" The aliens of the Tay banks are all species which have been in cultivation for their beauty or utility. *Poa palustris* is not, I believe, a fodder grass* nor

* In this, it seems, I am mistaken. Dr Aitken kindly tells me that it has been experimentally cultivated near Edinburgh, and promises to be a good fodder grass. I cannot find, however, that it has ever been cultivated in Perthshire. A careful search in the pasture fields in the neighbourhood of

would it be cultivated for its beauty. It is widely, but not universally, distributed in Europe—both north and south and east and west—and occurs also in North America. On the banks of the Tay it grows mixed with the local, but undoubtedly wild, *Carex aquatilis.* Looking, therefore, to all probabilities, we came to the conclusion that the species was indigenous.

Corroboration of this view was obtained soon afterwards by the discovery of another station. This was in a wild marsh near Crieff, sixteen miles distant, and with no possibility of transmission by water of seeds from one place to the other.

It seems not improbable that *Poa palustris* may be detected in other places. It is by no means unlike its allies, and might readily be passed over. Most of all it resembles *P. nemoralis*—with which it has been confounded—but the presence of a conspicuous ligule is a ready mark of distinction. It is more slender than either *P. pratensis* or *P. trivialis*, while the absence of stolons, as well as other characters, separates it from the former, and the almost nerveless spikelets from the latter.

Till somewhat recently the grass has been known as *Poa serotina*, Ehrh., the Linnean name *P. palustris* being supposed to be at least doubtful, if indeed it did not really belong—as Smith affirmed—to *Leersia oryzoides.* Nyman (*Conspectus*), however, catalogues the plant as *P. palustris* (L.), Rth., and says that it seems to be the same as the *palustris* of the *Systema*, 10th ed., and of *Species Plantarum*, 2nd ed.

the place where it grows in the marsh beside the Tay showed that it was not there, at any rate ; and though it now occurs on the raised artificial bank of the river, its presence there is due to the fact that the bank had been mended with earth taken from the marsh. In cultivation in my garden the grass has become much more luxuriant. The wild specimens from near Crieff are much more slender than the Tay plant, and retain this characteristic under cultivation. This, I think, rather favours the view that *Poa palustris* is indigenous in Perthshire.—F. B. W.

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 19½ 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 11½ inches; these should be placed through the drying paper, so as to divide it up into so many equal parcels.

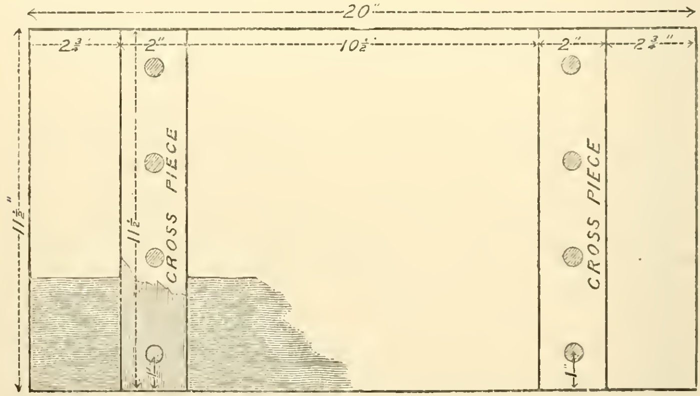

FIG. 1.—Diagram of board with cross pieces attached, and showing the run of the grain of the wood.

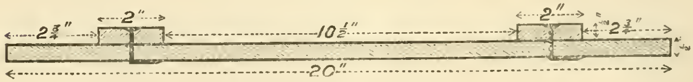

FIG. 2.—Section of fig. 1.

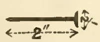

FIG. 3.—Diagram of nail.

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

20 inches by 11½ inches by ½ inch thick, and be made of ordinary deal wood; the cross pieces should be 11½ inches by 2 inches by ½ 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 2¾ 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 11½ inches by ½ inch, with four loose cross pieces 11½ inches by 2 inches by ½ 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

		lbs.	oz.
Some good stout twine, two pieces, each 40 feet, 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

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 1½ 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 Umbelliferæ, Euphorbiaceæ, and Compositæ, 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.

The Marine Algæ of the Dunbar Coast. By George W. Traill, Joppa.

(Read 9th January 1890.)

The coast of Dunbar is one of the richest localities for Marine Algæ in the Firth of Forth.

Though the species, so far as at present known, are less numerous than those occurring on the coast of Elie, the plants are generally luxuriant and, in many cases, of larger growth.

Owing, probably, to the depth and purity of the water, *Laminaria hyperborea* is unusually abundant; and, consequently, many deep-water Algæ which are generally epiphytic on this plant, and seldom met with at any great distance up the estuary of the Firth, are here of frequent occurrence, and often fine as specimens.

On account of the numerous pools between tide-marks, and owing to the rocky shores being intersected with many creeks and crevices affording every variety of light and shade, the species belonging to the littoral zone are also fairly well represented, and are almost as remarkable for their luxuriant growth as those occurring in deep water.

Near the "Vault," at Broxmouth Point, there is an extensive rocky platform sloping down gradually towards the sea. This place, besides being fertile in species, is most instructive, as it illustrates in a remarkably clear way—often in sharply defined zones—the particular Algæ applicable to each successive level.

In the following list I have given the habitats of the Algæ, and, in the cases of the rarer species, their exact localities; also their usual life periods, and seasons for fructification. The dates are necessarily approximate in some cases, as they vary according to the climatic influences of different years.

Where the species is epiphytic on other Algæ, a list of the most usual host plants is given, and the order in which they are mentioned expresses their respective numbers.

In another paper * I have endeavoured to show, from numerous examples, that the epiphyte, or parasite, by some process of natural selection, invariably attaches itself to a

* "The Parasitical Algæ of the Firth of Forth," read before the Royal Society of Dublin, April 1882.

host plant which has naturally a life period sufficiently long to allow time for the development of its fruit, and the escape of its spores; and, further, that the life period of the epiphyte, irrespective of its time for fruit, is, in the great majority of cases, very much shorter than that of its host plant.

It will, I think, be seen that this principle is borne out in the examples of epiphytism observed at the Dunbar coast, which I have enumerated in the following pages.

The classification I have adopted is that of Mr Batters in his excellent work, recently published, on the Marine Algæ of Berwick-on-Tweed.

Class I.—CYANOPHYCEÆ.

Order I.—SCHIZOPHYCEÆ.

Family.—CHROOCOCCACEÆ.

DERMOCARPA (Crn.), Bornet.

1. **Dermocarpa prasina** (Reinsch), Bornet.

Epiphytic on *Polysiphonia fastigiata*, *Catenella Opuntia*, *Ceramium rubrum*, &c., between tide marks. Fruit in winter. (G. W. T. 1884.)

Family.—NOSTOCHINEÆ.

Tribe I.—Oscillarieæ.

MICROCOLEUS, Desmaz.

2. **Microcoleus chthonoplastes** (*Fl. Dan.*), Thur.

Found at Broxmouth by Mr Batters in November 1889. This is the *Microcoleus anguiformis* of Harvey.

SYMPLOCA, Kütz.

3. **Symploca Harveyi**, Le Jolis. (*Calothrix semiplena*, Ag.)

Near the "Vault," Broxmouth Point, in shallow rock pools near high-water mark, the finest specimens being in the shade. Annual. Summer and autumn. (G. W. T. 1882.)

Tribe II.—Rivularieæ.

RIVULARIA, Roth.

4. **Rivularia atra**, Roth.

On rocks and stones, also epiphytic on small Algæ in pools near high-water mark. At all seasons. Host plants: *Cladophora rupestris*, *Sphacelaria cirrhosa*, *Corallina officinalis*, *Enteromorpha percursa*, *Cladostephus spongiosus*.

CALOTHRIX, Ag.

5. Calothrix confervicola (Dillw.), Ag.

Epiphytic on *Sphacelaria cirrhosa*, *Cladophora rupestris*, *Ceramium rubrum*, *Ceramium acanthonotum*, *Ceramium Deslongchampsii*, and other small Algæ, in pools above half-tide level. Always submerged. Annual. Summer and autumn. ("Summer," Le Jolis.)

6. Calothrix pulvinata (Mert.), Ag.

Usually on vertical rocks in the shade; also epiphytic on *Fucus vesiculosus* and *Pelvetia canaliculata*, near high-water mark. All the year. Occurs in some abundance at the base of the cliffs west of Dunbar, near the "Sucking-in-Goat;" also abundantly, and in very fine specimens, on rocks east of the esplanade. (G. W. T. 1881.)

6a. Calothrix fasciculata, Ag.

On vertical rocks in the shade near high-water mark at the base of the cliffs west of Dunbar, associated with the preceding species. (G. W. T. 1890.) All the year.

7. Calothrix scopulorum (Web. and Mohr), Ag.

Plentiful on rocks near high-water mark, at several places, especially to the west of the castle. All the year.

Class II.—CHLOROPHYCEÆ.

Order II.—CHLOROZOOSPOREÆ.

Family.—ULVACEÆ.

PRASIOLA, Suhr.

8. Prasiola stipitata, Suhr.

On rocks and boulders at about the high-water mark of neap tides. All the year. Usually in best condition in winter and spring; and poor in summer and autumn. Fruit in February and March. Left uncovered by the tide, and exposed to the light for many hours daily. Not uncommon east of the old harbour; also below the cliffs west of Dunbar, near the boys' bathing pool.

MONOSTROMA, Thur.

9. Monostroma Grevillei (Thur.), Wittr. (*Ulva lactuca*, Harv.)

At about half-tide level at the burn at the esplanade. Annual. March to June. Epiphytic on *Cladophora rupestris*, &c.

ENTEROMORPHA, Link.

10. Enteromorpha clathrata (Roth), Grev.

In pools at about half-tide level. Annual. April to September.

11. Enteromorpha compressa (Linn.), Grev.

Common on rocks and stones between tide marks; also epiphytic on Algæ. Vegetates at all seasons. Fruit in spring and summer. Host plants very numerous.

12. **Enteromorpha erecta** (Lyngb.), Hook.

In rock pools at about half-tide level; also in deep water. Annual. Spring and summer.

13. **Enteromorpha intestinalis** (Linn.), Link.

Common, chiefly in brackish water. Annual. April to September.

14. **Enteromorpha Linza** (Linn.), J. Ag. (*Ulva Linza*, Linn.)

Common in pools at about half-tide level. Annual. May to September.

15. **Enteromorpha percursa** (Ag.), Hook.

In shallow pools near high-water mark, below the links, at the west of the burn. Annual. Spring and summer.

ULVA, Linn.

16. **Ulva lactuca**, Linn. (*Ulva latissima*, Harv.)

Common on rocks and stones, and epiphytic on Algæ, in pools between tide marks. All the year. In best condition in May, June, and July. Host plants numerous. Perhaps the most frequent are: *Cladophora lætevirens*, *Cladophora rupestris*, *Corallina officinalis*, *Ceramium rubrum*, and *Cladostephus spongiosus*.

Family.—CONFERVACEÆ.

CHÆTOMORPHA, Kütz.

17. **Chætomorpha Melagonium** (Web. and Mohr), Kütz. (*Conferva melagonium*, Harv.)

Common in pools near low-water mark. Fronds often from 12 to 15 inches in length. Perennial. Fruit in summer.

18. **Chætomorpha tortuosa** (Dillw.), Kleen. (*Conferva tortuosa*, Harv.)

On rocks, and epiphytic on *Chondrus crispus* and *Corallina officinalis*, in pools at about half-tide level. Very abundant at the west of the cliffs. Annual. May to October. Plants sometimes live over the winter. Spores escape towards the end of July.

ULOTHRIX, Kütz.

19. **Ulothrix flacca** (Dillw.), Thuret. (*Lyngbya flacca*, Harv.)

On rocks, and epiphytic on Algæ, near high-water mark, usually in the shade, often associated with *Ulothrix isogona*. Annual. November to August. Fruit in winter and spring. Spores escape in May and June. Host plants: *Fucus vesiculosus*, *Fucus platycarpus*, *Rhodochorton Rothii*, *Corallina officinalis*.

20. **Ulothrix isogona** (*Eng. Bot.*), Thuret. (*Conferva Youngana*, Dillw.)

Associated with the above. Annual. November to August. Fruit in winter and spring. Spores escape in May and June.

RHIZOCLONIUM, Kütz.

21. Rhizoclonium riparium (Roth), Harv.

On sand-covered rocks, and sometimes epiphytic on Fuci, near high-water mark. Occasionally forms widely spreading strata at quiet, flat, muddy, or sandy places near high-water mark. Left uncovered by the tide, and exposed to the light for many hours daily. All the year. At many places, but usually very fine a little to the west of the ladies' bathing pool; also at the east of the esplanade.

CLADOPHORA, Kütz.

22. Cladophora albida, var. *refracta* (Harv.), Thur.

In pools near low-water mark west of the "Vault," Broxmouth Point. Rather rare. Annual. Summer.

23. Cladophora arcta (Dillw.), Kütz.

In pools near low-water mark, fine and common, especially in the vicinity of the "Vault." Annual. March to October.

24. Cladophora arctiuscula, Crouan.

On exposed rocks near high-water mark. All the year. In best condition from March to October. Fruit in spring. Not common.

25. Cladophora lætevirens (Dillw.), Kütz.

On rocks, and epiphytic on Algæ, in pools usually at about half-tide level. Always submerged. Annual. March to December. Plants sometimes last through the winter. Fruit in summer. Young plants, and new shoots on plants of the last season, have their ramelli *secund;* all the ramelli being produced on the inner side of the ramulus previously to those on the outer side. Host plants: *Cladophora rupestris*, *Chondrus crispus*, *Polysiphonia nigrescens*, *Corallina officinalis*, &c.

26. Cladophora lanosa (Roth), Kütz.

Epiphytic on *Polyides rotundus*, *Ahnfeldtia plicata*, *Ceramium rubrum*, *Furcellaria fastigiata*, *Halidrys siliquosa*, and other small Algæ, near low-water mark. Annual. Spring to end of autumn.

27. Cladophora lanosa, var. *uncialis* (Harv.), Thur.

On flat rocks and large stones near low-water mark. Annual. From about March to end of autumn; some of the plants apparently lasting through the winter. In best condition in July. Old plants lose their gloss, and become lighter in colour, and ropy. Abundant at the "Vault."

28. Cladophora rupestris (Linn.), Kütz.

Common and very fine on rocks between tide marks, and at a lower level. Rarely epiphytic on Algæ. All the year. Fruit in summer.

Order III.—OOSPOREÆ.

Family.—VAUCHERIACEÆ.

VAUCHERIA, De Candolle.

29. **Vaucheria sphærospora,** Nordst.; *forma genuina,* Nord.; and *forma dioica,* Nord.

On the sides of grass tufts near high-water mark, below the links, at several places. Covered by the sea at high tides only. August 1888. (G. W. T.) Certified by Nordstedt.

Class III.—PHÆOPHYCEÆ.

Order IV.—PHÆOZOOSPOREÆ.

Family.—SCYTOSIPHONACEÆ.

PHYLLITIS, Kütz.

30. **Phyllitis fascia** (*Fl. Dan.*), Rke. (*Laminaria fascia,* Ag.)

On rocks and stones in pools at about half-tide level, especially below the esplanade. Annual. March to November. Trichosporangia in spring and summer. Rarely epiphytic on *Fucus vesiculosus* and *Chondrus crispus.*

SCYTOSIPHON, Ag.

31. **Scytosiphon lomentarius** (Lyngb.), J. Ag. (*Chorda lomentaria,* Lyngb.)

Usually on rocks in pools between tide marks. Annual. March to November. Trichosporangia in July and August. Host plants: *Cladophora rupestris, Corallina officinalis, Polysiphonia fibrillosa.*

Family.—PUNCTARIACEÆ.

LITOSIPHON, Harv.

32. **Litosiphon Laminariæ** (Lyngb.), Harv.

Epiphytic on *Alaria esculenta* in pools near low-water mark, and at a lower level. Annual. June to October. Fruit in August.

33. **Litosiphon pusillus** (Carm.), Harv.

Epiphytic on *Chorda filum,* but not plentiful. Annual. Spores escape in July and August.

PUNCTARIA, Grev.

34. **Punctaria plantaginea** (Roth), Grev.

On rocks and stones in pools between tide marks. Occasionally epiphytic on Algæ. Annual. Summer and autumn. Not uncommon, especially below the esplanade in a large pool above half-tide level, east of the stile.

Family.—DESMARESTIACEÆ.

DESMARESTIA, Lamour.

35. Desmarestia aculeata (Linn.), Lamour.

On stone and rocks from a little below the low-water mark of spring tides to deep water. Perennial.

36. Desmarestia viridis (*Fl. Dan.*), Lamour.

On stone and rocks from a little below the low-water mark of spring tides to deep water. Perennial. Usually associated with the preceding.

Family.—DICTYOSIPHONACEÆ.

DICTYOSIPHON, Grev.

37. Dictyosiphon fœniculaceus (Huds.), Grev.

Common in pools at about half-tide level. Epiphytic on *Scytosiphon lomentarius*, *Chondrus crispus*, *Phyllitis fascia*, *Gigartina mamillosa*, *Cladophora rupestris*, and other Algæ. Always submerged. Annual. April to October. Spores escape in July and August. The variety *hispidus* of Kjellman also occurs.

38. Dictyosiphon hippuroides (Lyngb.), Kütz.

In pools from about half-tide level to low-water mark. Nearly always epiphytic on *Chordaria flagelliformis*. Annual. May to November. Spores escape in July and August. Common, and often of large size, especially at the "Vault," where I obtained the first known British plants in 1880.

39. Dictyosiphon mesogloia, Ag.

In shallow pools, usually a little below the high-water mark of neap tides. Annual. May to September. In fruit usually during July and August, when the spores are enveloped until maturity in gelatinous globules attached to the exterior of the fronds. Common, especially in pools below the cliffs west of Dunbar; often in fine specimens. (G. W. T. 1881.)

STICTYOSIPHON, Kütz.

40. Stictyosiphon tortilis (Rupr.), Rke.

Usually in pools at about half-tide level. Always submerged. Never epiphytic on Algæ. Annual. Usual duration from about the beginning of March to September. Fruit in July and August. In muddy pools at the ladies' bathing pool west of the castle. (G. W. T. 1890.)

Family.—ECTOCARPACEÆ.

MYRIOTRICHIA, Harv.

41. Myriotrichia clavæformis, Harv.

Epiphytic on *Asperococcus echinatus*, *Cladophora rupestris*, *Dictyosiphon hippuroides*, and *Scytosiphon lomentarius*, &c., in pools from near high-water mark to about half-tide level. Annual. Spring and summer.

41a. Myriotrichia clavæformis, var. *filiformis* (Harv.), Farlow.

Associated with the preceding. Annual. Spring and summer.

ECTOCARPUS, Lyngb.

42. Ectocarpus confervoides (Roth), Le Jolis. (*Ectocarpus siliculosus*, Lyngb.)

Epiphytic on Algæ in pools between tide-marks. Annual. May to September. Fruit in June and July. Host plants: *Corallina officinalis, Cladophora rupestris, Scytosiphon lomentarius, Chordaria flagelliformis, Halidrys siliquosa, Asperococcus echinatus, Chorda filum, Polysiphonia elongata, Laminaria phyllitis, Polysiphonia urceolata, Myriotrichia clavæformis*, &c.

43. Ectocarpus granulosus (*Eng. Bot.*), Ag.

In pools near low-water mark. Annual. April to October. Fruit from May to September. Rather rare. Chiefly in pools below the esplanade. Epiphytic on *Ceramium rubrum* and *Laminaria saccharina.*

44. Ectocarpus hyemalis (?).

In pools above half-tide level, below the esplanade; rare.

45. Ectocarpus insignis, Crouan.

Occurs near low-water mark in shaded pools below the esplanade; also epiphytic on small Algæ. Annual. Fruit in summer. Found by E. M. Holmes in 1884.

46. Ectocarpus secundus (?), Kütz.

Epiphytic on *Punctaria plantaginea* in shallow pools at the esplanade stile. Annual. May to September.

47. Ectocarpus tomentosus (Huds.), Lyngb.

Epiphytic on *Fucus vesiculosus, Fucus serratus, Himanthalia lorea,* and other Algæ, near low-water mark, especially at the "Vault." Annual. April to September. Fruit in summer.

48. Ectocarpus velutinus (Grev.), Kütz. (*Elachista velutina*, Fries.)

Epiphytic on *Himanthalia lorea;* usually associated with *Elachista scutulata.* Annual. June to October. Fruit in July and August.

ISTHMOPLEA, Kjell.

49. Isthmoplea sphærophora (Harv.), Kjell. (*Ectocarpus sphærophorus*, Carm.)

Epiphytic on Algæ in caverns, and on exposed rocks, between tide marks. Generally fine and common at the east of the "Vault." Annual. April to September. Fruit from May to August. Host plants: *Ptilota elegans, Cladophora rupestris, Callithamnion arbuscula*, &c

PYLAIELLA, Bory.

50. Pylaiella littoralis (Linn.), Kjell. (*Ectocarpus littoralis*, Lyngb.)

Epiphytic on Algæ in pools between tide marks; also on exposed rocks. At all seasons. Fruit in summer. Host plants: *Fucus serratus*, *Fucus vesiculosus*, *Fucus platycarpus*, *Scytosiphon lomentarius*, *Polysiphonia fastigiata*, *Halidrys siliquosa*, *Cladophora rupestris*, *Callithamnion arbuscula*, *Laminaria digitata*, *Ulva lactuca*, Linn., *Chætomorpha Melagonium*, *Rhodymenia palmata*, *Polysiphonia fibrillosa*.

Family.—SPHACELARIACEÆ.

SPHACELARIA, Lyngb.

51. Sphacelaria cirrhosa (Roth), Ag.

Epiphytic on Algæ in pools at many places at and above half-tide level. All the year. Fruit in June and July; propagula in July. Host plants: *Halidrys siliquosa*, *Cladophora rupestris*, *Polysiphonia fibrillosa*, *Polyides rotundus*, *Fucus vesiculosus*, *Polysiphonia nigrescens*, *Cladostephus spongiosus*, *Corallina officinalis*, *Gelidium corneum*.

52. Sphacelaria radicans (Dillw.), Harv.

Usually on sand-covered rocks near low-water mark. All the year. Fruit in winter.

52a. Sphacelaria radicans (Dillw.), Harv., var. *olivacea* (Dillw.), Batters.

Usually in velvety patches on rocks near high-water mark, accompanying *Rhodochorton Rothii*. All the year. Unilocular pedicellate sporangia in winter. Rather rare.

53. Sphacelaria tribuloides, Menegh.

Occurs in a round basin-like pool at rather a high level, a little to the west of the ladies' bathing pool, west of the castle. It accompanies *Sphacelaria cirrhosa*, but does not seem to be epiphytic. Found by Mr Holmes in 1884.

CHÆTOPTERIS, Kütz.

53a. Chætopteris plumosa (Lyngb.), Kütz.

Occurs in considerable abundance in pools at about half-tide level, especially at the west of the castle. Perennial. Fruit in winter. (G. W. T. 1890.)

CLADOSTEPHUS, Ag.

54. Cladostephus spongiosus (Lightf.), Ag.

Common on rocks and in pools near low-water mark. Perennial. Fruit in winter.

Family.—RALFSIACEÆ.

RALFSIA, Berk.

55. Ralfsia verrucosa, Aresch.

Common in shallow pools between high-water mark and half-tide level, incrusting rocks and stones; also on exposed rocks in damp places. Perennial. Fruit in winter.

FAMILY.—MYRIONEMACEÆ.

MYRIONEMA, Grev.

56. Myrionema vulgare, Thur. (*Myrionema strangulans*, Grev.)

Epiphytic on *Enteromorpha compressa* at about half-tide level. Left uncovered by the tide, and exposed to the light for some hours daily. Annual. Summer and autumn. Fruit in July and August.

56a. Myrionema vulgare, var. *punctiforme* (Harv.), Batters.

Epiphytic on *Porphyra laciniata* at about half-tide level. Annual. Summer and autumn. Fruit in July and August.

FAMILY.—CHORDARIACEÆ.

Tribe I.—LEATHESIEÆ.

ELACHISTA, Duby.

57. Elachista Areschougii, Crouan.

Epiphytic on *Himanthalia lorea.* Annual. June to October. Fruit in July and August. Found by Edward Batters in July 1884. New to Britain.

58. Elachista flaccida, Aresch.

Epiphytic on *Halidrys siliquosa, Himanthalia lorea, Fucus vesiculosus, Ahnfeldtia plicata*, and other Algæ between tide marks. Annual. June to September. Fruit in July and August.

59. Elachista fucicola (Velley), Fries.

Epiphytic on *Fucus serratus* and *Fucus vesiculosus* between tide marks. Rarely on rocks. Common. Annual. June to September. Fruit in July and August.

60. Elachista Grevillei, Harv. in *Nat. Hist. Review*, vol. iv. p. 202.

Epiphytic on *Cladophora rupestris* in shallow pools above half-tide level. Annual. Summer and autumn.

61. Elachista scutulata (*Eng. Bot.*), Duby.

Epiphytic on *Himanthalia lorea.* Annual. Summer and autumn.

LEATHESIA, Gray.

62. Leathesia difformis (Linn.), Aresch. (*Leathesia tuberiformis*, Gray.)

On sand-covered rocks, and epiphytic on small Algæ, chiefly in shaded places, from about half-tide level to low-water mark. Usually left dry by the tide for some hours daily. Annual. May to October. Usual host plants: *Corallina officinalis, Cladophora rupestris, Halidrys siliquosa, Laurencia hybrida, Polysiphonia nigrescens, Polysiphonia fibrillosa, Cladophora lætevirens, Asperococcus echinatus.*

Tribe II.—Euchordarieæ.

CHORDARIA, Ag.

63. **Chordaria flagelliformis** (Müll., *Fl. Dan.*), Ag.

Common in pools between tide marks. Annual. April to November. Fruit in August.

Tribe III.—Mesoglœeæ.

MESOGLOIA, Ag.

64. **Mesogloia vermicularis** (*Eng. Bot.*), Ag.

Generally a little below low-water mark on stones and rocks; also epiphytic on Algæ. Always submerged. Annual. Summer. Host plants: *Polyides rotundus*, *Furcellaria fastigiata*, *Phyllophora Brodiæi.*

CASTAGNEA (Derb. et Sol.), Thuret.

65. **Castagnea virescens** (Carm.), Thur. (*Mesogloia virescens*, Carm.)

Common on rocks and stones in pools at about half-tide level; very rarely epiphytic on *Laurencia hybrida*, and other Algæ. Always submerged. Annual. Spring and summer. In pools at several places; especially to the east of the boys' bathing pool.

Family.—ASPEROCOCCACEÆ.

ASPEROCOCCUS, Lamour.

66. **Asperococcus echinatus** (Ag.), Grev.

Common at many places in shallow sunny pools from near high-water mark to about half-tide level. Always submerged. Often epiphytic on Algæ. Annual. April to October. Sporangia in summer. The variety *vermicularis* also occurs. Host plants: *Cladophora rupestris*, *Corallina officinalis*, *Halidrys siliquosa*, rarely, *Polysiphonia fibrillosa*, rarely, *Cystoclonium purpurascens*, rarely, *Fucus vesiculosus*, rarely.

Family.—LAMINARIACEÆ.

CHORDA, Stackh.

67. **Chorda filum** (Linn.), Stackh.

Chiefly in sandy bays, from a little above low-water mark to 4 or 5 fathoms of water. Annual. April to December. Fruit in July and August. Not plentiful.

ALARIA, Grev.

68. **Alaria esculenta** (Linn.), Grev.

Very plentiful, and often of large size, in exposed places at about low-water mark. Always submerged. Young plants about March. Perennial. Fruit in winter.

SACCORHIZA, De la Pylaie.

69. **Saccorhiza bulbosa** (Huds.), De la Pylaie. (*Laminaria bulbosa* (Huds.), Lam.)

In deep water. Perennial. Fruit in autumn.

LAMINARIA, Lamour.

70. **Laminaria digitata** (Linn.), Edm.

On rocks at about low-water mark. Perennial. Fruit in winter. The variety *stenophylla*, Harv., also occurs.

71. **Laminaria hyperborea** (Gunn), Foslie. (*Laminaria digitata*, Linn., partim.)

In deep water. Perennial. Fruit in winter.

72. **Laminaria saccharina** (Linn.), Lamour.

In pools near low-water mark, also in deep water. Sometimes epiphytic on other Algæ. All the year. Fruit in summer and autumn.

72a. **Laminaria saccharina**, var. *Phyllitis* (Stackh.), Le Jolis.

In pools near low-water mark, also in deep water. Rather uncertain in its appearance. " Fruits without growing to a large size, while small plants of *Laminaria saccharina*"—with which it is often confounded—" growing along with it, do not" (J. M'Bain). Annual. Spring and summer.

Order V.—FUCOIDEÆ.

Family.—FUCACEÆ.

HALIDRYS, Lyngb.

73. **Halidrys siliquosa** (Linn.), Lyngb.

Common in pools at and below half-tide level. Always submerged. Larger plants in deep water. Perennial. Fruit in winter. Spores escape in April from the plants growing between tide marks. A slender feathery variety also occurs in pools between tide marks. It accompanies the common form, but does not seem to pass into it, and may be looked upon as a permanent variety.

FUCUS, Linn.

74. **Fucus ceranoides**, Linn.

On rocks and stones between tide marks, chiefly at the mouth of the burn at the links. Perennial. Fruit in spring and summer.

75. **Fucus platycarpus**, Thuret.

Common on rocks below the Coast-Guard House, east of the old pier, from near high-water mark to about half-tide level, and occasionally at a lower level. Usually growing in the shade, and left uncovered by the tide for some hours daily. Perennial. Sporangia all the year. Spores escape in August.

76. Fucus serratus, Linn.

Common on rocks at about half-tide level. Perennial. Left uncovered by the tide, and exposed to the light for some hours daily. Fruit best in winter.

77. Fucus vesiculosus, Linn.

Common on rocks between tide marks. Left uncovered by the tide, and exposed to the light for some hours daily. Perennial. Fruit in winter and summer. Host plants: *Cladostephus spongiosus*, *Chondrus crispus*.

PELVETIA, Dene.

78. Pelvetia canaliculata (Linn.), Dene and Thur. (*Fucodium canaliculatum*, J. Ag.) (*Fucus canaliculatus*, Harv.)

Common on rocks between half-tide level and high-water mark. Left uncovered by the tide, and exposed to the light for many hours daily. Perennial. Fruit from June to September.

ASCOPHYLLUM, Stackh.

79. Ascophyllum nodosum (Linn.), Le Jolis. (*Fucus nodosus*, Linn.)

Common on rocks and boulders at about half-tide level. Perennial. Fruit from December to September.

HIMANTHALIA, Lyngb.

80. Himanthalia lorea (Linn.), Lyngb.

On exposed rocks at about low-water mark. All the year. Fruit in summer. Spores escape in August.

Order VI.—DICTYOTEÆ.

DICTYOTA, Lamour.

81. Dictyota dichotoma (Huds.), Lamour.

In pools at low-water mark, and probably at a greater depth, east of the old harbour; rather rare. (G. W. T. 1888.) Annual. Summer.

Class IV.—RHODOPHYCEÆ.

Order VII.—FLORIDEÆ.

Family.—PORPHYRACEÆ.

PORPHYRA, Ag.

82. Porphyra laciniata (Lightf.), Ag.

Common on exposed rocks, and epiphytic on Algæ, usually between half-tide level and high-water mark. Left uncovered by the tide, and exposed to the light for many hours daily. All the year. Fruit best in August and September. Host plants: *Corallina officinalis*, *Callithamnion arbuscula*, *Himanthalia lorea*, *Polysiphonia fibrillosa, Chondrus crispus, Gigartina mamillosa, Cladophora rupestris, Fucus serratus, Fucus vesiculosus, Fucus platycarpus.*

82a. Porphyra laciniata (Lightf.), Ag., var. *vulgaris* (Ag.), Le Jolis.

Common on rocks, and epiphytic on Algæ, in pools between tide marks. Annual. May to October. Fruit in August and September. Host plants: *Chondrus crispus, Dumontia filiformis, Fucus serratus, Fucus vesiculosus.*

82b. Porphyra linearis, Grev.

On rocks at about the high-water mark of neap tides. Winter and spring.

83. Porphyra leucosticta, Thur.

Epiphytic on Algæ from about half-tide level to low-water mark. Usually left uncovered by the tide, and exposed to the light for several hours daily. Annual. May to October. Fruit best in September. Host plants: *Fucus serratus, Fucus vesiculosus, Fucus platycarpus, Callithamnion arbuscula, Himanthalia lorea.*

BANGIA, Lyngb.

84. Bangia fusco-purpurea (Dillw.), Lyngb.

On smooth rocks and stones at and above half-tide level. Usually left uncovered by the tide, and exposed to the light for some hours daily. Sometimes abundant at the "Vault," Broxmouth, but rather uncertain in its appearance. Annual. March to September. Fruit in May and June.

Family.—SQUAMARIACEÆ.

PETROCELIS, J. Ag.

85. Petrocelis cruenta, J. Ag.

On rocks usually at about low-water mark. Perennial. Fruit in winter.

CRUORIA, Fries.

86. Cruoria pellita, Fries.

On rocks at about half-tide level; also epiphytic on stems of *Laminaria hyperborea.* All the year. Fruit in winter. Rather rare.

Family.—HILDENBRANDTIACEÆ.

HILDENBRANDTIA, Nardo.

87. Hildenbrandtia rosea, Kütz. (*Hildenbrandtia rubra,* Meneg.)

On pebbles and smooth stones in shallow pools, generally at about half-tide level. Always submerged. All the year. Fruit in autumn and winter.

Family.—WRANGELIACEÆ.

CHANTRANSIA, Fries.

88. **Chantransia secundata** (Lyngb.), Thur. (*Callithamnion secundatum*, J. Ag.)

Epiphytic on *Rhodymenia palmata* and *Porphyra laciniata* from about half-tide level to low-water mark. Usually left uncovered by the tide, and exposed to the light for some hours daily. Annual. May to September. Fruit in summer.

SPERMOTHAMNION, Aresch.

89. **Spermothamnion Turneri** (Mert.), Aresch. (*Callitham. Turneri* (Dillw.), Ag.)

Epiphytic on *Polyides rotundus*, *Furcellaria fastigiata*, *Phyllophora Brodiæi*, *Polysiphonia nigrescens*, *Corallina officinalis*, &c., near low-water mark, in sandy places, east of the old harbour. Always submerged. Annual. May to September. Fruit in summer. The var. *variabile*, Ag., also occurs.

Family—CERAMIACEÆ.

RHODOCHORTON, Näg.

90. **Rhodochorton floridulum** (Dillw.), Näg. (*Callithamnion floridulum* (Dillw.), Ag.

On sandy rocks near low-water mark. Usually left dry by the tide, and exposed to the light for several hours daily. All the year. Fruit in autumn and winter. Extremely abundant and fine on sand-covered rocks at the east of the old harbour.

91. **Rhodochorton Rothii** (*Eng. Bot.*), Näg. (*Callithamnion Rothii* (Linn.), Lyngb.)

On rocks near high-water mark. Usually in the shade, and always at places which are left dry at ebb tide. Perennial. Fruit in winter.

92. **Rhodochorton sparsum** (Harv.), Kjellm. (*Callithamnion sparsum*, Harv.)

Epiphytic on stems of *Laminaria hyperborea*. Annual. Summer and autumn.

CALLITHAMNION, Lyngb.

93. **Callithamnion arbuscula** (Dillw.), Lyngb.

On vertical rocks in the shade, usually a little below half-tide level, in places which are left uncovered by the tide for some hours daily. Perennial, but in poor condition, and stunted, during winter. Fruit from April to September. Abundant at many places.

94. **Callithamnion Hookeri** (Dillw.), Ag.

Common on rocks; also epiphytic on *Cladostephus spongiosus*, *Ptilota elegans*, &c., from about half-tide level to low-water mark. Usually left uncovered by the tide for some hours daily. Annual. March to October. Fruit from May to August.

95. Callithamnion polyspermum, Ag.

On shaded vertical rocks, often in muddy places, at about half-tide level; also epiphytic on *Polysiphonia fastigiata*, *Cladophora rupestris*, *Gigartina mamillosa*, and other small Algæ. Always at places which are left uncovered by the tide for several hours daily. Annual. March to October. Fruit in May, June, and July. Spores usually escape towards the end of July.

GRIFFITHSIA, Ag.

96. Griffithsia corallina (Linn.), Ag.

On rocks at low-water mark, and at a greater depth; also epiphytic on Algæ, always submerged. Annual. Fruit in summer.

97. Griffithsia setacea (Ellis), Ag.

In deep, shaded pools between tide marks; on the perpendicular sides of exposed rocks in the shade near low-water mark; also in deep water. Sometimes in very fine specimens. Perennial. Fruit in April, May, and June.

PTILOTA, Ag.

98. Ptilota elegans, Bonnem. (*Ptilota sericea*, Kütz.)

On shaded rocks, and in dark crevices, from a little below half-tide level to low-water mark. Usually left uncovered by the tide, in the shade, for some hours daily. Perennial. Fruit in spring and summer. Very fine on rocks east of the "Vault," Broxmouth.

99. Ptilota plumosa (Linn.), Ag.

Epiphytic on *Laminaria hyperborea* in deep water. Perennial. Fruit in spring and summer, so far as my experience goes; but Mr Batters finds fruit nearly all the year at Berwick. Fine and very common.

CERAMIUM, Lyngb.

100. Ceramium acanthonotum, Carm.

Common on rocks in the shade from about half-tide level to low-water mark. All the year. Fruit in winter and spring. Epiphytic on the following Algæ: *Ptilota elegans*, *Cladostephus spongiosus*, *Callithamnion arbuscula*, *Polysiphonia byssoides*, &c.

101. Ceramium Deslongchampsii, Chauv.

On rocks between tide marks, generally in pools; also epiphytic on Algæ. All the year. Fruit in July, August, and September. Host plants: *Ptilota elegans*, *Cladophora rupestris*, *Cladostephus spongiosus*, *Chondrus crispus*, *Corallina officinalis*, *Polysiphonia nigrescens*.

102. Ceramium diaphanum (Lightf.), Roth.

On rocks, and epiphytic on small Algæ, in pools between tide marks. Annual. March to September. Fruit in July and August. Host plants: *Halidrys siliquosa*, *Polysiphonia nigrescens*, *Cladostephus spongiosus*, *Polysiphonia fibrillosa*, &c.

103. Ceramium rubrum (Huds.), Ag.

On rocks, and epiphytic on Algæ, in pools between tide marks. All the year. Fruit in summer. The variety *proliferum* also occurs in pools, and in shaded niches at the "Vault." Host plants numerous: I have given thirty-three in my paper on the "Parasitical Algæ of the Firth of Forth," and others could be mentioned.

Family.—CRYPTONEMIACEÆ.

SARCOPHYLLIS, Kütz.

104. Sarcophyllis edulis (Stackh.), J. Ag. (*Iridæa edulis*, Bory.)

Common on rocks in exposed places, in the shade, near low-water mark. Perennial. Fruit in autumn and winter.

FASTIGIARIA, Stackh.

105. Fastigiaria furcellata (Linn.), Stackh. (*Furcellaria fastigiata* (Huds.), Lamour.)

On rocks, chiefly in sandy pools near low-water mark. Perennial. Fruit in winter.

DUMONTIA, Lamour.

106. Dumontia filiformis (*Fl. Dan.*), Grev.

In rock pools at about half-tide level. All the year. In best condition from March to October; plants being comparatively rare, and stunted, during winter. Fruit in summer. The variety *crispata* also occurs, chiefly where there are streams of either salt or fresh water.

Family.—GIGARTINACEÆ.

CHONDRUS, Stackh.

107. Chondrus crispus (Linn.), Lyngb.

Common on rocks between tide marks. Always submerged. Perennial. Fruit in winter and spring.

GIGARTINA, Stackh.

108. Gigartina mamillosa (Good. and Woodw.), J. Ag.

Common on exposed rocks, and in pools, from about half-tide level to low-water mark. Perennial. Fruit in winter.

CALLOPHYLLIS, Kütz.

109. Callophyllis laciniata (Huds.), Kütz. (*Rhodymenia laciniata*, Grev.)

Epiphytic on *Laminaria hyperborea*. Cast ashore in fine specimens. Biennial. Capsules in spring; granules in summer.

AHNFELDTIA, Fr.

110. Ahnfeldtia plicata, Fr. (*Gymnogongrus plicatus*, Kütz.)

Common, and sometimes of large size, in sandy pools near low-water mark. Always submerged. Perennial. Fruit early in winter.

PHYLLOPHORA, Grev.

111. Phyllophora Brodiæi (Turn.), J. Ag.

On rocks in sandy pools near low-water mark; also in deep water. Perennial. Fruit in winter. Not uncommon.

112. Phyllophora membranifolia (Good. and Woodw.), J. Ag.

On rocks and stones, generally about low-water mark; also at a greater depth. Sometimes epiphytic on the roots of *Laminaria hyperborea.* Perennial. Fruit in winter. Always submerged.

113. Phyllophora rubens (Linn.), Grev.

In pools and under shelving rocks, especially at the west of the castle, near the low-water mark of spring tides; also in deep water. Perennial. Fruit in winter.

114. Phyllophora Traillii, Holmes.

On shaded rocks or in pools at about the low-water mark of spring tides; sometimes amongst sponges. All the year. Fruit in winter.

CYSTOCLONIUM, Kütz.

115. Cystoclonium purpurascens (Huds.), Kütz.

Common in pools and on exposed rocks from about half-tide level to low-water mark. Annual. April to October. Fruit in summer. The variety *cirrhosa* also occurs.

Family.—RHODYMENIACEÆ.

CHYLOCLADIA, Grev.

116. Chylocladia articulata (Lightf.), Grev.

On rocks in the shade, and sometimes epiphytic on Algæ, near low-water mark. Usually left uncovered by the tide for some hours daily. Common, but usually of small size. Annual. April to October. Fruit in Summer. Host plants: *Laminaria digitata, Fucus serratus, Fucus vesiculosus, Polysiphonia nigrescens, Cladostephus spongiosus*—all rarely.

117. Chylocladia clavellosa (Turn.), Grev.

Growing at the low-water limit of spring tides on rocks and stones, and epiphytic on Algæ. Annual. April to October. Fruit in July and August. Host plants: *Laminaria hyperborea, Phyllophora membranifolia, Polyides rotundus, Fastigiaria furcellata.*

RHODYMENIA, Grev.

118. Rhodymenia palmata (Linn.), Grev.

Common on exposed rocks and in pools between tide marks; also epiphytic on Algæ. Biennial. Granules in January and February; tetraspores in summer; tubercles in June, July, and August. Host plants: *Ahnfeldtia plicata, Laminaria digitata, Fucus serratus, Fucus vesiculosus, Chætomorpha Melagonium, Chondrus crispus*—all more or less rarely.

PLOCAMIUM, Lamour.

119. Plocamium coccineum (Huds.), Lyngb.

On rocks, and sometimes epiphytic on Algæ, in deep water. Rarely growing between tide marks, and then of small size. Perennial. Fruit in summer. Common and fine. Host plants: *Laminaria hyperborea, Rhodomela lycopodioides, Polyides rotundus, Odonthalia dentata.*

EUTHORA, J. Ag.

120. Euthora cristata (Linn.), J. Ag. (*Rhodymenia cristata*, Grev.)

Epiphytic on the stems and roots of *Laminaria hyperborea*. Annual. Summer. Rare.

HYDROLAPATHUM, Rupr.

121. Hydrolapathum sanguineum (Linn.), Stackh. (*Delesseria sanguinea*, Lamour.)

Growing in deep rock pools near low-water mark, also under projecting ledges of rock, in the shade; rarely epiphytic on Algæ. Larger specimens in deep water, especially in tide-ways. Biennial. Fruit from November to March inclusive. Common.

Family.—DELESSERIACEÆ.

NITOPHYLLUM, Grev.

122. Nitophyllum Bonnemaisoni, Grev.

In deep water, epiphytic on *Laminaria hyperborea*. Annual. Summer. Rather rare.

123. Nitophyllum laceratum (Gmel.), Grev.

On rocks near the low-water mark of spring tides, and epiphytic on the stems of *Laminaria hyperborea*, in deep water. The specimens are often fine. Annual. May to September. Fruit in July and August. The variety *Smithii* also occurs.

124. Nitophyllum punctatum (Stackh.), Grev.

Epiphytic on Algæ in pools at about the low-water mark of spring tides. Large specimens epiphytic on *Laminaria hyperborea* in deep water. Annual. May to September. Fruit in July and August. The variety *ocellatum* also occurs.

DELESSERIA, Grev.

125. Delesseria alata (Huds.), Lamour.

On rocks, and epiphytic on Algæ at and below low-water mark. All the year. Fruit from March to May. Host plants: *Laminaria hyperborea, Rhodomela lycopodioides, Ptilota elegans, Ptilota plumosa, Cladostephus spongiosus*, &c.

126. Delesseria sinuosa (Good. and Woodw.), Lamour.

On rocks, and epiphytic on Algæ, either in deep pools between tide marks or at a lower level. Biennial. Fruit in winter and spring. Host plants: *Laminaria hyperborea, Odonthalia dentata, Ptilota plumosa,* &c.

FAMILY.—SOLIERIACEÆ.

CATENELLA, Grev.

127. Catenella Opuntia (Good. and Wood.), Grev.

In dark crevices and on vertical rocks, in the shade, near high-water mark. Perennial. Tetraspores in July. Extremely fine, and in abundance, in creeks and channels below the cliffs west of Dunbar.

FAMILY.—GELIDIACEÆ

GELIDIUM, Lamour.

128. Gelidium corneum (Huds.), Lamour.

In sandy pools west of the castle, near the boys' bathing pool. Perennial. Fruit in August.

FAMILY.—SPONGIOCARPEÆ.

POLYIDES, Ag.

129. Polyides rotundus (Gm.), Grev.

Common, and often of large size, on sandy rocks in pools near low-water mark. Perennial. Fruit in winter.

FAMILY.—RHODOMELACEÆ.

ODONTHALIA, Lyngb.

130. Odonthalia dentata (Linn.), Lyngb.

On stones and rocks from a little below the low-water mark of ordinary tides to deep water. Common, and often of large size. Perennial. Fruit in winter.

RHODOMELA, Ag.

131. Rhodomela lycopodioides (Linn.), Ag.

Epiphytic on stems of *Laminaria hyperborea*; also on perpendicular rocks in the shade at low-water mark at the west of the castle, and at other places in the district. Perennial. Fruit in June, July, and August.

131a. Rhodomela lycopodioides, var. β. *laxa*, Kjellm.

In pools near low-water mark east of the esplanade. Perennial. Rather rare.

132. Rhodomela subfusca (Woodw.), Ag.

Common on rocks and stones in pools between tide marks. Perennial. Tetraspores in swollen ultimate ramuli in summer, and in stichidia in winter.

POLYSIPHONIA, Grev.

133. Polysiphonia atro-rubescens (Dillw.), Grev.

On sand-covered rocks, also in pools, near low-water mark, and at a greater depth. All the year. Fruit in summer and autumn.

134. Polysiphonia Brodiæi (Dillw.), Grev.

On rocks, and sometimes epiphytic on *Chordaria flagelliformis*, in pools generally near low-water mark. Annual. May to September. Fruit in July and August. Not uncommon, amongst other places, in rocks pools a little to the west of the ladies' bathing pool, west of Dunbar.

135. Polysiphonia byssoides (Good. and Woodw.), Grev.

On rocks in deep water. Annual. June to October. Fruit in July and August.

136. Polysiphonia elongata (Huds.), Harv.

On stones and shells in deep water. Rarely growing between tide marks. Perennial. Fruit in July and August.

137. Polysiphonia fastigiata (Roth.), Grev.

Usually epiphytic on *Ascophyllum nodosum*; rarely growing on rocks as at the east of the esplanade. Always left uncovered by the tide, and exposed to the light, for many hours daily. Perennial. Fruit from June to September.

138. Polysiphonia fibrata (Dillw.), Harv.

On damp exposed rocks, and epiphytic on Algæ, in the shade, a little below half-tide level; also in pools. Annual. Summer and autumn. Fruit from June to September inclusive. Common. Host plants: *Corallina officinalis*, *Polysiphonia nigrescens*, *Cladostephus spongiosus*, *Chondrus crispus*, *Laurencia pinnatifida*, &c.

139. Polysiphonia fibrillosa (Dillw.), Grev.

On rocks, also epiphytic on *Cladostephus spongiosus*, in clear sunny pools from about half-tide level to near low-water mark. Perennial. Fruit in July, August, and September.

140. Polysiphonia formosa, Suhr.

In pools between tide marks. Annual. May to September. Fruit in August. This plant has generally been referred to *P. formosa*, but it is not quite typical.

141. Polysiphonia nigrescens (Huds.), Harv.

Common on rocks in pools between tide marks; also epiphytic on *Corallina officinalis*. Perennial; but more usual, duration from March to October. Young fronds on old plants generally appear in January. Fruit from June to September.

142. Polysiphonia parasitica (Huds.), Grev.

On rocks in shaded pools between tide marks, and at a lower level; also epiphytic on *Laminaria hyperborea*. Always submerged. Annual. April to October. Fruit in July and August. Sometimes cast ashore in fine specimens, and in considerable abundance, by easterly gales in autumn.

143. Polysiphonia thuyoides, Grev. (*Rytiphlœa thuyoides,* Harv. in Mackay, *Fl. Hib.*)

In dark niches in a slaty sandstone reef at half-tide level at the "Vault," Broxmouth; rare. (G. W. T. 1880.) Perennial. Fruit in summer.

144. Polysiphonia urceolata (Lightf.), Grev.

On rocks, and epiphytic on Algæ, between tide marks, usually in pools; also at a lower level, epiphytic on the stems of *Laminaria hyperborea.* Usual duration from March to October, but plants sometimes last through the winter. Fruit in July and August. Other host plants: *Cladostephus spongiosus, Cladophora uncialis, Corallina officinalis.*

BONNEMAISONIA, Ag.

145. Bonnemaisonia asparagoides (Woodw.), Ag.

Cast ashore from deep water, sometimes in very fine specimens. Annual. June to September. Fruit in July and August.

LAURENCIA, Lamour.

146. Laurencia hybrida (De Cand.), Lenorm. (*Laurencia cæspitosa,* Lamour.)

Common on exposed rocks and in pools at about half-tide level; rarely epiphytic on Algæ. All the year. Tetraspores in winter and summer; ceramidia in July.

147. Laurencia pinnatifida (Gmel.), Lamour.

On exposed rocks at about low-water mark; and sometimes epiphytic on Algæ. In fine specimens. All the year. Tetraspores in winter and spring; ceramidia in summer.

DASYA, Ag.

148. Dasya coccinea (Huds.), Ag.

Cast ashore from deep water. Epiphytic on *Laminaria hyperborea.* Annual. April to October. Fruit in July and August.

Family.—CORALLINACEÆ.

MELOBESIA, Lamour.

149. Melobesia Laminariæ, Crn.

Epiphytic on *Laminaria hyperborea.*

150. Melobesia Lenormandi, Aresch.

On shells and stones, but not common.

151. Melobesia pustulata, Lamour.

Epiphytic on *Furcellaria fastigiata, Chondrus crispus, Himanthalia lorea, Polyides rotundus,* and *Gigartina mamillosa,* &c., between tide marks.

LITHOTHAMNION, Phil.

152. Lithothamnion polymorphum (Linn.), Aresch. (*Melobesia polymorpha* (Linn.), Harv.)

Common on rocks in pools between tide marks, and in deep water.

CORALLINA, Linn.

153. Corallina officinalis, Linn.

Common, and very fine, in rock pools between tide marks. Perennial. Fruit in winter and spring.

INDEX.

Supplementary Note to Mr Traill's Paper. By Professor BAYLEY BALFOUR.

Mr Traill's work upon the Algæ of the Dunbar coast has been completed at a most opportune time, when, as I shall presently relate, opportunities, such as have been hoped for during many years—have been even supposed to be afforded, though they have not been—are at last provided in our neighbourhood for steady and continuous, and it is to be hoped successful, work upon the life-history of the Algæ of our coasts. It is a sad confession, but it will not be news I think to members of this Society, that the study of Algæ in this country is in a, shall I say, depressed condition at present. I do not require to remind members that there was a time when Great Britain took the lead in the work upon these plants. The early numbers of our *Transactions* will have told this to all of you, for here in Edinburgh some of the best researches into the group were made. But alas! the names of Greville, Walker-Arnott, Ralfs, Smith, Hassall are classical now—but where are the successors? We have, fortunately, amongst us Mr Traill who has shown himself by his ability and knowledge a worthy follower of the older men—but in Scotland what other algologists have we? And it has come to this, that if one wants fresh-water Algæ accurately and carefully named they have to be sent to continental authorities; and that although we inhabitants of Britain have the sea all around us, and easy of access, yet more work upon the Algæ is accomplished in the centre of Germany than is done in this country.

But as in other forms of depression let us hope there is a lowest limit. And there are now signs of more attention being devoted to the subject of Algæ in this country; and one of the most efficient stimuli to this line of research is the creation of such laboratories for study and work as that I am now going to refer to, and which has been recently formed at Dunbar.

As you are aware, such laboratories, especially for the study of marine animal-life, have been founded at several places on our shores. At Plymouth there is a large establishment, partly endowed by Government; at Liverpool also there is one. At

St Andrews Professor Mackintosh is favourably situated for marine scientific work, and has a laboratory; and nearer home there was a Granton Marine Station some years ago, although it has ceased to be a centre for algological research. Now, however, by the efforts of Professor Cossar Ewart the Fishery Board for Scotland has formed, or rather is forming, a laboratory at Dunbar. The object of the foundation of the laboratory is the study of the life-history of our food-fishes, and the discovery of facts which shall make the fishing industry of our coasts more remunerative to the large population dependent thereon, and the investigation of the Algal flora of our coasts is one—if not the most important—of those which fall to be undertaken in such a laboratory.

A portion of the land adjoining the harbour has been obtained from the town for the purposes of the laboratory. It lies just behind the old castle. Those who know Dunbar will recollect the ruined archway connecting the east bastion of the castle with the main portion of it. The ground for the laboratory faces this, and the two natural creeks formed at the spot when closed in by a rampart will form two natural ponds in which culture can be carried out. Pending the completion of the full design for the laboratory a temporary one has been erected in which all necessary provision for a few workers exists, and is under the charge of an energetic naturalist, Dr Beard of the Fishery Board.

We have, then, within easy distance from Edinburgh—on a coast with splendid clear water, and, as Mr Traill shows, with an exceedingly rich marine flora—means provided for scientific investigations of which it is to be hoped full advantage will be taken. And I am sure that it will be the opinion of the members of this Society that to Professor Cossar Ewart for initiating the scheme, and to the Fishery Board for its enlightened policy in carrying it out, the gratitude of those interested in science is due. As you are aware, a committee of reference in scientific matters has been appointed by the Marquis of Lothian, to which it may be expected the duty of supervising this station will be deputed; and we may hope that the energy which has been shown by all concerned at the outset of this promising departure may be continued, and that many valuable results may be obtained at the station.

The Marine Algæ of the Orkney Islands. By George W. Traill.

(Read 12th June 1890.)

The Marine Algæ of Orkney are so remarkable, both on account of their beauty and rarity, that I trust the following attempt to record all the known species with their principal localities may meet with the approval of algologists.

Excellent work was done many years ago by the Rev. Charles Clouston; and, subsequently, the Rev. John H. Pollexfen was most successful in dredging as well as in collecting between tide marks. Mrs Moffat, and her sister Miss Watt of Skaill, and some others, are also deserving of high commendation for their labours in different localities.

The late Dr James M'Bain, R.N., dredged during the years 1842–46, while soundings were being taken for the Admiralty Chart, and has added much to our knowledge of the deep-water species.

On Dr M'Bain's death I acquired his collection of Algæ and relative manuscript notes, from which I derived much assistance in the preparation of the following record of species. I am also greatly indebted to Mr Pollexfen for much valuable and interesting information, and for his kindness in carefully revising the list.

During a visit to Orkney in 1887 I searched for a number of unrecorded species, which it was thought should occur there, and was fortunate in discovering the majority of them. The more important are specially referred to in the list; and it will be observed that several are new to the British marine flora.

Though the list contains many more species than were formerly known, the total still falls short of what might have been expected, looking to the extent of coast, which, according to the late Captain Thomas, R.N., has an outline of 573·7 miles. This may partly be accounted for by the comparatively few good rock pools to be met with between tide marks.

The following may be mentioned as good localities:—

The north shore of Westray; Backaskaill Bay, Sanday;

the island of Stronsay generally, according to Mr James Cursiter; Rousay (especially between Broch and Providence Gjio), but the north shore, which has not been worked, looks promising; Carness Bay; west side of Scapa Bay; Deerness; Howquoy Head; Burray (at Water Sound); Hoy Sound, from Stromness to Breckness, in pools; and Skaill Bay, West Mainland.

The dates given for the fructification and duration of the species are necessarily approximate in many cases, varying as they do with the locality, as well as with the climatic influences of different years.

The classification adopted is that of Mr Edward Batters in his excellent work, recently published, on the Marine Algæ of Berwick-on-Tweed.

Class I.—CYANOPHYCEÆ.

Order I.—SCHIZOPHYCEÆ.

Family.—CHROOCOCCACEÆ.

DERMOCARPA (Crn.), Bornet.

1. **Dermocarpa prasina** (Reinsch), Bornet.

At Scapa Bay, epiphytic on *Polysiphonia fastigiata.* Fruit in winter. (G. W. T. 1887.) New to Orkney.

Family.—NOSTOCHINEÆ.

Tribe.—Rivularieæ.

RIVULARIA, Roth.

2. **Rivularia atra**, Roth.

On rocks and stones, also epiphytic on *Sphacelaria cirrhosa, Corallina officinalis*, &c., in pools at Carness, opposite Hellyar Holm. At all seasons.

CALOTHRIX, Ag.

Calothrix confervicola (Dillw.), Ag.

In pools, Bay of Carness, opposite Hellyar Holm, very fine, epiphytic on *Sphacelaria cirrhosa.* Always submerged. Annual. Summer and autumn.

Class II.—CHLOROPHYCEÆ.

Order II.—CHLOROZOOSPOREÆ.

Family.—ULVACEÆ.

PRASIOLA, Suhr.

4. **Prasiola stipitata,** Suhr.

At Scapa, near the burn, on large stones at about the high-water mark of neap tides, 1887 (G. W. T.) Left uncovered by the tide, and exposed to the light for many hours daily. All the year. Usually in best condition in winter and spring, and poor in summer and autumn. Fruit in February and March. New to Orkney.

MONOSTROMA, Thur.

5. **Monostroma Grevillei** (Thur.), Wittr. (*Ulva lactuca,* Harv. *non* Linn.)

At above half-tide level, chiefly where there are fresh-water streams. Epiphytic on Algæ. Annual. March to June.

ENTEROMORPHA, Link.

6. **Enteromorpha percursa** (Ag.), Hook.

In pools near high-water mark. Annual. Spring and summer. "Peerie Sea," Kirkwall; Scapa; July 1887 (G. W. T.). Corroborated by E. M. Holmes.

7. **Enteromorpha erecta** (Lyngb.), Hook.

In rock pools at about half-tide level. Fine specimens in deep water in Kirkwall Bay. Annual. Spring and summer.

8. **Enteromorpha clathrata** (Roth), Grev.

In pools at about half-tide level. Annual. April to September. Corroborated by E. M. Holmes.

9. **Enteromorpha compressa** (Linn.), Grev.

Common on rocks and stones, also epiphytic on Algæ, between tide marks. Vegetates at all seasons. Fruit in spring and summer.

10. **Enteromorpha Linza** (Linn.), J. Ag. (*Ulva Linza*, Linn.)

Common in pools at about half-tide level. Always submerged. Annual. May to September. Fine in Damsay Bay.

11. **Enteromorpha intestinalis** (Linn.), Link.

Common, chiefly in brackish water. Always submerged. Annual. April to September.

12. **Enteromorpha cornucopiæ,** Hook.

In brackish pools, Marwick Head, &c. Mr Pollexfen is under the impression that this should be included under *Monostroma Grevillei.*

ULVA, Linn.

13. **Ulva lactuca**, Linn. (*Ulva latissima*, Harv.)

Common on rocks and stones, and epiphytic on Algæ, in pools between tide marks. All the year. In best condition in May, June, and July.

FAMILY.—CONFERVACEÆ.

CHÆTOMORPHA, Kütz.

14. **Chætomorpha implexa** (Dillw.), Kütz. (*Conferva implexa*, Dillw.)

On rocks, and epiphytic on Algæ, in pools between tide marks. Annual. Found by Mr Pollexfen.

15. **Chætomorpha tortuosa** (Dillw.), Kütz. (*Conferva tortuosa*, Dillw.)

On rocks, and epiphytic on Algæ, in pools at about half-tide level. Always submerged. Annual. May to October. Plants sometimes last through the winter. Spores escape towards the end of July. Papa-Westray, in pools; Carness, opposite Hellyar Holm, in pools.

16. **Chætomorpha littorea** (Harv.), Kütz. (*Conferva littorea*, Harv.)

Usually on muddy sea-shores between tide marks. Annual. Summer. Found by Harvey in Orkney.

17. **Chætomorpha arenosa** (Carm.), Kütz. (*Conferva arenosa*, Carm.)

In shallow pools between tide marks. "Peerie Sea," Kirkwall, and Scapa; 1887 (G. W. T.). Corroborated by E. M. Holmes.

18. **Chætomorpha cannabina** (Kütz.), Aresch.

Kirkwall, in the "Peerie Sea," 1887 (G. W. T.). New to Britain. Identified by Prof. Kjellman of Upsala.

19. **Chætomorpha Linum** (Roth.), Kütz. (*Conferva Linum*, Roth.)

Usually occurs in muddy pools between tide marks. Always submerged. Annual. Summer and autumn. In the Loch of Stenness, Pollexfen; in the "Peerie Sea," Kirkwall, 1887 (G. W. T.).

20. **Chætomorpha ærea** (Dillw.), Kütz. (*Conferva ærea*, Dillw.)

At the Bay of Carness, in pools opposite Hellyar Holm, 1887 (G. W. T.). Certified by Prof. Kjellman of Upsala. Annual. Summer. Found also at Skaill according to Mr Pollexfen.

21. **Chætomorpha Melagonium** (Web. and Mohr), Kütz. (*Conferva Melagonium*, Web. and Mohr.)

In pools near low-water mark. Always submerged. Perennial. Fruit in summer. Near Hoy Mouth, Rev. C. Clouston; Carness, in pools opposite Hellyar Holm, &c. Common.

ULOTHRIX, Kütz.

22. **Ulothrix flacca** (Dillw.), Thur. (*Lyngbya flacca*, Harv.)

On rocks, and epiphytic on Algæ, near high-water mark; usually in the shade; often associated with *Ulothrix isogona*. Annual.

November to August. Fruit in winter and spring. Spores escape in May and June. Kirkwall and Scapa Bays, 1887 (G. W. T.). Corroborated by Prof. Bornet, Paris.

23. Ulothrix isogona (*Eng. Bot.*), Thur. (*Lyngbya speciosa*, Carm.)

Associated with the preceding. Annual. November to August. Fruit in winter and spring. Spores escape in May and June. Kirkwall and Scapa Bays, 1887 (G. W. T.). Corroborated by Prof. Kjellman, Upsala.

RHIZOCLONIUM, Kütz.

24. Rhizoclonium riparium (Roth), Harv.

On sand-covered rocks, and sometimes epiphytic on Algæ, near high-water mark. Occasionally forms widely-spreading strata in quiet, flat, sandy or muddy places near high-water mark. Left uncovered by the tide, and exposed to the light for many hours daily. All the year. "Peerie Sea," Kirkwall, and west side of Scapa Bay (G. W. T.). Corroborated by E. M. Holmes.

CLADOPHORA, Kütz.

25. Cladophora arcta (Dillw.), Kütz.

In pools near low-water mark. Always submerged. Annual. March to October. Shapansey, fine ; Rousay, opposite Wire, fine and abundant ; Black Craig. The variety *centralis* of Lyngbye also occurs at Rousay, among other places.

26. Cladophora lanosa (Roth), Kütz.

Near low-water mark ; usually epiphytic on Algæ. Always submerged. Annual. Spring to the end of autumn. Carness Bay, in pools opposite Hellyar Holm.

26a. Cladophora lanosa, var. *uncialis* (Harv.), Thur.

On flat rocks and stones near low-water mark, exposed to the light. Annual. Usual duration from beginning of spring to end of autumn, some plants apparently lasting through winter. In best condition in July. Old plants lose their gloss, and become lighter in colour. Occurs, among other places, at the east of Providence Gjio, in Rousay, very fine.

27. Cladophora rupestris (Linn.), Kütz.

Common on rocks between tide marks, and at a lower level. Rarely epiphytic on Algæ. All the year. Fruit in summer.

28. Cladophora pellucida (Huds.), Kütz.

In pools, generally near low-water mark. Annual. Summer Found by Mr Pollexfen.

29. Cladophora Hutchinsiæ (Dillw.), Harv.

On the rocky bottoms of clear tide pools near low-water mark. Annual. Summer. Found by Mr Pollexfen.

30. **Cladophora lætevirens** (Dillw.), Kütz.

On rocks, and epiphytic on Algæ, in pools, usually at about half-tide level. Always submerged. Annual. March to December. Plants sometimes live through the winter. Fruit in summer. Young plants, and new shoots on old plants of the last season, have their ramelli *secund;* all the ramelli being produced on the inner side of the ramulus previously to those on the outer side. Occurs at Carness in pools.

31. **Cladophora gracilis**, Griff.

Usually grows on Zostera and the larger Algæ in deep water. Annual. Summer. Identified in Mr Pollexfen's collection by Mr Edward Batters.

32. **Cladophora glaucescens** (Griff.), Harv.

On rocks and stones between tide marks. Always submerged Annual. Summer.

33. **Cladophora albida** (Huds.), Kütz.

On rocks, and epiphytic on Algæ, near low-water mark. Annual. Summer. Common.

33a. **Cladophora albida**, var. *refracta* (Harv.), Thur.

In pools near low-water mark. Always submerged. Annual. Summer. Common.

34. **Cladophora fracta** (*Fl. Dan.*), Kütz.

Loch of Stenness; also Holland Head, Inganess Bay, and Scapa at high-water mark. Annual. Summer and autumn. 1887 (G. W. T.). Corroborated by E. M. Holmes.

Family.—CODIACEÆ.

CODIUM, Stackh.

35. **Codium tomentosum** (Huds.), Stackh.

In pools, generally near low-water mark. Occasionally epiphytic on *Polyides rotundus.* Perennial. Summer. Clet, Westray; Linga Island (M'Bain,) fine; Pharay Island; Kirkwall Bay, opposite Iceland Skerry; Carness Bay, opposite Hellyar Holm; South Ronaldshay.

Family.—BRYOPSIDEÆ.

BRYOPSIS, Lamour.

36. **Bryopsis plumosa** (Huds.), Ag.

In pools at many places from about half-tide level to low-water mark. Annual. May to October.

Order III.—OOSPOREÆ.

Family.—VAUCHERIACEÆ.

VAUCHERIA, De Candolle.

37. **Vaucheria sphærospora**, Nordst. (*Forma genuina*, Nordst., and *Forma dioica*, Nordst.)

Kirkwall and Scapa Bays, in the shade on mud covered by the sea at high tides only. July 1887 (G. W. T.). Certified by Prof. Nordstedt of Lund, Sweden. New to Orkney.

Class. III.—PHÆOPHYCEÆ.

Order IV.—PHÆOZOOSPOREÆ.

Family.—SCYTOSIPHONACEÆ.

PHYLLITIS, Kütz.

38. **Phyllitis fascia** (*Fl. Dan.*), Rke. (*Laminaria fascia*, Ag.)

On rocks and stones in pools at about half-tide level. Always submerged. Annual. March to November. Trichosporangia in spring and summer. Rather rare. Found among other places at Skaill, West Mainland.

SCYTOSIPHON, Ag.

39. **Scytosiphon lomentarius** (Lyngb.), J. Ag. (*Chorda lomentaria*, Lyngb.)

Usually on rocks in pools between tide marks. Annual. March to November. Nearly always submerged. Trichosporangia in July and August. Large specimens in bays; smaller on exposed shores. A minute form, about $\frac{3}{4}$ inch high, occurs near high-water mark at Kirkwall Bay,—corroborated by Kjellman.

Family.—PUNCTARIACEÆ.

LITOSIPHON, Harv.

40. **Litosiphon Laminariæ** (Lyngb.), Harv.

Epiphytic on *Alaria esculenta* in pools near low-water mark. Always submerged. Annual. June to October. Fruit in August. Broch in Rousay, 1887 (G. W. T.). Found also at Skaill, West Mainland, and at Kirkwall Bay.

41. **Litosiphon pusillus** (Carm.), Harv.

Epiphytic on *Zostera marina* (M'Bain), also on *Chorda filum*. Annual. Spores escape in July and August. Kirkwall Bay, good; Westness Bay, Rousay.

PUNCTARIA, Greville.

42. **Punctaria tenuissima**, Grev.

Epiphytic on "Laminaria," according to Dr M'Bain, in Calf Sound, 4 fathoms, rare; also in Kirkwall Bay, according to Mr Pollexfen. Annual. Summer.

43. **Punctaria latifolia**, Grev.

On rocks and stones in deep water. Annual. Summer. Calf Sound, 4 fathoms, rare; Rousay, cast ashore.

44. **Punctaria plantaginea** (Roth), Grev.

On rocks and stones in pools between tide marks; occasionally epiphytic on Algæ. Always submerged. Annual. Summer and autumn. Calf Sound, 4 fathoms; Rousay.

STRIARIA, Greville.

45. **Striaria attenuata**, Grev.

Epiphytic on the smaller Algæ in deep water. Annual. Summer. Found by Mr Pollexfen in Damsay Bay and Kirkwall Bay. Cast ashore in Rousay.

Family.—DESMARESTIACEÆ.

DESMARESTIA, Lamour.

46. **Desmarestia aculeata** (Linn.), Lamour.

On stones and rocks from a little below the low-water mark of spring tides to deep water. Perennial. Calf Sound, 4 fathoms, stony bottom; Kirkwall Bay, off Crossiecrown, 5½ fathoms; and, generally, in sheltered bays, sandy and coral bottoms.

47. **Desmarestia ligulata** (Lightf.), Lamour.

In rock pools near low-water mark, and at a greater depth. Annual. Summer. Grows to the height of from 20 to 30 inches. North Shore, Westray, fine (J. W. Gray). Mr Pollexfen has dredged very fine specimens in Kirkwall Bay; but by far the largest he has ever seen were found at Skaill, West Mainland. Occurs also at Skaill, in Rousay.

48. **Desmarestia viridis** (*Fl. Dan.*), Lamour.

On stones and rocks from a little below the low-water mark of spring tides to deep water. Perennial. Kirkwall Bay, off Crossiecrown, 5½ fathoms; Rousay; Deer Sound, 15 fathoms, very fine; "Pentland Firth, 40 fathoms, when dredging for Zoophytes" (M'Bain).

Family.—DICTYOSIPHONACEÆ.

DICTYOSIPHON, Grev.

49. **Dictyosiphon fœniculaceus** (Huds.), Grev.

Common in pools at about half-tide level, epiphytic on *Scytosiphon lomentarius*, and other small Algæ. Always submerged. Annual. April to October. Spores escape in July and August.

50. Dictyosiphon hippuroides (Lyngb.), Kütz.

In pools at about half-tide level, and sometimes at a lower level. Nearly always epiphytic on *Chordaria flagelliformis*. Annual. May to November. Spores escape in July and August. Holland Head, Inganess Bay; Kirkwall Bay, growing in pools opposite Iceland Skerry, 1887 (G. W. T). Mr Pollexfen has also several fine specimens of this plant in his collection, recently identified by Mr Batters. Now for the first time recorded for Orkney.

STICTYOSIPHON, Kütz.

51. Stictyosiphon tortilis (Rupr.), Rke.

Usually in pools at about half-tide level. Always submerged. Annual. March to September. Fruit in July and August. Found at Holm, East Mainland, by Mr J. W. Cursiter. Identified by G. W. T. 1887. Corroborated by E. M. Holmes. New to Orkney.

52. Stictyosiphon subarticulata (Aresch.), Hauck.

Lately identified by Mr Batters in Mr Pollexfen's collection. Found at Skaill Bay, West Mainland. New to Orkney.

53. Stictyosiphon brachiatus (*Eng. Bot.*), Bornet. (*Ectocarpus brachiatus* (*Eng. Bot.*), Ag.)

Epiphytic on *Rhodymenia palmata* in pools between tide marks. Always submerged. Annual. Fruit, June, July, August. East side of Kirkwall Bay; Rousay at Broch; also at Skaill, West Mainland; and in the Loch of Stenness. Mr Pollexfen tells me that his specimens from the locality last mentioned struck Harvey as being "very curious," and as being more "rigid" than ordinary specimens of *Ectocarpus brachiatus*.

Family.—ARTHROCLADIACEÆ.

ARTHROCLADIA, Duby.

54. Arthrocladia villosa (Huds.), Duby.

Dredged in 5 or 6 fathoms (M'Bain). Annual. Summer and autumn. Rare. Found once by Mr Pollexfen when dredging in Kirkwall Bay near the mouth of the "String."

Family.—SPOROCHNACEÆ.

SPOROCHNUS, Ag.

55. Sporochnus pedunculatus (Huds.), Ag.

On rocks, shells, &c., in deep water. Annual. Summer and autumn. Kirkwall Bay, clay bottom, 6 to 8 fathoms, fine; Calf Sound, coral ground, 8 to 15 fathoms, &c.

STILOPHORA, J. Ag.

56. Stilophora rhizodes (Ehr.), J. Ag.

Growing on rocks, or epiphytic on Algæ, below low-water mark in sheltered bays. Annual. Summer.

57. Stilophora Lyngbyæi, J. Ag.

In land-locked bays and estuaries, on a muddy and sandy bottom, in from 4 to 10 fathoms. Annual. Summer. Kirkwall Bay, fine.

Family.—CUTLERIACEÆ.

CUTLERIA, Grev.

58. Cutleria multifida (*Eng. Bot.*), Grev.

In still water—Howan Sound and Kirkwall Bay; epiphytic on *Laminaria hyperborea.* Annual. Summer and autumn.

Mr Pollexfen tells me that a specimen of this seaweed, which he dredged in Kirkwall Bay more than fifty years ago, was the first on which Dr Greville ever saw the anther-like fruit described some years afterwards by Dr Dickie of Aberdeen; that in the following year he dredged other specimens in the same locality, which differed very much in appearance and had the more common fructification; that they are extremely narrow, and so regularly dichotomous, that he placed them for some time in his herbarium under the MS. name *C. dichotoma*; that latterly he regarded them merely as a very narrow variety of *C. multifida*; and that they are so narrow as to be easily mistaken at first sight for *Stilophora Lyngbyæi*, which is by no means uncommon in the same place. Mr Batters, who has examined the specimens, confirms the accuracy of Mr Pollexfen's nomenclature.

Family.—ECTOCARPACEÆ.

MYRIOTRICHIA, Harv.

59. Myriotrichia clavæformis, Harv.

In pools from near high-water mark to about half-tide level; epiphytic on Algæ. Annual. Spring and summer. Occurs at the west side of Broch in Rousay epiphytic on *Asperococcus echinatus*.

60. Myriotrichia clavæformis, var. *filiformis* (Harv.), Farlow.

Associated with the preceding. Annual. Spring and summer.

61. Ectocarpus confervoides (Roth), Le Jolis. (*Ectocarpus siliculosus*, Lyngb.)

Epiphytic on Algæ in pools between tide marks. Always submerged. Annual. May to September. Fruit in June and July.

62. Ectocarpus tomentosus (Huds.), Lyngb.

Common on *fuci* between tide marks. Usually in places left uncovered by the tide, and exposed to the light for some hours daily. Annual. April to September. Fruit in summer.

63. Ectocarpus fasciculatus, Harv.

Epiphytic on *Laminaria saccharina* and *Chorda filum*; also on rocks in pools near low-water mark. Always submerged. Annual. April to October. Fruit from May to September. Whalgjio, Westray; Skaill, West Mainland; Kirkwall Bay, &c.

64. Ectocarpus Hincksiæ, Harv.

Epiphytic on *Alaria esculenta*, west of Broch in Rousay, July, 1887 (G. W. T.). Corroborated by E. M. Holmes. Annual. Summer. Epiphytic on *Laminaria digitata* (M'Bain).

65. Ectocarpus granulosus (*Eng. Bot.*), Ag.

On rocks in pools near low-water mark, and at a greater depth. Annual. April to October. Fruit from May to September. Calf Sound, 7 fathoms; Kirkwall Bay.

66. Ectocarpus longifructus, Harv.

Epiphytic on Algæ in pools between tide marks. Annual. Summer. Discovered by Mrs Moffat at Skaill, West Mainland.

ISTHMOPLEA, Kjellman.

67. Isthmoplea sphærophora (Harv.), Kjellm. (*Ectocarpus sphærophorus*, Carm.)

In caverns, also on exposed rocks between tide marks, epiphytic on Algæ. Usually left dry by the tide, in the shade, for several hours daily. Annual. April to September. Fruit from May to August. In a dark narrow chasm, east side of Eday, epiphytic on *Ptilota elegans* and *Cladophora rupestris.* Found also in Kirkwall Bay, &c.

PYLAIELLA, Bory.

68. Pylaiella littoralis (Linn.), Kjellm. (*Ectocarpus littoralis*, Lyngb.)

Common on *fuci* in pools between tide marks; also on exposed rocks. At all seasons. Fruit in summer.

TILOPTERIS.

69. Tilopteris Mertensii (*Eng. Bot.*), Kütz. (*Ectocarpus Mertensii*, Ag.)

Usually on mud-covered rocks and stones near low-water mark, and at a greater depth. Sometimes occurs where fresh-water streams enter the sea. Annual. Spring. Skaill Bay, West Mainland.

Family.—SPHACELARIACEÆ.

SPHACELARIA, Lyngb.

70. Sphacelaria radicans (Dillw.), Harv.

On sand-covered rocks between tide marks at the east side of Kirkwall Bay. All the year. Fruit in winter. Uncovered by the tide, and exposed to the light for some hours daily.

70a. Sphacelaria radicans (Dillw.), Harv., var. *olivacea* (Dillw.), Batters.

Usually in velvety patches on rocks near high-water mark, accompanying *Rhodochorton Rothii.* Uncovered by the tide, and exposed to the light for many hours daily. All the year. Unilocular pedicellate sporangia in winter. Harvey mentions that Messrs Hooker and Borrer collected this species in Orkney; but the locality is not known.

71. **Sphacelaria cirrhosa** (Roth), Ag.

Epiphytic on Algæ in pools at and above half-tide level. All the year. Fruit in June and July. Propagula in July. Carness in pools; Shapansey; Rousay, &c.

72. **Sphacelaria plumigera** (Lyngb.), Holmes. (*Sphacelaria plumosa*, Harv.)

Doubtful as an Orkney species; and probably *Chætopteris plumosa*, Kütz, has been confounded with it.

CHÆTOPTERIS, Kütz.

73. **Chætopteris plumosa** (Lyngb.), Kütz.

In bays, 7 fathoms, coral bottoms. Pierowall, Kirkwall, Linga Sound, &c. Perennial. Fruit in winter.

CLADOSTEPHUS, Ag.

74. **Cladostephus spongiosus** (Lightf.), Ag.

Common on rocks and in pools near low-water mark. Perennial. Fruit in winter.

75. **Cladostephus verticillatus** (Lightf.), Ag.

Submerged in bays on rocks and stones; also epiphytic on *Corallina officinalis*. Perennial. Fruit in winter. Occurs at Eday, Widefirth, &c.

Family.—RALFSIACEÆ.

RALFSIA, Berk.

76. **Ralfsia verrucosa**, Aresch. (*Ralfsia deusta*, Berk.)

In shallow pools between high-water mark and half-tide level, incrusting rocks and stones; also on exposed rocks in damp places. Perennial. Fruit in winter.

Family.—MYRIONEMACEÆ.

MYRIONEMA, Grev.

77. **Myrionema vulgare**, Thur. (*Myrionema strangulans*, Grev.)

At about half-tide level. Left uncovered by the tide, and exposed to the light for some hours daily. Annual. Summer and autumn. Fruit in July and August. Epiphytic on *Ceramium rubrum*, Westray; on *Enteromorpha compressa* at Broch, Rousay.

77a. **Myrionema vulgare**, var. *punctiforme* (Harv.), Batters. (*Myrionema punctiforme*, Harv.)

At about half-tide level. Annual. Summer and autumn. Fruit in July and August. At Skaill, Rousay, epiphytic on *Porphyra laciniata*, var. *vulgaris*. At Kirkwall Bay on *Ceramium rubrum*.

77b. Myrionema Leclancherii, Harv.

Usually epiphytic on decaying fronds of *Rhodymenia palmata* and *Ulva Lactuca*, Linn. Annual. Autumn. One specimen from Rousay epiphytic on *Ulva Lactuca*, Linn., found by Mrs Traill of Woodwick about the year 1839. Identified recently by Mr Batters. This is the only Orkney specimen recorded.

Family.—CHORDARIACEÆ.

Tribe I.—Leathesieæ.

ELACHISTA, Duby.

78. Elachista stellaris, Aresch.

Found in Kirkwall Bay epiphytic on *Stilophora Lyngbyæi* by Mr Pollexfen. Identified by Mr Batters. New to Orkney.

79. Elachista fucicola (Velley), Fries.

Epiphytic on *fuci* between tide marks. Annual. June to September. Fruit in July and August.

80. Elachista scutulata (*Eng. Bot.*), Duby.

Epiphytic on *Himanthalia lorea*. Annual. Summer and autumn. Fruit in August.

LEATHESIA, Gray.

81. Leathesia difformis (Linn.), Aresch. (*Leathesia tuberiformis*, S. F. Gray.)

On sand-covered rocks, and epiphytic on small Algæ, from about half-tide level to low-water mark. Usually left uncovered by the tide in shaded places for several hours daily. Annual. May to October.

Tribe II.—Euchordarieæ.

CHORDARIA, Ag.

82. Chordaria flagelliformis (Müll., *Fl. Dan.*), Ag.

In pools between tide marks; common. Annual. April to November. Fruit in August.

Tribe III.—Mesoglœeæ.

MESOGLOIA, Ag.

83. Mesogloia vermicularis (*Eng. Bot.*), Ag.

Generally a little below low-water mark on stones and rocks; also epiphytic on Algæ. Always submerged. Annual. Summer. Exposed rocks, Skaill, West Mainland; Broch of Deerness, fine.

CASTAGNEA (Derb. et Sol.), Thuret.

84. Castagnea virescens (Carm.), Thur. (*Mesogloia virescens*, Carm.)

Common on rocks and stones in pools at about half-tide level; very rarely epiphytic on Algæ. Always submerged. Annual. Spring and summer.

Family.—ASPEROCOCCACEÆ.

ASPEROCOCCUS, Lamour.

85. Asperococcus bullosus, Lamour. (*A. Turneri*, Hook.)

On stones, and epiphytic on the larger Algæ. Often growing in 4 or 5 fathoms. Annual. Summer and autumn. Howan Sound; Linga Sound, common; Kirkwall Bay, fine.

86. Asperococcus compressus, Griff.

On coral and stony bottoms, Calf Sound. Annual. Summer.

87. Asperococcus echinatus (Ag.), Grev.

Common in shallow pools from near high-water mark to about half-tide level. Always submerged. Often epiphytic on Algæ. Annual. April to October. Sporangia in summer. The variety *vermicularis*, Harv., occurs, amongst other places, in pools near high-water mark at the west side of Scapa Bay.

Family.—LAMINARIACEÆ.

CHORDA, Stackh.

88. Chorda filum (Linn.), Stackh.

Common, chiefly in sandy bays, from a little above low-water mark to 4 or 5 fathoms. Annual. April to December. Fruit in July and August. Natural place of growth a little outside of the Laminarian belt.

89. Chorda tomentosa, Lyngb. (*Chorda filum*, var. β *tomentosa*, Harv.)

On submerged rocks beyond low-water mark. Annual. Skaill Bay, West Mainland; Kirkwall Bay.

ALARIA, Grev.

90. Alaria esculenta (Linn.), Grev.

Common at exposed places at about low-water mark. Always submerged. Perennial. Fruit in winter. Called "*Murlins*" in Orkney.

SACCORHIZA, De la Pylaie.

91. Saccorhiza (Laminaria) bulbosa (Huds.), De la Pylaie.

In deep water. Perennial. Fruit in autumn. Large, just within the eddy of strong tides. Very large specimens in 4 fathoms, Calf Sound, just within the eddy of a very strong tide, on a stony bottom.

LAMINARIA, Lamour.

92. Laminaria digitata (Linn.), Edm.

On rocks at about low-water mark. Perennial. Fruit in winter. The variety *stenophylla*, Harv., also occurs.

93. Laminaria hyperborea (Gunn), Foslie. (*L. Cloustoni* (Edm.), Le Jolis. *L. digitata*, Auct., partim.)

In deep water. Perennial. Fruit in winter.

94. Laminaria longicruris, De la Pyl.

Water-worn specimens cast ashore at Sanday.

95. Laminaria saccharina (Linn.), Lamour.

In pools near low-water mark, also in deep water. Sometimes epiphytic on other Algæ. Always submerged. Perennial. Fruit in summer and autumn. The variety *caperata* also occurs, usually in from 3 to 10 fathoms, coral bottoms.

95a. Laminaria saccharina, var. *Phyllitis* (Stack.), Le Jolis. (*Laminaria Phyllitis*, Lamour.)

In pools near low-water mark, also in deep water. Rather uncertain in its appearance. "Fruits without growing to a large size, while small plants of *Laminaria saccharina* (Linn.), Lamour, growing along with it do not" (M'Bain). Annual. Spring and summer.

Order V.—FUCOIDEÆ.

Family.—FUCACEÆ.

HALIDRYS, Lyngb.

96. Halidrys siliquosa (Linn.), Lyngb.

Common in pools at and below half-tide level. Always submerged. Large plants in deep water. Perennial. Fruit in winter. Spores escape in April from the plants growing between tide marks.

FUCUS, Linn.

97. Fucus ceranoides, Linn.

On rocks and stones between tide marks; usually where fresh-water streams enter the sea, often in land-locked bays and estuaries. Always submerged. Perennial. Fruit in spring and summer. Papa-Westray; Loch of Stenness, where a very narrow form occurs.

98. Fucus vesiculosus, Linn.

Common on rocks between tide marks, and left uncovered by the tide and exposed to the light for some hours daily. Perennial. Fruit in winter and summer.

99. Fucus platycarpus, Thuret.

Common on rocks from near high-water mark to about half-tide level, and occasionally at a lower level. Usually left uncovered by the tide in shaded places for several hours daily. Perennial. Sporangia all the year. Spores escape in August.

100. Fucus serratus, Linn.

Common on rocks at about half-tide level. Usually left uncovered by the tide, and exposed to the light for some hours daily. Perennial. Fruit best in winter. An extremely broad form occurs at the Bay of Damsay; the var. *latifolius* of Turner. I learn from Mr Pollexfen that Turner gave the name *latifolius* to specimens 2 inches wide; and that Greville speaks of one $2\frac{1}{2}$ inches broad. One in Mr Pollexfen's possession from Damsay Bay, lately measured by Mr Batters, was found to be $5\frac{1}{2}$ inches in breadth!

PELVETIA, Dene.

101. Pelvetia canaliculata (Linn.), Dene et Thuret. (*Fucus canaliculatus.* (Linn.)

Common on rocks between half-tide level and high-water mark. Always left uncovered by the tide, and exposed to the light for some hours daily. Perennial. Fruit from June to September.

ASCOPHYLLUM, Stackh.

102. Ascophyllum nodosum (Linn.), Le Jolis. (*Fucus nodosus*, Linn.)

Common on rocks and boulders at about half-tide level. Perennial. Fruit from December to September.

103. Ascophyllum Mackaii (Turn.), Batters and Holmes. (*Fucus Mackaii*, Turn.)

Sea-shores, usually of land-locked bays. Perennial. April and May. Mrs Moffat and Dr M'Bain both had Orkney specimens in their collections, but the exact locality is unknown.

HIMANTHALIA, Lyngb.

104. Himanthalia lorea (Linn.), Lyngb.

On exposed rocks at about low-water mark. All the year. Fruit in summer. Spores escape in August.

SARGASSUM, Ag.

104a. Sargassum bacciferum (Turn.), Ag.

Sometimes cast ashore.

104b. Sargassum vulgare, Ag.

Sometimes cast ashore.

Order VI.—DICTYOTEÆ.

DICTYOTA, Lamour.

105. Dictyota dichotoma (Huds.), Lamour.

On rocks, and also epiphytic on Algæ, in tide pools near low-water mark, and at a greater depth. Annual. Summer. Found at Broch, Rousay; Wire Sound anchorage; Howan Sound anchorage, &c.; variety β *intricata*, Grev., which variety has also been dredged in Kirkwall Bay.

Class IV.—RHODOPHYCEÆ.

Order VII.—FLORIDEÆ.

FAMILY.—PORPHYRACEÆ.

PORPHYRA, Ag.

106. Porphyra abyssicola, Kjellm.

Some specimens from Skaill Bay in Mrs Moffat's collection have been attributed to this northern species; and another from Rousay, found by the late Mrs Traill of Woodwick in 1839, appears to Mr Batters, on a careful microscopic examination, to agree very well with Kjellman's figure and description, and with Foslie's specimens.

107. Porphyra coccinea, J. Ag. (= *P. minima*, Crn.).

Dredged by Mr Pollexfen in Kirkwall Bay. Epiphytic on other Algæ. Identified by Mr Batters. New to Orkney.

108. Porphyra laciniata (Lightf.), Ag.

Common on exposed rocks, and epiphytic on Algæ, usually between half-tide level and high-water mark. Usually left dry by the tide, and exposed to the light for many hours daily. All the year. August and September are usually the best months for fruit.

108a. Porphyra laciniata (Lightf.), Ag., var. *vulgaris* (Ag.), Le Jolis.

Common on rocks, and epiphytic on Algæ, in pools between tide marks. Always submerged. Annual. May to October. Fruit in August and September.

109. Porphyra leucosticta, Thur.

Epiphytic on Algæ from half-tide level to low-water mark. Usually left uncovered by the tide, and exposed to the light for several hours daily. Annual. May to October. September is usually the best time for fruit. Skaill, in Rousay; Inganess Bay; Deerness.

110. Porphyra linearis, Grev.

Usually on rocks at about the high-water mark of neap tides. Annual. Winter and spring. Found at Skaill, West Mainland; at Kirkwall Bay; and by Dr M'Bain at Calf Sound.

111. Diploderma miniata, Kjellm.

A single and very large specimen of this plant was dredged in Kirkwall Bay by Mr Pollexfen. Identified by Mr Batters. New to Orkney.

FAMILY.—SQUAMARIACEÆ.

PETROCELIS, J. Ag.

112. Petrocelis cruenta, J. Ag. (*Cruoria pellita*, Fries.)

On rocks between half-tide level and low-water mark. Usually left uncovered by the tide, and exposed to the light for some hours daily. Perennial. Fruit in winter.

Family.—HILDENBRANDTIACEÆ.

HILDENBRANDTIA, Nardo.

113. **Hildenbrandtia rosea,** Kütz. (*Hildenbrandtia rubra,* Meneg.)

On pebbles and smooth stones in shallow pools, generally at about half-tide level. All the year. Fruit in autumn and winter.

Family—WRANGELIACEÆ.

CHANTRANSIA, Fries.

114. **Chantransia Daviesii** (Dillw.), Thur. (*Callithamnion Daviesii,* Lyngb.)

Epiphytic on various Algæ at Skaill Bay, West Mainland, and Kirkwall Bay. Specimens named both by Professor Harvey and Mr Batters. Annual. Summer and autumn.

115. **Chantransia secundata** (Lyngb.), Thur. (*Callithamnion secundatum,* J. Ag.)

Epiphytic on Algæ from about half-tide level to low-water mark. Usually uncovered by the tide, and exposed to the light for some hours daily. Annual. May to September. Fruit in summer. Occurs at Skaill, West Mainland, and named by Harvey; at Broch in Rousay, epiphytic on *Alaria esculenta* (G. W. T.); corroborated by E. M. Holmes.

116. **Chantransia virgatula,** Thur. (*Callithamnion virgatulum,* Harv.)

Usually epiphytic on *Ceramium rubrum* in pools between tide marks. Annual. Summer. Found in Kirkwall Bay by Mr Pollexfen; named by Mr Batters.

MONOSPORA, Sol.

117. **Monospora pedicellata** (*Eng. Bot.*), Sol. (*Callithamnion pedicellatum,* Ag.)

Dredged in Kirkwall Bay (Pollexfen); dredged in Calf Sound, 7 fathoms, stony and coral bottom (M'Bain). Annual. Summer.

SPERMOTHAMNION, Aresch.

118. **Spermothamnion Turneri** (Mert.), Aresch. (*Callithamnion Turneri* (Dillw.), Ag.)

Epiphytic on small Algæ near low-water mark; always submerged. Annual. May to September. Fruit in summer. Occurs at Sanday in pools; also in Kirkwall Bay; and at Skaill, West Mainland. The variety *repens* also occurs.

Family.—HELMINTHOCLADIACEÆ.

HELMINTHORA, J. Ag.

119. **Helminthora divaricata** (Ag.), J. Ag. (*Dudresnaya divaricata,* J. Ag.)

On rocks and stones, or epiphytic on Algæ, near low-water mark, and in deep water; sandy and coral bottoms. Annual. Summer and autumn. Very fine at Skaill, West Mainland.

NEMALEON, Duby.

120. Nemaleon multifidum (Web. and Mohr), J. Ag.

On rocks and shells near low-water mark in exposed places. Cast ashore south of Stromness, at Hoy Sound (J. W. Gray). Found also by Mr Pollexfen.

SCINAIA, Bivona.

121. Scinaia furcellata (Turn.), Bivona. (*Ginnania furcellata*, Mont.)

Usually on rocks, stones, and shells, &c., from low-water mark to deep water. Annual. Summer. Dredged by Dr M'Bain in Deer Sound, 15 fathoms, coral bottom, in fruit, with very broad fronds, and having unusually bright colour, attached to shells. Very rare. Identified by Harvey. This is the variety *subcostata* of J. Agardh.

Family.—CERAMIACEÆ.

RHODOCHORTON, Näg.

122. Rhodochorton membranaceum, Magnus.

This plant was found by Mr Pollexfen more than fifty years ago epiphytic on a Sertularia in a rocky pool at the "Point of the Mount," Kirkwall Bay. Professor Harvey wrote on a specimen he examined, "Parasitic Callithamnion, new to me." It is now pronounced by Mr Batters to be this *Rhodochorton* described by Magnus.

123. Rhodochorton floridulum (Dillw.), Näg. (*Callithamnion floridulum* (Dillw.), Ag.)

On sandy rocks and muddy places near low-water mark. Usually dry at ebb tide, and exposed to the light for several hours daily. All the year. Fruit in autumn and winter. Skaill, West Mainland; Inganess Bay, fine; Kirkwall Bay, &c. Common.

124. Rhodochorton Rothii (*Eng. Bot.*), Näg. (*Callithamnion Rothii* (Linn.), Lyngb.)

On rocks near high-water mark. Usually in the shade, and always at places which are uncovered at ebb tide. Perennial. Fruit in winter. Sanday, Crossiecrown, Saverock, &c.

125. Rhodochorton sparsum (Harv.), Kjellm. (*Callithamnion sparsum*, Harv.)

Epiphytic on stems of *Laminaria hyperborea* at Broch in Rousay, 1887 (G. W. T.). Annual. Summer and autumn.

ANTITHAMNION, Näg.

126. Antithamnion floccosum (Müll.), Kleen. (*Callithamnion floccosum*, Ag.)

Usually occurs on rocks at about the low-water mark of spring tides; also epiphytic on *Laminaria hyperborea.* Annual. Spring and summer.

In regard to this species Mr Pollexfen writes to me as follows:—"The first specimen of this seaweed found in this country was gathered by me floating in a rocky pool at Skaill Bay. The description of the species as given by Agardh did not enable Harvey to recognise the plant, which was young, but in perfect condition, and he considered it a new species, and so named it. He afterwards, however, discovered that it had been previously figured in the *Flora Danica*, and, of course, the old name was restored. It has since been found at Skaill by Mrs Moffat."

127. **Antithamnion plumula** (Ellis), Thur. (*Callithamnion plumula* (Ellis), Lyngb.)

In deep water in quiet places, coral bottoms. Annual. Summer. Fruit, July, August. Skaill Bay, West Mainland; Kirkwall Bay, dredged by Mr Pollexfen.

CALLITHAMNION, Lyngb.

128. **Callithamnion Borreri** (*Eng. Bot.*), Ag.

Found by Mr Pollexfen in Kirkwall Bay, but very rare. Identified by Mr Batters. "In quiet places" according to Dr M'Bain. Annual. Summer.

129. **Callithamnion thuyoideum** (*Eng. Bot.*), Harv.

Usually on rocks near low-water mark. Annual. Spring and summer. Dredged by Mr Pollexfen in Kirkwall Bay. Identified by Mrs Griffiths, and recently by Mr Batters.

130. **Callithamnion roseum** (Roth), Lyngb.

Occurs in quiet bays, 4 fathoms, coral bottoms. Annual. Summer. Kirkwall Bay.

131. **Callithamnion polyspermum**, Ag.

Occurs at about half-tide level on shaded vertical rocks, and epiphytic on Algæ. Always in places which are uncovered by the tide for several hours daily. Annual. March to October. Fruit, May, June, July. Spores usually escape towards the end of July. Rousay; Eday; Skaill Bay, West Mainland; in Kirkwall Bay, and on Kirkwall Pier, &c. One of the Orkney specimens Harvey describes as "a beautiful variety."

132. **Callithamnion Hookeri** (Dillw.), Ag.

Epiphytic on Algæ from about half-tide level to near low-water mark. Usually at places which are uncovered by the tide, and exposed to the light for several hours daily. Annual. March to October. Fruit from May to August. Papa-Westray; Skaill, West Mainland; also in the Pentland Firth. The variety *lanosum* of Harvey also occurs.

133. **Callithamnion Brodiæi**, Harv.

On rocks in the shade near low-water mark. Usually uncovered by the tide for some hours daily. Annual. May to October. Skaill Bay, West Mainland, very fine.

134. Callithamnion tetragonum (With.), Ag.

Epiphytic on the larger Algæ. Annual. Summer. Eday, fine; Skaill, West Mainland, fine. There are some very fine Orkney specimens in the Greville Herbarium presented by Mr Pollexfen.

135. Callithamnion brachiatum, Bonnem.

Epiphytic on the larger Algæ. Annual. Summer. Abundant at Skaill, West Mainland.

136. Callithamnion granulatum (Ducl.), Ag. (*Callithamnion spongiosum*, Harv.)

On perpendicular rocks, and in pools, near low-water mark. Annual. Summer. Skaill, West Mainland, and other places.

137. Callithamnion corymbosum (*Eng. Bot.*), Ag.

In quiet places at about low-water mark. Always submerged. Annual. June to September. Fruit, July, August. Occurs in considerable abundance in Kirkwall Bay.

138. Callithamnion seirospermum, Griff. (*Seirospora Griffithsiana* Harv.)

On rocks and stones in deep water. Annual. Summer. Kirkwall Bay, opposite Crossiecrown, in $5\frac{1}{2}$ fathoms, where I obtained it very fine, in fruit, when dredging with Mr William Cowan in July 1887.

In regard to this species Mr Pollexfen writes to me as follows:—"My finest specimens (and they were very fine) were dredged in Kirkwall Bay; indeed, I doubt whether it has been found elsewhere in Orkney. Some of the specimens Harvey describes as 'more delicate than the Devonshire plant,' and one with '*favellæ*,' and with the smaller branches chiefly on one side of the larger ones, giving the upper branches a somewhat ensiform appearance, he marks 'Seirospora? variety or species? quite new and curious.'"

139. Callithamnion versicolor, Ag.

This Alga was dredged in Kirkwall Bay many years ago by Mr Pollexfen and then identified. The history of its title to be reckoned as a distinct species is curious, and Mr Pollexfen writes to me regarding it as follows:—"Harvey gave it a place in Hooker's *British Flora*. He afterwards in the *Flora Hibernica* describes a variety of *Call. versicolor* as *β seirospermum*, which Mrs Griffiths made a new species, *Callothamnion seirospermum* (the species immediately preceding), having no doubt of their being quite distinct, and Harvey describes them as distinct species in his *Manual of British Algæ* published in 1841. In an early number of the *Phycologia Britannica*, pl. xxi., he makes the variety *seirospermum* a new *genus*—*Seirospora Griffithsiana*—pointing out the difference between it and *Callithamnion versicolor*, which he still speaks of as a distinct species of *Callithamnion*. Later on, however, when he comes to pl. cclxxii., he describes *Call. corymbosum*, and gives *Call. versicolor* as a synonym, and states his reasons for considering them identical. It would appear that some modern algologists consider the new genus as merely a species of *Callithamnion*, while they think that *Call. corymbosum* and *Call. versicolor* should be regarded as distinct species. Mr Batters when here lately picked out several specimens of *Call. versicolor* from a parcel of *Callithamnia* dredged in Kirkwall Bay, the greater number of which he at once pronounced to be *Call. corymbosum*."

140. **Callithamnion arbuscula** (Dillw.), Lyngb.

On vertical rocks in the shade, usually a little below half-tide level, in places which are uncovered for some hours daily. Perennial, but in poor condition and stunted during winter. Fruit from April to August. Skaill, West Mainland; Rousay; Birstane Pier, &c.

GRIFFITHSIA, Ag.

141. **Griffithsia setacea** (Ellis), Ag.

In deep, shaded pools between tide marks; on the perpendicular sides of exposed rocks in the shade near low-water mark; also in deep water. Perennial. Fruit in April, May, and June Dredged off Crossiecrown, Kirkwall Bay, 5½ fathoms; Rousay. Common in bays.

142. **Griffithsia corallina** (Linn.), Ag.

On rocks at low-water mark, and at a greater depth; also epiphytic on Algæ. Always submerged. Annual. Fruit in summer. Dredged off Crossiecrown, near Kirkwall, 5½ fathoms; Carness, very fine; Rousay. Common in bays.

PTILOTA, Ag.

143. **Ptilota elegans**, Bonnem. (*Ptilota sericea*, Gmel.)

On shaded rocks and in dark crevices from a little below half-tide level to low-water mark. Left uncovered by the tide in the shade for several hours daily. Perennial. Fruit in spring and summer. Eday, in a narrow dark chasm east of the island; Carness, opposite Thieves' Holm, fine.

144. **Ptilota plumosa** (Linn.), Ag.

In deep water; epiphytic on *Laminaria hyperborea*. Perennial. Fruit in spring and summer. Common, and often very fine.

DUDRESNAYA, Bonnem.

145. **Dudresnaya coccinea** (Ag.), Bonnem.

Usually either on rocks near low-water mark, or, more generally, in 4 to 10 fathoms. Annual. Summer. Found in Kirkwall Bay by Mr Pollexfen.

GLOIOSIPHONIA, Carm.

146. **Gloiosiphonia capillaris** (Huds.), Carm.

On rocks and stones from a little below low-water mark to deep water. Seldom in pools between tide marks. Somewhat uncertain in its appearance. Annual. June to September. Fruit in July and August. Rousay Sound; and at Sacquoy Head in Rousay; Calf Sound, 4 fathoms; Widefirth; Skaill Bay, West Mainland, &c. Often attains the length of 14 inches.

MICROCLADIA, Grev.

147. Microcladia glandulosa (Soland.), Grev.

Usually on rocks, Algæ, or sponges, either near the low-water mark of spring tide or at a greater depth. Rare. Annual. The only Orkney specimen I have seen is a small one, in fruit, found by Dr M'Bain, now in my collection.

CERAMIUM, Lyngb.

148. Ceramium acanthonotum, Carm.

On rocks in the shade from about half-tide level to near low-water mark. Not in pools. All the year. Fruit in winter and spring. Rousay, near Westness, fine; Birstane Pier, &c. The so-called "*Ceramium ciliatum*" of M'Bain should, probably, be referred to this species.

149. Ceramium echionotum, J. Ag.

Usually on rocks and stones, and in pools, between tide marks; epiphytic on Algæ. Annual. Summer and autumn. One specimen in Mr Pollexfen's collection.

150. Ceramium ciliatum, Ducluz.

Usually in pools between tide marks; epiphytic on Algæ. Sometimes in places left uncovered by the tide at low water. Annual. Summer. Mentioned by Harvey as found in Orkney.

151. Ceramium diaphanum (Lightf.), Roth.

On rocks, and epiphytic on small Algæ, in pools between tide marks. Always submerged. Annual. March to September. Fruit in July and August. Fine at Quoy Bay, Hoy; good at Kirkwall Bay, opposite Iceland Skerry; at Inhallow.

152. Ceramium tenuissimum, Chauv. (*Ceramium nodosum*, Griff. and Harv.)

Usually occurs on sandy shores; epiphytic on small Algæ and on *Zostera marina*. Annual. Summer. Found by Mr Pollexfen in Kirkwall Bay; epiphytic on *Ceramium rubrum*. Named by Mr Batters.

153. Ceramium Deslongchampsii, Chauv.

Occurs on rocks between tide marks, and epiphytic on the smaller Algæ. Usually in pools. All the year. Fruit, July, August, September. Inganess Bay; Carness; Rousay, in pools east of Providence Gjio.

154. Ceramium rubrum (Huds.), Ag.

On rocks, and epiphytic on Algæ, in pools between tide marks. Always submerged. All the year. Fruit in summer. The variety *proliferum* (= *C. decurreus*, Harv.) also occurs at Kirkwall Bay, Rousay, &c.

Family.—CRYPTONEMIACEÆ.

SARCOPHYLLIS, Kütz.

155. Sarcophyllis edulis (Stackh.), J. Ag. (*Iridæa edulis* (Stackh.), Bory.)

Common on rocks on exposed shores near low-water mark in the shade. Perennial. Fruit in autumn and winter.

HALYMENIA, Ag.

156. Halymenia ligulata (Wood.), Ag.

On rocks and stones near low-water mark; also in deep water. Annual. Summer. Dredged in Kirkwall Bay by Mr Pollexfen.

FASTIGIARIA, Stackh.

157. Fastigiaria furcellata (Linn.), Stackh. (*Furcellaria fastigiata* (Huds.), Lamour.)

On rocks, chiefly in sandy pools, near low-water mark. Always submerged. Perennial. Fruit in winter.

DUMONTIA, Lamour.

158. Dumontia filiformis (*Fl. Dan.*), Grev.

Common in rock pools at about half-tide level. All the year. In best condition from March to October; plants being stunted and comparatively rare during winter. Fruit in summer. The variety *β crispata* also occurs, chiefly where there are fresh-water streams.

Family.—GIGARTINACEÆ.

CHONDRUS, Stackh.

159. Chondrus crispus (Linn.), Lyngb.

Common on rocks between tide marks. Perennial. Fruit in winter and spring.

GIGARTINA, Stackh.

160. Gigartina mamillosa (Good. and Wood.), J. Ag.

Common on exposed rocks and in pools from half-tide level to low-water mark. Perennial. Fruit in winter.

GYMNOGONGRUS, Martins.

161. Gymnogongrus Griffithsiæ (Turn.), Martins.

On submarine rocks near low-water mark. Perennial. Fruit in autumn and winter. Odin's Bay, Stronsay.

162. Gymnogongrus Norvegicus (Gunn), Lamour. (*Chondrus Norvegicus*, Lamour.)

Usually on rocks near low-water mark. Annual. September to March.

KALLYMENIA, J. Ag.

163. Kallymenia reniformis (Turn.), J. Ag.

In deep, shaded pools at extreme low-water mark; also epiphytic on *Laminaria hyperborea*. Perennial. Fruit in summer and autumn. Skaill Bay, &c. Not uncommon. Very fine at Papa-Westray.

CALLOPHYLLIS, Kütz.

164. Callophyllis laciniata (Huds.), Kütz. (*Rhodymenia laciniata*, Grev.)

Cast ashore from deep water. Biennial. Capsules in spring; granules in summer. Commonly epiphytic on stems of *Laminaria hyperborea*. North shore, Westray, very fine (J. W. Gray); Rousay, at Broch, very fine, collected by the late Mrs Traill of Woodwick in 1839; Scapa, fine; Kirkwall Bay; Carness; Skaill Bay, &c.

AHNFELDTIA, Fr.

165. Ahnfeldtia plicata, Fr. (*Gymnogongrus plicatus*, Kütz.)

Common in sandy pools near low-water mark. Always submerged. Perennial. Fruit early in winter.

PHYLLOPHORA, Grev.

166. Phyllophora Brodiæi (Turn.), J. Ag.

On rocks in sandy pools near low-water mark; also in deep water. Perennial. Fruit in winter. Kirkwall Bay; Hoy Sound, &c.

167. Phyllophora membranifolia (Good. and Wood.), J. Ag.

On rocks and stones near low-water mark, and at a greater depth; also on roots of *Laminaria hyperborea*. Perennial. Fruit in winter.

168. Phyllophora rubens (Linn.), Grev.

In pools and under shelving rocks near low-water mark; also in bays, coral bottoms, from 2 to 15 fathoms. Perennial. Fruit in winter. Kirkwall Bay, in good specimens.

CYSTOCLONIUM, Kütz.

169. Cystoclonium purpurascens (Huds.), Kütz. (*Hypnea purpurascens*, Harv.)

Common in pools and on exposed rocks from about half-tide level to low-water mark. Annual. April to October. Fruit in summer.

Family.—RHODYMENIACEÆ.

CHYLOCLADIA, Grev.

170. Chylocladia articulata (Lightf.), Grev.

On rocks in the shade, and sometimes epiphytic on Algæ, near low-water mark. Usually left dry by the tide at low water. Very common, and often fine. Annual. April to October. Fruit in summer.

171. Chylocladia clavellosa (Turn.), Grev. (*Chrysymenia clavellosa*, J. Ag.)

Growing at the low-water mark of the lowest tides on rocks and stones; also epiphytic on Algæ. Always submerged. Annual. April to October. Fruit in July and August. Fine and common at many localities.

172. Chylocladia rosea, Harv. (*Chrysymenia rosea*, var. *Orcadensis*, Harv.)

Originally discovered in Orkney by Miss Watt at Skaill on *Laminaria hyperborea.* Sunda Firth, 8 fathoms (M'Bain).

CHAMPIA, Harv.

173. Champia parvula (Ag.), Harv. (*Chylocladia parvula*, Hook.)

Epiphytic on the smaller Algæ in pools near low-water mark. There is an Orkney specimen in the late Mrs Clarke's collection, but the particular locality is unknown.

RHODYMENIA, Grev.

174. Rhodymenia palmata (Linn.), Grev.

Common on exposed rocks and in pools between tide marks; also epiphytic on Algæ. Biennial. Granules, January, February; tetraspores, August; tubercles, June, July, August. The narrow form (var. *sobolifera*, Grev.) is very fine and extremely abundant at Kirkwall Bay between tide marks, especially at the Ayre and at Weyland.

175. Rhodymenia Palmetta (Esper), Grev.

Usually on rocks near the limit of low-water mark, and at a greater depth; also epiphytic on the stems of *Laminaria hyperborea.* Annual. Summer and autumn. At Kirkwall Bay (Pollexfen); as identified by Greville, and more recently by Batters.

PLOCAMIUM, Lamour.

176. Plocamium coccineum (Huds.), Lyngb.

On rocks, and sometimes epiphytic on Algæ, in deep water. Perennial. Fruit in summer. Common, and often very fine.

CALLIBLEPHARIS, Kütz.

177. Calliblepharis ciliata (Linn.), Kütz. (*Rhodymenia ciliata*, Grev.)

At Widefirth as identified by Harvey. Annual. Fruit in winter.

178. Calliblepharis jubata (Good. and Wood.), Kütz. (*Rhodymenia jubata*, Grev.)

Shapansey; Carness; Kirkwall Bay, opposite Crossiecrown, 5½ fathoms, July 1887, extremely narrow form; identified by Kjellman. Annual. Fruit in summer.

RHODOPHYLLIS, Kütz.

179. Rhodophyllis bifida (Good. and Wood.), Kütz. (*Rhodymenia bifida*, Grev.)

On rocks, and epiphytic on Algæ, in deep water. Annual. Summer. Kirkwall Bay, Carness, &c., quiet places, coral bottoms. Also the variety *appendiculata*, which was found by Mr Pollexfen in Kirkwall Bay.

EUTHORA, J. Ag.

180. Euthora cristata (Linn.), J. Ag. (*Rhodymenia cristata*, Grev.)

At Elwick harbour in deep water; epiphytic on the roots and stems of *Laminaria hyperborea*. Annual. Summer. Harvey said these were the finest British specimens he had ever seen.

HYDROLAPATHUM, Stackh.

181. Hydrolapathum sanguineum (Linn.), Stackh. (*Delesseria sanguinea*, Lamour.)

Growing in deep rock pools near low-water mark, also under projecting ledges in the shade. Rarely epiphytic on Algæ. Large plants in sounds and tide-ways. Biennial. Fruit from November to March inclusive. Common.

Family.—DELESSERIACEÆ.

NITOPHYLLUM, Grev.

182. Nitophyllum laceratum (Gmel.), Grev.

On rocks, and epiphytic on the stems of *Laminaria hyperborea*, near low-water mark, and at a greater depth. Always submerged. Annual. May to September. Fruit in July and August. Hoy Sound, near Stromness, very fine (J. W. Gray); Breckness; near Carness, opposite Iceland Sherry; Scapa Bay. The varieties *Smithii* and *uncinatum* also occur.

183. Nitophyllum uncinatum, J. Ag. (Agardh's species, but not his synonym.)

Found by Mr Pollexfen at Skaill, West Mainland, and for years kept separate by him from his other species of *Nitophylla* as something distinct, and quite new to him. Mr Batters, who lately examined the plant, has no doubt about its being *N. uncinatum*. It is quite different from the var. *uncinatum* of *N. laceratum*, which is also found in Orkney.

184. Nitophyllum Gmelini, Grev.

On rocks near low-water mark; also epiphytic on *Laminaria hyperborea* in deep water. Annual. Summer.

185. Nitophyllum punctatum (Stackh.), Grev. (Also var. β *ocellatum* (Grev.), Harv.; var. γ *crispatum*, Harv.; var. δ *Pollexfenii*, Harv.)

Epiphytic on Algæ in pools at about low-water mark. Always submerged. Larger specimens in deep water. Annual. May to

September. Fruit in July and August. Common, and often very fine. Epiphytic on *Laminaria hyperborea* near Broch in Rousay, very fine, found by the late Mrs Traill of Woodwick in 1839; Scapa Bay, fair; Carness; Skaill, West Mainland, &c. The variety γ has been found at Skaill, West Mainland; extremely fine at Broch in Rousay, by Mrs Traill, sometimes epiphytic on old fronds of *Desmarestia aculeata;* and also in Kirkwall Bay. The variety δ seems to be confined to Orkney. Harvey had never seen it till he examined Mr Pollexfen's collection. Mr Pollexfen tells me that he dredged it originally in Kirkwall Bay, and that, so far as he knows, it has not been found elsewhere except in Rousay. Some of the specimens are covered with antheridia, by far the rarest of the organs of fructification of the *Nitophylla.* Mr Pollexfen writes to me:—"Crouan has found in France a species of *Nitophyllum* to which he gave the specific name *Alliaceum.* This, J. Agardh makes a variety of *N. punctatum,* to which he gives Crouan's specific name; and as a synonym he adds the var. *Pollexfenii* of Harvey. He (J. Agardh) states, on the authority of Crouan, that a recently gathered specimen when plunged in fresh water emits the odour of garlic. I have no recollection of my plants giving out this smell; though I think I should have noticed it, as in those days I paid much attention to the different odours of Algæ, and was able to tell by the smell alone, before seeing them, the names of most of the species of seaweeds collected by a friend and put into a handkerchief. It is very desirable that collectors in Orkney, who are fortunate enough to find the variety δ of *N. punctatum,* should ascertain whether, when put in fresh water, it has any smell of garlic."

186. Nitophyllum Bonnemaisoni, Grev.

Epiphytic on *Laminaria hyperborea.* Annual. Summer. Cast ashore south of Stromness, at Hoy Sound (J. W. Gray). Mr Pollexfen has found this plant at Skaill, West Mainland, and very fine at Papa-Westray. He tells me that he has found it at different places on the west coast, but very rarely on the east.

187. Nitophyllum Hilliæ, Grev.

On the shaded sides of deep pools near low-water mark, and at a greater depth. Annual. Summer and autumn. Occurs at Skaill Bay, West Mainland, according to Mr Pollexfen.

DELESSERIA, Grev.

188. Delesseria alata (Huds.), Lamour.

On rocks, and epiphytic on Algæ, at and below low-water mark. All the year. Fruit, March to May. Common, and often very fine.

189. Delesseria angustissima, Griff.

Shapansey, fine; Holm, Deerness (J. Cursiter); Inganess Bay (J. H. Pollexfen); Linga Sound, rare (M'Bain); Sanday (Rev. Gilbert Laing).

190. Delesseria hypoglossum (Wood.), Lamour.

Fine and plentiful on rocks, and epiphytic on *Laminaria hyperborea*, in deep water. Annual. Summer. Sometimes grows to the height of 14 inches. Fine at Skaill Bay, West Mainland; fine near Broch in Rousay; very fine in Kirkwall Bay. Two varieties, α and β, occur.

191. Delesseria ruscifolia (Turner), Lamour.

On rocks, and sometimes epiphytic on *Laminaria hyperborea*. Annual. Spring, summer, and autumn. Kirkwall Bay; Carness; Saequoy Head, Rousay, in small specimens.

192. Delesseria sinuosa (Good. and Wood.), Lamour.

Fine in sounds and tide-ways; also on rocks, and epiphytic on Algæ, in deep pools between tide marks. Cast ashore at Skaill, Rousay, very fine. Biennial. Fruit in winter and spring.

Family.—SPHÆROCOCCACEÆ.

SPHÆROCOCCUS, Stackh.

193. Sphærococcus coronopifolius (Good. and Wood.), Ag.

On rocky sea-shores at extreme low-water mark, also at a greater depth. Perennial. Summer and autumn. Backaskaill, Sanday (J. W. Gray); Kirkwall.

GRACILARIA, Grev.

194. Gracilaria confervoides (Linn.), Grev.

On rocks and stones in the sea near low-water mark, and at a greater depth. Perennial. Fruit in summer and autumn. Skaill Bay, West Mainland.

CORDYLECLADIA, J. Ag.

195. Cordylecladia erecta (Grev.), J. Ag. (*Gracilaria erecta*, Grev.)

Submerged in bays—Kirkwall Bay, &c. Determined by Harvey, and also by Messrs Holmes and Batters. Perennial. Stichidia due in July; capsules in September and October; but no specimen in fruit has yet been found in Orkney.

Family.—SOLIERIACEÆ.

CATENELLA, Grev.

196. Catenella Opuntia (Good. and Wood.), Grev.

In dark crevices and on vertical rocks in the shade near high-water mark; never in pools. Perennial. Tetraspores in July. Hole of Howan, Skaill, West Mainland; Crossiecrown, near Kirkwall.

Family.—GELIDIACEÆ.

GELIDIUM, Lamour.

197. Gelidium corneum (Huds.), Lamour.

Usually in pools and on exposed rocks at about half-tide level. Perennial. *Forma typica* said to be found at Linga Sound, rare; var. *clavatum* east side of Kirkwall Bay, 1887 (G. W. T.).

Family.—SPONGIOCARPEÆ.

POLYIDES, Ag.

198. Polyides rotundus (Gm.), Grev.

Common on sandy flat shores in pools near low-water mark. Perennial. Fruit in winter.

Family.—LOMENTARIACEÆ.

LOMENTARIA, Gaill.

199. Lomentaria kaliformis (Good. and Wood.), Gaill. (*Chylocladia kaliformis*, Hook.)

On rocks and stones in deep water, and sometimes between tide marks. Annual. Spring and summer. Bay of Work, good; Rousay, near Broch, good; very fine in Kirkwall Bay. When growing in still water from 2 to 3 feet in length, according to M'Bain.

200. Lomentaria ovalis (Huds.), Endl. (*Chylocladia ovalis*, Hook.)

On rocks and stones in pools between tide marks. Annual. Fruit in summer. Occurs at Papa-Westray.

Family.—RHODOMELACEÆ.

ODONTHALIA, Lyngb.

201. Odonthalia dentata (Linn.), Lyngb.

On stones and rocks from a little below low-water mark to deep water. Perennial. Fruit in winter. Common.

RHODOMELA, Ag.

202. Rhodomela lycopodioides (Linn.), Ag.

Forma typica common on stems of *Laminaria hyperborea*. Biennial. Fruit in June, July, and August. Broch of Deerness, fine.

202a. Rhodomela lycopodioides, var. *β laxa*, Kjellm.

I found this well-marked form in 1887 in pools, Bay of Carness, due south from Hellyar Holm. On my forwarding a specimen to Professor Kjellman, Upsala, he identified it as his var. *β laxa*, which is new to Britain. Several specimens in Mr Pollexfen's collection from Skaill have lately been examined by Mr Batters, and he pronounces them to be this variety also.

203. Rhodomela subfusca (Wood.), Ag.

Common on rocks and stones in pools between tide marks. Perennial. Tetraspores in swollen ultimate ramuli in summer; in stichidia in winter.

POLYSIPHONIA, Grev.

204. Polysiphonia urceolata (Lightf.), Grev.

On rocks, and epiphytic on Algæ, between tide marks; especially in pools. Usual duration from March to October, but plants sometimes last through the winter. Fruit in July and August. Scapa, fine; Hoy Sound; West Mainland, as at Skaill Bay; Rousay, &c. The vars. *patens* and *formosa* also occur.

205. Polysiphonia roseola (Ag.), Aresch.

Epiphytic on *Ulva Lactuca*, Linn., in the "Peerie Sea," Kirkwall. Identified by Kjellman as young plants of *Polysiphonia roseola*, which species is probably new to Britain. July 1887 (G. W. T.)

206. Polysiphonia fibrata (Dillw.), Harv.

On damp exposed rocks, and epiphytic on Algæ, in the shade, a little below half-tide level; also in pools, but less commonly. Usually left uncovered by the tide for some hours daily. Annual. Summer and autumn. Fruit from June to September inclusive. Papa-Westray, in pools; fine at "Ting of the Dyke," Scapa; Birstane Bay, &c., common.

207. Polysiphonia violacea (Ag.), Wyatt.

On rocks and stones, and epiphytic on several of the smaller Algæ, near low-water mark. Annual. Hunda Sound; Water Sound, Burray, fine (J. W. Gray).

208. Polysiphonia fibrillosa (Dillw.), Grev.

On rocks, and epiphytic on *Polyides rotundus*, *Cladostephus spongiosus*, &c., in clear sunny pools at about half-tide level. Perennial. Fruit in July, August, and September. Lingro, Scapa; Bay of Carness, in pools, &c.

209. Polysiphonia Brodiæi (Dillw.), Grev.

On rocks, and parasitic on Algæ, in pools near low-water mark. Annual. May to September. Fruit in July and August. Skaill Bay, West Mainland; Scapa; Kirkwall Bay, opposite Iceland Skerry, &c.

210. Polysiphonia elongella, Harv.

On shells and stones in deep water. Biennial. Spring and summer. Calf Sound, 4 fathoms, coral bottom. Found also in Kirkwall Bay.

211. Polysiphonia elongata (Huds.), Harv.

On stones and shells in deep water. Perennial. Fruit in July and August. Linga Sound; Deer Sound; Hoy Sound, &c., 4 to 15 fathoms. Not uncommon.

212. Polysiphonia simulans, Harv.

On rocks in tide pools near low-water mark. Annual (?) Summer. Skaill Bay, West Mainland. Identified by Harvey.

213. Polysiphonia fastigiata (Roth), Grev.

Usually epiphytic on *Ascophyllum nodosum.* Left uncovered by the tide, and exposed to the light for some hours daily. Perennial. Fruit from June to September.

214. Polysiphonia atro-rubescens (Dillw.), Grev.

On sand-covered rocks, also in pools near low-water mark, and at a greater depth. All the year. Fruit in summer and autumn. Calf Sound, 4 fathoms, coral bottom. The variety *Agardhiana* also occurs.

215. Polysiphonia nigrescens (Huds.), Harv.

Common on rocks in pools between tide marks. Perennial, but usual duration from March to October. Young shoots on old plants generally appear in January. Fruit from June to September.

216. Polysiphonia parasitica (Huds.), Grev.

On rocks in shaded pools between tide marks; also epiphytic on *Laminaria hyperborea.* Always submerged. Annual. April to October. Fruit in July and August. Mr Pollexfen has found this plant in Kirkwall Bay, Skaill, Cairston Bay, and South Ronaldshay.

217. Polysiphonia byssoides (Good. and Wood.), Grev.

In deep water. Annual. June to October. Fruit in July and August. Papa-Westray; Rousay; Skaill Bay, West Mainland, good; Scapa Bay; Carness; dredged off Crossiecrown, Kirkwall Bay, $5\frac{1}{2}$ fathoms.

BONNEMAISONIA, Ag.

218. Bonnemaisonia asparagoides (Wood.), Ag.

At quiet places in deep water. Annual. June to September. Fruit in summer. Linga Sound; Deer Sound; Kirkwall Bay; and Skaill Bay, West Mainland.

LAURENCIA, Lamour.

219. Laurencia pinnatifida (Gmel.), Lamour.

On rocks in exposed places at low-water mark. Sometimes epiphytic on Algæ. All the year. Tetraspores in winter and spring; ceramidia in summer.

220. Laurencia hybrida (De Cand.), Lenorm. (*Laurencia cæspitosa*, Lamour.)

Common on exposed rocks and in pools at about half-tide level. Rarely epiphytic on Algæ. All the year. Tetraspores in winter and spring; ceramidia in July.

221. Laurencia obtusa (Huds.), Lamour.

Epiphytic on several of the smaller Algæ between tide marks. Annual. Summer.

CHONDRIA, Ag.

222. Chondria dasyphylla (Wood.), Ag. (*Laurencia dasyphylla*, Grev.)

On stones and shells in pools near low-water mark. Annual. Summer. Rare. On Dr Greville's authority.

DASYA, Ag.

223. Dasya coccinea (Huds.), Ag.

Fine and common in bays at the depth of from 4 to 10 fathoms. Annual. April to October, Fruit in July and August.

223a. Dasya coccinea (Huds.), Ag., var. *tenuis*, J. Ag.

Scapa, fine; Shapansey fine. Dredged in Kirkwall Bay by Mr Pollexfen. Dr Agardh, to whom I forwarded specimens of this plant in 1886, calls it var. *tenuis*, and says that it is probably a northern form of *Dasya coccinea*. Mr Pollexfen writes to me in regard to it as follows :—" I am inclined to think that the slender variety of *Dasya coccinea* which I dredged in Kirkwall Bay, and which you found at Scapa and Shapansey, is the *D. coccinea*, var. *β tenuior*, described by Harvey in both editions of his *Manual of British Algæ*, but not mentioned in his *Phycologia Britannica*. It was that which you sent to Agardh, and which he calls 'var. *tenuis*.' The specimen in my collection named *D. media* was not sent to him, and Mr Batters considers it quite distinct from the other—indeed to be a new species. The latter I therefore place as an addition to the Orkney list under the name *Dasya media*, Harv. It was dredged by me in Kirkwall Bay, but not with the other."

224. Dasya media, Harv.

Dredged by Mr Pollexfen in Kirkwall Bay, and probably a new species. See Mr Pollexfen's remarks on the variety last mentioned.

225. Dasya arbuscula (Dillw.), Ag.

Dredged in Kirkwall Bay by Mr Pollexfen. Identified by Mr Batters. Orkney is said to have been the original locality for this species.

Family.—CORALLINACEÆ.

HAPALIDIUM, Kütz.

226. Hapalidium Hildenbrandtioides, Crn.

At Kirkwall Bay, opposite Iceland Skerry, epiphytic on *Phyllophora rubens*, 1887 (G. W. T.). Identified by E. M. Holmes.

MELOBESIA, Lamour.

227. Melobesia farinosa, Lamour.

Epiphytic on *Phyllophora rubens*, Kirkwall Bay, 1887 (G. W. T.). Identified by E. M. Holmes.

228. Melobesia pustulata, Lamour.

Epiphytic on *Fastigiaria furcellata* and other Algæ. Common.

229. Melobesia Laminariæ, Crn.

Epiphytic on *Laminaria hyperborea*.

230. Melobesia Lenormandi, Aresch.

On shells and stones between tide marks.

LITHOTHAMNION, Phil.

231. Lithothamnion calcareum (Ell. and Sol.), Aresch. (*Melobesia calcarea*, Ell. and Sol.)

Common on sandy bottoms, 4 to 15 fathoms. Perennial.

232. Lithothamnion fasciculatum, Aresch. (*Melobesia fasciculata*, Harv.)

Found by Mr Pollexfen at Kirkwall Bay. Identified by Mr Batters. New to Orkney.

233. Lithothamnion polymorphum (Linn.), Aresch. (*Melobesia polymorpha*, Linn.)

Common on rocks in pools between tide marks; also in deep water.

CORALLINA, Linn.

234. Corallina officinalis, Linn.

Usually in rock pools between tide marks. Perennial. Fruit in winter and spring.

235. Corallina rubens, Linn. (*Jania rubens*, Lamour.)

Epiphytic on several of the smaller Algæ between tide marks. Perennial. Fruit in summer.

INDEX.

The Use of Sphagnum Moss in Open-Air Gardening in the Riviera. By PHILLIP SEWELL.

(Read 8th May 1890.)

During the last few years various articles have appeared in the *Gardeners' Chronicle* and elsewhere upon the use and value of Sphagnum Moss for gardening purposes. "Fertilised moss," as it has been called, has been advocated for the growth of various classes of plants, not alone for use in orchid-houses and stoves, but for those grown in the open air in England. It is probable that in a cold, damp climate it will never be much in demand for out-door gardening; but we are able to furnish details as to its use in Mr Hanbury's notable garden of La Mortola, which show in a most convincing manner its real value for the growth of decorative plants in regions with conditions of climate similar to those which obtain along the Riviera.

Such evidence might also be forthcoming from the Botanical Gardens at Genoa, from whence Mr Hanbury copied the plan of introducing beds of Sphagnum. At Genoa it has answered remarkably well, and there may be seen plants growing with extraordinary vigour of *Pinus, Abies, Picea, Pittosporum, Pimelea, Erica, Arbutus, Diosma, Citrus, Cytisus, Genista,* among many others.

Perhaps no portion of Mr Hanbury's wonderfully cultivated thirty acres is so generally admired as is the long and gracefully-curved stretch of covered walk known in all Italian gardens by the name of "pergola" or "topia." But at La Mortola the "pergola" is no mere lengthy arbour, covered over by vine-trellises, as is most commonly the case in gardens of the Riviera.

It is a marvellous piece of decorative gardening, planned not only to show to the best advantage the many climbers which here luxuriate, but with a view to the unrivalled landscapes to be seen from it.

It extends for some two hundred yards or more along the steep hillside, and, thanks to Mr Hanbury's opinion as contrasted with that of the gardener who constructed it, possesses angular irregularities in its course, which allow of sudden changes of vista from among the gracefully-festooned pillars on the seaward side; from it the eye may wander over masses of verdure from rare trees and shrubs to the waters of the Mediterranean.

But the "pergola" has an especial interest from the bordering wealth of flowers, grown more or less in the cool shade of the climbers in curiously constructed beds of Sphagnum Moss. Inasmuch as the presence of these bordering flower-beds gives a finished effect to this portion of the garden which it did not possess a few years ago, it is well to describe with some detail the nature of the difficulties, and the steps which have been taken to overcome them by the use of beds of Sphagnum.

From the requirements of the design that shade should be afforded by numerous climbers, it appeared at first impossible to have other than a very formal and ordinary edging to the gravel walk, which is bounded on the one side by a generally low retaining-wall, above which, as on the other side, are steeply sloping beds. The climbers appeared to usurp all the nutriment placed about the roots of any plants which it was attempted to grow on either side of this walk. There was also at times a destructive splashing produced by the drip from branches and woodwork overhead.

The beds, as I shall explain later, have been so constructed that the roots of the climbers and of the surrounding trees cannot have access to the rich stores of nutritious compost of pure Sphagnum, or of Sphagnum and pressed root-fibres which have passed through the stables. The moss binds together with a firm surface; it retains moisture admirably, the only difficulty in connection with its use being that the blackbirds on every occasion are ready to peck at it and strew it about the adjoining walks in their search for food.

The main result of the introduction of these distinct beds has been that not only have plants grown well in such positions of disadvantage as we have indicated, but it has been possible, in a tidy manner, to grow plants in places about the garden walls of the Palazzo Orengo, where otherwise they could not have survived. Moreover, several interesting species, which it had not before been possible to grow in the ordinarily prepared soil of the garden, and which, we may presume, are not grown elsewhere in the Riviera, may now be seen to thrive remarkably well in such conditions.

Before we proceed to enumerate the plants so grown, we would give actual measurements of some of the Sphagnum beds, which may convey the clearest impression as to this novel method of gardening.

The extensive beds bordering the "pergola" walk are rarely more than a foot and a half across, whilst the average of extreme depths is little above four inches. This statement as to the depth of the compost will, we expect, be received with some surprise; but when it is recognised that the moss is merely heaped up upon flat slabs of cemented stone or slate, and that the beds are in no sense troughs, whilst the depth of moss slopes away to nothing towards the edges, it will be seen that a breadth of a foot and a half does not allow of any very considerable filling up in the middle.

Certainly about the roots of one or two of the more vigorous plants, *e.g.*, *Pleroma* and *Hardenbergia*, the compost is heaped up so as to reach a maximum depth of a little more than seven inches, but, as we have indicated, such a depth is extremely exceptional. It is indicative of the slight depth of moss that a small plant of *Ardisia crenulata* has raised itself very visibly out of the bed by shoving with its stout-growing roots against the slabs of slate upon which the moss has been placed.

In place of slates firmly cemented together, stones or bricks may be used; the prime object of their so solid construction being to isolate the nutritious compost from the ordinary soil in which are the greedy roots of the surrounding plants. In some situations, however, the moss is placed upon a solid retaining-wall, behind which, though not quite on a level with the Sphagnum bed, is a steeply sloping bed of ordinary earth. In certain of the sunny or shadier angles of the house pockets of moss are formed by means of larger irregular stones placed directly upon an ordinary pavement. In one of these pockets, where the compost is somewhat deeper than usual, a magnificently luxuriant growth of *Hardenbergia ovata* is to be seen, which a few weeks ago was densely covered with its striking lilac-coloured racemes of flowers. In the same place there may also be seen *Boissiæa, Tellima, Leucophyta, Saxifraga, Erica arborea,* and *Primula.*

The positions of these beds are varied in regard to exposure to light, and to the direct rays of the sun. Some are absolutely in the shade, others in an almost continuous glare of the sunshine; but plants may readily be found suitable for one or the other position.

The attention which the Sphagnum beds require is but little. In dry weather watering three or four times in the week is necessary, whilst in winter once a week is sufficient. From the nature of the moss, water may be applied quickly, and without a rose to the can.

The following plants, growing at the present time in these shallow beds of Sphagnum Moss, refuse altogether to grow in the ordinary beds in the garden, or else they remain as stunted and almost lifeless plants, little larger year by year than when they were first planted:—*Æschynanthus angustifolia, Æschynanthus grandiflora, Alpinia vittata, Anthurium cordatum, Ardisia crenulata, Aristolochia Thwaitesii, Bauera rubioides* (perhaps also in loam), *Billbergia thyrsoidea, Billbergia* "*discolor,*" *Billbergia* "*fasciata,*" *Bossiæa heterophylla, Bossiæa ovata, Bossiæa rufa, Cypripedium insigne, Cyrtanthera magnifica, Cyrtanthera polyantha, Calceolaria rugosa, Daphne rupestris, Didymocarpus Griffithii, Dietes bicolor, Dipteracanthus canescens, Dipteracanthus* "*squarrosus,*" *Dracæna* "*Hookeri,*" *Fuchsia gracilis, Fuchsia procumbens, Gardenia citriodora* (not healthy), *Gonospermum fruticosum, Hardenbergia ovata, Hebeclinium atrorubens, Hebeclinium* "*Panamense,*" *Hiptage Madablota, Kalmia latifolia, Lopezia macrophylla, Lachenalia pendula, Monstera deliciosa, Philodendron pinnatifidum, Pleroma macranthum, Pimelia* "*mirabilis,*" *Rondeletia* (*Rogeria*) *cordata, Sansevicra Zeylanica, Scutellaria cordifolia, Skimmia* "*oblata,*" *Tetranema mexicanum, Thomasia purpurea, Thomasia* "*comosa.*"

Many species of ferns—*e.g.*, of *Lomaria, Polypodium, Pteris, Platycerium* and *Adiantum*—were grown in shady places in these beds, nor would it be possible to grow them so well without more constant attention in other parts of the garden. The following plants appear, on the whole, more at home in the beds of Sphagnum than in other soils in the garden. Whenever there is any contrast noticeable between the plants so grown under these different conditions, the characters associated with the Sphagnum-grown plants are as follows :—they have a more vigorous vegetation, larger leaves and longer shoots ; commonly a deeper green in the foliage, many of the plants grown in ordinary soil being yellowish in colour ; at times, too, there is associated with this more vigorous vegetation a scarcer display of flowers, a feature very clearly marked in *Senecio speciosus.* Not uncommonly, however, in such plants as *Erica arborea* and *Cantua dependens,* the time of flowering is much earlier (even as much as from three to five weeks) than when the plants are grown in the ordinary soil of the garden. The growth in Sphagnum may, perhaps, have some effect upon the ripening of the wood, for not only have we these cases of earlier flowering, but there is the curious fact that *Streptosolen Jamesoni* grown in Sphagnum was not killed in the recent frost and fall of snow, whilst larger plants of the same species grown in the ordinary beds were killed. These plants, some of which, at least, grow better in the Sphagnum, are as under—*Asparagus plumosus, Begonia* (many species), *Cantua dependens, Cineraria cruenta* (vars.), *Cyclamen persicum, Daphne indica, Daphne hybrida, Diosma ericoides, Epacris* (several species), *Erica* (several species), *Eranthis hyemalis, Freesia refracta* (from seed), *Grevillea Thelemoniana, Juncus spiralis, Primula auricula, Primula acaulis, Primula cashmeriana, Primula sinensis, Primula tubiflora, Russelia juncea, Tellima grandiflora, Tradescantia* (species). (When larger they do not grow so well for want of room.)

The following plants were also growing as well in the Sphagnum as in the open ground—*Hebeclinium (Eupatorium) macrophyllum, Hyacinthus* (sps.), *Pelargonium zonale, Melicope ternata, Margyricarpus setosus, Saxifraga Cotyledon, Chorizema, Correa* (sps.), *Fuchsia Riccartoni, Libonia* (sps.), *Lotus Jacobæus.*

Many seedlings of annuals and biennials were readily germinating, or had produced plants of some size. Amongst these were—*Aubrietia* (sps.), *Arabis rosea, Alonsoa* (sps.), *Aquilegia* (sps.), *Ianthe buzulifolia, Ionopsidium acaule, Phyllanthus Niruri.* We might notice also many other species of hard-wooded or bulbous plants—*Rhododendron, Tulipa, Iris*—

including many of the common bedding-out plants of English gardens, which from time to time are placed in these beds, and removed as soon as they have finished flowering. A few species, notably *Imantophyllum*, thrive better in the stiffer soil of the ordinary beds. The leaves are more yellow when grown in the restricted space in the Sphagnum beds, whilst the flowers in the latter case are in consequence poorer and often abnormal. In one of these beds also, *Linnæa borealis*, which was introduced from Edinburgh in December, has grown well; making, as it appears to us, larger, thinner, and perhaps more evidently serrated leaves than formerly. It will be interesting to observe how the summer affects this plant. Doubtless also many of the *Ericaceæ* and other plants of the damp upper slopes of the further mountains could be grown in this way, at this altitude, which is approximately that of the sea-level; nor must any who have seen the remarkably full list of plants grown at Mortola, which has been lately printed by Mr Hanbury, suppose that the lists given in this paper include all those from the Mortola collection which would thrive better in these exceptional beds. Doubtless experiments would show scores of others; the above lists are of those only which are so grown at the present time.

Mr Hanbury informs us that through several previous years he has grown a vigorous and regularly flowering plant of the Edelweiss (*Gnaphalium Leontopodium*) in one of the beds of Sphagnum. It appeared to him to have a more drawn-out appearance in leaves and flower-stalks than is common to the plant when grown in high altitudes.

Were time at our disposal, we think that much more might be learnt from these data regarding the beds of Sphagnum than the mere fact that it allows a good collection to be very materially enriched by its use. We have already hinted at certain general tendencies in such variations as we have instanced among plants grown in one species of bed or the other, but more detailed examination of leaves and roots—both of plants grown in this country in Sphagnum and in ordinary beds, and also in Britain—would prove highly instructive. We should, at least, gain definite information regarding that which every amateur or professional gardener should desire to know—viz., how to recognise a plant's requirements, or evidence of response to different environments in its external morphology. It may be that this is mainly a question for the botanist, and that there is no likelihood of more than an infinitesimal gain in the practical details of horticulture from knowledge under this head.

We are well aware what a risky and thankless task it is to put forward hypotheses to account for facts which all are ready to receive; but we would venture on a hypothesis in regard to this subject. It is as follows:—The Sphagnum, apparently so unsuited as a medium for the growth of *Erica, Epacris, Hardenbergia, Primula sinensis,* &c., in Britain, is in the Riviera kept sweet and wholesome, though more often watered it may be, by reason of the vastly warmer and drier climate. In Britain, just the same nutriment, and the same loose substance as a compost, might be given to the plants as is given in the Riviera, yet it cannot be imagined that there would be the same amount of circulation of the water held by the investing medium about the plants' roots. Consequently, in place of sweetness, there would be sourness and stagnation. We would even say that the same amount of direct sunshine and the same amount of warmth might be given to these plants, supposing we were to grow them in Sphagnum in Britain as we do in the Riviera, yet in the greenhouse in Britain there would not be that dry air, that absence of humidity, and that freshness of the wind which here causes quick evaporation; and hence it would appear improbable that the food about the plants' roots could be presented in a suitable way by using Sphagnum in England, though it may well be used here.

We come to a similar conclusion in reference to the different habitats of the same species of plants as observed growing in Lapland and at the Yugor Straits. Soils, whether of peat or clay or sand, had little meaning, except inasmuch as they retained or drained off the water resulting from the melting of the snows or from rain. In Lapland a steep hillside covered with peat answered much the same purpose as the nearly level tracts of sand along the shore of Northern Siberia.

However this may be, such facts of distribution or of cultural methods should teach us something to be put to use some time as to the adaptability and the requirements of our garden plants.

Observations upon the Germination and Growth of Species of Salvia in the Garden of Thomas Hanbury, Esq., F.L.S., *at La Mortola, Ventimiglia, Italy.* By Philip Sewell.

(Read 12th June 1890.)

The following observations upon certain of the species of *Salvia* grown in Mr Hanbury's garden at La Mortola, have been made during a period of more than five months, from November 1889 to April 1890. Observations of a similar nature have been made upon species of other genera, with which, in a subsequent paper, it is my wish to make certain comparisons. At present I have contented myself with the attempt to give, in as detailed a manner as appears necessary, facts regarding the germination and early growth of the selected species, which may be of service in adding to our knowledge of life histories of Phanerogams, and in aiding us to elucidate the significance of ordinary morphological features; perhaps, also, they may be useful, when supported by further observations of a like nature, because of their bearing upon horticulture, in connection with the raising of plants from seed.

In the following pages attention is confined to external morphology; for, with such observations as may be made in a garden like Mr Hanbury's, it appears out of place to devote much attention to details of minute anatomy. Should it appear likely that histological data would be of value in explanation of any of the points raised, or have any bearing upon the classification of the species, they may be subsequently attempted.

The notes thus collected have reference especially to the following points:—The species capable of being grown in the open air at La Mortola; the rate and success of germination amongst these; the nature of the nutlets; the appearance, shape, texture, &c., of the cotyledons as also of the plumule and subsequent leaves; the relation of these to the cotyledons; transitions in shape, texture, &c.; general habit, and rough classification based upon early characters; movements of leaves in young plants; possible significance of special characters indicated by readiness or reluctance to germinate successfully, &c. &c.

The species of Salvia sown on the 6th of November 1889 were as follows:—

S. albo-cærulea (see Nich. *Gard. Dict.*),	Mexico,	Perennial.
S. aurita, Thun.,	Cape,	"
S. canariensis, Linn.,	Canary,	"
S. ceratophylla, Linn.,	Asia Minor,	Biennial.
S. confertiflora, Pohl,	Brazil,	Perennial.
S. Dominica, Linn.,	Italy, Syria,	"

Also sown under the synonym *S. graveolens.*

S. Forskohlei, Linn.,	Asia Minor,	"
S. gesneræflora, Lindl.,	New Granada,	"
S. Greggii, Gray,	Mexico,	"
S. Heeriana (See Nick. *Gard. Dict.*),	Peru,	"
S. hispanica, Linn.,	West Indies,	Annual.
S. interrupta, Schousb.,	Tangiers,	Perennial.

It is probable that the seeds sown under the name "*S. candelabrum*," and described in the following notes as *interrupta* "*cand.*," belong to this species. A mature plant, so named in Mr Hanbury's collection, is apparently a form of *S. interrupta*, with loose panicled inflorescence, instead of a verticillate inflorescence, which characterises the form of *S. interrupta* sent from Kew.

S. lantanæfolia, Marts. Gal., var. *limbata*.	Mexico,	Perennial.
S. Linkiana, Roem et Schult.,	Asia Minor,	"
S. lyrata, Linn.,	Mexico,	"
S. mexicana, Linn.,	"	"
S. nutans, Linn.,	Asia Minor,	"
S. obovata, Elliot,	North America,	"
S. polystachya, Orteg,	Mexico,	"
S. porphyrata, Dene.,	Texas,	"
S. pratensis, Linn.,	Europe,	"

Sown under the names *S. Tenorii* and *S. variegata*, by which they are described in the following notes:—

S. purpurea, Marts. Gal.,.	Mexico,	Perennial.
S. runcinata, Linn.,	Cape,	"
S. triangularis, Thunb.,	"	"

In addition, the following species are grown in the open air by Mr Hanbury:—*Salvia argentea,* Linn.; *S. aurea,* Linn.; *S. Benthellii*, Hort.; *S. bicolor*, Desf.; *S. boliviana*, Planch.; *S. cacalcæfolia*, Dec.; *S. calycina*, Sibth. Sm.; *S. "camphorata;"* *S. coccinea*, Linn.; *S. carduacea; S. "columnii;"* *S. crassifolia*, Desf.; *S. cretica*, Linn.; *S. discolor*, H. B. K.; *S. "dulcis;"* *S. farinacea*, Benth.; *S. "fruticosa;"* *S. gigantea*, Desf.; *S. glutinosa*. Linn.; *S. Grahami*, Benth.; *S. grandiflora*, Ettling.; *S. ianthina; S. involucrata*, Cav.; *S. leonuroides*, Glox.; *S. leucantha*, Cav.; *S. napifolia*, Jacq.; *S. nilotica*, Vahl.; *S. "oxylepis;"* *S. paniculata*, Linn.; *S. patens*, Cav.; *S. pseudo-coccinea*, Jacq.; *S. pulchella*, Dec.; *S. purpurea*, Cav.; *S. "Regeli;"* *S. "reginæ;"* *S. ringens*, Sibth. Sm.; *S. "sanguinea;"* *S. semiatrata*, Zuccar; *Salvia splendens*, Sellow; *S. "Verschaffelti;"* *S. virgata*, Ait.

The above list is extracted from Mr Hanbury's carefully compiled and remarkably full catalogue of plants grown at La Mortola. Where the specific name is placed in inverted commas, no authority can be found for it in the botanical or horticultural works to which we have access. It is probable also that some are incorrectly named.

The *conditions* under which the seeds were germinated were as nearly as possible identical. They were sown on the same day in 4-inch pots, two species sharing one pot in almost every case. From November 6th to November 28th the pots were placed in a somewhat shaded position in the open air. They then were exposed to the morning sun. Owing to injuries to some of the seedlings from the attacks of slugs, the pots were removed to an equally shaded position, where they were, however, more exposed to drying winds. On the 7th of December they were placed under glass in a cold frame, facing the south. The effect of this protection was, of course, quickly noticeable; but after a few days, during which the frame was kept "close," air was freely admitted throughout the day, the frame serving essentially as a protection against the considerable variations of temperature recorded at nights, when frosts even were registered at rare intervals in certain parts of the garden.

The rainfall was very slight before March. During that month, however, more than half the total average rainfall for the year fell. This average is 25 inches. From October

24th to November 25th rain only fell on one day, and that in slight amount; indeed, the greater number of days during the winter might be described as almost cloudless; only on twenty-three days, from October until the end of April, was rain recorded.

The averages of temperature, taken three times every day, are given for periods of six days; also the maxima and minima for these periods.

Date.	Average of 18 Readings.	Maxima.	Minima.
Nov. 8 to Nov. 15	12·0	16·0	6·5
,, 16 to ,, 21	9·0	11·0	6·25
,, 22 to ,, 27	9·5	11·75	6·0
,, 28 to Dec. 3	4.75	11·25	2·0
Dec. 4 to ,, 9	5·0	8·5	1·0
,, 10 to ,, 15	5·5	9·0	2·5
,, 16 to ,, 21	6·0	8·5	4·0
,, 22 to ,, 27	9·0	11·75	5·0
,, 28 to Jan. 2	7·0	11·0	3·5
Jan. 3 to ,, 8	10·0	12·0	7·0
,, 9 to ,, 14	10·0	11·75	6·5
,, 15 to ,, 20	10·0	11·25	6·5
,, 21 to ,, 26	12·5	15·5	7·75
,, 27 to Feb. 1	9·5	14·0	6·0
Feb. 2 to ,, 8	8·0	11·0	3·5
,, 9 to ,, 14	7·0	10·0	3·5
,, 15 to ,, 20	13·0	17·5	6·5
,, 21 to ,, 26	12·0	18·5	7·25
,, 27 to March 5	7·5	12·5	1·5
March 6 to ,, 11	12·0	16·25	7·5
,, 12 to ,, 17	13·25	18·0	13·5
,, 18 to ,, 23	13·25	16·5	8·0
,, 24 to ,, 29	15·0	17·5	10·0
,, 30 to April 4	17·0	19·0	12·0
April 5 to ,, 10	16·25	19·0	11·0
,, 11 to ,, 16	15·0	18·5	8·75
,, 17 to ,, 22	14·0	17·25	10·0
,, 23 to ,, 28	17·0	19·5	11·5

The Nutlets.

In the foregoing species, and in the others in Mr Hanbury's collection, there is not much variation in the size, shape, or nature of the surface of the nutlets. A few species (*S. interrupta* and *S. argentea*) may be described as possessing large nutlets, of which the following dimensions may serve as illustration:—

Mm. 3·75 × 3·3 × 2·75 in *S. interrupta.*

But by far the greater number attain an average size as follows:—

Mm. 2·5 × 1·8 × 1·65 in *S. Tenorii.*
Mm. 2·2 × 1·7 × 1·6 in *S. Forskohlei.*

A few amongst those in Mr Hanbury's collection having a more compressed or triquetrous shape, differ somewhat in size; *e.g., S. gesneræflora, S. Greggii, S. Heeriana, S. mexicana, S. sanguinea, S. triangularis.*

Mm. 3·2 × 2·3 × 1·5 in *S. Heeriana.*
Mm. 2·75 × 1·25 × 1·0 in *S. sanguinea.*

S. purpurea may be instanced as considerably the smallest seed in the collection.

Mm. 1·75 × 1·0 × ·75. in *S. purpurea.*

It will be evident from the preceding dimensions, that the nutlets are not large; most commonly they have an elongate appearance, inasmuch as they are more or less evidently compressed or even triquetrous.

They are described in the 'Genera Plantarum' of Hooker and Bentham as "*Nuculæ ovoideo-triquetræ vel compressiusculæ, læves;*" and Bentham in Decandolle's 'Prodromus' characterises them as "*Siccæ, glabræ plerumque lævissimæ.*" Their specific characters are of little importance, nor in the last-mentioned work are they again referred to in classification, presenting but slight dissimilarity one with another.

The surface of the persistent carpellary coat is, as a rule, slightly roughened or pitted. The greater number (I speak with reference to those in Mr Hanbury's collection) are black or dark-brown in colour; a few are lighter or very distinctly yellow. *S. canariensis, S. dominica, S. hispanica* may be instanced as examples of the species with darker coloured nutlets. Those which are lighter coloured are commonly also distinguished by their more elongated shape; whilst they are somewhat smoother in texture; *e.g., S. confertiflora, S. farinosa, S. nutans, S. Heeriana, S. mexicana, S. purpurea.*

In most species the walls of the cells of the outer coat break down into mucilage when they are placed in water or in a damp place, a commonly noticed phenomenon amongst the seeds of many families of plants; it perhaps serves as a remarkable adaptation for fixing the nutlet in a position where it shall have a chance of germinating to advantage, or it may afford aid in the actual process of germination by retaining moisture in close proximity to the seed. This production of a thick mucilaginous envelope is very quickly recognised upon the immersion in water of nutlets of a full black colour; it is not long, however, before it appears in those species with lighter coloured or even shining coats to the nutlet.

In *S. interrupta*, which we noticed as possessing the largest and most spherical nutlets of all the species, no production of mucilage can be induced even by immersion in boiling water.

Germination.

The following tables have been drawn up to shew the observed difference in the rates and results of germination of the various species.

In some there was evidently a second period of germination, when conditions were more favourable, after the pots had been placed in the frame. For the most successfully germinated species we have added the total percentage of individuals observed, but it is not probable that data on this point are absolutely correct.

It is natural for us to enquire whether we can account in any way for these observed differences, either by reference to the countries to which the plants are native, or by reference to their peculiar habitats, or from some other cause evident in the nutlets themselves.

We must refer to the list previously given for information regarding the countries of which the various species are natives, but we do not think that much can be learnt from reference to the native country without much more detailed information as to the exact habitats preferred by the species. Unfortunately, such information is not forthcoming in many cases. We believe, however, that definite morphological characters may be associated with successful or unsuccessful germination under different conditions of treatment, and these morphological characters have, doubtless, direct relationship to the plant's special habitat.

We shall later refer in more detail to the seeming relation between general habit, together with the nature of the young leaves, to the percentages of successes and failures to produce healthy plants; at present we may point out some more evident facts regarding distribution and germination, which are not, however, of much value apparently.

Thus, the first four species to germinate are natives of the South of Europe, Asia Minor, or the Canaries, where, doubtless, the conditions of climate in the open air are very similar to those at La Mortola. Again, the species which have not germinated at all are from Brazil, New Granada, and (actually!) Italy. The fact that *S. Dominica* (grown under that name, and in another pot under the synonym *S. graveolens*) should not have germinated, although the experiment has been made in the country where the plant is indigenous, is just one of those facts which shew us of how little value it may be to judge as to a plant's requirements, without reference to exact habitat or to the nature of the plant itself. It is, of course, possible that the seed of this species has been faulty, but more likely the conditions under which it was attempted to germinate it have been different from those of its habitat; perhaps an overplus of watering may afford an explanation. We imagine also that we have detected a connection between the nature of the coat of the nutlet and the amount of success in germination. It appears as if those of smaller size, with shining or smoother coats, had germinated less readily; certainly less successfully, as measured by the total percentage out of the fifty or one hundred seeds sown in each case.

This, which we put forward as little else than a speculation at present, does not seem so unnatural to us when we think of the vastly different habitats—the margin of a lake or the slope of a hill-side, where the species naturally scatter their seeds.

Yet we may point out that, although in the same species when germinated under the different synonyms of *S. Tenorii* and *S. variegata*, there was close agreement in response to the environment in which they were placed for germination, yet in the two forms of *S. interrupta* there was a difference of forty days in the time of germination.

Similarly, confining our attention to the percentages which germinated (as far as the attacks of slugs at an early period would allow us to determine with exactitude), whilst in the two forms of *S. interrupta* there was close agreement in the totals, in *S. pratensis* the form *S. variegata* only produced 20 per cent., whilst *S. Tenorii* produced 55 per cent.

So great differences within the limits of what are single species (again with the proviso that the seeds as supplied to us are correctly named in these cases) does not warrant the forming of many inferences.

The following tables show dates of germination, total percentages successfully germinated, dates upon which maximum number of individuals was first observed in each species:—

I. The following germinated before *ten days* had elapsed after the date upon which the seeds were sown:—

	Total.	Max. observed on
S. Forskohlei, . . .	80 per cent.	16th day.
S. canariensis, . . .	30 ,,	16th ,,
S. pratensis (*S. Tenorii*), .	55 ,,	16th ,,

II. The following germinated on dates between the 10th and 15th days:—

	Total.	Max. observed on
S. pratensis (*S. variegata*), .	20 per cent.	60th day ?
S. hispanica, . . .	45 ,,	32nd ,,
S. aurita, ...	65 ,,	45th ,
S. ceratophylla, . . .	4 ,,	30th ,,
S. Heeriana, . . .	20 ,,	50th ,,
S. interrupta (*Kew*), . .	20 ,,	50th ,,
S. obovata, . . .	8 ,,	16th ,,

III. The following germinated between the 30th and 40th days:—

	Total.	Max. observed on
S. purpurea, . . .	2 per cent.	32nd day.
S. triangularis, . . .	45 ,,	50th ,, ?
S. porphyrata, . . .	55 ,,	75th ,, ?

IV. The following between the 50th and 60th days:—

	Total.	Max. observed on
S. interrupta ? ("*S. candelabra*"),	25 per cent.	50th day. ?
S. runcinata, . . .	20 ,,	70th ,,
S. mexicana, . . .	4 ,,	70th ,,
S. lyrata, ...	30 ,,	50th ,,

V. The following after the 70th day:—

	Total.	Max. observed on
S. albo-cærulea, . . .	2 per cent.	70th day.

VI. A few seeds germinated in each of the following at very different dates, but the seedlings have failed to develop:—

S. Dominica.
S. Greggii.
S. nutans.
S. Linkiana.

VII. The following had shown no signs of germination by the 130th day:—

S. confertiflora.
S. gesneræflora.
S. graveolens.

We may note, in conclusion of this part of our subject, that out of the twenty-five species sown only six produce more than 40 per cent. of seedlings, only half of the total number produce 25 per cent., whilst more than a quarter produce a smaller percentage, of which only one or two individuals survive in most cases. In three species no germination has been observed.

The Cotyledons.

Just as we have observed but little difference in the sizes of the nutlets, so among these species of *Salvia* there was not much variation in the size of the cotyledons at the time when they first made their appearance above the soil.

The seeds being exalbuminous, the size of the cotyledons, as they emerge from the coats of the nutlet, has strict dependence on the character of the nutlet; they are longer or broader, according as we have noticed the seed to be longer or broader; thus they entirely fill the seed, having only towards their base a minute radicle and plumule, which together lie sunk in a tiny depression. The coats of the nutlet are ruptured at the base by the convergence of the radicle; they split as the cotyledons enlarge, and are thrown off when these are below the soil. When the free cotyledons make their appearance through the soil, pushed up by the straightening of the somewhat stout hypocotyl, the apex of the cotyledons is uppermost; they are perhaps three times as long and three times as broad as they were when enclosed within the seed. Thus the actual measurements of *S. Forskohlei*, when first noticed above the soil, were 3 mm. × 3 mm.; nor were there other species noticed that differed much from these dimensions, *S. interrupta*, the largest of the nutlets, having perhaps dimensions 4 m. × 4 m.

All the species were characterised by thick, almost fleshy, cotyledons, which remain appressed only for one or two days, as a rule, after emergence through the soil; in all the colour is light, and they are generally smooth, in only a very few instances appearing pubescent on the upper or under surfaces.

In the case of *S. interrupta*, which we must again notice, on account of other peculiarities, the cotyledons remained appressed for a number of days. Commonly, in favourable circumstances, the cotyledons spread their upper surfaces to the light quickly, after which a considerable increase in size and shape, and ultimately the development of petioles, may be noticed.

The ordinary phenomena of the growth to be observed in these species of *Salvia* are as follows:—

After the cotyledons are no longer in contact with their upper surfaces, they lie at first inclined to one another, subsequently in the same plane, or again inclined according to their position with regard to the amount of light to which they are exposed. They are commonly symmetrically opposed the one to the other; but in exceptional circumstances one may grow nearer to the other, if thereby it gains advantage from a better exposure to light. This ability in the cotyledon to place itself so that it is exposed to a greater amount of light is dependent mostly upon the growth of the cells in the petioles, but also in some species upon growth or variation in the turgescence of cells situate about the point of union of petiole and lamina; alteration at this point allows the lamina to lie in the same plane as the petiole, or to be at a greater or less angle to it. This variation in the inclination of the lamina, as distinct from the petiole, was noticeable most distinctly in those species where there is an abrupt transition from petiole to lamina.

The maximum increase in the size of the lamina occurs within the first eight to ten days after the expansion of the cotyledons; it is not, however, the case that all alteration in size or shape takes place within that limit of time. In some cases, even after forty or fifty days, a slight change in shape was noticeable, by which the cotyledons of every species assumed more or less an emarginate character. This might be due to enlargement of cells as distinguished from actual increase in the number of cells composing the lamina; certainly it was a character assumed at a later time apparently than when the growth of the lamina or petiole was most apparent.

The growth of the petiole was not noticeable for some days after the time when the laminæ had spread themselves out in a more or less horizontal position. The petioles developed simultaneously with the development of the plumule, which in most cases was not to be seen, unless with the aid of the microscope, until ten to fifteen days had elapsed after the cotyledons first appeared above the soil.

The time which elapsed between the first appearance of cotyledons and the first appearance of the plumule might, however, vary considerably, according to the time of year and the conditions under which the seeds were germinated. Where such facts have been observed they have been inserted, more with a view to future comparison than on account of any suggestions which they afford at present.

The cotyledons persisted in most species until the leaves subsequently developed cut off their supply of light, or pressed them upon the surface of the ground. Where the subsequent leaves and the cotyledons were very evidently petioled, they persisted for a longer period than was otherwise the case.

The following table allows of comparison as to the sizes attained by the cotyledons of various of the species when they were mature; the amount of spread from the top of one cotyledon to the top of the other is also indicated in most cases at its maximum, but as much variation was observed in the latter measurements, we shall refer to them subsequently:—

	Maximum Length of Petiole and Lamina in Single Cotyledon.			Max. Breadth of Single Cotyledon.	Area of Lamina (approx).	Max. Measurement from Tip to Tip of Pair of Cotyledons.
	Petiole. mm.		Lamina. mm.	mm.	Sq. mm.	mm.
S. albo-cærulea .	4	+	6	7	42	19
S. canariensis .	7	+	6	6	36	26
S. ceratophylla .	4	+	5	5	25	22
S. Forskohlei . .	5	+	7	5	35	25
S. Heeriana . .	8	+	6	6	36	26
S. hispanica . .	3	+	5	4	20	13
S. interrupta, var. "Cand." . .	18	+	9	11	99	38
S. interrupta (Kew) . . .	15	+	10	14	140	52
S. lyrata . . .	6	−	8	9	72	...
S. obovata . . .	5	+	7	8	56	...
S. porphyrata .	10	+	9	12	108	...
S. runcinata . .	6	+	6	7	42	22
S. Tenorii . .	5	+	5	7	35	25
S. triangularis .	7	+	8	9	70	28
S. variegata . .	2	+	6	6	36	18

Perhaps the fairest comparison which may be made among the species from the above data is that given by the approximate areas of the laminæ. As has been already pointed out, the inclination of the cotyledons, one to another, may vary very considerably at different times. Hence the amount of spread from tip to tip gives but little information as to the sizes attained by them. The specimens measured have invariably been the largest among the batch of seedlings ; in a few cases the results of competition with the other seedlings of the batch has been to produce cotyledons of considerably different dimensions from the above. Such a case was observed in *S. Tenorii*, where the petiole of one individual was 8 mm., and the lamina 4 × 4 mm. ; whilst in another the petiole was 4 mm., the lamina 7 × 5. Again, in *S. porphyrata* the growth of the cotyledons was considerably increased after the growth of the first pair of ordinary leaves. Thus, whilst on the 58th day after germination, the lamina is 6 × 6 mm. and the petiole 3 mm., on the 110th day the dimensions of the lamina are 9 × 8 mm., whilst the petiole has increased to 6 mm. In general it has been attempted to give the dimensions of the largest healthily-grown (and not "drawn") seedlings. We may consider in a more detailed manner such further observations as we have made regarding the shape and texture of the cotyledons, and as to those features which may be considered as especially characteristic of particular species.

As may be seen by reference to the foregoing table, the shape of the lamina of the cotyledon is approximately rounded, but generally somewhat broader than long. In some species there is a slightly emarginate apex, a feature more or less shown by all when mature.

The base of the lamina alters considerably in most of the species as they develop. In some species it is a transition from a slightly cordate base to one which merges gradually into the petiole. In most the transition is such us may be observed in the leaves subsequently developed, and is towards a form with a broader base at a later period. *S. obovata* and *S. variegata*, *S. Forskohlei* and *S. Tenorii* were decidedly cordate when the cotyledons expanded ; *S. Heeriana* and *S. runcinata* retained abruptly straight bases; *S. interrupta* shewed a peculiar thickening of the base of the lamina, causing a slight projection beyond the edge from the under surface.

These variations in shape of the cotyledon have probably reference to the variations in shape of the cauline leaves, an abrupt base or an attenuate apex, a long or a short petiole, being frequently seen both in cotyledons, and, at least, in some of the earlier subsequent leaves in certain of the species.

More distinct than such variations in shape are the few exceptions to the ordinary smooth type of cotyledons. *S. interrupta*, in its two forms, possesses almost hirsute cotyledons, in contrast to all the other species, just as it shewed a larger nutlet and one without a mucilaginous development in contrast with the rest of the species observed. The cotyledons of *S. interrupta* possess long petioles, and have much more the appearance of ordinary leaves than have most, having an almost recognisable midrib or line of venation through the fleshy lamina, in continuation with the petiole. The cotyledons persisted in this species for a longer time than was commonly the case amongst the others.

The cotyledons of *S. triangularis* and *S. Heeriana* also appeared somewhat pubescent, a fact which shows us again that characters distinguishing the mature plant make their appearance in the cotyledon, inasmuch as when mature these are the most pubescent of the species here considered.

The margins and under surface of many species were provided with minute, perhaps glandular, hairs, the purpose of which is apparently to prevent the passage of water between the expanding cotyledons, or to retain, as was actually observed, a film of air between the delicate cells of the young cotyledons and the moisture from the ground where they had germinated. Such hairs were also found upon the hypocotyls, and much more conspicuously and invariably upon the petioles of the cotyledons, where they often attained to a very considerable size. Their occurrence upon the petioles must assuredly be regarded in the light of a protection for the young leaves of the plumule, over which they met when the petioles were nearly approximated in the youngest stages of plumular development. In *S. lyrata* these hairs gave a markedly hirsute appearance to the petioles, although the lamina was ordinarily smooth.

As to the development of the petioles, we may further remark that the length of these in the greater number of instances did not exceed that of the laminæ. A glance at the foregoing table will show that they do not often exceed the length of the lamina. They commence to grow only after the laminæ have been visible for a considerable time, and, we presume, may vary very much in length, according as they are exposed to a greater or less amount of light.

In some cases a great difference was to be observed in the lengths of the two petioles in one individual, phenomena generally, but not always, to be accounted for by the position in which the seedling was growing. As a rule, the petioles are stout rather than attenuate. They attain their greatest length in those species in which the subsequent leaves have the longest petioles.

The growth of the hypocotyl is hardly evident in any of the species we have here considered. As will be observed later, the general habit of the greater number of these species is an appressed one, hence it is of *S. Heeriana* only that we have any note upon the development of the hypocotyl. Of this species, on the 75th day after germination we have noted, a "distinctive feature is, that whilst the seedlings are not crowded together, nor in a position where they are liable to be 'drawn up,' they have longer hypocotyls than any of the species in which 'a drawn' condition is not evident." Even in *S. Heeriana* the hypocotyl was only 11 mm. long. The great development of internodes which, at an early stage characterises this species among those which have germinated successfully, is sufficient explanation of the presence of the hypocotyl.

The Development of the Plumule.

The plumule in all the species of *Salvia* which we have examined is exceedingly small when the cotyledons expand above the surface of the soil. In *S. Forskohlei* and *S. Tenorii*, for instance, it could not be seen without the removal of a petiole and cotyledon, nor did it exceed 0·5 mm. until a few days after the cotyledons had emerged.

In the above-mentioned species it was not until the 16th day after the seed had germinated that the first two leaves of the young plant could be seen distinctly. Sixteen days later, in these two instances, the extreme measurement from tip to tip of these first leaves was only 4 mm. But the growth of the plumule in many species which germinated later was much more accelerated by the, we presume, more favourable conditions of temperature under glass. Nevertheless, among species which developed at the same time—*e.g.*, the two species we have instanced and *S. canariensis*—there was observable a very different rate of growth under the same conditions. By the 30th day the plumule of *S. canariensis* was more than twice the size it was in the other two species. At a later stage the mature leaves were much longer in this species. The growth of *S. triangularis* may be instanced, in which there was produced a first pair of leaves of the same size as those of *S. ceratophylla*, in half the time taken by the latter. In this case, however, the subsequent development was different, inasmuch as *S. ceratophylla* rushed ahead very quickly.

The sizes attained by the first leaves seemed to have no relation, either when mature or at the earlier period of their growth, to the sizes attained by the cotyledons.

Instances of this were frequent, where individuals of one species, with smaller cotyledons, would possess larger first and second leaves than others which at the first appeared the most vigorous by reason of their larger cotyledons.

This was noticed both in *S. Forskohlei*, where the individuals were crowded together, and in *S. interrupta*, where they were grown quite free from one another.

The first appearance of the ordinary leaves was as a wrinkled semi-equitant pair, having a greatest length in some species in a vertical direction, and in others (which ultimately showed a more lowly habit) in a horizontal direction.

Although the leaves were thus produced in pairs, it was almost always evident in early stages that one was grown more favourably than the other, either by reason of its position with relation to light, or from an actually earlier development. Just as one leaf in a pair seemed, at the first, to have the pre-eminence, so it was not long before the much greater growth in size of the later pairs made itself evident. A difference in size between the first and succeeding pairs was less marked in species with a considerable development of internodes.

The shape and texture of these early leaves differed considerably within the limits of single species, to facts under which head we may now refer.

Change of Shape in Leaves of the same Species.

In the detailed tables which we shall give of the dimensions of leaves, as observed at different dates and when mature, we shall be able to make rough comparisons as to such changes in shape as are brought about by increase in breadth in proportion to length, or *vice versa;* at present we may notice a few of the more general changes in shape.

In many species an increase in breadth towards the base of the lamina in the later leaves was clearly marked. Thus, in *S. Forskohlei* and *S. Tenorii* the first and second leaves which were produced were distinctly spathulate or obovate. Subsequent leaves were more oblong, some were oblong-lanceolate, due to the crowded manner in which the individuals were grown together, whilst others grown in a less crowded position produced broader and less lanceolate leaves.

The leaves of *S. ceratophylla*, which in many respects closely resembled the above in the earliest stages of the plant's development, although increasing very conspicuously in length, also became relatively broader; they change from lanceolate to ovate, the petioles subsequently elongating so as to free the lower earlier leaves from an overdue shading by the coarser uppermost ones. The leaves of *S. variegata* similarly pass through the same change, from an approximately spathulate to a more oblong-lanceolate shape, although it does not possess petioles in its earliest leaves.

A very distinct form of leaf, such as that of *S. canariensis*, is in general outline much the same in all the youngest leaves. It is some time before leaves are developed which show an evidently hastate base, although this is a characteristic feature of the leaves of the fully-developed plant.

Similarly, the first leaves in *S. hispanica* and *S. aurita* are more rotund than are the typical leaves; it is not until the third or fourth leaf that any indication is given of the lyrate or lobed character of the leaves of the fully-developed plant.

The pinnate leaves of the mature plant in *S. interrupta* are not produced in the pairs immediately succeeding the cotyledons. In some seedlings the third or fourth leaf showed a minute leaflet situate on the petiole at some little distance from the terminal leaflet. Also, in a note taken of this species on the 120th day, we have remarked that the lamina of the first leaf of the plumule resembles the cotyledon in that it is abruptly united to its petiole; the lamina and petiole of succeeding leaves are less bluntly united. The fifth and sixth leaves have each a pair of leaflets 6 mm. from the terminal leaflet and 15 mm. across on the above date.

Comparison may be made between the dimensions previously given of the leaves of *S. interrupta* and those taken on the 175th day, when fourteen leaves had been developed. The dimensions of the leaves of a mature plant are also given:—

175th day—Total length,	. .	100 mm.;	lamina, 55×35.
,,	Leaf from mature plant,	250 ,,	lamina, 110×60.

It is perhaps hardly worth while to notice in any detail the changes in size to be observed between the leaves of an early date and those of the more mature plant. Regarding changes in shape, perhaps no general statement can be made, except that it is at times a change from a simple leaf to a compound one—that a simple leaf always precedes a lobed or finely-divided one. This is seen not only in the young plants as they develop from seed, but it is shown in almost every mature plant on the different axes, where the simplest forms of leaves are those produced earliest; that is, those outermost in the bud.

Examples come to mind of the change that may be noticed in countless Leguminosæ, in *Scabiosa*, in *Cineraria maritima*, and others.

Perhaps, more distinct than such alteration in shape is the very evident alteration in the nature of the surface, especially in those species which are of appressed habit. This change, in general, is one from an almost characterless to a specialised leaf, from one without more than a light-coloured depression for midrib, with a few large veins given off on each side, to a leaf which is rugose, with a closely-netted venation and coarse veins on its under surface, and a wavy, crenate, or serrate leaf margin.

The features of most marked description of which we must now take notice are those which give to the plant its *general habit;* by this we shall roughly classify our species, calling attention to certain correlated or, at least, accompanying characters.

The *roots* of the species we have examined are all very much alike, in most species the primary root thickening very evidently, and from this small, wiry, secondary roots are given off in the upper part, and longer, somewhat more vigorous fibrous roots from lower down. In some species, as *S. Forskohlei*, the upper part of the primary root is very much thickened, giving the appearance of a tap root at first; in general it is wiry and branched at a distance of sixty to eighty mm. from the "crown."

S. canariensis apparently formed much less vigorous roots in comparison with the size of its leaves than any other species; the secondary roots were more wiry than was observed in other species. *S. lyrata* and *S. obovata* possessed roots in which the primary root was not so evidently thickened, others of almost equal size arising from its upper

TABLE, allowing Comparison as to Rate of Growth, as shown by the *Number* and *Sizes of Leaves produced* by 130th and 175th days.

SPECIES.	Number of Seedlings in each Pot. Competition indicated by a + sign.	Deduct Number of Days before Species Germinated.	Number of Leaves produced, omitting those of a Size under 2 mm., measured in Pair from Tip to Tip.	Size in mm. of First Leaf. Total Length, Length and Breadth of Lamina being given.	Size in mm. of Largest Leaf produced. Total Length, Length and Breadth of Lamina being given.		Number of Leaves produced by 175th Day. [After having been planted out.]	Size in mm. of Largest Leaf produced by 175th Day.	
					Total.	Lamina.		Total.	Lamina.
S. ceratophylla . .	2	16	12	35 25 × 10	95	85 × 35	18 (also buds and flowering axis)	140	95 × 55
S. Forskohlei . . .	25 +	6	10	30 20 × 10	50	? × 18	10–12	50	? × 18
S. Tenorii . . .	16 +	8	10	30 20 × 10	62	47 × 20	10–12	62	47 × 20
S. Heeriana . .	7	16	10 (and buds in axils of cotyledons)	(the largest leaf)	55	37 × 26	12 (buds very small still)	94	64 × 45
S. interrupta, "*cand.*"	3	52	8	(the largest leaf)	55	35 × 18	12	74	40 × 22
S. interrupta . . .	4	16	6 (buds in axils of 1st pair and of cotyledons)	32 14 × 12	77	45 × 31	14	100	55 × 35 (terminal leaflet)
S. hispanica . . .	2	15	8 (buds in axils)	24 17 × 12	25	19 × 16	10	42	32 × 23
S. aurita	16 +	16	8 (buds well developed)	36 20 × 20	48	30 × 25	12	55	35 × 25
S. lyrata	14 +	50	6	(the largest leaf)	33	26 × 15	8	60	45 × 30
S. obovata	4	16	6	(the largest leaf)	15	13 × 9	8	37	32 × 20
S. variegata . . .	7	12 [? 40]	6	... 15 × 6	...	17 × 8	...	...	...
S. canariensis . .	11 +	8	8	20 11 × 8	75	44 × 16	12	80	50 × 27
S. triangularis . .	18 +	38	4 (large buds in axils)	(the largest leaf)	30	18 × 16	8	56	30 × 21
S. porphyrata . .	14	40	4	(the largest leaf)	31	12 × 12	6	34	18 × 16
S. lantanæfolia . .	1	16 [? 50]	2 (3rd and 4th only just showing)	(the largest leaf)	...	15 × 11	8	20	17 × 11

part. A few secondary roots of a stouter and more vigorous nature were produced in many of the larger growing species, which may be compared in appearance with runners, but which had not developed sufficiently to allow a definite opinion being formed as to their nature.

General Habit of Various Seedlings.

A most evident distinction may be drawn amongst such a collection of young seedlings as we have undertaken to examine, based upon their general habit.

Of the several species which produced healthy seedlings before the 120th day, the following may be characterised as of a "squat" habit, *i.e.*, they produced rosettes of radical leaves, which, as they matured, assumed a horizontal position, oftenest being appressed closely to the ground :—

Table A.

	"Drawn up."	Day when Germinated.	120th Day. Height to Apex of Largest Leaf.
S. ceratophylla . .		16	5 mm.
S. Forskohlei . . .	+	6	...
S. Tenorii	+	8	...
S. lantanæfolia . .		16 [? 50]	3 ,,
S. lyrata	+	50	6 ,,
S. obovata . . .		16	3 ,,
S. polystachya . .		18	4 ,,
S. variegata . . .		12 [? 4]	3 ,,

Opposed to these were the following, in which internodes were developed to a greater or less extent :—

Table B.

	"Drawn up."	120th Day.	120th Day.
S. aurita . . .	+		23 mm.
S. candelabrum . .		52	63 ,,
S. hispanica . . .		15	14 ,,
S. *mexicana* . . .		50	...
S. triangularis . .	+	38	21 ,,

The following were not so evidently to be distinguished as of one class or the other. They may be considered as an intermediate group, in which, although the species possess no evident internodes, yet the leaves are long, petioled and erect :—

TABLE C.

	Day.	120th Day. Height to Apex of most erect Leaf.
S. canariensis	8	75 mm.
S. interrupta	16	83 ,,
S. porphyrata	40	26 ,,

That a better comparison may be made as to this difference in habit, we have given the heights in millimetres, as measured on the 130th day, to the tip of the most erect leaf in every case. Where drawn out because of competition among the individuals, we have placed a mark (+) after the name ; and in order that comparison may be clearer, we have inserted the number of the days which elapsed till each species germinated.

The difference in height is very apparent between the species enumerated in Table A. and those of Table B. Seedlings of *S. Forskohlei* and of *S. Tenorii*, growing near the edge of those which were crowded together in the pots, possessed leaves as closely appressed to the surface as was the case in *S. ceratophylla.* It was otherwise with the individuals of these species which were crowded together.

Although *S. interrupta* and *S. canariensis* (on Table C.) appear to have the most conspicuously erect habit of all the species, their excessive height is due to the greater development of their leaves and leaf-stalks, the internodes in *S. interrupta* developing somewhat later. Often, indeed, where internodes were developed, the leaves were borne almost horizontally, and on this account the measurement of "heights" is fallacious.

Intimately associated with this development of internodes was the *development of buds* in the axils of the leaves, and even in the axils of the cotyledons of certain species, at an early stage of the plant's growth.

In *S. aurita*, although the second pair of leaves of the primary axis were but 6 mm. in length, these were conspicuous in the axils of the cotyledons on the 50th day of germination; whilst, on the 130th day after the seeds were sown, when the elongated character was particularly noted, these axillary buds had developed leaves of some size as compared with the leaves of the primary axis.

In *S. Hecriana*, similarly, the leaves of the secondary buds were well developed on the 130th day after the seeds were sown, or the 114th after the germination of the species was recorded.

In *S. triangularis* secondary buds were developed in all the axils, some shewing two pairs of leaves well developed.

In *S. hispanica* they were evident, but perhaps their appearance in *S. interrupta* was the most remarkable. Hardly more than ten days previously we had noticed this species as of the intermediate class, C.; whilst on the 130th day, or the 114th after germination, the last node was 20 mm. from the bases of the petioles of the cotyledons, whilst buds appeared in the axils of the first and second leaves, as well as in the axils of the cotyledons.

Clearly the development of internodes, so conspicuously related to the appearance of secondary buds, had a certain advantage in raising the leaves of the primary axis out of the way of the secondary buds so as not to interfere with their growth.

The truest comparison as to the total amount of growth within the same limit of time and under the same conditions is, however, best afforded by the data previously given as to the sizes of the leaves. It is not, however, a profitable thing to make here such comparisons at any length. The conditions were somewhat different, owing to the crowding of the individuals together; but it appeared as if those of "squat" habit (Table A.) grew most quickly, producing the largest amount of leaf surface within the given time. The biennial, *S. ceratophylla*, developing horizontally-placed leaves of an exceedingly coarse nature, was of all the most remarkable, on account of the vigorous rate at which it grew. The annual, *S. hispanica*, shewed no such zealous haste to develop.

It might be suggested that the rosette of horizontal or cauline leaves is a saving of time and perhaps material to the plant, but this is hypothetical. Some, or most, of the species here considered shewed evidently an amount of natural difference in their rate of growth, just as they did in their morphological features.

Did we know more as to the exact habitats in which these species are found naturally, we might certainly with more justice attempt to understand the peculiar distinctions of habit between one and another; at present we must content ourselves with calling attention to certain other distinctions which were very evidently correlated to these of general habit.

Colour and Hairiness of Leaves Correlated to Habit.

When we had grouped by themselves those of our seedlings which showed very evidently the "squat" habit, it was noticeable that they were also distinguishable from the remaining seedlings by the darker green of their foliage and the general absence of hairiness upon the leaves.

That we might be the more sure that such a correlation was evident, we showed the batch of seedlings to one of Mr Hanbury's boys, who was with us at the time, and asked him whether he noticed any very distinct differences between the two groups.

He almost immediately indicated the much darker colour of the seedlings of "squat" habit, and, when questioned further, observed the greater abundance of hairs upon the leaves of those species which were distinguished by their lighter green colour.

We think that there is a clear suggestion from the above facts, that certain morphological characters may justly be linked to special conditions of habitat; and, in consequence, we may presume, special cultural conditions for the most successful germination. There would need to be a closer scrutiny as to the conditions of ripeness in which the seeds were gathered—the depths at which they were sown in the soil, &c.—before any very clearly substantiated proof of this could be laid down, but with our present data we may fairly make a few observations on this point.

From tables which have been given earlier in this paper, we have shown that there were very considerable differences in the total number of seedlings which, in one species and another, germinated successfully.

The extent to which this correlation is carried may be most clearly indicated by the following Tables:—

I.—Habit.	II.—Colour.	III.—Hairs.
Group A.—"*Squat*":— S. ceratophylla. S. Forskohlei. S. Tenorii.	*Dull bluish green*:— S. ceratophylla. S. Forskohlei. S. Tenorii.	*Absent entirely*:— S. ceratophylla (except a few sickly hairs on midrib and petiole). S. Forskohlei. S. Tenorii.
S. lantanæfolia. S. lyrata. S. obovata.		*Present chiefly on youngest leaves*:— S. lyrata. S. obovata.
S. polystachya. S. variegata.	S. polystachya. S. variegata.	*Absent entirely*:— S. polystachya. S. variegata.
Group B.—*Erect*:— S. aurita. S. candelabrum. S. hispanica. S. mexicana. S. triangularis. S. albo-cærulea.	*Generally a brighter yellower green*:— S. canariensis. S. interrupta. S. candelabrum. S. albo-cærulea, *having a dull although yellowish green colour.* S. lyrata *and* S. obovata *are exceptions.*	*More or less abundant*:— S. aurita (sparsely distributed on matured leaves). S. candelabrum. S. hispanica (more on under surface). S. mexicana. S. triangularis. S. albo-cærulea.
Group C.—*Intermediate*— S. canariensis. S. interrupta. S. porphyrata.		S. canariensis (woolly petioles and under surface). S. interrupta. S. porphyrata.

Such differences form the basis for the practical knowledge gained by the clever gardener, who asserts with confidence that such and such species are easily raised from seed, others not so. For anything that we know, there may be practical men who could run over the species of *Salvia* here enumerated, and assert of one species or another that it would be easy to grow in gardens in Britain or on the Riviera, or the reverse. Perhaps it is from lack of leisure, or from the idea that generalisations on the subject would always be useless and uncertain, that such men, who are the most practical observers, never attempt to make more than suggestions *why* some species succeed and others do not. But we are almost confident that series of careful observations of such a kind as we have brought forward would do much to establish in our minds clear ideas of cultural requirements as evidenced by the external morphology of the plants we attempt to grow; or, what is the same thing, *the external characters may, we believe, be associated definitely with the habitat preferred by the species.*

Unfortunately for us, in this particular instance there is very little information as to exact habitats, in such botanical works at least as we have had access to, to guide us in making a full comparison. We are also aware how difficult it is for a traveller during a short visit to distinguish in a very precise way as to what are the exact habitats affected by plants collected. It is work, nevertheless, which will repay persistent and careful research.

The facts given in tables earlier in the present paper show us, that as carefully as we can ascertain, with such observations as have been recorded, out of the total number of seeds sown, among species with glabrous and dark coloured leaves, 33 per cent. have germinated successfully; 25 per cent. have germinated amongst those species with lighter coloured leaves, which are but sparsely covered with hairs; 15 per cent. only of the seeds of those species with very distinctly pubescent or hairy leaves. We would wish to avoid anything like a hasty rushing to a conclusion; but it would appear that in this case, and, as a rule, glabrous-leaved plants suggest a damper habitat than that suggested by hirsute or pubescent leaves; damp-loving plants would, we think, fare better under such conditions as those in which the species of *Salvia* have been grown. But we might observe that of the five species with most distinctly hairy leaves, three were the last to germinate; also they germinated at a time when an altered temperature and position tended to keep the pots in which the seeds were sown in a drier position.

Perhaps there is nothing more in our first statement than is indicated by the common remark of the gardener—that such and such a species is one that "grows freely," or that is "coarsely growing." But what may rightly be described as "coarsely growing" wherever placed in an English garden might not be likely to prove so everywhere on the Riviera. In such a case we need more exact determination as to what are the requirements best suited to one kind of plant or the other. Comparison of plants requiring the same conditions will surely lead us to associate features such as those we have instanced—glabrous leaves or hairiness, with habitat and with the requirements of the plant for successful germination or growth.

It is of interest to make some slight comparison between the resemblances which, so far, we have detected among the various species here considered, and the natural affinities which have been recognised after systematic study of the genus.

Thus, in the groups to which we have called attention on account of the difference in texture of the leaves, the group in which hairs on the leaf are sparsely distributed, and in which the colour is a more lively green, contains—*S. triangularis*, *S. aurita*, *S. runcinata*, *S. lyrata*, and *S. obovata*—all of which belong to the section *Heterosphace* of Bentham.

This early resemblance in character is possibly only due to the fact that the species are herbaceous; if it is anything more, it may be regarded as evidence of relationship in the nature of the leaves and early growth, supporting the recognised relationship based upon the nature of the flowers. *S. lyrata* and *S. obovata*, which are very closely allied species, show their intimate relationship in a peculiar manner in their earliest stages—in that they are the only species observed in which the leaves are very strongly coloured: the colour was reddish-purple.

The above is perhaps the most evident instance, those species with dull and glabrous leaves being from several sections; as also those with a low growing habit in their earliest stages.

Note upon the Movements of Young Leaves of Salvia Species probably attributable to the Effects of Dry Air and consequent Evaporation.

Jan. 21, 1890, 11 P.M.—A pot of seedlings of *Salvia canariensis* which had remained for some hours in a dry warm position in a dwelling-room showed five seedlings out of nine, with the second pair of leaves (cotyledons excluded) in more or less close contact; each was about 16 mm. long, and had been separate from the other before the plants were brought into the room. The young leaves were closely pressed, one against the other, towards the base, but the tips of the leaves were generally somewhat reflexed. All the seedlings would, in all probability, have so responded to the stimulus, of whatever nature it might be (dry air probably), but the crowding together in the pot caused petioles or laminæ of one or another seedling to interfere with the movements of its neighbours.

In one case the third pair (larger) were developed, and they were closely appressed for the greater part of the extent of the lamina, the species being only 5 mm. apart. The petiole did not appear to move much, if at all, nor did both leaves move towards each other equally; the lamina of one would incline towards the lamina of the other, making an angle with its petiole, whilst the lamina and petiole of its opposite leaf might be curved much in the same direction throughout.

Jan. 22, 10 A.M.—The seedlings having been kept in the same position since they were last observed showed a *separation* of the leaves of those pairs, which, before, were observed to have been in partial or complete contact. In only one case was there any contact of the lamina of one leaf with that of its opposite leaf.

The following were the measurements of the distances between the tips of the various leaves :—

In the largest individual, . .	42 mm.
In average sized, . . .	20 ,,
In the smallest, . . .	10 ,,

Jan. 22, 2 P.M. Of one seedling it is noticed that it has drawn its young leaves together by 14 mm.

Jan. 22, 6 P.M. After having been out in the open air during the afternoon, the seedlings were brought into the warmer, drier air of the room; all showed the leaves widely separated. In selected seedlings the distances apart from tip to tip were as follows:—

A. (largest seedling.)		B.	
3rd and 4th leaves,	42 mm.	3rd and 4th leaves,	20 mm.
1st and 2nd leaves,	46 ,,	1st and 2nd leaves,	43 ,,
cotyledons,	18 ,,		

C.	
3rd and 4th leaves,	25 mm.
1st and 2nd leaves,	44 ,,

Jan. 23, 8 A.M.—The measurements of the above were:—

A.		B.	
3rd and 4th leaves,	28 mm.	3rd and 4th leaves,	25 mm.
1st and 2nd leaves,	46 ,,	1st and 2nd leaves,	42 ,,
cotyledons,	18 ,,		

C.	
3rd and 4th leaves,	20 mm.
1st and 2nd leaves,	43 ,,

It is probable that we have an explanation of the movements at first recorded, in the fact that on the morning of the 23rd the exhibited movement was less evident, indeed, hardly noticeable. The plants had, on this occasion, been placed in a cooler place in the room, and not, as before, within a couple of feet of a wall, where was a flue of hot air.

The movements of the leaves of *S. canariensis* may be compared with the movements exhibited in *S. interrupta*, the seedlings of which species were only twenty-five days old; those of *S. canariensis* were seventy-five days old; both were placed in identically similar conditions.

S. interrupta.—Jan. 21:—

A. 1st and 2nd leaves apart,		21 mm.
B.	,, ,,	18 ,,
C.	,, ,,	19 ,,

Jan. 22, 10 A.M.:—

A. 1st and 2nd leaves apart,		26 mm.
B.	,, ,,	21 ,,
C.	,, ,,	22 ,,

Jan. 22 and 23, at 6.30 (after exposure in open air):—

	(22nd)	(23rd)
A. 1st and 2nd leaves apart,	29 mm.	22 mm.
cotyledons,	38 ,,	38 ,,
B. 1st and 2nd leaves apart,	23 ,,	23 ,,
cotyledons,	32 ,,	32 ,,
C. 1st and 2nd leaves apart,	30 ,,	25 ,,
cotyledons,	26 ,,	26 ,,

Further comparison in both species shows that if they are placed out in open air they assume positions in which the leaves are further and further apart—due to growth in relation to light; but, whenever the above species, and also various others are brought into the drier air, and the greater darkness of the room, they exhibit movements such as we have indicated. Thus, the tips of leaves in *S. canariensis* moved from a position, 40 mm. apart, to a position of close contact, one leaf extending a little beyond the summit of the other, however.

It is perhaps not worth while to record these movements at greater length. Some leaves, especially when very young or old, being either too much appressed or too much recurved, exhibited no movement; thus, within two days, leaves of *Tenorii* moved from 57 mm. apart to 30, and back to 34, whilst younger leaves retained the more fixed position, 11 or 12 mm. apart. Some seedlings also exhibited greater divergence than others.

Although we have considered that this movement is brought about in many instances by altered conditions of moisture in the air about the plant, we cannot say whether it is a movement commonly to be observed in nature with a view to protect the tender leaves of the bud. The movements of the leaves may readily be so influenced by too great drought, when the soil in the pot becomes dry. We attempted to ascertain whether in mature plants of these and other species growing in the open air there was evident movement, but our observations were perhaps too limited in time to allow us to detect such.

Observations regarding the Flora of the Alpes Maritimes. By Philip Sewell.

(Read 10th July 1890.)

The following notes may present to the Society some picture of the rich alpine flora of the Maritime Alps, as seen in the neighbourhood of the Col di Tenda—a flora the more remarkable and interesting because, only 20 or 30 miles distant, that of the shores of the Mediterranean is almost African in its character.

As pointed out by Ardoino,* within this region, shut in between the northern bounds of the Maritime Alps and the sea, there is a flora, of over 2400 species, so much richer than that of the British Isles, whilst the area containing this wealth of species is not half the size of the island of Corsica.

New habitats for interesting rarities, such as *Fritillaria delphinensis,* known as *F. Burnati,* and also for *Primula Allioni* are recorded amongst our finds. The presence of this *Fritillaria* in considerable abundance is the more welcome to botanists because the Italian Government have prohibited access to its other known habitat—the slopes of the Col di Tenda, where they have erected extensive fortifications. Other notes as to fresh localities will, if of sufficient interest, be incorporated with Professor Penzig's forthcoming work on the "Flora of Liguria."

The disused Monastery of San Dalmazzo di Tenda, our station for a fortnight, is distant from the shore at Ventimiglia about 30 miles. It is just within the limits of the present Italian frontier line, and but a short distance from the famous pass leading from Liguria to the plains of Piedmont. From San Dalmazzo as headquarters, we were able in a few hours to reach either the sea-coast and its typical flora or the high altitudes of 8000 to 10,000 feet, where, at the time of our visit, was a considerable amount of snow; none of this, however, persists throughout the summer, except in the more shaded drifts.

The typical Mediterranean flora, as seen about La Mortola

* *Alpes Maritimes,* ed. ii., 1879.

and Ventimiglia, in shaded places among the olives, or along some of the river-sides, during the early summer months, presents a luxuriant growth of herbs, amongst which *Gladiolus, Narcissus, Allium neapolitanum, Arum italicum,* and *Arum ariseum* are prominent.

But the characteristic expanses of the country along the coast are the bare hill-sides, which are exposed during a rainless summer to the full glare of a scorching sun, where species of *Euphorbia, Cistus, Helianthemum, Galium, Thymus, Lavandula, Rosmarinus, Myrtus, Coris,* and species from several genera of *Leguminosæ,* amongst them the attractive but terribly spinous *Calcycotome spinosa* and *Spartium junceum.* Along the shore *Alyssum, Glaucium, Cineraria maritima, Moricandia, Diotis,* and other sea-beach plants occur, some of which are very widely spread throughout Europe. Plants growing upon the dry and scorched slopes have a distinct character of their own; their leaves are small, often linear, and rolled up at the edges, more commonly still they are coriaceous or fleshy; the whole plant is woody and low-growing, appearing truly as if it had a hard time of it, at least through the long summer. These characters particularly impressed us at the first, as so clearly offering resemblance to the character of plants such as *Ledum, Diapensia, Draba, Andromeda, Loiscleuria, Phyllodoce,* that we had noticed as especially characteristic of the exposed slopes of Lapland.* In the one case it is the hardship of a scorching sun and intense radiation, in the other it is freezing winds, but the effect upon the plants growing in these exposed places is the same, whether the difficulties they encounter in their struggle for existence be those associated with a frozen or with an arid zone. The plants of the more shady ravines—*Pistacia Lentiscus, Coriaria, Nerium Oleander, Myrtus, Coronilla, Arum, Serapias, Ophrys,* &c.—are no less characteristically southern. On the higher levels away from the sea the lemons, oranges, figs, and olives, the delight of all visitors to the Riviera, have disappeared. Choice gardens, such as that of Mr Hanbury at La Mortola, where so many semi-tropical plants exist, if transplanted to one of the valleys ten miles away from the sea-shore, would succumb to the frosts of the first winter.

* See *Trans. Bot. Soc. Edin.*, vol. xvii. p. 444.

The flora among the chestnuts, 2000 to 3000 feet above the sea, at Dalmazzo, is indeed a different one from that we have referred to as characteristic of the coast. The turf was rich with many gay species, but probably most noteworthy of all were the handsome flowers of *Lilium bulbiferum*, *L. Martagon*, *Anthericum*, and *Asphodelus*. Also specially, where great masses of rock cropped out, were *Sedum*, *Sempervivum*, and *Saxifraga*; among the last-named, *S. cuneifolia*, *S. Aizoon*, and *S. lingulata* were most abundant. So too was *Vincetoxicum officinale*, a plant rivalled in more wooded places by *Helleborus fœtidus*, and in the one locality of the Miniera valley, by *Geranium macrorhizon*.

In the Miniera valley plants of the alpine flora make their appearance at an elevation of 4500 and 5000 feet above the sea, where is an open wind-swept level in which, even in the middle of June, snow from the winter's avalanches may here and there remain. *Primula marginata* was abundant on the rocks on all sides, and near to the melting snow of the avalanches, where the turf was all pressed down and brown, were slopes enriched amongst other plants by a few individuals of *Rhododendron ferrugineum*, which had doubtless spread themselves from the great masses of this plant so predominant higher up the mountain sides among the pines. So, too, a few flowers of the remarkable yellow variety of *Fritillaria delphinensis*, known as *F. Moggridgei*, caused us to hunt more carefully, until 1000 feet higher up, acres of grassy slope, covered with the plants bearing their golden-coloured blossoms, were reached. At about the same altitude as the above-mentioned species we found amongst some rocky debris:—*Atragene alpina*, *Aconitum Napellus*, *Eranthis alpinus*, *Lonicera alpigena*, *Riscutella Burseri*, *Linaria supina*, &c. At still higher altitudes in the valley, the grassy slopes were adorned with *Ranunculus pyrenœus*. But after reaching an elevation of 6500 feet, we found the snow too abundant to allow full examination of the commonest plants; though, on certain sunny slopes of debris facing the south, were several plants of special interest to us, such as *Silene acaulis*, which, in this locality, had a peculiarly compressed habit, not always seen in alpine regions, but which was the characteristic form met with by us on the shores of the Yugor Straits.

Lloydia serotina, mentioned by Ardoino as known in this neighbourhood, was a very characteristic plant along the northern shores of the Siberian tundra. The red snow plant was very abundant in distinct depressions in the drifts. Such depressions were, perhaps, caused by the greater absorption of heat where the plant was. The following plants were seen at this elevation of 7000 feet—about the sides of the dreary Laghi di Meraviglie. They were often curiously dwarfed forms; especially was this noticeable in *Anemone alpina* and *Ranunculus pyrenæus*:—*Ranunculus pyrenæus, Anemone alpina, Helianthemum vulgare, Viola calcarata, Draba aizoides, Cardamine resedifolia, Hutchinsia alpina, Silene acaulis, Cerastium alpinum, Mœhringia muscosa, Astragalus, Hippocrepis comosa, Potentilla valderia, Sedum anacampseros, Sedum Rhodiola, Sempervivum*, 2 or 3 species, *Saxifraga exarata, Saxifraga moschata, Saxifraga lingulata, Saxifraga aizoides, Saxifraga bryoides, Saxifraga oppositifolia*(?) *Galium* sp.(?) *Gnaphalium dioicum, Cineraria alpina, Taraxacum officinale, Campanula pusilla*(?) *Thymus Serpyllum, Veronica saxatilis, Verbascum*(?) *Myosotis alpestris, Stachys alpina*(?) *Pedicularis rosea, Primula marginata, Primula integrifolia, Androsace carnea, Gentiana verna, Plantago alpina, Daphne Mezereum, Carex rupestris*(?) *Carex sempervirens*(?) *Gramineæ*, 2 or 3 species, *Polypodium vulgare, Aspidium Lonchitis.*

On a succeeding occasion we examined the botany of the side of the mountain exposed to the south, leaving the stream of the Miniera at an altitude of 5000 feet, and ascending to an altitude of 7500 feet—reaching the line of snow, which, however, was fast disappearing at a height of 6700 feet. Upon the summit was a rich expanse of *Gnaphalium Leontopodium*, and also of the following, some of which were seen at considerably lower elevations:—*Saxifraga oppositifolia, Saxifraga cæsia, Globularia cordifolia, Dryas octopetala, Draba Wahlenbergii, Potentilla verna, Potentilla maculata.* In the course of various observations as to the first appearance and the subsequent disappearance of various species, ranging in altitude from 6500 to 7500 feet, we found that it was after a break of 1000–1500 feet that damp slopes repeated the flora of the valley below. In both places the turf was richly covered with *Crocus, Gagea, Ranunculus pyrenæus,* *Gentiana*, &c. Between was a dry steep upon which grew *Helianthemum, Helleborus, Erysimum, Saponaria, Astragalus, Cytisus, Genista,* and various species of *Carlina* and *Carduus.* The greater warmth of the more open position had indeed matured the plants of the higher level more than was the case among the plants of the same species in the lower valley. *Gagea* and *Scilla bifolia* were in fruit, whilst the grasses of the turf were much more advanced. Additions to the flora observed in the valley below were numerous, an especially good find being the exceedingly rare dark variety of *Fritillaria delphinensis,* known as *F. Burnati,* a plant which (as we have remarked) it is the more interesting to find because access to the only other known locality in the region is on the prohibited Col di Tenda.

In certain curious and deep depressions occurring in this upper meadow, there was a constant succession of the three plants *Crocus albiflorus, Gagea Livitardi,* and *Ranunculus pyrenæus.* The *Crocus* was always lowest, its flowers pushing out from the discoloured turf from which the snow had only just melted; above this, on the shady side especially, was the *Gagea,* and above the *Gagea,* in greater profusion on the sunny side, was *Ranunculus pyrenæus.* Elsewhere, at the same altitude, although the presence of the *Crocus* was not observed, the darker colour of the green leaves in little isolated depressions in the meadow showed the persistent selection by the *Gagea* of positions of more than average moisture. On the other hand, the *Viola calcarata* preferred generally some slightly raised position whilst *Viola biflora* was conspicuous in the shade immediately about numerous large boulders. *Viola biflora* did not ascend to such altitude as *V. calcarata,* nor indeed did *V. palustris* or *V. hirta* in the region about Mont Blanc, where they were nevertheless seen at an altitude of close upon 7000 feet. It is of interest to note that, in Lapland, although *Viola biflora* may everywhere be seen associated with such damp-loving plants as *Veratrum,* and others of these mountains, yet *Viola calcarata* is unknown.

We ascended the mountain on the south side of the Miniera Valley that comparison might be made with the flora just described on the northern slopes. At a height of

6500 feet, snow was in such abundance as to prevent any examination of the flora. We left the valley at the same point from which we had set off previously. An almost entirely different flora was to be observed. As might be expected, *Vaccinium Myrtillus, Rubus Idæus, Paris quadrifolia, Soldanella, Tussilago,* and great masses of *Saxifraga cuneifolia,* were abundant. Higher than these, *Rhododendron ferrugineum* monopolised all the shadier places. Most interesting of all were some acres of *Fritillaria delphiniensis,* var. *Moggridgei,* which gave an effective yellow colour to the whole slope upon which they were growing. *Ranunculus pyrenæus* was the only other plant in any abundance upon this eastward facing slope.

A great expanse of rich green pasture for goats on mountains near to Mount Tanarello, especially attracted our attention. Above were the steep rocky summits, upon which, clearly enough localised, were patches dark with "Alpenrose," where the more constant mists allowed of its growth at elevations between 6500–7500 feet. In the broad conspicuous belt of verdure were sheets of *Anemone narcissiflora* (*Anemone alpina* was a little lower down), *Trollius, Veratrum, Gentiana lutea, verna,* and *acaulis; Orchis pallens, conopsea, ustulata,* and other species, *Pedicularis rosea,* &c. *Meum athamanticum* was exceedingly plentiful, especially in a somewhat damp depression; we had seen it in other localities, in actual swamps associated with *Caltha, Trollius, Colchicum autumnale, Ranunculus repens,* and *Polygonum Bistorta.*

We may call attention to the following genera as apparently more or less distinctive of the alpine and subalpine flora about Tenda, or because they are otherwise noteworthy on account of their predominance or curious distribution. *Helleborus* was represented by *H. fœtidus* and *H. viridis;* the former often reached altitudes of 6500 feet; at times, in rocky places amongst pines, it was quite the most prominent plant. Its range is more extensive than most plants that we observed, as it is a constant inhabitant of the steeps and somewhat shaded places near to Mortola, within fifty feet of the sea-level. It is a denizen of pine woods in the north of England, but does not extend north of Belgium on the continent. *Chelidonium majus* we noticed only in the grounds of the monastery of San Dalmazzo, although spoken of as *assez commun* in Ardoino's flora. Hooker describes it as native to Arctic Europe, but it was not one of the plants of which we saw any trace in Lapland or North Russia. The genera of Cruciferæ, observed at high elevations, were very different from those characteristic of northern latitudes. The comparative absence of species of *Draba*, the presence of several species of *Iberis*, and the frequency of the gay yellow flowers of *Biscutella Burseri*, were distinctive features in the flora. The excessive predominance of *Cerastium* and *Stellaria* which characterised the northern alpine regions gives place to a greater number of genera of that family, many of them brilliantly red or crimson coloured, and widely distributed, as, for instance, *Dianthus* and *Saponaria ocymoides.* There was almost an entire absence of *Malvaceæ* about Tenda. *Daphne Mezereum* was one of the most ubiquitous of the plants in the Alpine and sub-Alpine floras. *D. Laureola* was seen once in the gorge below San Dalmazzo. *Urtica,* so ubiquitous a plant throughout the world, reached a maximum elevation of 6000 feet, about some cattle troughs. The presence of *Maianthemum bifolium,* seen later on Monte Generoso, was exceedingly interesting to us. *Asparagus officinalis* did not extend much above San Dalmazzo; other members of this alliance, as *Paris quadrifolia, Polygonatum officinale,* and *P. verticillatum* were restricted to the Miniera Valley at an elevation of 5000 feet, or thereabouts. *Gagea Lidelardi* we have mentioned as one of the most abundant plants in damp places. *Tulipa australis* and *Scilla bifolia* we only observed once at an altitude of 6500 feet. There were two or three species of *Allium. Muscari comosum* was common in the meadows.

The Ferns collected by us were the following:—*Ceterach officinarum,* abundantly in the shadier places near the coast. *Polypodium vulgare,* actually up to 6500 feet about the snowy valley of the Laghi di Meraviglia; *P. Phegopteris* and *P. Dryopteris, P. Robertianum* (?); *Aspidium Lonchitis,* up to 7000 feet; *A. Filix-mas, A. fragile, Asplenium Adiantum-nigrum, A. Ruta-muraria,* near to Mortola; *A. septentrionale,* abundant about Tenda; *A. Trichomanes, A. Petrarchæ,* near Mentone; *Adiantum Capillus-veneris, Allosorus crispus, Pteris aquilina.*

At Courmayeur, a famous Alpine village near the foot of Mont Blanc, and at the head of the most picturesque Val d'Aosta, we found an absence of the large flora of the lower zones, though there are traces of the flora distinctive of San Dalmazzo. Mr Hanbury believes that the varied floras of Tenda are richer than those seen in the Great Alps, and the results of our visit appear to favour this conclusion, though it was made in July, a later period of the summer than when we collected at Tenda. Round Courmayeur we collected various plants of the pine woods—*i.e.*, near to Mortola, *A. septentrionale;* abundant about Tenda, *A. Trichomanes, A. Petrarchæ;* near Mentone, *Adiantum Capillus-veneris, Allosorus crispus, Pteris aquilina, Pyrola uniflora, P. rotundifolia,* with *Neottia Nidus-avis;* nearer the mountain summit we picked up *Empetrum nigrum,* two species of *Vaccinium* and *Lycopodium Selago,* which we had not found at similar elevations in the region about Tenda. So, too, regarding the following, seen near to Courmayer, but not observed about San Dalmazzo:—*Anemone Baldensis ? Campanula spicula, Epilobium Fleischeri, Silene Otites, S. campanula, Primula farinosa, Parnassia palustris,* &c. On the other hand, we missed in this mountain region the extensive patches of *Anemone narcissiflora* and *A. alpina.* Masses of *Ranunculus pyrenæus,* as well as of *Primula variabilis* and *P. officinalis,* characterised in a sparse way the green turfy slopes of only one locality.

Apparently a young plant of *Lilium bulbiferum,* which was first found growing abundantly along with *Asphodelus albus,* at an altitude of 5520 feet, ascended as high as 8000 feet. One plant of *Gentiana verna* was seen—a striking contrast to its profusion on the slopes of Col di Tenda; so, too, was *G. acaulis,* though not confined to a single specimen. Great patches of *Gentiana Burseri* were seen in flower up to an altitude of 6500 feet, on the slope opposite to the southern crags of Mont Blanc. Forming part of such patches were *Ranunculus aconitifolius, Veratrum album, Myosotis sylvatica,* &c. The steeper slopes higher up were covered almost solely by *Rhododendron ferrugineum* and *Vaccinium Myrtillus,* though mosses also abounded. At the foot of the Glacier of the Brenva, amongst the rock masses of its terminal moraine, were *Epilobium Fleischeri, Linaria alpina, Sempervivum, arachnoideum, Bellidiastrum Michelli, Biscutella Burseri*, &c., together with other less conspicuous *Cruciferæ* and *Caryophyllaceæ*.

The varied floras of these Alpine regions are well worth a thorough investigation by botanists, specially from the point of view of the botanico-geographical distribution of species.

Excursion of the Scottish Alpine Club to Braemar in 1889.

By Charles Stuart, M.D.

(Read 12th December 1889.)

The party this season was constituted by Professor Bayley Balfour, President, the Rev. Geo. Alison, chaplain, the Rev. D. Paul, the Rev. W. W. Peyton, Dr Stuart, and Dr Macfarlane and Messrs King and Turnbull as visitors. Travelling, on the 16th July, by the Fife route, we reached Braemar at 5.30 P.M., and were most comfortably accommodated at The Invercauld Arms. Through the courtesy of Sir Algernon Borthwick, Bart., M.P., the lessee of the Invercauld Deer Forest, we obtained permission to go to the corries of Bein-a-Bhuird, and also to Craigindal, for botanical purposes. The best thanks of the Club are due to him. Mr M'Hardy, his chief forester, acted as our guide.

On the morning of the 17th, at seven o'clock, the mountains were draped to their base in mist after a night of rain, but in the low country the rain cleared off by the time we started for Bein-a-Bhuird. Entering the pine woods behind Mr M'Hardy's house, we made northwards till we reached a pony track, which led us due west behind Cairn-na-Drochel, through Glen Candlich, to Sluggan Lodge, a hill cottage with offices, which may be five miles from Braemar and halfway to Bhein-a-Bhuird. By the sides of the path *Vaccinium Myrtillus*, covered with fruit, was in abundance, and *Erica cinerea* was in fine bloom. *Epilobium angustifolium*, Linn., was in bright flower, varying in height from a few inches in the higher regions to several feet lower down. On the rocky slope leading up to Sluggan Cottage many sub-alpine plants flourished, various willows covered the banks, the ground being carpeted with the oak and beech fern in profusion, while species of *Hieracium* and *Hypericum* gave a colour to the greenery all around. Shrubby plants assumed a prostrate habit here. The common broom, *Sarothamnus scoparius*, Koch, for example, instead of being upright, was flat on the ground. By the time Sluggan Lodge was reached the weather had become worse, a small cold rain coming down through the mist, and wetting us to the skin. The Ben was veiled to its base. Passing the shooting lodge, the heathery moors extended in every direction, Glen Quoich lying across the valley. A northerly direction was taken. Along the path *Drosera anglica, Arctostaphylos uva-ursi, Lycopodium annotinum, Pyrola media, Betula nana,* and *Cornus suecica* (in fruit), were observed.

Considering the season of the year, the cold was very trying, a north wind sending the rain in our faces as we crossed the stream coming from the lofty Ben Avon, and followed the steep course of the burn, flowing in a westerly direction from the Dhu Lochans in the corries of Bein-a-Bhuird. Here *Loiseleuria procumbens* was growing in profusion, its flowering season nearly past. Higher up the slopes, among boulders rolled down from the corry in which is Dhu Lochan, grew quantities of *Polypodium alpestre* and *Aspidium dilatatum*, in fine colour and many beautiful forms. The precipitous rocks round the higher Dhu Lochan were carefully examined, but proved very bare indeed. Not a single good *Carex* was obtained. The ordinary mountain saxifrages were plentiful, and our President, near the melting snow, gathered *Saxifraga rivularis* at the spot where the late Professor Balfour found it many years ago. This was the best plant obtained on this excursion. Notwithstanding the rain and mist, several of the party pushed on to the summit, which is not much under 4000 feet high, but the cold prevented any lengthened examination, and the party returned to Braemar by the route taken in the ascent, reaching the hotel after an absence of about twelve hours.

Among other plants obtained during the day were *Phleum alpinum, Saussurea alpina, Sibbaldia procumbens, Veronica alpina, Carex rigida, Tofieldia palustris, Hieracium alpinum, Cerastium arvense, Caltha palustris, Trollius europæus, Salix herbacea, Genista anglica,* and *Pyrola minor.*

At our evening meeting many well-known faces were missed, and I do not understand how the business was got through without Dr Craig, our energetic Treasurer.

On the 18th of July in fine weather we drove to Loch Callater, where our party divided. The President, with the main body, went by the right side of the loch, following the track by the stream till the ridge facing the loch was attained. After an hour's walking from the ridge, the party reached the Little Gilrannoch, the old station for *Lychnis* *alpina.* The plant, which has not been gathered for many years, owing to the exclusiveness of the owner of the Clova forest, was seen in quantity. In place of going into Glen Dole, "the riggins" were kept, till the spot over Glen Fee was reached, the habitat of *Oxytropis campestris.* Plenty of this fine plant was got at the old station. The *Oxytropis* as gathered was in fine state—the flowers pure white, and fragrant. When grown on the rock border in the south, the flowers are of a dingy white, and very different from those bathed in the dews of Craig Maid. The party also obtained *Saxifraga nivalis, Alopecurus alpinus, Phleum alpinum, Cornus suecica, Galium boreale, Carex pulicaris, C. rivalis, C. stellulata, C. curta, C. alpicola, C. aquatilis, C. vulgaris, C. pallescens, C. pilulifera, C. flava, C. binervis, Polystichum aculeatum, Trientalis europæa,* &c. Rev. G. Alison and myself walked by the right side of the Loch Callater, and up the valley till where the burn from the Breakneck Fall enters, and also the stream from Loch Ceann Mohr, which we followed to the loch and corry. We went straight up through the corry to the ridge—a very steep climb indeed,—on attaining which we looked over the plateau traversed by our friends to the Lychnis station, &c. Thereafter we shaped our course due south, always on the ridge, till we reached the summit of Cairn Glaishie. The air was clear, and we had a very extensive prospect over the country, both north and south. Glas Maol and Canlochan, Caness and Glen Islay were all well seen from our elevation. Descending into Corry Ceann Mohr, we carefully botanized all the best spots in it. The plants gathered on a former occasion were *Salix Sadleri* and *Carex frigida.* The chasm in which grows *Mulgedium alpinum* is inaccessible without ladders. The rarer species of Carex were very scarce, owing to the dry weather in June. The chief feature of the rocks is the profusion of alpine willows growing over their faces and ledges. *Salix lanata,* by far the most beautiful of the willows, was gathered with *S. reticulata, S. myrsinites, S. Lapponum, S. herbacea,* and *S. arenaria.* We walked slowly down to Loch Callater Lodge, slanting Cairn Turc on the way, and reached the keeper's lodge at the foot of Glen Callater by 6 P.M., the appointed hour, but there was no sign of our Clova friends. After tea, there being still no sign of the Clova party, Mr Alison and myself set off and walked to Braemar, six miles in an hour and a half,—not bad work after a hard day's fag. We had just got to the entrance to the village when the carriage arrived with our companions, greatly pleased with the success of their excursion, and a dinner at 10 P.M. terminated the labours of the day.

Accompanied by Mr M'Hardy, the Club paid a visit to the classic ground of Little Craigindal, in very fine weather, on Friday, the 19th July. Although the mountain is named Little Craigindal, it by no means answers to its designation, for it is composed of a huge mountain mass, and in height is only slightly lower than its bigger brother, Muckle Craigindal, which is separated from it by a deep valley, in the bottom of which runs a stream, Alt-na-Vrotachan. Our route lay across the Dee, and through the pine wood, behind Mr M'Hardy's cottage, till we crossed the Sluggan water. The track along which we walked to Bhein-a-Bhuird was again followed till the second burn crossing the track was reached, when, turning to the right, we followed the course of the stream Alt-na-Vrotachan for about three miles. Near some natural wood on the left of the stream we gathered *Pyrola secunda* and *P. rotundifolia*. Reaching the outworks of the mountain, covered with the glowing purple heather, which brightened the hillside, we again came on abundance of *Betula nana*. As we attained some elevation two large gray boulders were observed on the right hand, near the summit of the hill. Mr M'Hardy names the largest the Botanist's Stone. In common parlance it is named "The Sheep," and constitutes a guide to the part of the mountain on which the *Astragalus alpinus* grows. We started the ascent, which made the walk easier, but the distance is considerable—two hours' good tramp from Braemar. On the hillside, below the situation of the stone, in the turf, *Astragalus alpinus* grows in abundance. We found it in fine flower, and its delicate pinky-lilac blossoms were very beautiful. The roots are very long, and difficult to dig up in an entire state. Near the ridge of the hill the plants assumed an alpine smallness, but lower down they were much larger, and covered a considerable space of the hillside. The deer are fond of this Vetch and eagerly feed upon it. On the ridge *Dryas octopetala* was abundant, also *Veronica saxatilis, Galium boreale, Silene acaulis, Salix myrsinites, Potentilla rupestris, Polystichum Lonchitis, Saussurea alpina, Loiseluria procumbens, Cornus suecica, Tofieldia palustris, Lycopodium annotinum, Avena pratensis.* On a rocky face on Cairn-a-Drochel specimens of *Asplenium septentrionale* were obtained, the habitat being shown by Mr M'Hardy. *Astragalus alpinus* was the plant we most wished to see, and its discovery by the late Professor Graham and Dr Greville, in 1831, in the Glen of the Dole, was a very lucky one. Later on the late Professor John Hutton Balfour discovered it on Little Craigindal in far greater profusion. In company with Mr P. Neill Fraser, Dr Craig, and others, I have gathered this plant on Ben y Vrackie, near Pitlochry, in abundance. Mr Fraser, who discovered it there in 1884, certainly deserves great credit, for the hill must have been examined previously on many occasions by competent botanists without the Astragalus being observed. Craigindal is the sanctuary of the deer, and Mr M'Hardy kept sharp watch on our movements, in case we should frighten the herds over the march into the Duke of Richmond's forest. Noble herds were seen crossing the valley, while we were reposing near the ridge, on their way to Ben Avon. Mr Paul left the party on the hill, having to return to Roxburgh in the afternoon ; the rest of us reached Braemar in time for dinner, after a very pleasant excursion.

On Saturday, the 20th July, Dr Macfarlane and Mr Turnbull left by morning coach for Edinburgh. Some of us visited the Linn of Corrymulzie and Morrone Woods, getting nothing in the way of rare plants, but admiring the fine panorama of lofty mountains near the source of the Dee, which were clear to their summits. The weather being fine, we extended our walk till it was time to return to Braemar, where we found everything *en fete,* as the Shah of Persia had arrived in our absence at Invercauld. Our President and Mr King represented the Scottish Alpine Club at the ball given in the evening, and we all separated to our several homes on the 22nd, greatly the better of our excursion to Braemar.

A Comparative Study of Chlorophyll as occurring in some Algæ, Vascular Cryptogams, and Phanerogams. By GUSTAV MANN. (With Spectra in Plate II.)

(Read 10th April 1890.)

After making myself familiar with the literature published up to June 1889, I commenced studying the green colouring-matter of the fresh-water alga *Spirogyra*—firstly, as to its microscopic appearance, and secondly, as to its absorption-spectra, alike in the living organism and when extracted by various media. I then examined spectroscopically the marine alga *Ulva*, and finally I investigated representatives of the vascular cryptogams and of the phanerogams.

STRUCTURE OF CHLOROPLASTS IN SPIROGYRA.

As is well known, the chloroplasts occur in this alga in the form of bands, arranged spirally in the peripheral protoplasm, and, according to the species, these vary in number and in the amount of chlorophyll. Thus we find in *Spirogyra nitida*, Dillw., considerably greener and less transparent bands than in *Spirogyra jugalis*, Dillw., and for this reason the latter was chosen for the microscopic investigation of the green ground-substance. I shall only state here the result of my observations so far as they are necessary for the understanding of the investigation of chlorophyll I record in this paper. Other structural points are described in my paper, "Some Observations on Spirogyra," which follows this.

The microscopic examination of *Spirogyra jugalis* was carried on with the help of a 1½ mm. Prazmowski water immersion lens, in combination with various apochromatic eye-pieces by Zeiss.

The entire chlorophyll-band has a wavy outline, and is bounded by a clear protoplasmic layer. This hyaline layer does not give, however, the impression of a distinct membrane, but resembles rather the clear protoplasmic material lining the interior of a normal cell-wall. Enclosed by this clear bounding layer is the ground-substance, which consists of a finely granular mass of green protoplasm, arranged in the form of a network, or it is perhaps more correct to say, rendered spongy by the presence of a fatty material, the greater part of which usually aggregates to form oil-globules of various sizes, while a small quantity is diffused through the ground-substance. The larger oil-globules may be recognised by looking for granules which will, according to focussing, either become darker or lighter than the ground-substance; and sometimes it is possible to make out that these globules are slightly yellowish-green compared with the green protoplasm.

In vigorous threads I have several times seen a vibrating motion in the green ground-substance, specially near the oil-globules, and also by looking along the clear protoplasmic envelope of the chloroplast that small bulgings are formed, which after a time will collapse; and I believe that when the bulgings collapse a small quantity of oily material is given out directly into the surrounding protoplasm, and that the material may be seen there as minute granules, smaller than the microsomata. I have, however, not been able to make out the actual cutting off of the granules, although I looked most carefully.

These observations on perfectly normal material seem to be verified by the use of staining reagents, and the stains I found to answer my purpose best are—

1. *Cyanin, or Bleu de Quinolein,* in a 10 per cent. solution in absolute alcohol.
2. *Tincture of Alcanna root,* concentrated till a precipitate begins to form.
3. *Osmic acid* in a 1 per cent. solution.

Cyanin has a remarkable affinity for all fatty bodies, staining them a bright blue colour, and as it is readily taken up by Spirogyra without seemingly doing much harm, if sufficiently diluted, it is of the highest value in ascertaining where exactly fatty material occurs in a cell. To stain the chlorophyll-bands most successfully, I found the following plan the best:—A glass vessel is filled with two litres of water, to which six drops of the above-stated solution of Cyanin are added; then a small quantity of either *Spirogyra jugalis* or *Spirogyra nitida* is placed in the vessel, and the latter exposed to bright daylight. After some time, varying with the temperature of the room and the activity of the threads from three to twenty-four hours, the whole of the Cyanin will have been taken up by the threads. If the latter be examined microscopically, we find the ground-substance of the chlorophyll-bands to have changed from a green to a bluish-green colour, while the oil-globules in the ground-substance have taken on a blue colour. But beside the globules in the chlorophyll bands, many of the microsomata between the bands have turned distinctly blue, thus revealing their fatty nature.

If concentrated tincture of Alcanna root be used, it is necessary to leave the *Spirogyra* material for twenty-four hours in the staining fluid, and then to wash out the threads in distilled water. Tincture of Alcanna root is, however, much inferior to Cyanin, as the alcohol is very apt to dissolve out the fatty material of the chloroplasts, and to deposit it in large globules at the margin of the bands, or in the general protoplasm. When the oil-globules are deposited along the chlorophyll bands, we get an appearance very similar to the hypochlorin reaction. The globules appear at first to be quite black, but with strong light they are seen to be dark red, with the characteristic microscopical appearance of oil-globules. The ground-substance of the chlorophyll-bands will appear spongy, and stained of a pale pink colour.

Osmic acid is inferior to both Cyanin and Alcanna, as it is apt to stain the whole cell; but again we find the oil-globules and the bands stained brownish-black.

Absorption-Spectra of Chlorophyll.

After completing the microscopical investigation of *Spirogyra*, I began the study of the absorption-spectra of chlorophyll. The instrument used was a Browning spectroscope, and I take this opportunity of expressing my sincerest thanks to Dr Haycraft, who made me familiar with the working of the instrument and with the calculation of wave-lengths in millionths of a millimetre [λ] by interpolation curves, after the method described by Dr MacMunn in his work, *The Spectroscope in Medicine*, page 32. The method is :

A piece of paper ruled into square inches and tenths has a scale of wave-lengths ruled off along one edge, and the edge at right angles to this has a scale corresponding to the scale of the instrument marked on it. The value of the Fraunhofer lines on the scale of the spectroscope is observed, and also their value in wave-lengths; they are then marked in their proper places on the scale with two x x. A curve is then drawn through these marks as uniformly as possible. When a band or bright line has to be mapped out, all that is necessary is to take its reading on the scale; then, knowing between what lines it is placed, we find its position on the curve opposite which its wave-length is printed on the right-hand edge." *

In all the absorption-spectra which I have drawn I have endeavoured to be as accurate as possible in giving to the different absorption-bands their true extent and their respective degree of intensity of absorption.

Spirogyra.—Various species were tried, but I give the preference, when studying living chlorophyll, to slender species, as they seem to let the light come through more uniformly. *Spirogyra longata*, for example, serves the purpose admirably. The first spectrum I attempted to define was that of chlorophyll in its living condition, and I proceeded thus: By means of a glass rod a quantity of threads running parallel with one another was lifted out of a basin; the material assumed the shape of a cone, and was carefully introduced into a test-tube, sufficiently wide to allow of its being filled with water after the glass rod supporting the threads had been laid across the mouth of the test-tube. The advantage of this procedure is that we get a larger number of threads in the upper part of the test-tube as compared with the lower end, and therefore we may study readily the modifications which the spectrum undergoes according to the amount of light absorbed by various thicknesses of the material we are examining; all we require to do is to arrange the test-tube in such a way before the spectroscope that a green pencil of

* The wave-lengths of Fraunhofer lines are, according to Ångstrom, in *Recherches sur le Spectre Solaire, Spectre Normal du Soliel*, p. 25. Upsala, 1868.

A = 7604.	B = 6868.	C = 6562.	
D = 5892,	E = 5269.	F = 4860.	G = 4307.

light falls on the slit of the spectroscope; direct sunlight should be used in the first instance, and if a thick layer of threads has to be examined, the rays should be condensed by a lens. By arranging the test-tube in such a way that the light falls through its lower end, we get the following spectrum (*vide* spectrum 1, Plate II.):—

1. In the middle, between the lines B and C, a rather dark band, λ 678—λ 662.
2. To the right of C a second very faint band, λ 654—λ 638.

At the blue end of the spectrum absorption commences at λ 531, and then shows again very little absorption about λ 459, thus we have marked out:

3. Absorption to the left of λ 459, the centre of this absorption about λ 485.
4. To the right of λ 459 absorption again occurs, and I think it is possible to see most absorption about λ 450, the spectrum to the right of λ 450 (about λ 445) showing again less absorption, after which we have the normal absorption towards the extreme end of the spectrum.

This result, so different from the absorption-spectrum usually given, inasmuch as band 2 has, to my knowledge, never been observed before, made me at first dubious about the material I was working with, therefore some fresh material was got from the pond in the Royal Botanic Garden and investigated by the same method, and it gave results identical with the first. It appears, therefore, that what Kraus has described as the first band of chlorophyll really consists of two bands; and in confirmation of this, if a thick layer of *Spirogyra* is used in the experiment by letting the light fall through the upper part of the test-tube, prepared as was stated above, only one band will appear in the red end of the spectrum, and this band has a breadth λ 686—λ 641, including, therefore, the two bands, one with wave-lengths λ 678—λ 662, and the other with wave-lengths λ 654—λ 638. The second band (λ 654—λ 638) can only be seen, firstly, if the layer of green material examined is thin enough to prevent band 1 becoming very evident by widening out and fusing with the second band, which itself becomes darker; and if, secondly, not too much light is used, or the pale second band will be "flooded" with light, and will be invisible.

This second band is most evident if an Argand burner be used as the source of light; and also when working with cryptogamic and phanerogamic plants I find it best to use the Argand burner, as the Fraunhofer lines in the red end of the spectrum are very apt to mislead in the calculation of the absorption-bands. I may mention further that, although many authorities who have been working at chlorophyll state that the bands in the blue end of the spectrum can only be seen in sunlight, it is not only possible to see them in artificial light, but to me at least they are as evident as in sunlight, if not more so.

Whether it is possible to see Kraus' bands II. and III. in *Spirogyra* when examined as above stated I cannot definitely say; but sometimes when working with very thick layers I believe I have seen an absorption in the yellow orange, but I am not able to prepare material to demonstrate the bands beyond all doubt.

The absorption in the blue end of the spectrum with its centre, about λ 485, is evident enough; but the second absorption, with its centre about λ 450, is very difficult to make out.

I next proceeded to make an alcoholic extract in the following manner:—*Spirogyra*, in as healthy a condition as possible, was carefully washed in distilled water to remove all impurities, organic and inorganic, which might be clinging to the threads, and then placed on filter paper in a thoroughly cleaned glass funnel; and after five minutes, when most of the water had run off, it was placed by means of a glass rod into another funnel and pressed down firmly, without injuring the threads, however, and absolute alcohol was poured slowly over the mass; after two to three minutes a good deal of the colouring-matter was extracted, and then the absolute alcohol, which had been collected in a wide test-tube, was filtered twice and examined at once. The whole process occupied about ten to fifteen minutes after washing the material in distilled water, and was conducted in a room with just sufficient light to allow me to see what I was doing.

By pouring the alcoholic extract into test-tubes of different diameters we get the same effect as if we were working with extracts of different strengths. A moderately strong solution is to the naked eye dark green by transmitted light, and shows the well-known fluorescence, of a colour like fresh blood-clot. It has the following absorption-spectrum (spectrum 2, Plate II.):—

1. Band I. of Kraus, λ 678 – λ 628.
2. „ II. „ its centre = λ 604.
3. „ III. „ its centre = λ 575.
4. General absorption commencing at λ 518, very dark at λ 504.

It will be seen that there is no absorption in the green part of the spectrum corresponding to Kraus' band IV., and a solution which will show the three first bands as plainly as shown in spectrum 2, Plate II., will not show the slightest trace of a band in the green.

Spectra 3, 4, 5, 6, and 7 (Plate II.) are of special importance for the understanding of the band in the green. I shall, however, state only shortly at present what these figures represent, and shall discuss the band fully afterwards.

Spectrum 3 shows the absorption-spectrum of a very concentrated alcoholic extract from fresh material after standing for forty-eight hours. The layer used was so thick as to appear to the naked eye on transmitted light of a dark red colour:—

1. Absorption from λ 690—λ 555.
2. „ „ λ 543 [centre = λ 535]—λ 527.
3. „ commencing at λ 515.

Spectrum 4, the alcoholic extract, the spectrum of which is shown in spectrum 3, was evaporated on a water-bath, the black-green residue dissolved in as much benzol as to have the same bulk as used in spectrum 3. The exposure to the oxygen of the air probably caused the change in Kraus' band IV.

1. Absorption from λ 690 – λ 550.
2. Band from λ 544 [centre = λ 535] – λ 525.
3. Absorption commencing at λ 515.

Spectrum 5, an alcoholic extract after boiling the material for ten minutes:—

Band 1. λ 690 [centre = λ 643] – λ 635.
„ 2. λ 618 [centre = λ 607] – λ 596.
„ 3. centre at λ 570.
„ 4. λ 542 [centre = λ 538] – λ 530.
„ 5. absorption commences at λ 517.

Spectrum 6 same as extract of spectrum 5, but after treatment with liquor ammonia:—

Band 1. centre at λ 706.
„ 2. λ 690 – λ 644.
„ 3. λ 618 – λ 596.
„ 4. λ 542 – λ 530.
„ 5. commences at λ 514.

Spectrum 7 same as extract of spectrum 5, after treatment with nitric acid:—

Band 1. λ 682 – λ 635.
„ 2. λ 618 – λ 596.
„ 3. centre at λ 570.
„ 4. centre at λ 538.
„ 5. commences at λ 517.

Spectrum 8 shows the absorption-spectrum of an extract made with benzol, freshly prepared. The two bands in the blue end are drawn in such a way that the left half of each band shows the intensity of absorption, while the right half is drawn darker to bring out the centre of the band:—

Band 1. λ 674 – λ 632.
„ 2. centre of band – λ 486.
„ 3. centre of band – λ 453.

The extract was got by triturating purified *Spirogyra*-material with benzol; after ten minutes a yellow extract with a slightly greenish tint was obtained, which showed very slight fluorescence.

Spectrum 9 represents the absorption-spectrum of an extract made with xylol from fresh material. At first the light was allowed to shine through a thin layer to define the two bands in the blue, and afterwards through a thicker layer, to bring out the bands in the red and orange:—

Band 1. λ 676 [centre = λ 666]—λ 656.
„ 2. λ 656—λ 643.
„ 3. centre = λ 613.
„ 4. centre = λ 492.
„ 5. centre = λ 458.

Spectrum 10 represents an extract with a petroleum ether, which has the peculiarity that it does not dissolve out any material producing absorption in the red end of the spectrum. The extract was quite free from any green tinge, as occurring in extracts made with benzol and xylol. The wave-lengths of the bands in fig. 10 are these:—

Band 1. λ 488 [centre = λ 479]—λ 469.
„ 2. λ 456 [centre = λ 441]—λ 431.

The least absorption between these two bands is at λ 461.

To extract a pure yellow colouring-matter which will give no absorption band in the red end of the spectrum, even if highly concentrated, it is best to triturate fresh *Spirogyra* till the petroleum ether shows a faint yellowish tinge, which it will do after ten minutes. Of this pale yellow extract 100–150 c.cm. are allowed to evaporate spontaneously in an evaporating chamber till the extract is of a deep golden colour; great care must be taken not to have a flame near the chamber, for the vapours are very apt to ignite and cause an explosion; also, when examining the extract, a tightly-fitting cork should be inserted in the test-tube, or there may be a risk of the vapours extending to the Argand-burner, and causing mischief.

To recapitulate shortly, I consider the absorption-spectrum of chlorophyll in *Spirogyra* to be as follows:—

1.	A band	λ 678 – λ 662	} =	Kraus'	I.
2.	„	λ 654 – λ 638	}		
3.	„	centre = λ 604	=	„	II.
4.	„	centre = λ 575	=	„	III.
5.	„	centre about = λ 484	=	Kraus'	V.
6.	„	centre about = λ 450	=	„	VI.

Ulva latissima.

The absorption-spectrum of this alga is the following:—

1. A dark band, λ 694 [centre $= \lambda$ 682] $- \lambda$ 662.
2. A pale band, its centre at λ 650.
3. A very pale band, centre at λ 578·5.
4. Absorption commencing at λ 494.
5. Most absorption about λ 483.
6. Very slight absorption, with its centre about λ 452.

As representatives of the vascular cryptogams and phanerogams types were chosen, with transparent leaves in which the chlorophyll was not developed to such an extent as to render the two bands in the red end of the spectrum confluent, or at least in which the band commonly known as Kraus' band I. showed distinctly a right darker and a left paler absorption, the latter corresponding to my second band, when *one* leaf was interposed between the direct sunlight or an Argand-burner and the spectroscope.

Leaves which have to be examined are arranged in a very suitable way thus:—They are placed between two pieces of blackened cardboard, in the centre of each of which is a square hole about an inch and a half broad, in such a way that when the two pieces of cardboard are put together, the leaf fills up the hole entirely, and thus prevents any light reaching the spectroscope which has not passed through its substance. The cardboard should be about twelve inches broad, to prevent the examiner seeing the Argand-burner, for after one's eyes have seen a bright flame it is impossible to do any fine spectroscopic work. If two sides of the cardboard are stitched together, about an inch from the margin of the central hole, a leaf placed between them is held firmly enough if the opposite side of the cardboards be fixed by a clamp or test-tube holder. We arrange next the leaf thus prepared in front of the spectroscope, and illuminate it by concentrating upon it the light of an Argand-burner by means of a condenser. With a soft, broad, and flat camel-hair brush both sides of the leaf are wetted from time to time to keep the leaf fresh; and if we are working with two or three leaves at the same time there should always be a layer of water between the individual leaves, so that we may have as little refraction of light as possible. After we have made all these preparations, we commence with the study of the red end of the spectrum, gradually narrowing and widening the slit of the collimator, and thereby modifying the amount of light; and when we have found the first band we have to focus it very carefully with the collimating lens. Speaking generally, I find that the red end of the spectrum requires less and the blue end more light; further, that in the red end my band I. requires more light than my band II. for proper definition, the band II. is apt to be "flooded" with light just as preparations may be flooded in using the microscope, and thus either rendered invisible or very indistinct.

Of all the higher plants I find *Trichomanes reniforme*, a New Zealand fern, to give the most satisfactory results, for the leaves are very transparent, due to the fact that the mesophyll is only one layer thick towards the periphery; hence in one leaf about 1½ inch broad one may study the difference in the absorption between the paler peripheral and the darker basal portion; and further, the epidermis of the leaf retains water for a long time, the latter not falling off in drops; and if several leaves have to be examined, the water between the leaves lets us practically work as with one single leaf. Being specially suitable, therefore, I shall commence with the description of its absorption-spectrum.

Trichomanes reniforme, Foster.

A. One leaf examined showed—

1. A dark band, λ 694 [centre at λ 685] – λ 677.
2. A pale band, λ 650 [centre at λ 649] – λ 648.
3. A very faint band, λ 490·5 [centre at λ 484] – λ 469·5.
4. General absorption at λ 446·3.

The band No. 3 is a very faint absorption, and is best seen by looking for a portion of the blue end of the spectrum showing less absorption than the rest, lying about λ 470 – λ 450, and then studying the area to its left. To see band No. 3 well we must use all the light at our disposal.

The general absorption at λ 446·3 commences rather abruptly, so as to give almost the impression of another absorption-band commencing here, but nothing definite can be made out. At the red end of the spectrum we have general absorption, also commencing rather abruptly at λ 712.

B. Two leaves placed together and examined showed—

1. A dark band at λ 692 [centre at λ 674] – λ 662·1.
2. A paler band from λ 662·1 – λ 637.
3. General absorption, commencing at λ 506·3.

C. Four leaves laid together showed—

1. A dark band, λ 675 – λ 642.
2. A doubtful absorption, its centre about λ 628.
3. Very faint absorption, its centre at λ 579.
4. General absorption, commencing at λ 523.

The three sets of spectra just described were got when experimenting with rather old leaves, on which the veins had assumed a dark-brown colour. If a single young leaf be taken, in which the veins at the base of the leaf only have a dark colour, we get a spectrum similar to that described above, where two leaves were taken. The reason is that the leaves gradually become paler and more transparent as they grow older.

The absorption-spectrum of a young leaf is the following:—

1. Dark band: λ 695 [centre = λ 672] – λ 661.
2. Pale band: λ 649 [centre = λ 643] – λ 636.
3. Absorption at blue end commences at λ 518.

The absorption-spectrum of living chlorophyll in *Trichomanes* would be therefore approximately—

$$\left.\begin{array}{l}\text{1. Dark band: } \lambda\ 694 - \lambda\ 677 \\ \text{2. Paler band: } \lambda\ 650 - \lambda\ 648\end{array}\right\} = \text{Kraus' I.}$$

3. Very pale absorption, with centre about λ 628 = Kraus' II.
4. A more marked absorption, its centre about λ 579 = Kraus' III.
5. A faint band: λ 490·5 – λ 469·5 = Kraus' V.
6. General absorption commencing at λ 446·3.

D. An alcoholic extract, made by triturating two young leaves for twenty minutes with 50 c.cm. of absolute alcohol, gave a very pale green solution, with the following bands:—

1. Dark band: λ 678 [centre = λ 668] – λ 656.
2. Pale band: from λ 656 – λ 648.
3. Absorption commencing at λ 526.
   Absorption ending at λ 462.
   Centre of the area showing least absorption: λ 454·3.
4. General absorption commencing at λ 446.

E. An extract made by triturating two young leaves with petroleum ether, was to the naked eye of a pale yellow colour. There were no absorption-bands in the red end of the spectrum, but the blue end showed—

1. The centre of first absorption at λ 475·5.
   Centre of least absorption at λ 457·3.
2. The second absorption commencing at λ 455·5.
   " " its centre at λ 442·5.

In the same extract, but more diluted, the centre of the second band seemed to be at λ 441.

Asplenium nidus-avis.

A. One leaf studied in sunlight showed—

1. Dark band from λ 698 [centre = λ 668] – λ 655.
2. Pale band, its centre = λ 643·5.
3. Pale absorption, its breadth equal to breadth of the first two bands } centre = λ 578.
4. Absorption in blue commencing at λ 499·3, and densest at λ 485.
5. A second absorption commencing at λ 445, darkest at λ 436·5, which, after becoming slightly lighter, merged into the normal absorption at the blue end of the spectrum.

B. Two leaves studied in sunlight showed:—

1. Dark band from λ 676 – λ 658.
2. Pale band from λ 658 – λ 642.
3. Absorption, its centre at λ 618·5.
4. Absorption, its centre at λ 576.
5. General absorption commencing at λ 495.

Therefore the absorption spectrum consists of—

1. Dark band, from λ 698 — λ 655	= Kraus'		I.
2. Pale band, its centre at λ 643·5			
3. Absorption, its centre at λ 618·5	=	„	II.
4. Absorption, its centre at λ 578	=	„	III.
5. Absorption, its centre at λ 485	=	„	V.
6. Absorption, its centre at λ 436·5	=	„	VI.

Stangeria paradoxa, Moore.

One leaflet examined in gas-light showed—

1. A dark band: λ 690 — λ 662.
2. A paler band: λ 652 — λ 643·3.
3. A still paler band, its centre = λ 585.
4. General absorption commencing at λ 507.

Podocarpus pruinosus.

One leaflet examined in gas-light showed—

1. Dark band: λ 686 [centre = λ662] — λ 652.
2. Pale band: λ 643·5 — λ 633.
3. Slight absorption, its centre about λ 576.
4. General absorption commencing at λ 503.

Hedychium coronarium, Koen.

A. One leaf examined in gas-light showed—

1. Dark band: λ 686 — λ 672.
2. Paler band, from λ 672 — λ 656.
3. General absorption commencing at λ 506.

B. Two leaves laid together and examined showed—

1. One dark band: λ 695 — λ 622.
2. Absorption, its centre at λ 574·5.
3. Absorption commencing at λ 560, and becoming markedly darker at λ 490, as if this corresponded to the centre of first band in the blue; with very strong light there seemed to be comparatively less absorption about λ 466.

Pitcairnia corallina, Pendell Court.

One leaf examined in gas-light showed—

1. One dark band: λ 686 — λ 653.
2. Paler band, from λ 653 [centre = λ 643] — λ 633.
3. General absorption commencing at λ 511.

TABLE—*Showing the Centres of Absorption-Bands of Living Chlorophyll as occurring in representatives of Algæ, Vascular Cryptogams, and Phanerogams, with a calculation of the Average Centre for each Band.*

Names of Plants.	Band I.	Band II.	Band III.	Band IV.	Band V.	Band VI.
Spirogyra, ...	λ 672	λ 646	?	?	λ 485	λ 450
Ulva, ...	λ 678	λ 650		λ 578·5		
Trichomanes, ...	λ 685	λ 649	λ 628	λ 579	λ 485	
Asplenium, ...	λ 668	λ 643·5	λ 618	λ 577	λ 485	λ 436·5
Stangeria, ...	λ 676	λ 647·6		λ 585	General absorption commences at λ 507	
Podocarpus, ...	λ 669	λ 638·2		λ 576	General absorption commences at λ 503	
Hedychium, ...	λ 679	λ 669		λ 574·5	λ 490	
Pitcairnia, ...	λ 669·5	λ 643			General absorption commences at λ 511	
Chelidonium, ...	λ 674	λ 649			General absorption commences at λ 503	
Nymphæa, ...	λ 673·5	λ 652	λ 604	λ 576	General absorption commences at λ 520	
Average, . .	λ 674·4	λ 648·73	λ 616·6	λ 578	λ 486·25	λ 443·25

Chelidonium majus, L.

One leaf examined in gas-light showed—

1. Dark band : λ 686 [centre = λ 672] – λ 662.
2. Paler band : from λ 662 – λ 636·5.
3. General absorption commencing in the blue end at λ 503.

Nymphæa alba, L.

A young leaf examined in gas-light showed—

1. Dark band : λ 686 [centre 667] – λ 661.
2. A paler band : from λ 661 – λ 643·5.
3. A very faint band, centre at λ 604.
4. An absorption with a very faint centre at λ 576.

Having thus briefly described the methods employed in my investigation, and the results got with each plant separately, I shall now endeavour, by comparing these, to form a conclusion as to the absorption-spectrum of living chlorophyll. I begin with the bands in the red end of the spectrum.

The First Absorption-Band of living chlorophyll extends in—

Spirogyra	from	λ 678 – λ 662	
Ulva	„	λ 694 – λ 662	
Trichomanes	„	λ 694 – λ 677	= one leaf.
„	„	λ 692 – λ 662	= two leaves.
„	„	λ 675 – λ ?	= four leaves.
Asplenium	„	λ 698 – λ 655	= one leaf.
„	„	λ 676 – λ 658	= two leaves.
Stangeria	„	λ 690 – λ 662	= one leaf.
Podocarpus	„	λ 686 – λ 652	= „
Hedychium	„	λ 686 – λ 672	= „
Pitcairnia	„	λ 686 – λ 653	= „
Chelidonium	„	λ 686 – λ 662	= „
Nymphæa	„	λ 686 – λ 661	= „

The average is therefore λ 686·69 – λ 661·5

The position of the first band I believe to be very approximately between λ 686·6 and λ 661·5, with its centre about λ 674·4, as a reference to the table on page 408 will show.

The differences in the breadth of the band, according to the plant examined, are mainly due to differences in the amount of chlorophyll developed in each plant, to the more or less transparent character of the material examined, and the amount of light used by the operator in his researches.

The Second Band has the following extent in—

Spirogyra	from	λ 654 — λ 638	
Trichomanes	„	λ 650 — λ 648	= one leaf.
„	„	λ 662·1 — λ 637	= two leaves.
„	„	λ ? — λ 642	= four leaves.
Asplenium	„	λ 658 — λ 642	= two leaves.
Stangeria	„	λ 652 — λ 643·3	= one leaf.
Podocarpus	„	λ 643·5 — λ 633	= one leaf.
Hedychium	„	λ 672 — λ 656	= one leaf.
Pitcairnia	„	λ 653 — λ 633	= one leaf.
Chelidonium	„	λ 662 — λ 636·5	= one leaf.
Nymphæa	„	λ 661 — λ 643·5	

The average = λ 656·86 — λ 640·93

The Third and Fourth Bands appear only as absorptions, and I was unable to define their extent; but the third band shows most absorption about λ 616·6, and the fourth band is darkest at λ 578.

The Fifth Band does not give very satisfactory results—

Spirogyra	from	λ 531 — λ 459	
Ulva	„	λ 494 — λ 460 (?)	
Trichomanes	„	λ 490·5 — λ 469·5	= one leaf.
Asplenium	„	λ 499 — λ 450	
Hedychium	„	λ 560 — λ 466	= two leaves.

The average = λ 514·9 — λ 460·9

The Sixth Band is the least satisfactory—

Spirogyra	from	λ 459 — λ 445
Asplenium	„	λ 445 — λ 436·5

The average = λ 452 — λ 440·75

Living chlorophyll shows therefore six bands, the two first of which correspond to Kraus' band I., the third to Kraus' band II., the fourth to Kraus' band III., the fifth to

Kraus' band V., and the sixth to Kraus' band VI. I have not been able to see tne band in the green part of the spectrum or Kraus' band IV.; but I have proved that Kraus' band I. really consists of two bands, and accordingly I have drawn in spectrum 11, Plate II., what I consider to be the correct absorption-spectrum of chlorophyll. It will be seen from this figure that the darkest band in the spectrum is my band No. 1; then come in succession band No. 5, bands No. 6 and No. 2, band No. 4, and ultimately band No. 3. It is evident, therefore, that band No. 3 is paler and narrower than No. 4 in living chlorophyll, while in alcoholic and xylol extracts the reverse is the case. This is difficult to explain; it may be that the extractive acts on the normal chlorophyll, producing this change, or that the fourth band becomes more evident when once removed from tissues, or that the spectrum of chlorophyll is the spectrum not of "one" body, but of several bodies, which are extracted in varying amounts according to the nature of the extractive.

I shall proceed now to compare the absorption-spectrum of living chlorophyll with the absorption-spectra of extracts made in various ways.

The two first bands (Kraus' band I.), which, in a moderately strong alcoholic extract of fresh material (spectrum 2) extend from λ 678 — λ 628, occupy, in an extract made from material which has been boiled for ten minutes, a position between λ 690 — λ 635 (spectrum 5). The two bands are darker in colour, and shifted also slightly towards the red end of the spectrum. The addition of three drops of liquor ammonii to a test-tube full of an extract made from boiled material will cause Kraus' band I. to become lighter towards the blue end of the spectrum, and in addition it will form a new band to the left of Kraus' band I., the centre of this new band being about λ 706 (spectrum 6). This peculiar action of a strong caustic was first described by F. Chautard.*

While thus the addition of an alkali causes the appearance of a new band to the left of what is normally the first band, an acid seems to have the reverse action, for it renders the spectrum to the left of the Fraunhofer line B brighter, and it shifts the position of the left margin of the first band

* *Comptes Rendus,* tom. lxxvi. 570.

towards the right side, as will be seen by comparing spectra 6 and 7, the left margin in fig. 6 equalling λ 690, while in spectrum 7 it corresponds to λ 682.

In extracts made with benzol and xylol the extent of the two first bands corresponds almost to that of living chlorophyll, for in *Spirogyra* the two first bands collectively equal λ 678 — λ 638 in living chlorophyll, while the bands measure in benzol and xylol on an average λ 675 — λ 633·5.

Spectra 8 and 9 will show also that Kraus' band I. is the result of the fusion of the darker left band with the paler right one.

I may just mention that Schunck * has drawn in spectrum 2, representing a very dilute alcoholic extract, a band corresponding very nearly to my first band.

As to bands 3 and 4 (Kraus' bands II. and III.) I have already stated that in living chlorophyll band 4 is darker than band 3, while the reverse holds good for extracts.

As to the absorption-band in the green part of the spectrum, namely, Kraus' band IV., I must say that I have not been able to make out the slightest absorption when working with living chlorophyll; Tschirch † figures Kraus' band IV. amongst his absorption-bands of living chlorophyll. According to his statements, it becomes visible if four or more leaves are examined at once, but as neither the name of the plant nor the method of examination are described, I was unable to repeat his experiments. The fourth band of Kraus can therefore either not be demonstrated by the methods I employed, or it does not exist in normal living chlorophyll.

Schunck notices that the band in the green, according to some authors, is very faint, while, according to others, it is considerably darker than the band in the yellow; and he is of the opinion that the band in perfectly pure chlorophyll would be absent. By referring to my figure 3, a band in the green part of the spectrum will be noticed, but the layer of extract used was sufficiently thick to cause fusion of the first three bands of Kraus into one absorption. This extract was made according to my method, as fully stated above. If we compare spectrum 3 with spectrum 5 we find

* "Chemistry of Chlorophyll," *Annals of Botany*, vol. iii. No. ix.

† *Berichte der Deutschen Botan. Gesellsch.*, Band i.

that Kraus' band IV. is very evident in spectrum 5, without there being, however, any fusion of the first three bands; the alcoholic extract represented in spectrum 5 was made from *Spirogyra* material which had been washed in distilled water, then boiled for ten minutes, washed again in distilled water, and extracted with absolute alcohol. The explanation of the difference between the two just-mentioned extracts I would suggest is that in fresh material the green colouring-matter is a protoplasmic, hence an alkaline body, and that absolute alcohol extracts the colouring-matter so rapidly as to restrict to a minimum the action of post-mortem changes on the alkaline chlorophyll, amongst which changes one of the first seems to be that the alkaline protoplasm becomes acid. In material, on the other hand, which has been boiled, the chlorophyll will be exposed to post-mortem changes, the acid cell sap will be able to act on the chlorophyll as well as any gases that may be in the water, such as carbon dioxide, &c.; and the very act of prolonged boiling will bring the material we are treating in contact with the oxygen of the air, and thus the chlorophyll will change its composition, and the appearance of the band in the green will be the consequence. Now, one might ask, does not the boiling itself affect the chlorophyll, cause its decomposition, and the appearance of the band? This does not seem to be the case, for I boiled an alcoholic extract made from fresh material, according to my method, for eight minutes, but could not detect any change in the band in the green part of the spectrum; the band did not become darker. What the effect of an alkali is on an extract of chlorophyll, made with absolute alcohol from boiled material, with regard to Kraus' band IV., is readily seen by comparing spectra 5 and 6. In spectrum 6 the band is much paler than in spectrum 5, for three drops of liquor ammonii were added to a test-tube full of the extract, and the extract then heated up to the boiling-point for one minute. It is evident, therefore, that a strong alkali, such as ammonia, will decrease the amount of absorption in the green part of the spectrum; an acid, on the other hand, *e.g.*, nitric acid, will increase the intensity of absorption, as shown in spectrum 7; but great care must be taken in adding a strong acid, or the whole of the spectrum will be changed, and the band in the green will become paler again.

The fourth band is also absent in benzolic extracts. I must state, however, that I was not able to examine an extract which contained chlorophyll in such a degree of concentration as to cause absorption similar to that shown in spectrum 3, and it is therefore possible that benzol would show an absorption in the green part of the spectrum if a sufficiently thick layer could be examined. Taking everything into consideration, I am at present of the opinion that the fourth band of Kraus is a decomposition-product, caused probably by post-mortem changes; whether it is possible, by the addition of an alkali to the alcohol to counteract the tendency of the chlorophyll to become acid, is doubtful.

The centres of the two absorption-bands in the blue end of the spectrum in living Spirogyra are about λ 485 and λ 450. In an extract made with benzol the centres equal λ 486 and λ 453 respectively, showing how closely a benzolic extract resembles the normal spectrum; an extract made with xylol shifts the centres of the two bands slightly towards the red end of the spectrum (λ 492 and λ 458 respectively); while an extract with petroleum ether shifts the centres towards the blue end of the spectrum (λ 479 and λ 441 respectively).

Whether the extract made with petroleum ether is identical with Schunck's Chrysophyll in Ether I am not as yet prepared to say; but I must repeat that in very thick layers not the slightest absorption was to be seen in the red end of the spectrum. There seem to be, however, various kinds of petroleum ether, for ether got from one dealer produced an extract very like that of benzol, and with marked absorption in the red end of the spectrum, while ether supplied by another dealer gave an extract with a spectrum, as figured in spectrum 10, Plate II. One could detect that the two petroleum ethers were not the same from the odour alone.

Extracts made by triturating green tissues with benzol, xylol, turpentine, petroleum ether, and similar bodies, have one thing in common, namely, that they are of a yellow or yellowish-green colour. If, now, an alcoholic extract of chlorophyll, which is believed to contain normal chlorophyll, is treated in such a way as to cause benzol, when brought in contact with what is still considered to be normal chlorophyll, to take up a blue colouring-matter, it is evident that some change must have occurred in the chlorophyll since its extraction, or benzol would not take up in one case a yellow, in the other case a blue, colouring-matter. What brings about this peculiar change is probably the addition of water to the alcoholic extract; and I believe that if we could extract chlorophyll by absolute alcohol, avoiding the presence of water, the above-mentioned decomposition would not occur. For the same reason I believe extracts made by triturating healthy material with substances similar to benzol to be superior to extracts made by absolute alcohol. The great disadvantage, however, of triturating is that only small quantities of chlorophyll can be extracted.

The conclusions which I have arrived at from microscopic and spectroscopic investigations are shortly these:—

1. Chloroplasts consist of an individual green protoplasmic ground-substance, which is rendered spongy by the presence of an oily material secreted by the ground-substance, and which is enclosed in a clear protoplasmic envelope.
2. The fatty or oily material in *Spirogyra* is partly given off directly into the surrounding protoplasm, partly consumed by the ground-substance.
3. Chlorophyll does not consist of a mixture of a yellow and blue colouring-matter, but is a green substance, which readily decomposes into a yellow and blue colouring-matter.
4. The first absorption-band of Kraus really consists of two bands. The fourth band of Kraus is in all probability a decomposition-product, and hence the absorption-spectrum of living chlorophyll is the following:—

Band 1 = λ 686·69 – λ 661·5	} = Kraus' band	I.
Band 2 = λ 656·86 – λ 640·93	}	
Band 3 = centre at λ 616·6	= „ „	II.
Band 4 = centre at λ 578	= „ „	III.
Band 5 = λ 514·9 – λ 460·9	= „ „	V.
Band 6 = λ 452 – λ 440·75	= „ „	VI.

Methods employed by different Observers to Extract their Pure Chlorophyll.

I here add a list of the different methods employed for the extraction of what each writer considers pure chlorophyll. The methods mentioned are those of Gautier, Hansen, Hoppe-Seyler, A. Meyer, Pringsheim, Sachsse, Schunk, and Tschirch; along with Detmer's method of preparing a crude chlorophyll extract.

*Detmer's Method of preparing a Crude Chlorophyll Extract.**

Young wheat plants or *Elodea canadensis* are boiled for a quarter to half an hour in distilled water. The water is then poured off, and the plants are washed in water, and extracted with strong alcohol. To quicken the process, the alcohol may be warmed.

Gautier's Method.†

1. Green leaves are triturated with sodium carbonate and alcohol, and the green alcoholic product is treated with animal charcoal, which takes up the colouring-matter and leaves the impurities behind.

2. The charcoal is extracted with alcohol, which removes a yellow colouring-matter.

3. Next, the charcoal on treatment with common ether or petrol ether should give a green solution, which, on evaporation, allows the green colouring-matter to crystallise out. A. Hansen repeated the process, but was unable to get the same results, the charcoal not giving up the colouring-matter on treatment with ether or petroleum ether.

Dr Adolph Hansen's Method of preparing "Chlorophyll-green."‡

The material used is grass, because it contains no resins, tannin, turpenes, &c.

1. Boil a quantity of grass to get rid of soluble substances and yellow and brown colouring-matters, which on evaporation form a brown extract.

* *Das Pflanzen physiologische Practicum.*
† *Comptes Rendus*, lxxxix. 861.
‡ *Arbeiten d. Bot. Instituts in Würzburg*, iii. 123, 430.

The boiling, which must be gentle, lasts for half to three-quarters of an hour.

2. Wash till the water runs off quite colourless.

3. Dry the material at a low temperature as quickly as possible. When dry, the material may be used at once, or kept for future investigations in the dark.

4. Treat the dried material with absolute alcohol, and a dark green solution is got. After a time no more colouring-matter is taken up, and after the first quantity of alcohol is poured off, the material is extracted with a second, and it may be third quantity of alcohol, till most of the colouring-matter has been removed.

All these manipulations, as also the succeeding ones, have to be done in a darkened room, since the colouring-matter is very susceptible to light.

5. Evaporate the alcoholic extract to one-eighth of its volume.

6. Saponify by Kühne's method—

(*a.*) Make a solution of caustic soda by taking 1 part of NaOH, 5 parts of water.

(*b.*) Add of this solution 40 to 50 c.cm. to 2½ litres of the concentrated alcoholic solution thus: While the alcoholic extract is boiling, add the caustic soda solution drop by drop, stirring all the time.

(*c.*) Drive off the alcohol and add water; evaporate the water to a small quantity. Then add alcohol for a second time, and the saponification is completed.

7. To get the soap in a solid form, evaporate the alcohol, add water and an excess of sodium chloride. Thus we get the soap separated in the form of black-green granules.

8. Add petrol-ether to the soap, and a dark yellow colour is extracted. [If I understand the author correctly, it is more advisable to treat the black-green granules (7) first with ether (9), and then with petrol ether (8), as less of the latter will thus be required for the removal of the yellow colouring matter.—G. M.]

9. Next, wash the soap with ether, which will remove foreign bodies, along with a small quantity of colouring-matter.

10. Treat the soap with ether, mixed with a few cubic centimetres of alcohol, and a clear green extract results.

Thus we get the yellow colour in petrol ether and the green colour in alcoholic ether. The yellow colour crystallises in dark yellow needles out of the petrol ether, or after this has been evaporated and the residue treated with absolute alcohol out of the latter.

The green colour crystallises in sphæro-crystals, and to get it pure we proceed thus :—

1. Filter the dark green ethereal solution.
2. After twenty-four hours repeat the process.
3. Remove all traces of yellow colour with petrol ether, after having evaporated the ethereal solution to dryness.
4. Redissolve and crystallise out of an alcoholic ethereal solution.

The sphæro-crystals the author calls "chlorophyll-green."

*Hoppe-Seyler's Method of preparing Chlorophyllan Crystals.**

1. Grass is washed three or four times with ether to remove the waxy covering of the leaves.

2. The leaves are then treated with boiling absolute alcohol, which extracts the green colour.

3. The green alcoholic extract is evaporated by heating it at a low temperature. The resulting residue is washed in cold water and redissolved in ether.

4. The ethereal solution is slowly evaporated in loosely-covered glass vessels, and thus are got :—

5. Granular crystals, brown with transmitted, dark green on reflected light. These crystals are purified by recrystallisation, and are called "Chlorophyllan" crystals.

A. Meyer's Method of preparing Chlorophyllan.†

Since chlorophyllan is readily soluble in hot glacial acetic acid, A. Meyer proceeds thus :—

Treat the leaves directly with hot glacial acetic acid, filter the extract, evaporate it, extract the residue with alcohol, and let the chlorophyllan crystallise out.

* *Zeitschrift f. Physiologische Chemie*, iii. 339, iv. 193, v. 75.

† Arthur Meyer says (*Das Cholorophyllkorn*, Leipzig, 1883) Pringsheim's hypochlorin is identical with Hoppe-Seyler's chlorophyllan.

*Pringsheim's Method of Preparing Hypochlorin.**

Pringsheim's method for the separation of the colouring-matter of chloroplasts from the ground-substance consists in warming green tissue for fifteen minutes to an hour in water heated up to 50°–80° C., or by exposing the tissue to steam of boiling water from fifteen minutes to several hours, when variously-coloured drops exude (the commonest colours are shades of green up to olive-green; rarer are blue-green, yellow, or reddish-brown). These are of an oily nature, and keep the colouring-matters in solution; they are soluble in alcohol and ether. When the exudation is completed the ground-substance of the chloroplasts shows up as a hollow sponge-like ball, and the oil is believed to have been contained in the meshes of this hollow ball.

Exposure to intense light has the same effect, for by bleaching the colouring-matter the ground-substance is revealed, and shows the hollow spongy nature of it.

The exuded drops the author calls "Hypochlorin."

Sachsse's Method of preparing Chlorophyll.†

Sixty kilogrammes of *Primula elatior* and the same quantity of *Allium ursinum* are boiled in water, well pressed to get rid of the water, extracted with 44 litres of boiling 90 per cent. alcohol to each 60 kilogrammes of raw material, then the material pressed again to get rid of the alcohol, and twice boiled in so-called "light" benzin (0·7 sp. gr.) After each boiling the material is pressed, and the benzin extracts, after filtering, are added to the alcoholic extract, when the benzin will take up most of the green colour, leaving the yellow colour to the alcohol.

After several days' standing the benzin solution is decanted, bottled, and treated with pieces of sodium.

After eight to fourteen days the benzin solution becomes cloudy, and ultimately a precipitate is thrown down. The process is completed when the benzin has assumed a pure golden-yellow colour, and when it does not show even in very thick layers the characteristic band of chlorophyll between the lines B and C.

* *Lichtwirkung Chlorophyllfunction in der Pflanze*, Leipzig, 1881.

† *Phytochemische Untersuchungen*, Dr Robert Sachsse (Leipzig, Verlag von Leopold Voss, 1880).

Should the precipitate formed be so fine as not to deposit readily, we may hasten the process by passing a strong current of carbon dioxide through the benzin.

The precipitate is separated from the benzin by filtration, is washed repeatedly with benzin, and evaporated on a water-bath. When dry the precipitate forms a nearly black pulverisable mass, readily soluble in water and alcohol, imparting to them a dark green colour. This precipitate is "the green colouring-matter."

*Schunck's Method of preparing two Colouring-Matters identical with Frémy's Phyllocyanin and Phylloxanthin.**

Fresh green leaves—preferably grass—are treated with strong boiling alcohol, and the dark-green extract having been poured off from the exhausted leaves, is allowed to stand for a day or two, when it deposits a quantity of wax, fatty matter, and other impurities, which had been extracted along with the colouring-matter. The deposit being filtered off, a current of hydrochloric acid gas is passed through the filtrate. This produces a dark green, nearly black, voluminous precipitate which increases in quantity on standing. The precipitate is separated by filtration, and washed with alcohol along with an excess of acid.

The precipitate contains, with impurities, chiefly of a fatty nature, two distinct colouring-matters, identical with the phyllocyanin and phylloxanthin of Frémy.

Tschirch's Method.†

To prepare the chlorophyllan of *Hoppe-Seyler*, which Tschirch believes to be identical with Pringsheim's hypochlorin and Gautier's crystallisable chlorophyll, he proceeds either according to Hoppe-Seyler's method, or according to A. Meyer, or ultimately according to his own method, namely, thus—

Wash the leaves (grass) with ether, treat them with diluted hydrochloric acid, wash, make an extract with boiling alcohol, filter it and evaporate down to half its original volume, and on cooling hypochlorin will be deposited in considerable quantities.

* *Annals of Botany*, vol. iii. No. 9, page 88.

† *Berichte der deutschen Botanischen Gesellschaft*, i.

Some Observations on Spirogyra. By Mr Gustav Mann.

(With Figs. 1–8, Plate II.)

(Read 10th April 1890.)

The fresh water alga *Spirogyra*, known to most people as it presents itself as smaller or larger patches floating on the surface of ponds and of slowly flowing waters, seems, however, when in this condition not to be growing normally. About two years ago, while I was fishing from a boat in Duddingston Loch, near Edinburgh, I accidentally came across large banks of this alga growing at a depth of from four to five feet; the species found were chiefly *S. nitida* and *S. jugalis*, in about equal proportion; the individual threads were from $2\frac{1}{2}$ to 3 feet long, not at all entangled, and in perfectly healthy condition. The bottom of the loch at places where this alga was growing was covered with a brownish-red material, which, on microscopic examination, proved to consist of dead *Spirogyra*-cells in which the chloroplasts had undergone a peculiar disintegration, giving rise to the formation of pink or reddish granules.

Each *Spirogyra*-thread is conveniently divided into an apical, a shaft, and a foot portion. I make this division because there are differences in the cells of these three regions.

The apical cell is slightly bulged out at its free end, the chlorophyll bands broaden out at the ends nearest the apex, and the cell as a whole seems to be the most vigorous in growth, as I conclude from the fact that I have seen twice division occurring in it, while, in one of these cases, the second cell only, and in the other case not a single cell of the thread—and I examined a piece at least 3 inches long—in either case, showed any indication of division.

The cells of the shaft are those usually described, and they normally divide. As we approach the lower end of a thread however, the cells appear to divide less regularly; *i.e.*, some may be far advanced in division, while neighbouring cells show no sign of it. The cells in the lower region of the shaft are slightly longer than those in the upper, but the difference is not so marked in cells formed during the summer as compared to cells formed in the winter months. In fig. 1, Plate II., I have represented two cells of *S. nitida*; the shaded portion shows the increase in length that takes place during winter. The cells are drawn by aid of a Nachet's camera. The smaller cell represents the average length in the month of July, while the larger shows the average length of cells in February; but I shall refer to this fact again later on in my paper.

The cells at the very foot of each thread show signs of decay, for the chlorophyll bands tend to be irregularly disposed and to become vacuolated. As these cells decay they will not be able to support the weight of the whole thread, they will collapse therefore and form the already mentioned brownish material; but this change is so gradual that, under normal conditions, the foot will be strong enough to moor the whole thread to the bottom of the pond.

To estimate the amount of water, combustible and non-combustible solids, I proceeded thus: Healthy *Spirogyra* material (*S. nitida* and *S. jugalis* in about equal proportions) was repeatedly washed to remove all impurities, as bits of decayed matter, water insects, &c.; then the material was washed in distilled water to remove the salts which are in ordinary water, placed on muslin in a large filter and allowed to drain till it assumed a light green colour, showing that the water between the threads had run off. One kilogramme of this drained material was placed in a large shallow porcelain dish, the weight of which had been previously ascertained, and the dish exposed on a sand-bath to a temperature of 200° F. for 48 hours, then the temperature was raised to 230° degrees F. for 6 hours. The *Spirogyra* material had formed a hard crust in the dish, and as soon as the dish had cooled it was weighed; for if the weighing be delayed for several hours, the dried material will increase considerably in weight from condensation of the atmospheric moisture. The result of the weighing showed that of the original 1000 grms., 968 grms. had been evaporated, giving a percentage of 96·8 of water, and a residue of 32 grms. of solids. The residue was placed in a platinum vessel and burnt, to calculate the amount of pure ash; after burning, the amount of ash equalled 4·8 grm., the volatile substances therefore equalling 27·2 grm. for 1000 grm. The percentage of water, volatile and non-volatile constituents, in *Spirogyra* is therefore as follows:—

Water, . . .	96·8	per cent.
Volatile constituents, .	2·72	„
Non-volatile constituents,	0·48	„
	100	per cent.

This large amount of water led me to the following experiment, showing to what extent turgor stretches the elastic cell-wall. A slide is immersed in water in which are a few threads, preferably of *Spirogyra nitida;* one end of a thread is fixed on the slide with the index finger and the slide gently withdrawn, when the thread will lie in a straight line. The slide and thread are arranged under a magnifying power sufficiently high to allow the individual cells being counted readily; the ordinary eyepiece is then replaced by a micrometer-eyepiece, and the number of cells covered by the scale is counted and marked down; then the same process is repeated with another part of the same thread, to see whether the number of cells counted the second time agrees approximately with the first number, and if the difference between the two numbers is only a slight one, *i.e.*, not more than half the length of one cell, the thread may be used for the experiment. We apply now a 75 per cent. solution of common salt, which will produce plasmolysis and cause the thread to become shorter. The thread is arranged again, and the number of cells covered by the scale on the eyepiece counted. The average shortening is close on 10 per cent. of the original length—*e.g.*, in one case I counted 20 cells, and after treatment with salt-solution 22 and part of a 23rd cell. We may therefore say that the cells owe one-tenth of their original size to turgescence.

As *Spirogyra* is a plant very suitable for many observations and experiments, it is convenient to have always a supply of fresh material at hand, and a few words on its cultivation may not be out of place. When a mass of *Spirogyra* material is placed in a vessel it will sink at first to the bottom, then the more vigorous threads begin to grow upwards towards the surface of the water, and in doing so ribbon-shaped masses or strands will be formed: this vigorously growing material alone should be used for studies, and not the thread lying at the bottom of the vessel.

Strassburger's and Detmer's methods for cultivating *Spirogyra* answer both very well. Strassburger's method is shortly this. The material is placed in shallow vessels with opaque walls, to prevent unilateral light acting on the plant, but at the same time the vessel is placed in a light place, protected from the direct action of the sun, and a room towards the north is to be preferred. From time to time pieces of turf soaked in the following nutrient fluid :—

Water, ...	100 ccm.
Potassium nitrate, . . .	1 grm.
Sodium chloride, . . .	$\frac{1}{2}$ "
Calcium sulphate, . . .	$\frac{1}{2}$ "
Magnesium sulphate, . .	$\frac{1}{2}$ "
Calcium phosphate, . .	$\frac{1}{2}$ "

are placed in the vessels containing river or spring water.

Detmer's formula for a nutritive solution is :—

1	grm.	Ca_2NO_3, .	in 1 litre of distilled water.
0·25	"	KCl, . .	
0·25	"	$MgSO_4$, .	
0·25	"	KH_2PO_4, .	

I find that if $1\frac{1}{2}$ litre of distilled water instead of 1 litre be taken, that *Spirogyra* will grow more vigorously.

The vessel I like best for cultivating *Spirogyra* is one made of glass and covered with white tissue paper, about 18 inches deep by 18 inches broad (if broader ones are to be had they should be taken); it is filled with fresh spring water up to 3 inches from the top, then a current of carbon dioxide is passed through the water for five minutes, the material placed into the water and exposed to bright daylight. The carbon dioxide I prepare in the usual way with nitric acid and pieces of marble, and it is purified by being passed through a lye of caustic potash. The purified gas is conducted to the vessel with water by means of an india-rubber tube, into the end of which a glass tube is fitted, drawn out into a fine point. Whenever the gas begins to escape by the glass tube, the latter is pushed to the bottom of the vessel and moved about, to allow the gas bubbles to come in contact with as much water as possible.

After the *Spirogyra* has began to grow in the vessel, which it will have done after 24 hours, we supply it daily early in the morning for two minutes with a stream of carbon dioxide bubbles, avoiding any undue commotion in the water, and thereby mixing of the healthy threads with the decaying ones lying at the bottom of the vessel. Every week the vigorous *Spirogyra* should be lifted out carefully and placed in another vessel, to allow removal of the débris lying at the bottom of the vessel.

What effect an extra supply of carbon dioxide has on carbon assimilation the following experiment shows clearly:—Take two glass jars, 4 inches broad by 2 feet high, fill them with ordinary water up to 6 inches from the top, pass through the water in vessel A a stream of carbon dioxide for five minutes, while the water in vessel B does not receive any CO_2 in addition to that already present in the water. Next take an equal quantity of vigorously-growing *Spirogyra* and push it to the bottom of vessels A and B, and expose these to bright daylight. After a varying time, according to the strength of the light, the material in vessel A will rise to the surface of the water a considerable time before the material in vessel B will do so, owing to the fact that assimilation, going on faster in vessel A (containing an extra amount of CO_2), a greater number of oxygen bubbles will be set free, which, acting as buoys, will carry the *Spirogyra* threads upwards.

By a process similar to the one just described the patches of *Spirogyra* that grow on the surface of ponds, &c., are brought about; for whenever the threads become entangled, and bubbles of oxygen that are given out during assimilation cannot escape through the entangled mass, the gas will gather till it is strong enough to overcome the resistance of the threads mooring the mass to the bottom of the pond, the foot-end of the threads will break, and, as already stated, a floating mass of *Spirogyra* will result.

The apices of threads grown in a glass jar have a nutative power, as will become evident from fig. 2, Plate II., which represents a mass of *Spirogyra* in the shape of a band, the broad side being directed towards the source of light. The band does not grow upwards, however, in a straight line, for at *a* and *b*/ the threads have grown towards the source of light, or rather, after cell division had taken place during the preceding night, the threads exhibited during the day a heliotropic tendency, they approached the side of the vessel next the window only to grow away from that side during the night. I believe the nutation to be brought about in the following way:—As soon as the strong stimulus "light" has stopped acting on the cells, each cell, and thus the whole thread, will tend to procure for itself as large an area of water as possible, for the larger the area of water the more readily can respiration be carried out, and the more oxygen there is taken up by each cell the more energetic will be the metabolism of starch into directly available material.

This material will be consumed, firstly, by those elements of the cell which are essential for the maintenance of the life of the cell as an individual; any surplus of nourishment will be used for purposes of cell division or multiplication; or, to put it more clearly, it is of the highest importance to recognise that there are in each cell definite structures essential for division, *i.e.*, a reproduction of the cell, namely, the nucleolus with its contents; and other structures, which bring about this division by procuring and elaborating nutritive substances, namely, the nucleus proper, the cytoplasma, and the cell wall. Thus to distinguish in each cell between a reproducing and a vegetating element. The view just stated allows us to understand why, during the colder months of the year, cells of *Spirogyra* should attain a larger size than during the warmer months; for, during winter, each cell will have to combat low temperature, want of light, and similar conditions unfavourable for procuring and elaborating nutritive material, and hence the vegetating element of the cell will be specially developed to save at least the life of the individual cell.

It is only natural that under such conditions a cell should sometimes have enough energy to start division, without, however, being able to complete it, as is evident in those cases, not uncommon during winter, in which two nuclei are found in one large cell with either no indication of a new cell wall, or with only the rudiments of a cell plate attached to the inner aspect of the old wall (fig. 3, Plate II.). That in these cases we deal with cells which would not have formed a complete partition, had they not been disturbed in doing so by fixing the threads for microscopical study, is proved by two facts: Firstly, the nuclei are fully formed, with no indication of a nuclear barrel; and, secondly, a line drawn between the two nuclei would not be at right angles to the plane of the rudimentary cell wall, and would not pass through the centre of this plane, as one of the nuclei is usually found close to the side of the mother cell, or even both nuclei may be on one side of the partition, the other half of the cell having no nucleus.

I shall conclude this paper by recording some miscellaneous observations made while studying the chlorophyll-bands, specially with regard to changes in the shape of the chlorophyll-bands, the form of the protein crystals, methods of staining nuclei and threads, &c., and ultimately I shall refer to the occurrence of crystals. The chlorophyll-bands represent on cross section usually a "Y" shape if examined during the day; but if material which has been kept in the dark for 48 hours is examined, the chlorophyll-bands show an oval or flattened outline (fig. 4). What the cause of this peculiar change is, I cannot state definitely, but one explanation may be this: the pyrenoids are placed in the centre of the chlorophyll-bands and sunk in the substance of the band, and as starch is gradually laid down in them, they will swell, and being pulled towards the nucleus by the threads joining them to it, they will alter the shape of the band, rendering the latter convex on the side next the nucleus, and concave next the cell wall. This view is strengthened by the fact that the more starch is laid down in the pyrenoids, the more marked is the ridge on the surface of the chloroplast next the nucleus. This change will also bring about less surface exposure of the band to light, and so diminish the elaboration of starch.

The threads joining the pyrenoids to the nucleus have a structure as first described by Pringsheim, namely, at the pyrenoidal end they form deeper or shallower cups, enclosing the starch-centres or protein crystals, as Strassburger terms them, while at the nuclear end the threads fuse, according to my observations, in two bags, in the shape of hemispheres, the margins of which are united together. The two bags are placed in the long axis of the cell, and are specially well seen in *Spirogyra jugalis*, if threads be treated first with absolute alchohol and then with water, which causes the bags to expand and to form bladder-like structures, to which the threads are attached. In *S. nitida* the two bags are so dense that they won't swell up, and they seem to have fused completely to form only one circular bag. Fig. 5 represents a portion of the bag surrounding the nucleus with threads going to the pyrenoids, dissected out from a cell of *Spirogyra nitida.*

There seems to be considerable difference of opinion about the starch-centre or protein crystal, contained in the cup-like expansion of the threads. A. Meyer, in *Bot. Zeitung,* 1883, No. 30, describes the protein crystals as bodies with angular outline; Strassburger describes them similarly in his *Practical Botany;* Berthold denies the angular outline, and also the statement made by Schmitz that the protein crystal consists of a substance identical with the chromatin of the nucleus; A. Meyer and Schimper also deny the first-mentioned identity; Zacharias considers the nucleoli and pyrenoids to be similar, since both consist of digestible albuminoids. I myself hold that the protein crystals are either globular or angular, according to the amount of starch stored up in the pyrenoids. If a pyrenoid be examined in which there is no starch we see a central rounded body, the protein crystal surrounded by a pale ring, the cup-like expansion of the thread. As starch is being formed it is laid down outside the protein crystal round definite centres, and therefore we see, if a small quantity of starch is present in the pyrenoid, minute granules lying close to the protein crystal. As more and more starch is deposited, these small granules gradually increase in size, and assume a bi-convex shape; and whenever they have increased so much in size as to touch one another, the protein crystal assumes an angular shape. If assimilation has been going on very vigorously, so much starch may be deposited that it is no longer possible to make out the different starch granules, and they will appear to have fused to form a swollen ring-like mass round the protein crystal; and the latter will have, on focussing, a circular outline, as is best seen in *S. nitida,* if threads be examined towards the evening of a warm, sunny summer day. For explanation of the figures see page 431.

To study the relation of the starch granules to the protein crystals, the two best ways are these:—

1. Detmer's method—

Spirogyra (preferably *Sp. jugalis*) is placed in strong warm alcohol, which, in about ten minutes, will have extracted the whole of the chlorophyll. The bleached threads are laid either for a short time in hot, or for twenty hours in cold, not much concentrated caustic potash (a 5 per cent. solution I find best); next the threads are carefully washed out with distilled water, then treated with dilute acetic acid to neutralise the potash completely; again washed in water and placed in a solution of—

Iodine, ...	0·05	grm.
Potassium iodide, . .	0·2	„
Water, ...	15·	„

2. Mann's method—

Treat the threads for two minutes with liquor chlori, and examine at once in liquor chlori.

Methods for demonstrating the nuclei and threads I may mention here also.

Nuclei show the endo-nucleoli beautifully if treated with a saturated solution of bichloride of mercury and picric acid in water or in absolute alcohol. Threads treated in this way show hardly any plasmolysis.

The threads joining the nucleus with the pyrenoids are stained most satisfactorily by placing some *Spirogyra* threads for three hours into a saturated watery solution of picric acid, to which nigrosine, readily soluble in water, has been added, till a layer, 1 inch thick, is of a deep olive-green colour. The *Spirogyra* is then washed thoroughly in distilled water to remove the picric acid. The threads and the nucleus will be stained a bluish black, and the nucleolus will be almost black.

Another equally good method for demonstrating the threads is this: place *Spirogyra* for twenty-four hours in a 1 per cent. gold chloride solution, and examine in this solution; the threads are not stained, but are well defined, having become very refractive. A saturated watery solution of picric acid renders the threads also very evident.

I may mention here that although, as a rule, the nucleus is only indirectly in communication with the pyrenoids by means of the first-mentioned threads, that in a species which I found in February 1889 in the pond in the Royal Botanic Gardens, and the name of which I am unable to determine (*vide* fig. 7), the chlorophyll-bands touched the nucleus directly. Each cell contains three chlorophyll-bands, and as these approach the nucleus the spirals become steeper, the bands broaden out, and are closely applied to the surface of the nucleus, forming a complete bag, which seems to replace the threads. Remarkable is also the fact that the bag is packed with pyrenoids, which will act as a storehouse of nourishing material close to the nucleus. As I was not able to find this form of *Spirogyra* during last summer, it is possible that it may just be an ordinary species, which in this way has become modified to enable it to perform its functions during the cold spring months.

If *Spirogyra* material is placed in water to which a few drops of a 10 per cent. gold chloride solution have been added, the gold chloride will be reduced by the action of the threads joining the pyrenoids and the nuclei. I find, at least, the gold chloride deposited as small black granules along the course of the threads; but in addition to this, the gold chloride in the water is also reduced, imparting a beautiful violet colour to the water on transmitted light.

About ten years ago Dr Macfarlane observed crystals in *Spirogyra*, and according to a notice in *Nature* (1888), Strassburger has also observed them. My investigations, which were carried on mainly during the winter of 1889-90, enabled me, for this very reason, to pay special attention to these crystals, for during the colder months of the year, when the cells are merely vegetating and growing to exceptionally large sizes, the number of crystals in a cell may increase from two or three up to seventeen, this being the largest number of crystals I counted in one cell. The crystals are of common occurrence in *S. nitida* and *S. jugalis* growing in Duddingston Loch; they occur commonly in the form of a cross with slender pointed arms, as represented in fig. 8, *b*; by a fusion of a number of these crosses, forms, as represented in *d* and *f* are brought about. The crystals represented in figs. *g* and *h* I saw only once in a thread; the knobs were quite distinct, and had not the appearance of crystals which are being dissolved. The composition of the crystals seems to be oxalate of calcium, as the crystals dissolve without evolution of gas in nitric acid, and as they are insoluble in acetic acid.

EXPLANATION OF PLATE II.

(Illustrating Mr Mann's papers on Chlorophyll and *Spirogyra.*)

Absorption Spectra of Chlorophyll.

1. *Spirogyra*, living chlorophyll.
2. Moderately strong alcoholic extract from living material.
3. Strong solution alcoholic extract from living material.
4. Alcoholic extract evaporated and redissolved in benzole.
5. Alcoholic extract from boiled material.
6. Alcoholic extract from boiled material with ammonia added.
7. Alcoholic extract from boiled material with nitric acid added.
8. Extract made by triturating with benzole.
9. Extract made by triturating with xylol.
10. Extract made by triturating with petroleum ether.
11. Average spectrum given by living plants.

Fig. 1. *a*, Normal size of one cell of *Spirogyra nitida* during summer. *b*, Increase during winter.

Fig. 2. Jar cultivation of *Spirogyra*. *a*, Viewed laterally. *b*, Viewed from the front. *x*, Lower part with equal growth of *S. nitida* and *S. jugalis*. *y*, Middle part consisting largely of *S. nitida*. *z*, Upper part consisting entirely of *S. nitida*.

Fig. 3. *Spirogyra jugalis*. Cell with two nuclei and incomplete cell wall.

Fig. 4. Side view of cell showing change in outline of two chlorophyll-bands from deposition of starch.

Fig. 5. Bag formed by fusion of the nuclear ends of the supporting threads. The nucleus has been removed.

Fig. 6. Stages in starch formation. *a–f*, Surface view. *a′–f′*, Lateral view.

Fig. 7. *Spirogyra*, sp., showing chlorophyll-bands forming a bag round the nucleus.

Fig. 8. *a–h*, Crystals.

On a Method of Preparing Vegetable and Animal Tissues for Paraffin Imbedding, with a few Remarks as to Mounting Sections. By Gustav Mann.

(Read 11th July 1890.)

Requisites—

I. Picro-corrosive alcohol.

Heat absolute alcohol to 50° C., saturate with picric acid, and then add bichloride of mercury to saturation. When cool decant. This solution may be made in quantity and kept.

II. Absolute alcohol.

III. Chloroform-alcohol—chloroform and absolute alcohol mixed in equal parts.

IV. Chloroform.

V. Solid paraffin, melting point 46°–50° C.

VI. Short wide-mouthed bottles.

VII. Best cork stoppers, two for each bottle; the one fitted with a piece of glass tubing 1 cm. in diameter and 3 cm. long.

VIII. Number of glass rods drawn out into fine points, as one must avoid bringing metal instruments in contact with the picro-corrosive fluid.

Method—

A. The fixing and hardening of tissues.

Place tissue in at least fifty times its bulk of the picro-corrosive alcohol. Leave small objects (up to 1 cubic cm.) for twenty-four hours, larger objects for forty-eight hours and upwards in the fluid. *Keep the bottle well corked.*

B. The replacement of the picro-corrosive alcohol by pure absolute alcohol.

1. Pour off the hardening fluid till the tissue is just covered. Add absolute alcohol according to the size of the tissue in 1–10 drops every ten minutes, till the tissue is again in fifty times its bulk of fluid. After each addition move the bottle very gently to allow the added alcohol to mix with the hardening fluid. Leave tissue in this diluted mixture for twenty-four hours. In no case should this process be hurried, or

Method *B—continued.*

strong diffusion currents will be set up and the protoplasmic contents of the cell separate from the cell-wall.

2. Pour off the fluid till the tissue is just covered, and add absolute alcohol up to the original bulk. Move about the bottle gently every three or four hours. Most of the picro-corrosive material will thus be extracted after twenty-four hours.
3. Draw the fluid rapidly off by means of a pipette, and add absolute alcohol up to half of the original bulk. Any drying of the tissue must be carefully guarded against. Leave for twenty-four hours, and repeat the process.

C. The replacement of the alcohol by chloroform.

1. Pass, by means of a pipette, the chloroform-alcohol mixture to the bottom of the vessel, when the tissue will float on the mixture. Remove then the superfluous alcohol by a pipette, leaving only enough to cover the tissue.
2. When the tissue has sunk in the chloroform-alcohol mixture, introduce by a pipette pure chloroform, on which the tissue will float; the fluid above the tissue is removed by a pipette. After twenty-four hours the tissue may or may not have sunk in the chloroform; if not, it may be induced to do so by heating the chloroform to 20° C. (not higher); if this fail, a little sulphuric ether may be added. After the tissue has sunk, leave for twenty-four hours.
3. Place a fresh supply of chloroform at the bottom of the vessel (50 times the bulk of the tissue), and if there is a distinct line of demarcation between the newly-added and the old chloroform, the upper layer should be removed by a pipette.

D. The replacement of chloroform by paraffin.

1. Place the tissue in a warm chamber heated to 25° C.; add solid paraffin in pieces up to the size of a small pea. After each piece has dissolved, the bottle has to be moved about very

Method *D—continued.*

gently to hasten the mixing of the paraffin, which will be in the upper layers, with the chloroform. Continue till no more paraffin dissolves. [Tissue which did not sink in pure chloroform will always sink as soon as paraffin is added.]

2. Place the tissue in a warm chamber heated to 30° C. for twenty-four hours.
3. Place the tissue in a warm chamber heated to the melting point of the paraffin (46° C.), and after six hours replace the ordinary cork stopper (which up to this stage has always to be employed) by a perforated one. This method is adopted to ensure a gradual giving off of the chloroform, for I find that, if the latter be driven off rapidly, a good deal of shrinkage always results. When all the chloroform has evaporated, *i.e.*, if after shaking the bottle gently one is unable to detect by smelling the faintest trace of chloroform, then the tissue is ready for sectioning. [If the bottle be not shaken gently before smelling the solution, it is often impossible to detect chloroform, although a large quantity of the latter is still in the lower layers of the paraffin, as the upper layers part more readily with the chloroform.]
4. The tissues should not be exposed longer than just necessary to the temperature of melted paraffin, but should be imbedded by means of Leuchart's type-metal box, or by two L-shaped pieces of metal running in an oblong box, the breadth of which correspond to the short limb of the L. The metal boxes should be warmed and filled with melted paraffin. After five to twenty seconds, when the paraffin at the bottom of the box has solidified, the tissue is removed from the bottle by a copper lifter, and, without being allowed to cool, it is dropped into the imbedding box, put into any desired position by means of hot needles, and the paraffin cooled very gradually. It is best not to touch the tissue by any instrument till it is

Method *D—continued.*

ready to be placed in the imbedding box, and also to avoid heating the copper lifter or the needles too much. Tissues thus imbedded may be kept unchanged for any length of time.

To get perfectly satisfactory results, the tissue we are treating must be living; smaller vegetable objects, as flower buds, ovaries, growing apices, &c., must be dropped into the fluid as soon as separated from the plant, and animals like tadpoles, worms, and larvæ are placed directly into the fluid, where they are killed rapidly and in an extended position. Tissues of plants and animals must be placed in the fluid as soon as separated by dissection. Tissues of warm-blooded animals should be placed in the picro-corrosive alcohol of corresponding warmth. Treating tissues like brain, it is best to place into the bottom of the vessel a pad of cotton-wool or felt to allow the hardening fluid to penetrate readily; the pad must be removed before the chloroform-alcohol is placed below the tissue. My method was found to give very satisfactory results with plasmodia of myxomycetes, growing apices, developing endosperm, stem and leaf structures, human fœtal brain, frog's cartilage, muscle, myxomatous tissue, retina, tadpoles, wasp larvæ, caterpillars, &c. Karyokinetic figures are specially well fixed, and show the minutest details.

Now, a few words as to mounting sections. Sections cut in ribbons (I use the Cambridge rocking microtome) are fixed to a slide by Schällibaum's method, thus:—An even layer of the fixing material is spread on the slide, the slide heated to 30° C. (melting point of paraffin = 46° C.), and a piece of the ribbon gripped by a pair of forceps at one end and quickly laid down on the warm slide. In this way I get the sections to lie perfectly flat, and it is even possible to make a closely coiled-up ribbon expand with the greatest ease, without causing any further trouble. The slide is next heated above a Bunsen, just enough to melt the paraffin; it is then placed in a vessel containing resinified turpentine, which latter removes the paraffin in a few minutes; the turpentine is removed by absolute alcohol, and the sections stained by any of the current methods, then dehydrated in absolute alcohol, cleared in resinified turpentine, and, lastly, mounted in Canada balsam dissolved in turpentine, as turpentine-balsam has a low refractive index.

Observations on Glands in the Cotyledons, and on the Mineral Secretions of Galium Aparine, L. By Thomas Berwick, University of St Andrews. Communicated by Dr John Wilson. (Plate III.)

(Read 13th February 1890.)

In a paper read before this Society Professor Lawson says that " In *Galiaceæ* the glands occur apparently in the axils, but in reality in the inner or upper surface of the bases of the leaves. In structure they bear a considerable resemblance to the stipular glands of many *Cinchonaceæ*, with this difference, however, that they are generally either distinctly stipitate, or club-shaped; whereas those of *Cinchonaceæ* are usually thickest at the base, and taper (more or less gradually in different species) towards the apex. When stipitate, the stalk of the galiaceous gland is composed of two or three (sometimes more) series of cells, those running up the centre sometimes containing green chlorophyll granules; none of these, however, being usually exhibited in the body of the gland." * His excellent paper deals with the glands of the leaf whorls, but it is the development of the cotyledonary glands which we shall now consider, of which no notice, so far as I am aware, has been taken. The plant examined with this object was *Galium Aparine.*

With reference to glands in cotyledons, however, Dr John Wilson informs me that he detected mucilage glands in the axils of the cotyledons of *Statice* and *Armeria*, but that they did not occur in all genera of the *Plumbagineæ.*

In *Galium Aparine* they occur in the axil of the cotyledons, just as the above author describes them as occurring in the stipules and leaves composing the whorls. I detected two glands in an embryo (Plate III., fig. 1), dissected out of a seed which had lain in the soil, but no germination had taken place, and the albumen was still quite horny; these glands were in the axil of the cotyledons. Another embryo dissected out of a seed which had lain in the soil rather longer, but in which likewise no germination had taken place, had also two glands in the same position. On staining

* *Trans. Bot. Soc. Edin.* (1856), vol. v., part i., p. 6.

with eosin each cell in the glands of the embryo last mentioned was nucleated (Plate III., fig. 2, *gl.*).

The peripheral oval cells of an embryo surround a longitudinal layer of cells. The glands of the embryo (Plate III., fig. 2, *gl.*) arise as rounded epidermal papillæ, and when fully grown they conform to Professor Lawson's description above quoted. The earliest glands observed were seen in an embryo (Plate III., fig. 1), removed from a hardened seed. They measured in height ·14, across ·13 mm. These embryonic glands are sessile. They would seem to be developed before the plumule, and certainly they are developed before the spiral vessels appear. I may here state that the spiral vessels in *Galium Aparine* are unconnected with the glands of the plant.

The growth of these embryonic glands is very rapid, for in an embryo whose radicle had only protruded ·2 of an inch, the largest glands, *i.e.*, the early glands above referred to, measured in height ·75, across ·52 mm., even already attaining almost maximum development, as far as my observations have gone, when as yet the cotyledons and hypocotyl were still in the horny albumen. The plumule, however, was now noticeable. In a seedling 1·3 inch in length, the cotyledonary glands were numerous, and in another (Plate III., fig. 3), measuring 2 inches, the cotyledonary glands were also numerous, in fact, forming a whorl (Plate III., fig. 4); and the two first to appear still keep the lead. In the latter seedling these two glands (Plate III., fig. 4, *gl.*) measured in height ·8, across ·53 mm., which is the maximum growth of a cotyledonary gland.

In a seedling (Plate III., fig. 5), measuring 2·2 of an inch, several of the cotyledonary glands were nucleated in every cell (Plate III., fig. 6). Professor Lawson, in the paper just cited, found that " in *Rubia tinctorum* each cell of the gland contains a large green central nuclear body." * The glands, however, referred to were those of the whorls doubtless.

The leaf glands in *Galium Aparine*, as far as I have seen, never attain the size of the two first cotyledonary glands. They vary much in size, the largest measuring in height ·55, across ·22 mm.; they are mostly smaller. This I consider important. The fact that the adult cotyledon is much

* *Trans. Bot. Soc. Edin.* (1856), vol. v., part i., pp. 5, 6.

larger than an adult leaf does not satisfactorily account for two of the cotyledonary glands—the two embryonic glands—being larger than any gland developed in the axil of a leaf. For these two cotyledonary glands attain their maximum development when the cotyledons are still no larger than the ordinary leaves, and are still half in the soil (Plate III., fig. 3), owing to the bending of the hypocotyl.

The mature glands of the whorl of stipules and leaves become brown, and are therefore easily seen with the naked eye. But before maturity they are scarcely visible; on tearing away fresh cotyledons, however, the group of glands is easily seen with the naked eye. Prof. Lawson notes that globules of oil * are given off by the glands of *Cinchona Calisaya*, Willd.; the same feature is seen in fresh glands of *Galium Aparine*.

In numerous embryos dissected out from seeds of *Sherardia arvensis*, L., gathered in the University Garden from a withered plant on the day of examination, the albumen being horny, two glands were invariably found in the axil of the cotyledons, as in *Galium Aparine;* and also, as in *Galium Aparine*, no plumule was noticed at this stage. These embryonic glands must have some important function in these two plants. Their rapid growth and multiplication in *Galium Aparine* is very striking.

In numerous embryos of *Coffea arabica*, L., examined, no glands were discovered in the axils of the cotyledons, but I found them in the axil of a mature cotyledon. These cotyledons resemble those of *Fagus sylvatica* so much that a germinated coffee plant is apt to be taken for a germinated beech. They are functional for a considerable time, the cotyledon examined being taken from a plant six months old and nine inches above the ground. Hanstein, in a paper "On Resin and Mucilage producing Organs in Buds," † refers to the resin-producing glands of the interpetiolar stipules in *Coffea*, those in the buds being similar to those in the adult stipules, only smaller. Prof. Lawson also refers to the glands of the interpetiolar stipules in *Coffea*, but they may not have been hitherto noticed in the axils of the cotyledons. In the above papers no mention is made of glands

* *Trans. Bot. Soc. Edin.* (1856), vol. v., part i., pp. 5, 6.

† *Botanische Zeitung*, 23rd Oct. 1863, p. 711.

occurring in the leaves. I found a group of glands in the axil of an adult leaf.

Notes on Development of the Vascular System, &c.

In the embryo of *Galium Aparine* no spiral vessels are differentiated, but they soon appear on exit of the radicle, a bunch being formed, which splits into two groups, one for each cotyledon. In the cotyledon (Plate III., fig. 7), one vessel of each group is alternately given off to each side, and the rest form a mass whose extremities emerge in a series of water pores * (Plate III., fig. 7, *w. p.*), just below the indentation on the upper surface of the cotyledon. The adult cotyledons bear the hooked hairs (Plate III., fig. 7, *h.*), characteristic of the plant. The root, which consists of rows of longitudinal cells, becoming compressed towards its apex, has a greater or less development of spiral vessels, but the rootlets, which are similar in structure, have usually only two spiral vessels.

When placed in a flame the seed of *Galium Aparine* detonates, ignites, and becomes red hot, after the manner of the coffee bean, though on a smaller scale. I found that the roasted seed could be used as a substitute for coffee. But the recommendation that it might be so used has already been made. It was noticed that boiling with caustic soda caused in the seedlings reddening of the root, and blue coloration in the stem at the base of cotyledons, while caustic potash turned the same part of the stem brown and the root red. The blue tint permeated the cotyledons, being most marked round the margins; it also spread into the primary leaves, and often into the glands. But no coloration took place on boiling an embryo dissected out of a seed, or on any portion of an embryo which had required to be dissected out. Thus a blue coloration indicated after boiling how far the radicle had protruded from the seed. There was a brown and blue in a seedling where radicle had projected ·2 of an inch, and in that where radicle had projected ·3 of an inch there was a patch of blue indicating the point of junction with the seed. If a living seedling is placed in HCl, at the bend beneath the cotyledons, a

* See Turnbull on "Water Pores," *Annals of Botany*, vol. iii., No. ix., p. 123.

beautiful pink is taken on. The same result takes place with 5 per cent. HNO_3, and with picro-sulphuric acid.

Raphides.

These have been described as "the minute crystals of various saline matters, which are taken up into the tissues of plants, and whilst forming a part of the bulk of the living plant, nevertheless obey the lower laws of crystallization." * Dr Edwin Lankaster wrote on Raphides in the *Quarterly Journal of Microscopic Science;* as also did Professor Gulliver, the latter treating the subject very exhaustively. He says in a paper in that journal that "they commonly occur in bundles within a living and beautiful cell, the whole forming an organism as inimitable by mere chemistry as a spore or a pollen grain." † But here I may state that Vesque claims to have produced raphides chemically. ‡ Professor Gulliver says further, "that they are very easily separable from each other and from their cell; each raphis is generally without any obvious faces or angles on the shaft, which gradually vanishes without any angular appearance to a point at either end." § By the term raphides in the rest of this paper are to be understood the raphides proper, *i.e.*, acicular crystals.

According to Professor Gulliver, among British dicotyledons we can only name three orders characterised as raphis-bearers, viz., *Balsamineæ* (Lindley's alliance), *Onagraceæ*, and *Rubiaceæ*, || but they also occur in *Rumex* (*Polygoneæ*). He found that the seedlings of Willow Herb could, by means of their raphis-bearing character, be readily diagnosed from seedlings of other plants with which they were grown, as soon as the seed leaves were well developed.¶ But by means of the same character, I find that *Galium Aparine*, at all events, can be recognised at a much earlier stage of development. For when the radicle has projected ·2 of an inch (Plate III., fig. 8), the horizontal raphides—by *horizontal* is meant the direction of right angles to the axis of the root or rootlet; by *vertical* is meant the direction parallel to the axis of

* *English Botany*, vol. ix., 1873, p. 18.
† *Quart. Jour. of Mic. Sci.*, vol. vi., 1866, p. 2.
‡ *Ann. des Sc. Nat.*, ser. 5, tome xix., 1874, p. 300.
§ *Quart. Jour. of Mic. Sci.*, vol. vi., 1866, p. 6.
|| *Ibid*, p. 5. ¶ *Ibid*, p. 4.

the root, rootlets, or stem, and in the leaves to the midrib—piled above each other in column, as indicated in Plate III., fig. 9, *h. r.*, enable the seedling to be at once recognised.

The fruit of *Galium Aparine* is tuberculed, the rounded projections being crowned with hairs, having enlarged bases and sharply-hooked tips. Each fruit consists of two seeds with an amphitropous embryo in each. The raphides, which are frequent in the tuberculed coat (testa), dissolve out before the embryo germinates. The microscope discloses the presence of no raphides in the brown endoplure layer of polygonal cells, neither in the indurated albumen, nor in the embryo. Moreover, HCl causes no effervescence in contact with the ash of seeds from which the seed coats have been carefully removed. The great aggregation of lime in *Galium Aparine* is indicated on application of HCl to any portion of the ash of root, stem, leaves, or seed coats. These raphides consist of calcic oxalate.

In the embryo already referred to, where the radicle had protruded only ·2 of an inch, and in which the horizontal raphides arranged in columns occurred, there were further up, as well as at the very apex of the radicle, numerous vertical raphides (Plate III., fig. 9, *v. r.*). There were no raphides, however, discovered in the cotyledons removed from the horny albumen. In another germinating seed the same conditions were found in the radicle, which had protruded ·3 of an inch, but in the cotyledons dissected out several groups of raphides were seen (not more than three groups).

In a series of fully-developed seedlings, ranging from 1·3 to 2·5 inches, the vertical raphides occurred at the apex of the root, also in its upper portion, as well as in the stem, cotyledons, and, although sparingly, in the primary leaves; whilst the horizontal invariably occupied that portion of the radicle just above its extreme apex.

In numerous seedlings obtained in the fields the rootlets exhibited the same phenomena in the region of the root-cap, viz., horizontal raphides arranged in columns, and vertical raphides at the extreme apex. The absence almost entirely of the vertical raphides in the rootlet beyond the region of the root-cap is to be noted, as they occurred frequently in the corresponding region of the root.

The radicle emerges by an aperture of its own making, although there is in the seed a large cavity which has no connection with the exit of the radicle, or indeed of the cotyledons. The radicle is in a curved position for some time after protrusion. In the embryo (Plate III., fig. 10), the radicle in germinating formed a loop, and in the curve towards the apex of the radicle, where it touched the soil, the horizontal raphides were present. But it is questionable whether the curving of the radicle has any connection with the laying down of the raphides in a horizontal position. Possibly in the root, as well as in the rootlets, the development of the root-cap may have some connection with the laying down of the horizontal raphides, but if so, why are the raphides vertical at the apices of both root and rootlets? In young rootlets, almost invisible to the naked eye, small groups of horizontal raphides occur frequently. These are carried forward *in situ*, the columns increasing in depth, according to the length of the rootlet, the vertical raphides duly appearing at the extreme apices.

Raphides, then, in the seedling, as in the adult plant, *usually* occur abundantly in all parts of the plant in the vertical position, except as indicated in the region of the root-caps of the root and of the rootlets.

It is stated by De Bary that cells correspond in shape to the groups of crystals they contain.* I find this to be the case in those of the plant under consideration. It may here be noted that in adult leaves the bundles often seem to have outgrown their cells.

A single group of raphides occurred in several adult cotyledonary glands (Plate III., fig. 4, *r*.). It was found sometimes in the stalk, and sometimes in the centre of the gland, and it lay beneath the outer layer of cells.

In the crystals before us I have not detected the mucilage referred to by De Bary† and Strassburger,‡ as occurring around certain plant crystals, although I have observed granular contents in cells of the rootlets containing raphides.

Some seeds of *Galium Aparine*, from which the seed coats were removed, were sown in soil previously treated

* De Bary, *Comp. Anat.*, Eng. trans., 1884, p. 138.

† *Ibid*, p. 139.

‡ Strassburger, *Practical Botany*, Eng. trans., 1887, p. 98.

with HCl, but notwithstanding the radicles were laden in a similar manner with horizontal raphides. It is evident that the lime could not have been entirely removed from the soil. But a noticeable feature was, that the root developed an abnormal number of root-hairs. I may add here that raphides are absent from root-hairs in *Galium Aparine*.

As to other species, the rootlets of *Galium glabrum*, Thunb. (?), *Asperula odorata*, L., and *Asperula lævigata*, L., all showed the same horizontal raphides arranged in columns in the region of the root-cap. Those in *Asperula odorata* were however somewhat irregular, *i.e.*, all were not horizontal. In other species examined the roots were dormant, and could not be judged of satisfactorily. There is much reason, however, to believe that the same condition will occur in other species.

Raphides are very frequent in the testa of *Sherardia arvensis*, and may disappear before the embryo germinates, as is the case with *Galium Aparine*. They are, however, absent in the ungerminated embryo, as in the latter plant.

It may be stated that the raphides within the root-cap (as elsewhere throughout the plant) of the rootlet of *Epilobium montanum*, L., are vertical. They are often obscured by a brown pigment in certain cells, which is somewhat soluble in caustic potash. Many seedlings of an Epilobium self-sown in the Onagraceæ bed of the University Garden had the raphides in all parts likewise vertical. In *Lemna minor*, L., the raphides were all vertical, and they were numerous within the region of the root-cap.*

Explanation of Plate III.

Galium Aparine.

Fig. 1. Embryo (nat. size), from hard seed; its two glands measured in height ·14, across ·13 mm.

,, 2. An ungerminated embryo enlarged; its two nucleated glands marked *gl*.

,, 3. A seedling (nat. size), the cotyledonary glands seen in fig. 4; surface of soil indicated by dotted line, *m*.

* I have to thank Dr Wilson for placing material at my disposal, and for general assistance with the work; also Professor McIntosh, for the use of apparatus.

Fig. 4. Whorl of glands in axil of cotyledons of seedling, fig. 3, enlarged; *gl.* an adult embryonic gland, which measured in height ·8, across ·53 mm.; *p.*, plumule surrounded by leaves; *r.*, bundle of raphides in the other adult cotyledonary gland; *v. r.*, vertical raphides; *s. v.*, spiral vessels.

,, 5. A seedling (nat. size); surface of soil indicated by dotted line.

,, 6. Nucleated cotyledonary glands from seedling, fig. 5.

,, 7. An adult cotyledon: *w. p.*, water pores; *h.*, hair; *v. r.*, vertical raphides.

,, 8. A seed with its radicle protruding (nat. size).

,, 9. Root-cap region of radicle in fig. 8: *v. r.*, vertical raphides; *h. r.*, horizontal raphides.

,, 10. Seed with radicle forming a loop in germinating (nat. size).

Postscript.—In an embryo of *Galium cruciatum*, Scop. (from a fresh seed of this year), I have discovered two embryonic glands similar to those occurring in the embryo of *Galium Aparine*, L. In numerous other embryos of *G. cruciatum* examined, only one gland was detected, but this was due to the difficulty of dissection. The largest gland seen might measure $\frac{1}{75}$ of an inch in length.

In certain other native members of the order *Rubiaceæ* examined, the embryonic glands, if present, escaped detection. —*November* 1890.

Notes on Recent Additions to the Flora of the Moffat District.
By JOHN THORBURN JOHNSTONE, Moffat.

(Read 13th March 1890.)

The list of plants given in the recently-published edition of the *Moffat Guide* was compiled by me in the spring of last year; and while far from being a complete list of our Moffat plants, it is much more extensive than any that has preceded it. I have pleasure in submitting a list of additions made to it during the past summer, which number nineteen, and are as under:—

Ranunculus bulbosus, Linn.; *Lepidium campestre*, R. Br.; *Silene Cucubalus*, Wibel.; *Cerastium semidecandrum*, Linn.; *Sagina procumbens*, Linn.; var. *spinosa*, S. Gibs. This plant is new to the district, and was gathered on August 4, 1889, near the Devil's Beef Tub.

Medicago denticulata, Willd.

Saxifraga nivalis, Linn., Black's Hope, July 13, 1889, and is also a new plant added to the Dumfriesshire list.

Anthriscus sylvestris, Hoffm.; *Doronicum Pardalianches*, Linn. *Hieracium saxifragum*, Fr., Black's Hope, Correferon, Grey Mare's Tail. The occurrence of this plant in these glens, where it is fairly common, is rather interesting, and of more than ordinary local importance. As far back as the year 1850 or 1851 Mr J. Backhouse gathered this plant at the Grey Mare's Tail here,* and up till now it has never been placed on any list of Dumfriesshire plants; indeed, the eighth edition of the *London Catalogue* seems to have been the first British list it has been admitted to, and there its county distribution is given as two or three. The Rev. E. F. Linton, Bournemouth, named the plant I have in my possession.

Hieracium auratum, Fr., Moffat Water (rather rare); *Hieracium sparsifolium*, Lindeb., Craigmichen Scams (scarce). Both these Hieracia are new to the Moffat district, but they have been gathered in some of the other districts in Dumfriesshire. These plants were also named for me by Mr Linton.

* *Transactions of the Dumfries and Galloway Natural History and Antiquarian Society* for 1885–86, page 50.

Hieracium prenanthoides, Vill., Grey Mare's Tail. The Rev. E. F. Linton gathered this plant at the Grey Mare's Tail last year, when there botanising, but I have never seen it myself.

Crepis hieracioides, Wald. and Kit., Grey Mare's Tail and Craigmichen; *Anagallis arvensis,* Linn.; *Calamintha Clinopodium,* Benth.; *Stachys ambigua,* Sm.; *Habenaria viridis,* R. Br.; *Festuca rubra,* Linn.

It may interest some of your members to know that *Adoxa moschatellina* is found growing freely among the sheltered crags in Black's Hope at an elevation of about 2300 feet above sea level. *Botrychium Lunaria,* Sm., was also found in the same glen at an elevation of 2000 feet above sea level, but did not seem to be growing freely. While they seemed healthy enough plants, they were very small and attenuated in their parts.

In addition to the variety of *Lastrea dilatata,* Presl, given in the printed list, Mr James Anderson also found in this district the following varieties, viz., *robusta, grandidens, micromera,* and *valida.*

On the Difficulty of ascertaining the Age of certain Species of Trees in Uruguay, from the Number of Rings. By DAVID CHRISTISON, M.D. (Plate IV.)

(Read 13th March 1890.)

Until comparatively recent times it seems to have been accepted as a truth, alike by botanists and foresters, and perhaps without much thought on the subject, that the number of rings or zones of wood in an exogenous tree, in any part of the world, accurately corresponds with the years of its age. Even now I have met with not a few intelligent botanists who still believe this. Great reliance is also placed, even in the best text-books on forestry, upon the rings as being indicative of the age, and consequently of the important point of the rapidity of growth, in tropical trees. Nevertheless, in recent years it has been shown that in parts of the United States of America, which are not even sub-tropical, the rings may be more numerous, or even less numerous, than the years of age of trees. Sir Robert Christison also pointed out, about twelve years ago, that in sections of tropical trees examined by him the rings were confused, irregular, and far too numerous to correspond with the age; and, as it has been proved by experiment in Germany that two rings can be produced artificially in a single year, by stripping a tree of its leaves in midsummer, it seems probable that in certain climates the same result may be produced naturally, and that in very equable warm climates, where there is no marked annual check to vegetation, rings might be expected to be formed very irregularly, if at all. Even in temperate countries like our own, although as a rule the zones of wood agree with the years of age, yet I believe it has been ascertained that there are exceptions, arising from temporary injury or in old age, from the layers of wood ceasing to be produced at the lower part of the trunk.

As this is a field of inquiry which as yet has been but little worked, I have brought before the Society the following observations on some sections of trees sent to me last autumn, by Mr Charles E. Hall, from his estancia of San Jorge, in Central Uruguay. In the first place, however, I shall give a brief account of the nature of the country and climate in which these specimens were grown, derived partly from information furnished by Mr Hall, partly from notes taken by myself during a visit to San Jorge in 1867, and published in the *Transactions* of this Society, vol. xiii., 1877–78, and elsewhere.

The estancia of San Jorge is situated near the centre of the Republic of Uruguay, in 56° 8′ W. long. and 32° 43′ S. lat., and at an elevation varying from about 280 to 400 feet above the sea-level. In common with the greater part of Western and Southern Uruguay, the ground undulates in broad-backed ridges, rarely above 60 or 70 feet in height, with exceedingly gentle slopes, to the intervening hollows. The country is on the whole fairly well watered, and the soil is, for the most part, either a deep black stiff rich clay, or light black intermixed with sand, with patches of gravelly soil.

The undulating "campos" are entirely destitute of natural wood, but the edges of the streams are fringed with trees, which, few and scattered in the upper waters, form on the larger streams dense continuous belts, the so-called "montes," permeated by *nullahs*, and liable to inundation. Useful trees grow in these montes, but, as might have been expected, and as Mr Hall found by experiment, they do not thrive when transplanted to the comparatively dry campos.

The estancia of San Jorge, originally 330 square miles in extent, was broken up, and the Head Station, with 9 square miles of land, became Mr Hall's property in 1876. The "Quinta," or garden ground round the house, then contained about 350 Robinia, Lombardy poplar, and Paraiso (*Melia azedarach*) trees, besides a great variety of fruit trees. The quinta was at that time the wonder of the whole country for many leagues around, as very few of the estancias, particularly those owned by natives, had vegetable gardens, and still fewer fruit or ornamental trees; and Mr Hall is, I believe, entitled to the honour of being the pioneer of tree-planting for business purposes on the naked campos of Uruguay. It was in July 1880 that he commenced, and he has now 160 acres under plantation, carrying about 80,000 trees, the great majority being *Robinia pseudoacacia*, Lombardy poplar, and *Acacia melanoxylon* (Blackwood).

Mr Hall's example has not yet been extensively followed in Uruguay, as he informs me that, within a circuit of fifty miles, the estates that have so much as twenty acres planted could probably be counted on the fingers of one hand, while very few have as much as an acre, and the great majority are still quite bare of wood. It is to be expected, however, that a great change in this respect will take place when the encouraging results of Mr Hall's planting are more generally known; and I am glad to say that it is his intention to publish shortly a full account of his forestry experiments in Uruguay.

Meteorological observations were taken by Mr Hall with tested instruments, properly protected, and according to recognised scientific rules. The principal results are as follows:—

The climate is variable, and the extremes of temperature and rainfall are accentuated. Long droughts and long-continued rains are apt to occur. The annual rainfall is irregular in amount; thus, for the two years from July 1886 to June 1888, it was in all 32½ inches, but for the subsequent year it was no less than 79 inches. The annual average number of days of rain is 94, and the fall is torrential in character. April and September are the rainiest months, and February the driest.

December, January, and February may be taken as the summer months, the average maxima of temperature being 84°·7 F., the minima 58°·4. June, July, and August are the winter months—average maxima 60°·5, average minima 41°·3. The spring and autumn average maxima and minima are much alike—maxima 72°, minima 49°. Highest temperature in shade in nine years, 100°; lowest, 23°. Mean annual temperature, 60°·9. Frost at night is not at all infrequent in winter, but it disappears as the sun gains strength in the early morning.

It thus appears that the cold season is sufficiently well marked to lead us to expect a distinct annual check to vegetation, and that, in the warm season, temperature and rainfall are liable to sudden marked changes, from which minor effects on the growth might result.

The five sections sent by Mr Hall are from five species of trees, and were all cut close to the ground. I give some of their chief characteristics, together with the duration of the seasonal-growth of the species to which they belong, from monthly girth-measurements of other trees of their species taken for several years by Mr Hall.

Robinia pseudoacacia, Lin.—Age, ten years; annual girth-increase of the specimen, $1\frac{1}{2}$ inch; winter sleep of the species, six to eight months, during part of which, however, there was a very slight growth.

Melia azedarach.—Native of Syria, but naturalised in South Europe (Lind.); a favourite boulevard tree in Spanish South American cities, there called "Paraiso." Age, eleven years; annual girth-increase of the specimen, 2·27 inches; growth ceased, or was greatly retarded in the species for from four to six months annually; in 1888, after a good start in August, the rate fell greatly in September and October.

Acacia dealbata v. *mollissima*, Willd.—Evergreen; native of Australia. Age, seven years; annual girth-increase of specimen, 1·97, but that of two other of the species was 5 inches; growth of the species pretty steady through the year, except a total cessation from 12th February to 12th March in 1886, from 12th December to 12th January in 1886–87, and from 12th January to 12th February 1888.

Acacia melanoxylon, R. Br.—Black wattle; native of Australia. Age, eight years; annual girth-increase of the specimen, $3\frac{1}{4}$ inches; growth of the species much retarded for two to three winter months in 1886 and 1887, and ceased entirely for two months in 1888.

Acacia lophantha, Willd.—Deciduous; native of Australia. Age, five years; annual girth-increase of the specimen, 4 inches; growth of the species unknown.

Before proceeding to describe the rings in these sections, it will be well briefly to recall the characteristics of rings in hardwood trees of temperate climates.

1. Perhaps the most invariable differentiating character is the difference in density between the spring and autumn wood, the former being much looser in texture than the latter. This is very evident under the microscope, but often shows a marked distinction to the naked eye also.

2. At the outer side of the autumn wood there is usually, as it were, a rather sudden and extreme compression or flattening of the tissue, as seen under the microscope, which forms the

sharp line of demarcation, visible to the naked eye, of the zones of wood in so many of our forest trees.

3. This line of demarcation is, in many species, accentuated by an aggregation of the vessels into a circle close to the inner edge of the spring wood; but in other species this character is wanting, as the vessels are distributed more equally, often in successive circles, through the zone. The cut mouths of the vessels are generally quite visible to the naked eye.

Character of the Rings in the Specimens to the Naked Eye.

Robinia pseudoacacia.—On the dark smoothened surface of the block, ten thin whitish circles sharply mark out eleven zones of wood, corresponding with the known age of the specimen. These circles are caused by the presence of the second and third characteristics noted above. A large number of very distinct concentric rings are also caused by a tendency to a circular arrangement of the vessels throughout the zones, but there is no risk of these being mistaken for annual zones.

Melia azedarach.—On the smoothened, reddish-brown surface, nine whitish concentric lines, at tolerably regular intervals, are clearly marked, besides eight others confined to the inner radius of half an inch. Judged by a British standard, therefore, we should pronounce this tree to be eighteen years old, the earlier eight years' growth having been very slow, as we often see. But the actual age of the tree is only eleven years. Besides these solid-looking circles, there are upwards of 100 very distinct quasi-circles, formed of innumerable vessels with whitish walls.

Acacia melanoxylon.—The smoothened surface shows a series of concentric waves, alternately whitish and brownish, very numerous, and with no sharp lines of demarcation. At intervals, two or three of the brownish waves are broader and darker, and thus vaguely define eight zones of wood, corresponding in number to the years of age of the tree. The two inner of these vague boundaries are of a wavy blackish-brown all over. The vessels are small, numerous, and not in rows.

Acacia mollissima.—The smooth surface shows a large number of concentric waves, as in the last, distinct enough, yet too vague to be counted accurately. Groups of three or four, more distinctly marked, occur, but they do not in the least correspond with the age of the tree. Judged by a British standard, the tree might be considered to have badly-marked rings, occasionally arranged in more distinct groups of two or three, indicating, from the more distinct lines alone, an age of about twenty years, but it is only six and a half. In the illustration, Plate IV., which I owe to the skilful pencil of Mr Gustav Mann, the natural appearance is shown in the finished part of fig. 1; but the lines of demarcation of the first five years are accentuated to show their position better. The sixth line has not been so treated, as it is scarcely possible to make it out.

Acacia lophantha.—The smooth surface shows about forty concentric waves, very distinct at a glance, but with no sharp definition, and difficult to count. They do not differ much in distinctness, except a well-marked dark one near the centre.

The general results, so far as naked-eye surface characteristics of the blocks are concerned, are, that the zones are quite distinct, reliable, and annual in *Robinia;* that in *Melia* zones are clearly marked out, but are considerably more numerous than the years of age of the tree; that in *Acacia melanoxylon* the annual zones are vaguely marked by an accentuation of colour in certain groups of numerous rings which are not annual; that in *A. mollissima* and *lophantha* the annual zones are either unrecognisable, or are only to be made out with difficulty and doubt, amidst the numerous wave-like rings.

Microscopical Appearances.

It remained to ascertain whether, in the instances in which the rings were indistinct or unrecognisable to the naked eye, the true annual rings could be made out by aid of the microscope. Fine sections were accordingly made of *Acacia mollissima* and *lophantha* by Dr Macfarlane, and I had the advantage of his assistance in examining them. As the results in the two species were not materially different, I shall confine my observations to the *Acacia mollissima,* as the appearances in it are illustrated by Mr Mann in Plate IV. Fig. 2 shows the characteristics of a well-marked ring, the fifth. The somewhat gradual flattening or apparent compression of the latest autumn wood of the fourth year (*a*) into a circle forming a distinct line of demarcation is well shown, and the larger size of the cells of the spring wood of the fifth year (*b*), particularly at the very commencement, is noticeable. The differences, however, in density of tissue and size of lumina are not nearly so well marked as is ordinarily the case in the wood of temperate climates. In fig. 3, which shows the demarcation between the first and second year's growth, the comparative feebleness of the characteristics are seen; and it may be remarked that in other parts of this ring, as well as in other true rings both of *Acacia mollissima* and *Acacia lophantha*, the band of flattened cells almost, if not entirely, disappears. Fig. 4 shows the very slight differences between the older tissue (*a*) and the younger (*b*) in a false ring.

Thus we have a transition from the well-marked annual ring of the fifth year, through the feebly-marked annual ring of the first year, to the almost insensible impress of a seasonal variation—all, no doubt, due to the influence of varying degrees of heat or moisture, or both combined. And if these results occur in a climate with a well-marked summer and winter season, we are at no loss to account for the confused and numerous rings noted by Sir Robert Christison in tropical wood. His observations, however, were only with the naked eye, and it is much to be desired that the nature of the wood-rings in tropical dicotyledons should be thoroughly investigated by aid of the microscope.

Taking a general review of the results, the following conclusions may be drawn:—

1. The ages of the specimens cannot be determined with certainty by counting the rings on the blocks, except in *Robinia*. In *Melia*, zones of wood, sharply defined by lines of demarcation similar to those met with in our British trees, are seen, but the zones exceed in number the years of age of the tree. In the *Acacias* a series of wave-like rings greatly surpass in number the years of age of the trees, and it is difficult or impossible to pick out the true demarcation of the yearly growths.

2. In the two *Acacias*—*mollissima* and *lophantha*—which were examined microscopically, true lines of demarcation, although doubtful or invisible on the block, could be made out by the naked eye in transparent sections, but sometimes only with difficulty and after verification by the microscope. Even under the microscope the line of demarcation was sometimes feebly marked, and the distinction between the autumn wood on one side and the spring wood on the other was very slight.

3. In proportion to the shortness or imperfection of the winter rest in the different species, the demarcation of the zones appears to become less marked. Thus, in *Robinia*, which enjoys a long winter sleep, the demarcation of zones is quite distinct on the blocks, and the minute structure of the parts which contribute to the differentiation of the zones differs but little from that of our British trees. But in the Acacias, which have a short and, perhaps, in some seasons, little or no rest, the demarcation of zones is often difficult, doubtful, or even indistinguishable on the block, is seen with difficulty by the naked eye in thin sections, and is comparatively feebly marked, in some instances, under the microscope.

4. Quasi lines of demarcation, consisting of vessels arranged in concentric circles, are met with in *Melia* and *Robinia*. They are easily distinguished, even by the naked eye, from the true lines of demarcation, and do not form the limits of zones differing in appearance or minute structure from each other. In the Acacias there is a tendency to the same concentric arrangement of the vessels, but they make no show on the block, and the ringed appearance in these specimens is perhaps mainly due to numerous concentric zones of for the most part slightly-differing shades of colour. Under the microscope these false rings are perhaps distinguishable, but only by very trifling differences in the tissue indeed.

It is interesting to note the variety in the duration of the winter rest in the different species of trees measured by Mr Hall. It is his intention to show this fully in a paper upon the results of his tree measurements, to be read to our Society in the present Session. In this place it is sufficient to point out that trees introduced from England enjoy as long a winter rest as at home; that *Melia azedarach*, a native of Syria and naturalised in the South of Europe, and *Robinia* *pseudoacacia* have a shorter repose; and that the Acacias, natives of the still hotter Australia, only rest for a few weeks, in some seasons perhaps not at all. Thus each species appears to follow the practice of its ancestors, although all are now living under the same atmospheric conditions.

In conclusion, I may point out the desirability of making some distinction between the annual growth of wood and the line of demarcation between two annual growths. It is true the latter is a vague element which cannot be easily defined. Still it is often of practical utility in ordinary speech. Perhaps the annual growth might be called a *zone*, and the line of demarcation a *ring*.

EXPLANATION OF PLATE IV.

Fig. 1. Surface of a section of a stem of *Acacia mollissima*, 6½ years old. Natural size. The line of demarcation between the 6th and 7th year's growth is pretty strongly indicated to show its position, but is very feebly marked on the block, as shown in the finished part of the drawing. It is also very feebly marked microscopically.

Fig. 2. Junction of the 4th and 5th year's growth. Transverse section. Illustrates the structure of a true ring, × 600°. (*a*) 4th year's wood; (*b*.) 5th year's wood.

Fig. 3. Junction of the 1st and 2nd year's growth. Transverse section. Illustrates a less strongly marked true ring. Bounded on each side by a medullary ray, × 400°. (*a*) 1st year's wood; (*b*) 2nd year's wood.

Fig. 4. Transverse section of a false ring, between the 2nd and 3rd true rings, × 400°, (*a*.) older wood; (*b*) younger wood. Bounded on each side by a medullary ray.

Notes on Tree Measurements, made Monthly at San Jorge, Uruguay, from January 12, 1885, *to January* 12, 1890. By CHARLES E. HALL, of San Jorge. (Plates V. and VI.)

(Read 12th June 1890.)

In 1885 I began measuring the girth of twenty-eight trees every month at San Jorge, in the republic of Uruguay, in lat. 32° 43′ S. and long. 56° 8′ W., and own a debt of gratitude to Dr Christison, of Edinburgh, for having suggested to me a work which, interesting at first, has become more so each succeeding year.

My measuring day was almost invariably the 12th of each month; never earlier than the 11th and never later than the 14th. The trees are marked with a light-painted line, not half encircling the tree, at 3 feet above ground level; this is the measuring point. The measure used is a steel tape, marked to millimetres. When a measurement appeared doubtful it was repeated. The repetition of a measurement, in the case of rough-barked trees, was not found invariably to exactly corroborate the first measurement taken; but a discrepancy of 2 millimetres, or the thirteenth part of an inch, was cause enough for a third measurement being taken. Until the last ten months I have, with but four or five exceptions, taken the monthly measurements myself, but have frequently been accompanied and sometimes had my measurements corroborated by others.

I have been in the habit of noting the difference between dry and wet bulbs of a hygrometer at time of measurement, generally when I was half way through the measuring work, fancying that the humidity or dryness of the air may have some effect on the stiffness of the bits of lichen on the bark of a few of the trees or on the bark itself, and thus probably affecting actual girth-measurement. I made two or three trials as to this by measuring in early morning, when the air was nearly saturated with moisture, and again about 3 P.M., when there was a large difference between wet and dry bulbs. I have unfortunately lost or left at San Jorge the records of these trials; but what I remember about them is, that their results seemed to me uncertain and unsatisfactory.

In January 1887 I added a twenty-ninth tree to the list—an ombri (*Phytolacca dioica*); but as this was a year or two after subjected to rough usage, horses being tied up under its shade and cattle and sheep rubbing against it, its growth cannot be said to be normal, and I do not include this grand vegetable among my tables of tree-measurements. And in December 1889, partly in view of my own projected absence from San Jorge, and not wishing to tax more heavily than necessary the time and energies of my sufficiently-busy manager, who now continues the tree-measuring work, I struck out of the list a fig, a walnut, and a Spanish chestnut tree, all doing well, but growing very slowly; also a silver poplar, which grows in ground habitually dug over once or twice a year, but, though healthy, this tree grows very slowly. I also omitted a Robinia and a Blackwood, likewise planted in land forked over about once a year. I also turned out a "cina-cina" (*Parkinsonia*) and an acer (species ?), a very poor specimen, whose measurement rendered the record of its species highly deceptive. I have only seven or eight grown plants of this tree, but all greatly exceed in growth this one of two specimens I chose for measuring purposes.

I now measure twenty trees, as follows:—

1. *Young Trees.*

Evergreens.—Two *Acacia mollissima* (or ? *Acacia dealbata*).
Two *Eucalypti,* common varieties; but not *E. globulus* (blue gum).
Two Stone pines (*Pinus pinea*).
Two Blackwoods (*Acacia melanoxylon*).

All these grow on undisturbed grass, and in enclosed ground.

Deciduous.—Two oaks from English acorns, but I do not know if *Q. Robur* or not. These are in ground forked over yearly.
Two Paraisos (*Melia azedarach*).
Two Lombardy poplars (*Populus fastigiata*).
Two Robinias (*Robinia pseudoacacia*).

These last three sorts all grow on undisturbed enclosed ground.

2. *Older Trees.*

A large Paraiso and a large Robinia, in an avenue (partly for the sake of finding out when such trees really should be cut down); an acer (? species), companion of the specimen previously referred to; and a cottonwood, or Carolina poplar (*Populus angulata*). This last tree grows in ground periodically forked over.

I now present some tables showing the average monthly growth in millimetres for a term of five years, with the percentages of growth per month.

Table No. I.—*Monthly Increase in Girth and Percentage of Increase for each Month in eight Evergreen Trees, between* $8\frac{1}{2}$ *and* 15 *years of age, for five years, from* 12*th January* 1885 *to* 12*th January* 1890.

5 of each Month.	2 Ac. mollis.		2 Eucalypti.		2 P. pinea.		2 Ac. melan.	
	Millimetres	Percentage.	Millimetres	Percentage.	Millimetres	Percentage.	Millimetres	Percentage.
January, .	159	11	101	9	065	$6\frac{2}{3}$	126	$14\frac{1}{2}$
February, .	116	8	099	9	058	6	069	8
March, .	081	6	126	11	065	$6\frac{2}{3}$	082	9
April, . .	131	9	120	11	091	9	093	11
May, . .	113	8	105	9	069	7	082	9
June, . .	059	4	088	8	028	3	034	4
July, . .	060	4	053	5	015	2	017	2
August, .	060	4	063	6	065	$6\frac{2}{3}$	027	3
September, .	121	8	105	$9\frac{1}{2}$	158	16	050	6
October, .	170	11	095	$8\frac{1}{2}$	146	15	118	$13\frac{1}{2}$
November, .	199	14	075	7	116	12	103	12
December, .	184	13	071	7	093	10	071	8
	1453	100	1101	100	969	100	872	100

Table No. I. represents the monthly growth and percentage of growth of four species of evergreens, founded on the total growth of two trees of each species. In each species, July (= English January) is the month of least growth; the month of greatest growth is January ($14\frac{1}{2}$ per cent. of the annual amount) for *Acacia melanoxylon;* for *Eucalyptus*, March and April (11 per cent.); for *Pinus pinea*, September (16 per cent.); and for *Acacia mollissima*, November (14 per cent.).

The period of least growth in all the species was in the three winter months—June, July, and August; the total amount for these three months varying in the different species from 9 per cent. to 19 per cent.

On the other hand, the period of greatest activity occurred at very different times in the different species. Generally, it was for three or four months in spring and up to midsummer; but *Eucalyptus* was most active for the four months after midsummer, when they grew 40 per cent. of the general increase. The *Acacia mollissima* was the only species in which there was a regular rise and fall in the girth-increase throughout the year. The *Eucalypti* rose and fell to two extremes, one in September and one in March and April. The pines attained their maximum (16 per cent.) quite suddenly in September (=English March), and fell gradually till the middle of autumn, when there was a slight increase. The *Acacia melanoxylon* was very irregular.

TABLE No. II.—*Monthly Increase in Girth and Percentage of Increase for each Month, in eight Deciduous Trees, between* 8½ *and* 15 *years of age, for five years, from* 12*th January* 1885 *to* 12*th January* 1890.

5 of each Month.	2 Melia azedarach.		2 Oaks.		2 Populus fastigiata.		2 Robinia Ps. Acacia.	
	Millimetres	Percentage.	Millimetres	Percentage.	Millimetres	Percentage.	Millimetres	Percentage.
January, .	134	23	143	20	118	21	053	18½
February, .	127	21½	101	14	074	13	062	22
March, .	067	11	042	6	016	3	009	3
April, .	021	3½	012	1½	022	4	012	4
May, .	-009	-1	-003	-½	-016	-3	-009	-3
June, .	004	½	002	⅓	003	½	005	2
July, .	007	1	002	⅓	-002	-⅓	004	1½
August, .	005	1	002	⅓	003	½	003	1
September, .	034	6	007	1	003	½	007	2½
October, .	036	6	068	9	031	5½	027	9½
November, .	052	9	181	25	151	27	051	18
December, .	109	18½	167	23	158	20⅓	060	21
	587	100	724	100	561	100	284	100

Table No. II. represents eight deciduous trees under the same conditions, averages, percentages, &c. Each species has its own month for chief growth, varying from November to February; and in all the rise and fall to and from the maximum is regular, with trifling exceptions.

The May decrease in girths is noticeable; it occurs in all the species, and a month before the three months of comparative rest in the evergreens. With the exception of May, and, in the case of the Lombardy poplars, July, there is no month that does not show a slight increase in one or more species. But the nett growth for the six months, April to September, is, for Lombardy poplar, only 2 per cent. of the annual increase, and for *Acacia Robinia* $5\frac{1}{2}$ per cent; for the five months, April to August, the nett growth of Paraiso is only 5 per cent., and for the oak for the same five months only 2 per cent., and only 3 per cent. for the six months, April to September.

TABLE No. III.—*Monthly Increase in Girth and Proportion of Increase for each Month in the four older Deciduous Trees, for five years, from* 12*th January* 1885 *to* 12*th January* 1890.

5 of each Month.	Melia azedarach.		Acer (?).		Populus angulata.		Robinia Ps. Acacia.	
	Millimetres	Percentage.	Millimetres	Percentage.	Millimetres	Percentage.	Millimetres	Percentage.
January, .	033	17	086	22	123	23	011	10
February, .	043	23	050	13	088	16	−004	$-3\frac{1}{2}$
March, .	002	1	032	8	052	10	−002	−2
April, .	009	5	022	$5\frac{1}{2}$	025	5	006	$5\frac{1}{2}$
May, .	−009	−5	−006	$-1\frac{1}{2}$	−004	−1	−012	−11
June, .	011	6	006	$1\frac{1}{2}$	002	$\frac{1}{2}$	007	$6\frac{1}{2}$
July, .	−009	−5	−001	$-\frac{1}{4}$	001	...	007	$6\frac{1}{2}$
August, .	007	$3\frac{1}{2}$	−002	$-\frac{1}{4}$	006	1	−004	$-3\frac{1}{2}$
September, .	020	$10\frac{1}{2}$	002	$\frac{1}{2}$	002	$\frac{1}{2}$	008	7
October, .	022	$11\frac{1}{2}$	013	$3\frac{1}{2}$	029	5	033	30
November, .	027	14	090	$23\frac{1}{2}$	101	19	030	$27\frac{1}{4}$
December, .	035	$18\frac{1}{2}$	095	$24\frac{1}{2}$	114	21	030	$27\frac{1}{4}$
	191	100	387	100	539	100	110	100

Table No. III.—The old Paraiso does grow, but very slowly; the Robinia grows very irregularly, and shows numerous decreases. The Acer grows most in December, and the cottonwood in January. The cottonwood shows absolutely only 1 per cent. of the total annual increase in the five months, May to September; and the Acer no growth at all for those five months.

TABLE NO. IV.—*Showing the Monthly Averages of Increase of Girth and Percentage of Increase for the eight Evergreens in Table No. I.; for the eight Deciduous Trees in Table No. II.; and for the four older Deciduous Trees in Table No. III.—all for five years.*

5 of each Month.	Table I. 8 Evergreens.		Table II. 8 Deciduous.		Table III. 4 Deciduous.	
	Millimetres.	Percentage.	Millimetres.	Percentage.	Millimetres.	Percentage.
January, . .	113	10	112	21	063	21
February, .	085	8	091	17	044	14
March, . .	088	8	033	6	021	7
April, . .	109	10	017	3	016	5
May, . .	092	8	– 009	– 1	– 008	– 2½
June, . .	052	5	003	½	007	2
July, . .	036	3	003	...	...	...
August, . .	054	5	003	½	002	...
September, .	108	10	013	2	008	2½
October, . .	132	12	040	8	024	8
November, .	123	11	109	20	062	20
December, .	105	10	123	23	068	23
	1097	100	538	100	307	100

Table No. IV. represents the averages of each of these three groups, showing that in eight evergreens most growth occurs in October and least in July; that in eight young deciduous trees there is most growth in December, and that there is a general decrease of girth in May. The same is the rule for the group of four older deciduous trees.

I also present the Table No. V., which shows the girths of each individual tree at January 12, 1885, and at January 12, 1890, the increase of each tree, and the average annual increase—all in millimetres.

The considerable discrepancies in growth shown by individuals of some species are remarkable. The two examples of *Acacia mollissima* are on the same slope of ground, about 20 yards apart, were planted in 1882, and would thus be eight and a half years old, January 1890, being one year seedlings when planted. The two pines are not near each other, nor on the same slope of ground, the second pine being on more gravelly and better drained ground; it is younger than the first, which is possibly fourteen or fifteen years old. The two blackwoods are within, perhaps, 12 yards of

TABLE NO. V.—*Girths of Trees, and their Increase in Five Years.*

Group of Table No. I.

Measures in Millimetres.	Acacia mollissima.	Acacia mollissima.	Eucalyptus. (?)	Eucalyptus. (?)	Pinus pinea.	Pinus pinea.	Acacia melanoxylon.	Acacia melanoxylon.	8 Evergreens.
Girths of trees, Jan. 12, 1890,	1038	939	725	774	1141	980	727	989	7·313
Girths of trees, Jan. 12, 1885,	255	269	187	211	705	447	395	449	2·918
Increase in five years, . . .	783	670	538	563	436	533	332	540	4·395
Average annual increase, . .	156	134	108	112	87	107	66	108	110

Group of Table No. II.

Measures in Millimetres.	Melia azedarach.	Melia azedarach.	Quercus (?).	Quercus (?).	Populus fastigiata.	Populus fastigiata.	Robinia. Pseudo-acacia.	Robinia. Pseudo-acacia.	8 Deciduous.
Girths of trees, Jan. 12, 1890,	609	602	492	572	809	704	413	433	4·634
Girths of trees, Jan. 12, 1885,	304	320	162	178	557	395	252	310	2·478
Increase in five years, . . .	305	282	330	394	252	309	161	123	2·156
Average annual increase, . .	61	56	66	79	50	62	32	25	54

Group of Table No. III.

Measures in Millimetres.	Melia azedarach.	Acer (?).	Populus angulata.	Robinia Ps.-acacia.
Girths of trees, Jan. 12, 1890, ...	1·446	755	670	934
Girths of trees, Jan. 12, 1885, ...	1·255	216	283	824
Increase in five years, .	191	539	387	110
Average annual increase, .	38	108	77	22

each other, exactly the same ground and conditions. Planted in 1880, in January 1890 they were ten and a half years' old. The two Paraisos are on the same ground and level, perhaps 15 yards apart; they were planted in 1881, not as seedlings, but as plants that had come up from roots of older trees, and might be called each ten and a half years' old. The two Robinias are on the same ground and level, 20 yards apart; they were planted in 1880, and, like the Paraisos. were young rooted plants from older trees, and may be called eleven and a half years' old. The two oaks are on the same ground and level, 15 yards apart. I *believe* the acorns were sown in 1878; this would make them eleven and a half years' old. The two poplars are only 2 yards apart; they are not quite the same age, and I cannot make a guess at their age, being shoots that have grown up where other trees had been felled. The two gum trees are on the same slope of ground, about 50 yards apart, and are eight and a half years' old from seed, January 1890. Whilst making these estimates of ages, I will include the cottonwood, planted in 1882. As this must have been from a cutting, I daresay it was nine and a half years' old, January 1890; and the Acer I cannot make a good guess at, but *believe* I obtained the seed in 1874 or 1875. It may thus be fifteen or sixteen years' old.

I have represented in Plate V. the curves taken by the monthly-growth figures for each of these five years, and for eight classes of trees, the average of two trees of each species being taken; and Plate VI. shows the average growth-curves for the whole term of five years for the above sixteen trees, adding in also the five-year average growth-curve for eight evergreens and for eight deciduous trees. The numerals at the ends of all curves signify the actual number of millimetres of growth for each class, by their averages of two or of eight. Unfortunately, the ruling of the paper on which I have drawn these diagrams is not correct, or the diagrams as well as measurements would be in millimetres. The error of the ruling is about 4 per cent.; there should be one hundred lines in the space occupied by ninety-six lines.

I note on each yearly diagram the mean temperature for each year referred to, also the average monthly sunshine hours, also the average monthly rainfall in inches. I do not enter into the question of the correlation of weather and tree-growth; but this five-year term seems favourable for the purpose of investigating this subject, as rainfall especially has varied greatly during the term, two years being considerably under and one year over the average of rainfall.

The deciduous trees seem to begin their sleeping season about the middle of April, and on May 12th show an actual decrease from their girth of April 12th. Table No. VI. refers

Table No. VI.—*Increase or Decrease of twelve Deciduous Trees for Months of May and June.*

		Melia azedarach.	Melia azedarach.	Oak.	Oak.	Populus fastigiata.	Populus fastigiata.	Robinia Ps.-acacia.	Robinia Ps.-acacia.	Melia azedarach.	Acer. (?)	Populus angulata.	Robinia Ps.-acacia.	Increase.	Decrease.	Results.
1885	May	...	−4	...	−1	−1	−1	1	...	−5	−1	−2	−2	1	−17	−16
	June	1	3	−1	3	...	1	−1	...	9	−1	1	1	19	−3	16
1886	May	1	−1	1	...	−3	1	...	...	−1	−1	1	...	3	−7	−11
	June	...	...	−1	...	1	...	2	1	−1	1	−1	−1	3	−4	1
1887	May	1	...	−1	...	2	−4	−2	−1	−2	−2	−1	−5	3	−18	−15
	June	1	...	1	...	−1	3	...	1	1	2	...	3	11	−2	9
1888	May	−1	−3	...	−1	−2	−7	−2	−2	1	−2	−3	−3	1	−26	−25
	June	−2	2	...	...	1	...	...	1	1	3	2	...	10	−2	8
1889	May	−2	...	1	−2	2	−3	−2	−2	−2	...	1	−2	4	−15	−11
	June	−2	1	1	1	−1	1	2	4	1	1	...	2	14	−3	11
Increase		4	6	3	4	6	5	5	7	13	7	5	6	71	...	...
Decrease		−7	−8	−4	−4	−8	−16	−7	−5	−11	−7	−7	−13	...	−97	−26

The five Mays thus show a total decrease of 71 millimetres, or say, $2\frac{3}{4}$ English inches; and the five Junes a total increase of 45 millimetres, or say, $1\frac{3}{4}$ English inches—equalling thus a nett loss of 26 millimetres, or 1 English inch.

Note that the loss is incurred from measurement day, April 12, to next measurement day, May 12, and the gain from that day to June 12.

to the increase and decrease of twelve deciduous trees for the months of May and June, say from April 12 to June 12; the total decrease of twelve trees in five Mays amounting to 71 millimetres, or say $2\frac{3}{4}$ English inches, and there is a total increase on these trees in five Junes of 45 millimetres, or $1\frac{3}{4}$ English inches. This is shown in the column headed "Results."

Table No. VII. refers to the increase and decrease of three older deciduous trees, from April 12 to October 12, for five years. These three trees show a marked decrease in their measurements on May 12, an increase in June, again a decrease in July; it is to be supposed that they do not fairly recover their loss of girth until quite the end of September. Uruguayan May is English November, and English June is Uruguayan December, as regards season, but not as regards weather. April is the rainiest month in Uruguay, October the next rainiest.

TABLE No. VII.—*Increase and Decrease of three Deciduous Trees for six months.*

Year	Month	Acer. (?)	Populus fastigiata.	Populus fastigiata.	Increase.	Decrease.	Results.
1885.	May, .	−1	−1	−1	...	−3	−3
	June, .	−1	...	1	1	−1	...
	July, .	1	1	−1	2	−1	1
	August, .	...	−1	1	1	−1	...
	September,	...	...	2	2	...	2
	October, .	2	6	2	10	...	10
1886.	May, .	−1	−3	−1	...	−5	−5
	June, .	1	1	...	2	...	2
	July, .	...	−1	...	...	−1	−1
	August, .	...	3	1	4	...	4
	September,	...	−2	−2	...	−4	−4
	October, .	1	1	2	4	...	4
1887.	May, .	−2	2	−4	2	−6	−4
	June, .	2	−1	3	5	−1	4
	July, .	−1	...	−3	...	−4	−4
	August, .	1	1	...	2	...	2
	September,	−3	1	...	1	−3	−2
	October, .	6	...	3	9	...	9
1888.	May, .	−2	−2	−7	...	−11	−11
	June, .	3	1	...	4	...	4
	July, .	−1	1	1	2	−1	1
	August, .	−2	−2	−1	...	−5	−5
	September,	2	...	1	3	...	3
	October, .	3	6	6	15	...	15
1889.	May, .	...	2	−3	2	−3	−1
	June, .	1	−1	1	2	−1	1
	July, .	...	...	...	...	...	...
	August, .	−1	2	−1	2	−2	...
	September,	3	3	...	6	...	6
	October, .	1	−2	7	8	−2	6
		27	31	31	89	...	...
		−15	−16	−24	...	−55	34

Measurements in Millimetres.

5 Mays, . . .	−24
5 Junes, . . .	11
5 Julys, . . .	−3
5 Augusts, . . .	1
5 Septembers, . .	5
5 Octobers, . . .	44
	34

1885—6 months' increase,	10
1886— ,, ,,	...
1887— ,, ,,	5
1888— ,, ,,	7
1889— ,, ,,	12
	34

From measurement taken April 12 to the measurement of September 12 there is a decrease of girth of these three trees, which is not overcome until the measurement of October 12 is taken.

The evergreens do not seem to take any absolute rest; their growth is least in July and most in October; in February their growth undergoes a marked diminution; February is the driest month in Uruguay, and nearly as hot as January.

I will add some extracts concerning the fall of the leaf, &c., at San Jorge, from "Remarks" in *Monthly Meteorological Records,* and "Remarks" in *Monthly Tree-Measurement Records,* which I think show that decrease in tree-girth is synchronous with the fall of the leaf.

Averages of some Meteorological Records for the same five years' term, but ranging from January 1 *to December* 31.

Months.	Inches of Rainfall.	Mean Temperature.	Hours of Sunshine.	
Jan. 31,	4·29	73·3	303	
Feb., .	2·35	71	256	
March, .	3·65	68·9	272	
April, .	6·60	59·3	205	
May, .	4·75	53·6	194	
June, .	3·10	49	136	
July, .	3·65	49·9	173	
August,	4	52·1	206	Average rainfall for nine years, . . 3·83 inches.
Sept., .	3·34	54·8	203	,, temperature for nine years, 60°·9 Fahr.
October,	5·35	59	257	,, sunshine for nine years, . 236 hours.
Nov., .	3·42	64·5	281	
Dec. 31,	4·33	69·4	299	
Totals, .	48·83	724·8	2785	
Means, .	4·07	60·4	232	

April 13, 1881.—Robinia leaves falling fast.

April 24, 1883.—Paraiso and other leaves falling fast.

August 16, 1881.—A few leaves showing on Robinias and Paraisos.

August 20, 1882.—Robinias and young Paraisos beginning to show leaf.

August 25, 1883.—Robinia leaves beginning to show.

Sept. 3, 1885.—Robinias coming into leaf.

„ 22, 1885.—Some oaks coming into leaf.

„ 27, 1885.—Some trees in good leaf; almost all trees have plenty of small leaves.

Oct. 25, 1885.—Paraiso blossom fully out.

May 13, 1886.—Deciduous trees almost quite stripped.

March 12, 1887.—Leaves beginning to fall.

April 12, 1887.—Plenty of leaves on trees still.

May 12, 1887.—Robinias and poplars nearly leafless; *Acer* quite leafless; oaks and Paraisos leafy still.

June 12, 1887.—All deciduous trees leafless, except oaks and Paraisos.

August 12, 1887.—Leaves coming out on young Paraisos.

March 12, 1888.—Leaves beginning to fall from some trees.

May 12, 1888.—Robinias lost their leaves.

June 12, 1888.—Paraiso leaves fell suddenly after the heavy rains of 1st and 2nd.

Sept. 12, 1888.—Tender green leaves everywhere, except beech and ash. (Trees imported from England.)

Oct. 12, 1888.—Paraiso leaf and flower very backward still.

May 13, 1889.—Leaves almost all fallen.

July 11, 1889.—Signs of buds filling out, especially in oaks.

October 12, 1889.—Trees all in full foliage.

Concerning *decrease of growth*, I wish to include some remarks on the subject made by Dr Christison, for whose counsels during the compilation of the accompanying tables, &c., I am greatly obliged. He says, "I think it is pretty clear that these decreases must be due to failure of activity in growth of wood, due to fall of the leaf, because it is synchronous with it, and because there is no decrease in evergreens, whose leaf-functions may be supposed to be continuous. Of course this, *a priori*, should result in stagnation of growth, not in decrease; but it is not difficult to understand how decrease may happen. The new wood is formed from the sap between the bark and the already deposited wood, and that sap is in an active state of circulation, caused and modified by various agencies. It is easy to understand, therefore, that a distension of cells and vessels by a circulating fluid may be so far relaxed when the causes of it are removed as to produce a shrinkage. Now the leaf plays a most active part in promoting circulation."

In these notes I have tried to confine myself to statements as to the manner in which I have been measuring my trees; to remarks on circumstances that may or may not affect tree-growth; also to some sort of explanation as to what my tables and diagrams mean, remarking upon some leading features presented by them; and have also briefly remarked on the varying character of the weather at San Jorge for these five years.

Perhaps the most remarkable facts brought out are—*First*, As regards the deciduous class, the variety of months in which the different species attain their maximum increase in girth; and the apparent decrease that takes place in all of them in May.

Second, As regards the evergreens, a similar variety in the months of maximum increase and the continuance of growth through the winter,—in marked contrast to the absence of growth in evergreens during the six coldest months at Edinburgh, as proved by Sir Robert Christison (*Trans. Bot. Soc. Ed.*, 1879, p. 398). It is true that more frequent measurements might show that the evergreens do take a brief rest at one time or another during the winter; but, at all events, they all increased somewhat in the course of each winter month.

Incidentally we also learn the very different rates of annual increase in girth of the different species.

I do not think I can note down any additional facts, and at present refrain from attempting to derive effects from causes.

Report on the Progress of Vegetation at the Royal Botanic Garden, Edinburgh, from July 1889 *to June* 1890. By ROBERT LINDSAY, Curator.

July 1889.—This month was, on the whole, a very favourable one. The early part was warm and dry; grass on lawns and verges had a brown appearance during the first week. On the 7th, a good deal of rain fell, accompanied by thunder, after which no more browning took place during the season. Up to the middle of July the prospect of there being a really good season was very hopeful indeed; after this the outlook was not so promising.

The lowest night temperature was 38°, which occurred on the 8th, and the highest was 52°, on the 14th. The lowest day temperature was 51°, on the 11th; and the highest was 81°, on the 31st. Rain fell on fifteen days.

On the Rock Garden 258 species and well-marked varieties came into flower during the month, as against 276 for the corresponding month last year. Amongst the most interesting were:—*Astragalus alopecuroides, Calamintha glabella, Cocculus japonicus, Dallibarda repens, Eremurus Olgæ, Galax aphylla, Lithospermum petræum, Philesia buxifolia, Sagina Boydii, Symphiandra Hoffmanii, Veratrum Maackii, Veronica salicornioides,* &c.

August.—The weather during August was exceedingly cold and unsettled. Rain fell on twenty-one days, and all outdoor work was much retarded in consequence. So very unfavourable an August has not occurred for some years back. The lowest night temperature was 38°, which occurred on the 31st of the month; and the highest, 55°, on the 2nd. The lowest day temperature was 59°, on the 20th; and the highest 79°, on the 1st.

On the Rock Garden 99 plants came into flower, against 140 during last August. Amongst the most conspicuous were: —*Dietes Huttoni, Gentiana Andrewsii* and *ornata, Stokesia cyanea, Liatris elegans, Sparaxis pendula, Senecio speciosus, Pyrola rotundifolia* var. *arenaria, Sheffieldia repens,* &c.

September.—This month was, on the whole, favourable;

the first half being warm and dry. Occasional heavy showers occurred at intervals during the remainder of the month, but at no time was the rainfall in excess. There were twenty-one dry days, and out-door operations had but little interruption. The first frost this season took place on the night of the 21st, when the thermometer registered 29°; other low readings occurred on the 22nd, 25th, and 26th, when 32°, 35°, and 34° were registered respectively. The lowest day temperature was 55°, on the 21st; and the highest 72°, on the 10th. Most kinds of herbaceous plants flowered extremely well, and were at their best during this month. The earlier flowering kinds ripened an abundant crop of good seeds, which were secured in fine condition. Roses flowered very freely during September, the blossoms being equal to those developed earlier in the season. On the Rock Garden thirty-eight plants came into flower, a few of the most interesting being:—*Asclepias tuberosa, Gladiolus Saundersii, Gentiana alba, Gerbera anandria, Kniphofia nobilis, Sedum Ewersii, Synthiris reniformis, Thymus striatus,* &c.

October.—The weather throughout was exceedingly variable, with frequent rain and wind, but very little frost. Tender plants, such as Dahlias, Pelargoniums, Calceolarias, and Californian annuals completed their flowering season without having been much injured by frost. The thermometer was at or below the freezing point on five nights, indicating only 2° of frost for the month; during October 1888, which was also very mild, 9° of frost was registered. The lowest readings were on the 9th, 32°; 11th, 31°: 12th, 32°; 26th, 32°; 29th, 31°. The lowest day temperature was 47°, on the 26th; and the highest, 63°, on the 6th. Rain fell on twenty days. Herbaceous plants continued to flower in fine condition throughout the month, the most effective being the various species of *Aster*, or "Michaelmas Daisies," *Helianthus, Rudbeckias,* and other Compositæ; also *Kniphofia*, and Japanese Anemones. Leaves of deciduous trees and shrubs began to fall early in the month, and by the end most trees were stripped bare: with few exceptions, the leaves were not well coloured, and autumn tints were not so effective as usual. A notable exception was *Azalea pontica*, which produced its characteristic purple and yellow foliage in perfection.

Fruit is very deficient on trees and shrubs, with the exception of Yews, which had a good crop of berries, that are being greedily devoured by birds. Holly berries could hardly be scarcer than they are this year, while last year they were most abundant. Haws are also very scarce. If the converse holds good of the old adage, "Many haws, many snaws," we ought to have a remarkably mild winter.

Hardy Rhododendrons, Azaleas, Andromedas, and such like plants are fairly well set with flower-buds, in marked contrast to their barren condition last year. On the Rock Garden thirteen species of plants came into flower, amongst which were:—*Helleborus niger grandiflorus*, *Caryopteris Mastacanthus*, *Rhododendron lepidotum*, *Saxifraga Fortunei*, *Veronica Chathamica*, &c. The total number which have flowered since January 1 is 1473; at the same date last year, 1534 had flowered.

November.—The past month has been very mild for the season, and there has been extremely little rain or snow. A good deal of frost occurred during the last week of the month, which checked the too rapid growth that was taking place on some plants. The thermometer was at or below the freezing point on nine mornings, indicating collectively 38° of frost for the month. The lowest readings were on the 17th, 24°; 26th, 26°; 27th, 26°; 28th, 24°; and 29th, 30°. The lowest day temperature was 36°, on the 27th; and the highest, 60°, on the 7th. Rain fell on five days only during the month.

On the Rock Garden eight species came into blossom, viz., *Crocus Salzmanni*, *Crocus* sp., Asia Minor; *Iris Bakeriana*, *Androsace coronopifolia*, *Veronica ligustrifolia*, *Vinca acutiloba*, *Helleborus angustifolius*, *H. albicans.* Most outdoor plants are now in a resting state; still a few winter-flowering shrubs are in flower, such as *Jasminum nudiflorum*, Ivy, *Laurustinus*, and *Veronica Andersoni.* Fruit is remarkably scarce on shrubs generally.

December.—Like the preceding month, December has been remarkable for the extreme mildness of weather which prevailed. The thermometer was at or below the freezing point on eighteen occasions, the aggregate amount of frost registered being 70°, as against 57° for the same month of 1888. The lowest readings occurred on the 4th, 23°; 12th, 23°; 22nd, 25°; 28th, 25°; 30th, 25°. The lowest day temperature was 35°, on the 12th; and the highest, 55°, on the 17th.

On the Rock Garden the following species came into flower during the month, viz.:—*Iris sophonensis*, *Schizostylis coccinea*, and *Helleborus purpurascens* var. The total number of alpine and dwarf-growing herbaceous plants which have flowered during the past year in the Rock Garden amounts to 1484, being 58 less than during 1888. The number of species which came into flower each month was as follows:—January, 20; February, 27; March, 60; April, 134; May, 380; June, 444; July, 258; August, 99; September, 38; October, 13; November, 8; December, 3; total, 1484. *Tussilago fragrans*, one of the forty plants whose dates of flowering are annually reported to the Society, came into flower on the 12th of the month.

January 1890.—The past month has again been unusually mild. Vegetation is considerably in advance of what it was at the same date last year. Hardy spring flowers are not only earlier, but are more vigorous, and flowering more profusely than they have done for some years back. The various species and varieties of *Helleborus* have rarely been seen in such fine condition. Hazel, Alder, and Garrya are perfectly covered with flowers this season. During the month the thermometer was at or below the freezing point on twelve mornings, indicating collectively 45° of frost, as against 57° for the corresponding month last year. The lowest readings occurred on the 3rd, 24°; 23rd, 23°; 24th, 23°; 28th, 27°; 29th, 26°. The lowest day temperature was 35°, on the 23rd of the month; and the highest 57°, on the 16th.

On the Rock Garden 37 species and varieties came into flower, amongst which were *Crocus annulatus* and *Imperati*, *Colchicum crociflorum*, *Galanthus Elwesii* and *Imperati*, *Cyclamen Atkinsii*, *Hepatica angulosa*, *Leucojum carpaticum*, *Primula denticula*, *Hyacinthus azureus*, *Polygala Chamæbuxus*, *Ranunculus anemonoides*, *Saxifraga Burseriana*, &c. Of the forty plants whose dates of flowering are annually recorded, the following eighteen came into flower during the month, viz.:—*Dondia Epipactis*, on January 6; *Scilla præcox*, 6th;

S. sibirica, 7th; *Galanthus nivalis*, 13th; *Eranthis hyemalis*, 15th; *Corylus Avellana*, 15th; *Leucojum vernum*, 16th; *Galanthus plicatus*, 17th; *Rhododendron atrovirens*, 18th; *Tussilago alba*, 19th; *Rhododendron Nobleanum*, 20th; *Daphne Mezereum*, 24th; *Crocus susianus*, 26th; *Bulbocodium vernum*, 29th; *Crocus vernus*, 30th; *Tussilago nivea*, 30th; *Sisyrinchium grandiflorum*, 31st; *Symplocarpus fœtidus*, 31st. These are on an average three weeks earlier than last year.

February.—The month has been on the whole favourable, having been dry and cold generally. The thermometer was at or below freezing point on nineteen mornings, indicating collectively 101° of frost for the month, as against 103° for the corresponding month last year. No very low readings were registered, the lowest being on the 6th, 24°; 7th, 22°; 8th, 22°; 9th, 21°; 11th, 21°. The lowest day temperature was on the 8th, 34°, and the highest on the 23rd, 59°. Slight falls of snow occurred on seven days, and rain on four days.

Vegetation generally is well forward. A large number of spring flowers are in blossom. Ribes, Thorns, Lilacs, and other hardy shrubs are fast starting into growth; deciduous trees, such as Elm, Poplar, and Alder, are bearing enormous quantities of flower-buds. Many half-hardy Australian and New Zealand plants are still quite safe in the open borders, without their having been protected from frost. Spring-flowering bulbs, having received but little check, are flowering very profusely, and are fully up to the average in richness and quality of blossom. There is every prospect of the season being a good and early one.

The following spring-flowering plants annually recorded to the Society came into flower in February, viz.:—*Symphytum caucasicum* and *Arabis albida*, on the 1st; *Nordmannia cordifolia*, 2nd; *Scilla bifolia*, 15th; *Iris reticulata*, 16th; *Mandragora vernalis*, 18th; *Sisyrinchium grandiflorum album*, 26th; *Scilla bifolia alba*, 28th.

On the Rock Garden twenty-five species came into flower during the month, the most interesting being *Chionodoxa sardensis, Corydalis angustifolia, Crocus suaveolens, Daphne Blagayana, Doronicum caucasicum, Erica carnea, Galanthus Redoutei, Iris reticulata, Narcissus minimus, Rhododendron* *præcox, Saxifraga oppositifolia, S. Burseriana multiflora, Scilla bifolia alba.*

March.—During the month of March the thermometer was at or below the freezing point on thirteen mornings. The total amount of frost registered for the month was 49°, as against 90° for the corresponding month last year. The lowest temperatures were indicated on the mornings of the 3rd, 20°; 9th, 24°; 18th, 28°; 24th and 31st, 27°. The day temperatures were high, the lowest being 40°, on the 9th; and the highest 64°, on the 16th.

Rain fell on thirteen days, and snow on two days. There were frequent intervals of bright sunshine, and on the whole the month was a most favourable one.

Vegetation generally has made rapid progress. Deciduous trees and shrubs, such as Thorns, Lilac, Horse Chestnut, Plane, and Pyrus are already bursting into leaf. The different varieties of flowering Currant are in full blossom. On south walls the double-flowered Peach, *Magnolia Yulan* and *Forsythia viridissima,* are flowering more profusely than they have done for many seasons. Of the forty spring flowering plants whose dates of flowering are annually recorded, the following ten came into flower, viz.:—*Scilla bifolia taurica,* on March 5; *Narcissus pumilus,* 8th; *Orobus vernus,* 9th; *Draba aizoides,* 9th; *Erythronium Dens canis,* 10th; *Omphalodes verna,* 11th; *Narcissus pseudo-Narcissus,* 15th; *Corydalis solida,* 20th; *Ribes sanguineum,* 22nd; *Hyoscyamus Scopolia,* 23rd.

On the Rock Garden seventy-three species and varieties came into flower during the month, being thirteen more than for last March. Amongst the most conspicuous were:—*Anemone pulsatilla, Corbularia nivalis, Dentaria eneaphylla* and *pentaphylla, Narcissus bicolor* and varieties, *N. incomparabilis gigantea, N. rupicola, Olearia Gunniana, Pachystima Canbyii, Pulmonaria arvernensis, Primula marginata, P. cashmiriana, Saxifraga Burseriana Boydii, S. ciliata, S. imbricata, S. juniperina, Soldanella montana, Synthiris reniformis, Veronica Colensoii, Xanthorhiza apiifolia.*

Register of Spring-Flowering Plants, showing Dates of Flowering, at the Royal Botanic Garden, Edinburgh, during the years 1888, 1889, *and* 1890.

No.	Names of Plants.	First Flowers opened.		
		1888.	1889.	1890.
1	Adonis vernalis, . .	April 16	April 6	April 2
2	Arabis albida, . .	Feb. 6	March 18	Feb. 1
3	Aubrietia grandiflora, .	April 14	April 16	April 9
4	Bulbocodium vernum, .	Feb. 22	Feb. 18	Jan. 29
5	Corydalis solida, . .	April 6	March 23	March 20
6	Corylus Avellana, . .	Jan. 25	Feb. 22	Jan. 15
7	Crocus Susianus, . .	Jan. 26	Feb. 14	Jan. 26
8	,, vernus, . .	Feb. 23	Feb. 23	Jan. 30
9	Daphne Mezereum, .	Feb. 22	Jan. 26	Jan. 24
10	Dondia Epipactis, . .	Jan. 5	Jan. 3	Jan. 6
11	Draba aizoides, . .	March 30	March 22	March 9
12	Eranthis hyemalis, . .	Feb. 8	Feb. 3	Jan. 15
13	Erythronium Dens-canis, .	March 31	March 30	March 10
14	Fritillaria imperialis, .	April 29	April 30	April 10
15	Galanthus nivalis, . .	Jan. 26	Jan. 31	Jan. 13
16	,, plicatus, .	Jan. 26	Jan. 26	Jan. 17
17	Hyoscyamus Scopolia, .	April 13	March 29	March 23
18	Iris reticulata, . .	Feb. 23	Feb. 25	Feb. 16
19	Leucoium vernum, .	Feb. 4	Jan. 30	Jan. 16
20	Mandragora officinalis, .	March 8	March 12	Feb. 18
21	Narcissus Pseudo-Narcissus,	April 3	April 7	March 15
22	,, pumilus, . .	March 17	March 25	March 8
23	Nordmannia cordifolia, .	Feb. 11	March 4	Feb. 2
24	Omphalodes verna, .	March 23	March 16	March 11
25	Orobus vernus, . .	March 31	March 26	March 9
26	Rhododendron atrovirens, .	Feb. 3	Jan. 17	Jan. 18
27	,, Nobleanum,	April 13	Feb. 6	Jan. 20
28	Ribes sanguineum, . .	April 10	March 30	March 22
29	Scilla bifolia, . .	March 19	March 6	Feb. 15
30	,, ,, alba, .	March 8	March 12	Feb. 28
31	,, præcox, . .	Jan. 26	Feb. 1	Jan. 6
32	,, sibirica, . .	Jan. 30	Feb. 3	Jan. 7
33	,, taurica, . .	March 8	March 14	March 5
34	Sisyrinchium grandiflorum,	March 8	Feb. 20	Jan. 31
35	,, album, .	March 13	Feb. 26	Feb. 4
36	Symphytum caucasicum, .	April 18	April 16	Feb. 1
37	Symplocarpus fœtidus, .	Feb. 8	Feb. 22	Jan. 31
38	Tussilago alba, . .	Feb. 9	Feb. 14	Jan. 19
39	,, fragrans, .	Dec. 28 1887	Jan. 11	Dec. 12 1889
40	,, nivea, . .	April 10	Feb. 27	Jan. 30

April.—The month of April was dry and cold generally, with easterly wind. The thermometer fell below the freezing point on fifteen occasions; the total amount of frost registered was 54°, as against 6° for April 1889. The lowest readings were on the mornings of the 12th, 13th, 20th, 27th, and 28th of the month, when the glass fell to 27°, 25°, 25°, 25°, and 26° respectively. The lowest day temperature was 47°, on the 17th; and the highest 67°, on the 30th.

The collective amount of frost registered this season up to the end of April is 364°, as against 342° for the same period last year. The following is the distribution for each month:—September, 3° of frost; October, 2°; November, 38°; December, 70°; January, 45°; February, 103°; March, 49°; April, 54°. The lowest point reached this season was 20°, or 12° of frost, which occurred on March 20. Notwithstanding the cold nature of last month, vegetation generally has made good progress. The Rock Garden was very attractive during the month, from the large number of plants in blossom; 150 species and varieties came into flower in April, many of which display unwonted vigour. Of the forty spring-flowering plants annually recorded to show their periods of flowering, the following came into flower:—*Adonis vernalis,* on the 2nd; *Aubrietia grandiflora,* on the 9th; *Fritillaria imperialis,* on the 10th—thus completing the list much earlier than usual.

May.—The past month has been one of the most favourable experienced for some years. No actual frost occurred, which is somewhat unusual for May. Vegetation made rapid progress, and, in the absence of frost or severe winds, has gone on advancing in the most satisfactory manner. The foliage of most of the ordinary deciduous trees and shrubs is now in perfect condition, being very luxuriant and healthy. The flowering of nearly all kinds of ornamental trees and shrubs is far above the average this year. Nothing could well exceed the richness and profusion of blossoms displayed by the various varieties of Hawthorn, which were in full flower by the end of the month, and thus for once justifying the name of Mayflower. Rhododendrons, Azaleas, Horse Chestnut, Laburnum, and the various species of *Pyrus* and *Prunus* were remarkably fine and effective. Holly is flowering very freely, giving promise of a good crop of berries this year. Early flowering herbaceous and bulbous plants have developed abundance of fruit, particularly Hellebores, Scillas, and *Corydalis,* the capsules of which are already ripe, and contain good seed. The lowest night temperature registered at the garden was 33°, which occurred on the 31st of the month. Other low readings were registered. On the 2nd, 38°; 14th, 36°; 27th, 34°; 28th, 37°. The lowest day temperature was 48°, on the 10th, and the highest, 71°, on the 28th of the month. The Rock Garden was quite brilliant during the month; 365 species and varieties came into flower, while a large proportion of those that began to flower during the previous month were still in good condition.

June.—The past month has been very cold and wet for June, and somewhat disappointing after the good prospect held out in May.

Rain fell more or less on seventeen days during the month. The lowest night temperature was 35°, which occurred on the 8th; and the highest, 53°, on the 3rd of the month. The lowest day temperature was 52°, on the 12th; and the highest, 78°, on the 10th of the month.

Compared with June last year, the night temperature was very nearly the same, but the day readings were very much lower this June. The foliage of most deciduous trees and shrubs is now complete, and remarkably clean and perfect; insect pests are happily not very abundant. Grass and weeds of all kinds have grown at such a rapid rate that they have been difficult to keep in order. Conifers have made fine clean growths; fewer plants have come into flower this month than for any June during several years, in consequence of the want of heat and bright sunshine. On the Rock Garden 346 species and varieties came into flower during the month, being 100 less than for the corresponding month last year. The most effective plants in flower were the various New Zealand Veronicas and Olearias, large bushes of which have been completely covered with flowers. Other interesting plants in flower in the Rock Garden were—

Abutilon vitifolium
Aquilegia pyrenaica
Arum palæstinum
Calochortus cœruleus
Cyananthus lobatus
Cynoglossum nervosum
Dianthus alpinus
„ × barbatus
„ × superbus
„ cinnabarinus
„ neglectus
„ superbus
Delphinium nudicaule
Discaria Toumatou
Edraianthus pumiliorum
Epilobium latifolium
„ obcordatum
Eriogonum aureum
Galium cæspitosum
Geranium argenteum
Haberlea rhodopensis
Linnæa borealis
Leontopodium alpinum
Myosotis australis
Nardostachys Jatamansi
Olearia macrodonta
Orchis maculata superba
„ foliosa
Pentstemon humile
„ speciosus
Polemonium flavum
Primula scotica
Phlomis fruticosa
Ramondia pyrenaica
Spiræa procumbens
Saponaria Loderii
Saxifraga fimbriata
Wahlbergella apetala
Xerophyllum asphodeloides

OBITUARY NOTICE OF DECEASED FELLOW.

THOMAS BOYLE GRIERSON. By J. SHAW, Tynron.

(Read 13th February 1890.)

Dr Grierson of Thornhill, a zealous local antiquarian and naturalist, passed away from among us on 26th September 1889. He was the only son of the late William Grierson, draper, Dumfries, in which town he was born 19th February 1818. He had thus completed his seventy-first year. His father, in conjunction with a friend, issued the circular, seventeen years after the poet Burns' death, calling attention to the desirability of building a mausoleum over his ashes. He was secretary to the local Burns Club, and his son used to relate how the great Wedgewood punch-bowl of the club was taken to the house on the night of its arrival, and the month old naturalist "handselled" it by his father setting him inside it. His father acquired a small residential property, Grovehill, near Thornhill; and Dr Grierson, after finishing his medical education in Edinburgh, practised for a short time in Moniaive, and afterwards in Thornhill, where he remained during the rest of his life. Dr Grierson's tastes were versatile, and all through life he was an eager and omnivorous collector. The late Duke of Buccleuch, through his late chamberlain, Mr John Gilchrist Clark, having been made aware of his extensive collection crowded into a narrow room, granted a site on favourable terms, and assisted him to build a museum to contain them, which is now an ornament to the village of Thornhill and an attraction to all seekers after knowledge in the locality. It is perhaps as varied and valuable a collection as ever was gathered together by a private individual in Scotland. It is particularly rich in local antiquities.

As a botanist, Dr Grierson preferred living plants to pressed specimens. His extensive garden contained many shrubs and plants, but there was no attempt at system in the arrangement; and the whole park had the appearance of a wilderness, interspersed with stone crosses, old baptismal fonts, querns, and other antiquarian objects not liable to waste in the open air.

It was a principle with Dr Grierson that a botanist ought to assist nature in giving variety and beauty to the flora of a district. For this purpose he used to scatter the seeds of many of his garden plants by the wayside, in old churchyards, railway embankments, and waste places. Among these, which, through this practice, have lived with us for a quarter of a century, are *Allium oleraceum*, Acid wood, Tynron; *Luzula nivea*, Churchyard, Dalgarnock, and probably a few others looked on as garden stragglers.

His patients were often irritated at the way in which he would dismount from his pony to chase a rare butterfly, or go miles around for a monster lamb or a Roman pot. Next to collecting, his passion was to exhibit and explain what he had gathered. He sometimes entertained the school children of the district for miles around, who would come to the museum, and who were rewarded by having small prizes distributed to those who could write the best essay on the contents of the garden and the museum. He scarcely ever went from home, unless to attend the meetings of the British Association, where he was a well known character in several of the sections. He was interested in education, and especially in the teaching of science in schools, and was for many years a member of Morton School Board and President of the Thornhill Mutual Improvement Society. For a number of years he conducted a society of enquiry, which met in his museum for the discussion of subjects of scientific or public interest. Although broadly tolerant in speculation, he was always reverent. Next to his museum he was interested in young men in the district who betrayed any special gift, and was eager to assist young or old in the pursuit of knowledge, whether from nature or from books. He has left his garden, museum, and library under trust for the benefit of the public of the district.

Supplementary Remarks by Rev. W. M. M'Donald on Dr Grierson.

As an only child, Thomas Boyle Grierson was allowed very much to follow the bent of his own inclinations or tastes. I do not think it is likely he would have many companions, if any. While other boys would go in for fun, or even boyish mischief, he had his enjoyment in collecting plants, insects, and a variety of other lower animals. In fact, the boy was father of the man. He was a naturalist from his earliest recollection, and all through a many-sided mortal, neither easily understood nor easily described. His general knowledge was extensive, but not minute, and what he did know, he was ready on all proper occasions to communicate. He was inquisitive in the extreme, erratic, enthusiastic, easily captivated with novelties; hence a great hobby rider, till something fresh or more original arrested his attention,—very guarded and careful in his speech. His veneration was high, and no man could accuse him of uttering anything bordering on unbelief. Nevertheless he was speculative, and preferred to ask questions on any disputed subject rather than express any doubtful opinions.

During the forty years odds of his practice he was a careful collector of antiquities. While he had an eye to everything worth possessing, I do not think he offended anybody in coming into possession of lots of things, when they understood that they would be carefully preserved. When I suggested the preservation of the "Old Mortality" white pony, he was most indignant at me for imagining that an animal of such superiority should ever be a spectacle to the public in his museum.

I saw him several times before his death, and was among the first, if not the first, to tell him I dreaded a fatal issue. While he spoke of the museum as a valuable collection, his mind was more occupied with the conflict through which he was passing, and the solution of the great problem which was near at hand.

Grierson was a unique, passive rather than combative, sympathetic, original, and peculiar character, and he has left no successor in the midst of us.

PROCEEDINGS, EXHIBITIONS, AND MISCELLANEOUS COMMUNICATIONS

DURING SESSION 1889-90.

November 14, 1889.

The following gentlemen were elected Office-Bearers for the Session :—

PRESIDENT.

Robert Lindsay, Royal Botanic Garden.

VICE-PRESIDENTS.

William Watson, M.D.
William B. Boyd of Faldonside.
Thomas A. G. Balfour, M.D., F.R.S.E., F.R.C.P.E.
Malcolm Dunn, Dalkeith Palace Gardens.

COUNCILLORS.

David Christison, M.D., F.S.A. Scot.
Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S.
Alexander Buchan, M.A., LL.D., F.R.S.E.
Hugh Cleghorn, M.D., LL.D., F.R.S.E.
George Bird.
John Methven.
William Craig, M.D., F.R.S.E., F.R.C.S.E.
J. E. T. Aitchison, M.D., LL.D., C.I.E., F.R.S.
Andrew Taylor, F.R.P.S.
William Murray.

Honorary Secretary—Professor Sir Douglas Maclagan, M.D., F.R.S.E.
Honorary Curator—The Professor of Botany.
Foreign Secretary—Andrew P. Aitken, M.A., D.Sc., F.R.S.E.
Treasurer—Patrick Neill Fraser.
Assistant-Secretary—John M. Macfarlane, D.Sc., F.R.S.E.

LOCAL SECRETARIES.

Aberdeen—Stephen A. Wilson of North Kinmundy.
,, Professor J. W. H. Trail, M.A., M.D.
Berwick—Philip W. Maclagan, M.D.
,, Francis M. Norman, R.N.
Birmingham—George A. Panton, F.L.S., 73 Westfield Road.
Bridge of Allan—Alexander Paterson, M.D.
Calcutta—George King, M.D., F.R.S., Botanic Garden.
Cambridge—Charles C. Babington, M.A., F.R.S., Professor of Botany.
,, Arthur Evans, M.A.
Chirnside—Charles Stuart, M.D.
Croydon—A. Bennett, F.L.S.

Dublin—W. R. M'Nab, M.D., F.L.S., Professor of Botany, Royal College of Science.
Glasgow—Professor F. O. Bower, D.Sc.
Kelso—Rev. David Paul, M.A., Roxburgh Manse.
Kilbarchan—Rev. G. Alison.
Leicester—John Archibald, M.D.
London—William Carruthers, F.R.S., F.L.S., British Museum.
,, E. M. Holmes, F.L.S., F.R.H.S.
Manchester—Benjamin Carrington, M.D., Eccles.
Melbourne, Australia—Baron Ferdinand von Mueller, M.D.
Nairn—William Alex. Stables.
Nova Scotia—Professor George Lawson, LL.D., Dalhousie.
Ottawa, Ontario—W. R. Riddell, B.Sc., B.A., Prov. Normal School.
Perth—F. Buchanan White, M.D., F.L.S.
Saharunpore, India—J. F. Duthie, B.A., F.L.S.
Silloth—John Leitch, M.B., C.M.
Wellington, New Zealand—Sir James Hector, M.D., K.C.M.G., F.R.SS. L. & E.
Wolverhampton—John Fraser, M.A., M.D.

Mr Lindsay, the newly-elected President, thanked the Society for the high honour they had conferred upon him, and expressed the hope that he might be able to advance the aims of the Society as opportunity offered.

Professor Bayley Balfour exhibited specimens of proliferous Poppy gathered by Dr G. C. Purvis at Elie. In the axils of the sepals buds had developed.

Professor Bayley Balfour exhibited hypertrophied Pear from Mr Sam Elliot; an abnormal Grape from Mr S. Brocklehurst, B.Sc.; and a natural graft of *Prunus* gathered in the Royal Botanic Garden.

Mr Scott Elliot exhibited honey-sucking birds from South Africa collected by him during his recent travels there.

December 12.

The President, on taking the chair, said:—"Before beginning the public business, I regret to announce that since our last meeting the Society has sustained a great loss in the sudden death of Dr W. R. M'Nab, Professor of Botany in the Royal College of Science, Dublin. Dr M'Nab was long and intimately connected with our Society, and did much good work for it. He was an earnest, diligent, and enthusiastic worker in the science which he had made his profession. He has been taken away in the prime of life and in the midst of his usefulness. I am sure that every one present will join with me in expressing our sincere sympathy with his bereaved widow and family in their sorrow.

"The Society lost by death during the past year several of its most distinguished members—one Honorary Fellow, the Rev. Miles Joseph Berkeley. Five Ordinary Fellows—Mr John Allan, Portobello; Dr T. B. Grierson, Thornhill, Dumfriesshire; Dr Archibald

Inglis, Edinburgh; Rev. W. A. Leighton, Shrewsbury; Dr MacRaild, Greenock. Five Corresponding Members—Dr J. E. Areschoug, Upsala; Professor Caspary, Königsberg; Dr S. O. Lindberg, Helsingfors; Dr G. Meneghini, Pisa; Dr H. G. Reichenbach, Hamburg.

"During the past Session there have been added to our list of Members—one Honorary Fellow, fourteen Ordinary Fellows, one Lady Associate, and two Corresponding Members; in all, eighteen new Members.

"The Society now numbers 28 Honorary Fellows, 311 Ordinary Fellows, 10 Lady Associates, 64 Corresponding Members, and 29 Associates—in all, 442 Members."

Mr Campbell, Postmaster, Ledaig, sent for exhibition a parcel of flowers, then in bloom in his garden, which showed the extreme mildness and favourable situation of it.

January 9, 1890.

Dr J. M. Macfarlane described the structure and development of the glands of *Nepenthes,* and illustrated his observations by a microscopic demonstration.

Mr Robert Turnbull, B.Sc., exhibited several fine carpels of *Cycas revoluta* bearing seeds, which had been grown by Mr Forbes of Hawick.

Mr Campbell, Ledaig, sent for exhibition flowering twigs from his garden.

February 13.

Professor F. O. Bower described the formation of adventitious buds on the leaf of *Gnetum Gnemon.* He then exhibited embryo-sacs of the same plant, and a preparation he had received from Count Solms Laubach of Strassburg showing the archegonium of *Cycas.*

Mr Neill Fraser exhibited a fruit received from Demerara, which the President recognised as that of a species of *Dipladenia.*

The Curator exhibited from the Royal Botanic Garden flowers of *Brownea coccinea,* blossoms from seedlings of *Helleborus niger* and *H. orientalis* of varied colour, and a twin-flowered specimen of *Leucojum vernum.*

Mr Campbell sent for exhibition various cut flowers from his garden at Ledaig.

March 13.

Dr Hugh F. C. Cleghorn exhibited and presented to the Society the Type Specimens of Indian Grasses used by Mr W. Coldstream, B.A., B.Sc., in illustration of his "Grasses of the Southern Punjab." The warmest thanks of the Fellows were conveyed through Dr Cleghorn to the donor.

Dr J. M. Macfarlane gave a "microscopic demonstration of the Tissues of some Plant-Hybrids and of their Parents," and made explanatory references.

The following plants in flower were exhibited from the Royal Botanic Garden :—*Crocus Imperati albiflora*, *Chionodoxa sardensis*, *Daphne Blagayana*, *Narcissus cyclamineus*, *N. citrinus*, *Pinguicula lutea*, *Pyxidanthera barbulata*, *Saxifraga Stracheyi*.

Mr Sewell sent from Mr Hanbury's garden at La Mortola, Ventimiglia, Italy, fruits of species of Gourds, *Eucalyptus*, *Martynia*, *Solanum*, *Hakea*, and *Casuarina*.

April 10.

Professor Bayley Balfour gave a "Contribution to the History of the Royal Botanic Garden, Edinburgh," which proved that at one time the city had three distinct gardens, which were gradually amalgamated into the present Royal Garden. He also explained the relation which the University Professors had to these.

The following exhibits were displayed from the Royal Botanic Garden :—Cut flowers from the open air of *Magnolia conspicua*, double-flowered peach, *Rhododendron Thomsoni*, *R. ciliatum*, *R. campanulatum*, *Erythronium giganteum*, *E. giganteum* var. *roseum*, *E. grandiflorum*.

The Rev. J. M'Murtrie exhibited a fine growing specimen of *Primula viscosa* gathered by him in Switzerland fourteen years ago.

Mr Campbell, Ledaig, sent for exhibition specimens in flower from his garden, including a twig of *Acacia linearis*, which it was asserted had never been flowered before in the open air in Scotland.

Mr Charles M'Intosh, Dunkeld, sent various Mosses in fruit, along with tree branches which had been stripped by rabbits.

May 8.

Dr J. E. T. Aitchison exhibited and described * all the material requisite for a lengthened botanical trip, and such as he had found to be most serviceable on his Afghan expeditions.

Dr Paterson, Bridge of Allan, sent for exhibition a flower-truss and photograph of *Rhododendron Falconeri*.

The Curator exhibited and commented on numerous growing specimens from the Royal Botanic Garden, mostly rare hardy plants.

Mr Dunn, Dalkeith Palace Gardens, exhibited a fine truss of Rhododendron, Countess of Haddington, and also flowering branches of *Philesia buxifolia* and *Philageria Veitchii*.

June 12.

Mr Lindsay exhibited, from Captain Dundas of Ochtertyre, heterophyllous varieties of *Quercus Ilex*.

The Curator exhibited from the Royal Botanic Garden various interesting plants, principally Alpines.

* See *Transactions*, p. 267.

July 10.

Professor Bayley Balfour exhibited specimens of *Taphrina aurea*, received from Mrs T. B. Sprague, and *Exoascus pruni* received from Miss Hamilton Dalzell.

Mr W. B. Boyd of Faldonside exhibited a large series of alpine and other plants which were then flowering in his garden.

Dr W. Craig exhibited a finely fasciated stem of lily.

During the session Mr Bullen, Curator, made the following reports on temperature and vegetation at the Glasgow Botanic Garden :—

October.—A few very fine days have been recorded, but the majority have been sunless, with frequent rain, occasionally heavy. If we except the twelve nights on which the thermometer fell to or below the freezing-point, the temperature, both day and night, has been above the average. The lowest night reading was 26°, on the night of the 28th. Total frost, 18°, and three times at freezing-point. During one-half of the month the maximum day temperature in the shade varied from 50° to 55°. The lowest day reading was 41°, on the 26th. Single Dahlias were blooming freely up to the night of the 28th. Late-blooming perennials have been earlier and better developed than is usual in our climate. Many of the more tender annuals never recovered the muggy weather experienced for several successive days last month.

Comparatively few hardy plants have ripened seed satisfactorily, the latter part of the season being less propitious than the early part.

November.—The mean temperature has been high for the month, considering that frost was registered on eleven nights. Of the 49° recorded as the total for the month, no less than 30° were registered on the nights of the 25th, 26th, and 27th; 19°, or 13° of frost, being the lowest reading during the night of the 26th. The day temperature was invariably high, the only low reading being 31° on the 26th, and after a light fall of snow. This cold wave came quite opportunely, for the buds of most hardy plants were far advanced for the season. It has been a splendid season for outdoor garden work.

December 1889.—This has been a comparatively mild month, for although the thermometer has been at or below the freezing point on nineteen nights, the mean readings have been high for the month, varying from 32° to 22°, the latter being the lowest reading on the night of the 27th. Total readings, 61.° The day temperature was invariably high, so that, although light frosts were frequent, vegetation is in an advanced state. A plant of *Cydonia japonica* against a west wall has many fully developed leaves. Fruit of hardy trees and shrubs have rarely been so scarce as this year.

January 1890.—The mean temperature was unusually high for the month, and, with the exception of January 1884, less frost was registered than on any January for many years. The lowest reading was 23° (9° of frost) on the night of the 22nd. Total frost, only 35°.

Last year's total frost for January was 51°. The year previous 48°. So that we are experiencing a succession of mild winters. After the first day or two of the month, the weather became very variable, and continued so throughout. Rainfall was both frequent and heavy, with just sufficient sleet at times to remind us of winter. On the 14th, 18th, and 25th, storms of considerable severity and duration were experienced, the last one exceeding in severity and velocity either of the others. Professor Grant reports that a pressure of 28 lbs. to the square foot was registered at the Glasgow Observatory. These storms extended far beyond our shores, great damage being done. Vegetation is in a very advanced state, common Elder, Japan Quince, scarlet *Ribes*, &c., have young shoots from 1 to 3 inches in length.

February.—The high mean temperature experienced last month, was continued for the first two or three days of this month, 7° of frost being registered on the night of the 4th. Since then we have had continued cold. Frost was registered on twenty nights, the remainder being very cold. The lowest reading was 23° (9° of frost), and the total frost for the month 87°, and four times at the freezing point. Cold north and north-east winds were frequent, also an unusual number of hazy, foggy, sunless days. The warmth of the sun was felt here only twice during the month, *i.e.*, on the 5th and 23rd. The continued cold days and nights have thoroughly retarded vegetation ; this is a fortunate circumstance. Fortunately only hardy plants of foreign origin which, despite all acclimatization, will persist annually in pushing early growth, have suffered to any appreciable extent.

March.—Frost was registered on eight nights during the month, the lowest reading being on the night of the 2nd, when 10° were recorded. The total frost was only 28°. During March last year the total was 67°.

Although cold winds were frequently felt, they were mostly from the south and west, and as a consequence it has been comparatively mild, with a moderate rainfall, but a large proportion of dull or sunless days. Hardy vegetation is in a forward state, and neither sharp frosts nor withering winds occurred; it is likely to be a good fruit season.

Ribes sanguineum and the Japan Quince had expanded leaves at the end of the month, while the leaves of the Balsam Poplar, common Lilac, *Elæagnus argenteus*, had foliage half-developed, and which is an early date for these plants here. Hardy perennials are also early above ground.

April.—The temperature fell below the freezing point twelve times during the month. The lowest reading was 4° during the night of the 12th. The total readings were only 17°. A large number of fine and dry days are recorded, but of these many were comparatively sunless here, cold winds were very prevalent, and from all points of the compass. The rainfall was light.

All forms of plant life are better for the little retardation, so that, notwithstanding the mild winter, the spring is not an unusually early one, the only plants which are in a more forward state than usual are those which are capable of existence, and even flourish, after the most rigorous winters. Many deciduous trees and shrubs are not showing so much bloom as was anticipated; but it is yet early to judge of fruit prospects, the bloom being yet in an embryo state.

May.—The month as a whole was fine and favourable for garden work of all kinds. No frost was registered during the month, the lowest reading was 37° during the night of the 30th, consequently vegetation has grown steadily on, and the foliage of the early leafing trees is very fine. Although the mean night temperature of the month closely corresponds with that recorded for May last year, the day readings were much lower, particularly in the sun. Considerably the highest day readings in the shade were 68° and 67° on the 23rd and 24th, the highest in the sun was 86° on the 23rd. The numerous cool nights and sunless days had the effect of keeping late-leafing trees, such as the ash, in a backward state, and all kinds of trees are prolific of bloom. Great numbers of hardy herbaceous plants are early in bloom, but annuals are very backward.

June.—The month was remarkable for the cold, wet, and sunless weather experienced here throughout. In looking over my daily notes, I find only one really fine sunny day recorded, *i.e.*, the 29th, and even on that day we had rain early in the morning and late at night. The highest temperature in the shade was 68°, and in the sun 86°, the latter being the highest reading since May 23, when

86° was also registered. The shaded thermometer registered 68° on two days only. The lowest reading was 35°. Hardy trees, shrubs, grass, and most cereal crops made vigorous growth; the same may be said of herbaceous plants generally; but, considering the early and favourable season for growth, the later-blooming kinds are in a backward state. Half-hardy plants are stunted in growth, and poor in bloom. Chrysanthemums, which are undergoing the usual routine of cultivation, look as if they would not attain half the usual height. While we have been deluged with rain, it is curious to note that in parts of England they suffered badly from drought. Small fruits are an average crop in some places, but other edible fruit crops are a failure.

The following new Fellows and Associates were elected during Session 1889-90:—

1889.

Dec. 12. J. Russell Murray, Port of Spain, Trinidad—*Non-Res. Fellow.*

1890.

Jan. 9. Dr W. Somerville, Edinburgh University—*Res. Fellow.*

Feb. 13. R. C. Millar, C.A., 56 George Street—*Res. Fellow.*

,, ,, Charles M'Intosh, Dunkeld—*Associate.*

Mar. 13. Professor J. C. Ewart, Edinburgh University—*Res. Fellow.*

June 12. John S. Oliver, 12 Greenhill Park—*Res. Fellow.*

The Society exchanges Publications with—

AMERICA.

Canada.

Halifax, . . . Agricultural Department.—Prof. G. Lawson, Secretary.
Nova Scotia Institute of Natural Science.
Montreal, . . . Geological and Natural History Survey of Canada—Alfred R. C. Selwyn, Director.
Natural History Society.
Toronto, . . . Canadian Institute.

Costa Rica.

San José, . . . Museo Nacional.

United States.

Boston, . . . Boston Society of Natural History
Massachusetts Horticultural Society.
Cincinnati, . Cincinnati Society of Natural History.
Crawfordsville, Editor of *Botanical Gazette*.
Davenport, . Davenport Academy of Natural Sciences.
New Haven, . Connecticut Academy of Arts and Sciences.
New York, . American Museum of Natural History.
Columbia College.
New York Academy of Sciences.
Torrey Botanical Club.
Philadelphia, . Academy of Natural Sciences.
San Francisco, California Academy of Sciences.
Sacramento, . California State Board of Forestry.
Topeka, . . . Kansas Academy of Science.
Trenton, . . . Trenton Natural History Society.
Washington, . United States Geological and Geographical Survey of Territories.—J. V. Hayden, Director.
United States Geological Survey.—T. W. Powell, Director.
Smithsonian Institution.
United States Department of Agriculture, Section of Vegetable Pathology.—B. T. Galloway, Chief.

AUSTRALASIA.

New South Wales.

Sydney, . . . Royal Society of New South Wales.

NEW ZEALAND.

Wellington, . Colonial Museum and Geological Survey.
New Zealand Institute.

QUEENSLAND.

Brisbane, . . Royal Society of Queensland.

TASMANIA.

Hobart, . . . Royal Society of Tasmania.

VICTORIA.

Melbourne, . . Royal Society of Victoria.

EUROPE.

AUSTRIA.

Cracow, . . . Academija Umiejetnósci.
Graz, ... Naturwissenschaftlicher Verein für Steiermark.
Vienna, . . . K. K. Naturhistorisches Hofmuseum.
K. K. zoologisch-botanische Gesellschaft.

BELGIUM.

Brussels, . . Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique.
Société Royale de Botanique de Belgique.
Federation des Sociétés d'Horticulture de Belgique.
Ghent, . . . Editor of *Botanische Jaarboek*.

DENMARK.

Copenhagen, . Botaniske Forening.

FRANCE.

Amiens, . . . Société Linnéenne du Nord de la France.
Cherbourg, . . Société Nationale des Sciences Naturelles et Mathematiques.
Courrensan, . Société Française de Botanique.
Lyons, . . . Société Botanique.
Paris, . . . Société Botanique de France.
Société Linnéenne de Paris.

GERMANY.

Berlin, . . . Botanischer Verein für die Provinz Brandenburg und die angrenzenden Länder.
Bonn, . . . Naturhistorischer Verein der preussischen Rheinlande, Westfalens, und der Reg.-Bezirks Osnabruck.
Braunschweigh, Verein für Naturwissenschaft.
Bremen, . . . Naturwissenschaftlicher Verein.
Breslau, . . . Schlesische Gesellschaft für vaterlandische Cultur.

Erlangen, . . . Physikalisch-medicinische Societät.
Giessen, . . . Oberhessische Gesellschaft für Natur- und Heilkunde.
Halle, . . . Kais. leopoldinisch-carolinische deutsche Akademie der Naturforscher.
Königsberg, . Kön. physikalisch-oekonomische Gesellschaft.

GREAT BRITAIN AND IRELAND.

Alnwick, . . Berwickshire Naturalists' Club.
Belfast, . . . Natural History and Philosophical Society.
Belfast Naturalists' Field Club.
Bristol, . . . Bristol Naturalists' Society.
Buckhurst Hill, Essex Field Club.
Dublin, . . . Royal Dublin Society.
Dumfries, . . Dumfriesshire and Galloway Natural History and Antiquarian Society.
Edinburgh, . . Royal Scottish Arboricultural Society.
Royal College of Physicians.
Edinburgh Geological Society.
Royal Society of Edinburgh.
Royal Physical Society.
Royal Scottish Geographical Society.
Royal Scottish Society of Arts.
Glasgow, . . Natural History Society.
Philosophical Society.
Hertford, . . Hertfordshire Natural History Society and Field Club.
Liverpool, . . Literary and Philosophical Society.
London, . . Editor of *Gardeners' Chronicle.*
Linnean Society.
Editor of *Nature.*
Pharmaceutical Society of Great Britain.
Queckett Microscopical Club.
The Royal Society.
Royal Horticultural Society.
Manchester, . Manchester Literary and Philosophical Society.
Newcastle-upon-Tyne, . . . Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne, and the Tyneside Naturalists' Field Club.
Perth, . . . Perthshire Society of Natural Science.
Plymouth, . . Plymouth Institution.

HOLLAND.

Amsterdam, . Koninklijke Akademie van Wettenschappen.
Haarlem, . . Musée Teyler.
Nederlandische Maatschappij ter Bevordering van Nijverheid.
Luxembourg, . Société Botanique du Grand-duché de Luxembourg.

ITALY.

Rome, . . . Reale Instituto Botanico.

PORTUGAL.

Lisbon, . . . Academia real das Sciencias.

RUSSIA.

Helsingfors, . Societas pro Fauna et Flora Fennica.
Kieff, . . . Société des Naturalistes.
Moscow, . . Société impériale des Naturalistes.
St Petersburg, . Hortus botanicus imperialis.

SCANDINAVIA.

Lund, . . . Universitas Lundensis.
Stockholm, . . Kongl. Svenska Vetenskaps Akademien.
Upsala, . . Societas Regia Scientiarum.

SWITZERLAND.

Berne, . . . Naturforschende Gesellschaft.

Botanical Society of Edinburgh.

Patron:

HER MOST GRACIOUS MAJESTY THE QUEEN.

LIST OF MEMBERS,

Corrected to February 1891.

HONORARY FELLOWS.

HIS ROYAL HIGHNESS THE PRINCE OF WALES, K.G., Hon. F.R.S. L. & E.
HIS ROYAL HIGHNESS THE DUKE OF EDINBURGH, K.G., K.T., LL.D. Edin.
HIS MAJESTY PEDRO II. EX-EMPEROR OF BRAZIL, K.G., F.R.S.
HIS MAJESTY OSCAR II. KING OF SWEDEN.

BRITISH SUBJECTS (LIMITED TO SIX).

BABINGTON, CHARLES CARDALE, M.A., F.R.S., F.L.S., F.S.A., *Fellow of St John's College and Professor of Botany, Cambridge.*
CLEGHORN, HUGH F. C., M.D., LL.D., F.R.S.E., F.L.S., *Stravithie, St Andrews.*
DYER, WILLIAM TURNER THISELTON, M.A., C.M.G., F.R.S., *Director, Royal Gardens, Kew.*
HOOKER, Sir JOSEPH DALTON, M.D., K.C.S.I., C.B., D.C.L. Oxon., LL.D. Cantab., F.R.S., F.L.S., F.G.S., *The Camp, Sunningdale, Berks.*
OLIVER, DANIEL, F.R.S., F.L.S., *Kew.*
SPRUCE, RICHARD, Ph.D., *Coneysthorpe, Malton, Yorkshire.*

FOREIGN (LIMITED TO TWENTY-FIVE).

AGARDH, JAKOB GEORG, For. F.L.S., *Emeritus Professor of Botany, Lund, Sweden.*
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*Aitchison, J. E. T., M.D., LL.D., C.I.E., F.R.S., 20 *Chester Street.*

*Aitken, A. P., M.A., D.Sc., F.R.S.E., 57 *Great King St.*—FOREIGN SECRETARY.

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5‡Allan, Francis J., M.D., 1 *Dock Street, London, E.*

‡Allman, G. J., F.R.SS. L. & E., F.L.S., *Athenæum Club, London.*

Anderson, James M., S.S.C., *Strathearn Lodge, Strathearn Place.*

‡Anderson, John, M.D., F.L.S., 71 *Harrington Gardens, London, S.W.*

*Anderson, Rev. Thomas, 44 *Findhorn Place.*

10*Archibald, John, M.B., C.M., F.R.C.S.E., *Woodhouse Eaves, Loughborough.*

‡Armitage, S. H., M.D., 9 *Huntris Row, Scarborough.*

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*Balfour, Thos. Alex. Goldie, M.D., F.R.S.E., 51 *George Square.*

15†Barnes, Henry, M.D., F.R.S.E., 6 *Portland Square, Carlisle.*

‡Barty, Rev. Thomas, M.A., *The Manse, Kirkcolm.*

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‡Beveridge, James S., L.R.C.P. and S., 9 *Spring Gardens, London, S.W.*

20*Bird, George, 24 *Queen Street.*

‡Birdwood, Sir George, M.D., *India Office.*

*Black, James Gow, Sc.D., *Professor of Chemistry, University of Otago, New Zealand.*

Blackstock, W. S., 29 *Townsend Place, Kirkcaldy.*

*Bonnar, William, 8 *Lauriston Park.*

25 Bower, F. O., M.A., D.Sc., F.R.S.E., F.L.S., *Professor of Botany, University of Glasgow*, 45 *Kersland Street, Hillhead, Glasgow.*

*Boyd, W.B., *of Faldonside, Melrose.*

†Bramwell, John M., M.B., C.M., *Burlington House, Goole, Yorkshire.*

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Buchan, Alexander, M.A., LL.D., F.R.S.E., *Sec. Scot. Met. Soc.*, 72 *Northumberland St.*

*Buchanan, James, *Oswald Road.*

‡Burnett, Charles John, *Aberdeen.*

‡Burslem, Willoughby Marshall, M.D., *Bournemouth, Hants.*

40 Caird, Francis M., M.B., C.M., 21 *Rutland Street.*

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45‡Carter, James, M.R.C.S., *Cambridge.*

Christison, Sir Alexander, Bart., M.D., 40 *Moray Place.*

Christison, David, M.D., 20 *Magdala Crescent.*

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‡Clay, Robert H., M.D., 4 *Windsor Villas, Plymouth.*

50†Cleland, John, M.D., *Professor of Anatomy, University of Glasgow.*

Coats, William, 84 *George Street.*

‡Coldstream, Wm., B.A., B.Sc., *Commissioner, Punjab, India.*

‡Collingwood, Cuthbert, M.A., M.B., F.L.S., 2 *Gipsy Hill Villas, London.*

†Collins, James, 58 *Great Queen Street, Lincolns Inn Fields, London, W.C.*

55†Cooke, M. C., M.A., LL.D., 146 *Junction Road, London, N.*

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†Crawford, William Caldwell, 1 *Lockharton Gardens, Slateford.*

Croom, J. Halliday, M.D., F.R.C.P.E., 25 *Charlotte Square.*

60†Davies, A.E., Ph.D., F.L.S., *Portobello.*

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65‡Dobie, W. M., M.D., *Chester.*
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*Drummond, W. P., *Seedsman, Larkfield House, Ferry Road.*
†Duckworth, Sir Dyce, M.D., 11 *Grafton Street, Bond Street, London, W.*
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70*Duncanson, J. J. Kirk, M.D., C.M., F.R.S.E., 22 *Drumsheugh Gardens.*
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†Duthie, J. F., B.A., F.L.S., *Superintendent of the Botanic Gardens, Saharunpore, N.W.P., India.*
Edington, Alexander, M.B., C.M., 44 *Great King Street.*
75 Elliot, G. F. Scott, M.A., B.Sc., F.L.S., *Newton, Dumfries.*
‡Elliot, Robert, *Wolfelee, Hawick.*
*Evans, Arthur H., M.A., 9 *Harvey Road, Cambridge.*
Ewart, J. C., M.D., F.R.S.E., *Professor of Natural History, University.*
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‡Flower, Thomas Bruges, F.L.S., M.R.C.S., 9 *Beaufort Buildings West, Bath.*
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90 Foulis, James, M.D., F.R.C.P.E., 34 *Heriot Row.*
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105*Gaynor, Charles, M.D., F.R.S.E.
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‡Geikie, Archibald, LL.D., F.R.SS. L. & E., *Director General, H.M. Geol. Survey*, 4 *Jermyn Street, London.*
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Gibson, A. H., *West Fergus Place, Kirkcaldy.*
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135 Hunter, James, F.R.C.S.E., *School of Medicine*, 20 *Craigmillar Park, Edinburgh.*
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165*Macadam, Stevenson, Ph.D., F.R.S.E., *Surgeons' Hall.*
Macadam, W. I., F.C.S., F.I.C., *Lecturer on Chemistry, Surgeons' Hall.*
‡Macaulay, James, M.D., 22 *Cambridge Road, Kilburn, London, N.W.*
‡Macdonald, John, M.D., F.L.S., *Gothic House, Walton-on-Thames.*
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180 M'Laren, Hon. Lord, 46 *Moray Place.*
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Milne, Alex., 32 *Hanover Street.*
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Mitchell, Rev. James, M.A., D.D., *The Manse, Hermitage Place, Leith.*
Moffat, Andrew, 5 *Scone Gardens.*
195 Moffat, Grenville E., M.B., C.M., 5 *Castle Street, Brechin.*
Moffat, W. J., *Secretary, Scottish Arboricultural Society,* 5 *St Andrew Square.*
†More, A. G., F.L.S., M.R.I.A., *Curator, Science and Art Museum,* 92 *Leinster Road, Dublin.*
‡Morrieson, James Stuart, M.D., *Bengal.*
Morris, Rev. A. B., 18 *Eildon Street.*
200†Muirhead, George, F.R.S.E., *Mains of Haddo, Aberdeen.*
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Murray, William, 8 *Clifton Terrace.*
‡Nevins, John Birkbeck, M.D., 3 *Abercromby Square, Liverpool.*
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Ogilvie, William M'Dougall, *Royal Bank, Lochee, Dundee.*
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*Panton, Geo. A., F.R.S.E., 73 *Westfield Road, Edgbaston, Birmingham.*
210†Parker, Charles Eyre, 13 *Scarborough Terrace, Torquay, Devon.*
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‡Paterson, R., M.D., *Napier Road.*
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*Paul, Rev. David, M.A., *Roxburgh Manse, Kelso.*
215‡Paul, James, M.D., *Jamaica.*
*Paxton, W., *Orchardton, Fountainhall Road.*
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225‡Porteous, Geo. M., *Firknowe, Juniper Green.*
‡Post, G. E., M.D., *Beyrout.*
*Potts, George H., *of Fettes Mount, Lasswade*, 5 *Frederick Street.*
‡Priestley, W. O., M.D., 17 *Hertford Street, Mayfair, London.*
‡Prior, R. C. Alexander, M.D., F.L.S., 48 *York Ter., Regent's Park, London, and Halse House, Taunton.*
230†Ramsbotham, S. H., M.D., *Leeds.*
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‡Reid, Jas. R., C.M.G., *Bengal Civil Service.*
‡Riddell, William R., B.A., B.Sc., *Prov. Normal School, Ottawa, Ontario, Canada.*
*Robertson, A. Milne, M.B., C.M., *Gonville House, Roehampton Park, London, S.W.*
235 Robertson, Rev. J. M., *St Ninians, Stirling.*
Robertson, Robert, A., M.A., B.Sc., *Lecturer on Botany, St Andrews.*
†Rothery, Henry Cadogan, M.A., F.L.S., 94 *Gloucester Terrace, Hyde Park, London.*
Rutherford, William, M.D., F.R.SS. L. and E., *Professor of Institutes of Medicine*, 14 *Douglas Crescent.*
†Rylands, Thomas Glazebrook, F.L.S., *Highfields, Thelwall, near Warrington.*
240*Sanderson, William, *Talbot House, Ferry Road.*
*Scot-Skirving, Robert, *of Camptown*, 29 *Drummond Place.*
‡Scott, D. H., M.D., *Altavilla, Queenstown, Cork.*
‡Scott, Daniel, *Wood Manager, Darnaway Castle, Forres.*
‡Scott, John, *Greenock.*
245 Scott, J. S., L.S.A., 55 *Clowes Street, West Gorton, Manchester.*
Sewell, Philip, 8 *Hanover Terrace, Whitby.*
‡Shapter, Thomas, M.D., *Sudbury, Derby.*
‡Shaw, John Edward, M.B., 2 *Rodney Cottages, Clifton, Bristol.*
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250*Sibbald, John, M.D., F.R.S.E., 3 *St Margaret's Road.*
‡Sidney, M. J. F., *Cowpen, Morpeth.*
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‡Slack, Robert, M.D., *Holywalk, Leamington.*
255 Smith, J. Pentland, M.A., B.Sc., *Horticultural College, Swanley, Kent.*
Smith, Major-Gen. Sir R. Murdoch, R.E., *Director, Museum of Science and Art.*
†Somerville, Alexander, B.Sc., F.L.S., 4 *Bute Mansions, Hillhead, Glasgow.*
*Somerville, William, Œc.D., B.Sc., F.R.S.E.
‡Southwell, Thomas, F.Z.S., *Earlham Road, Norwich.*
260‡Spasshatt, Samuel P., M.D., *Armidale, New South Wales.*
Sprague, Thomas Bond, M.A., F.R.S.E., 29 *Buckingham Terrace.*
†Stabler, George, *Levens, Milnthorpe, Westmoreland.*
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265‡Steele, Robert, *Greenock.*
‡Stevens, Rev. Charles Abbott, M.A., *Port Slade Vicarage, Shoreham, Sussex.*
‡Stewart, Samuel A., 217 *Springfield Road. Belfast.*
Stewart, John, *Letham Mill, Arbroath.*
Stuart, Charles, M.D., *Chirnside.*
270 Syme, David, 1 *George IV. Bridge.*
*Taylor, Andrew, 11 *Lutton Place.*
‡Taylor, R. H., M.D., 1 *Percy Street, Liverpool.*
Terras, J. A., 34 *Findhorn Place.*
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275‡Thomson, Spencer, M.D., *Ashton, Torquay.*
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†Townsend, F., M.A., F.L.S., *Honington Hall, Shipston-on-Stour.*
*Trail, J. W. H., M.A., M.D., F.L.S., *Professor of Botany, Aberdeen.*
Tress, W. Maxwell, 7 *Melville Crescent.*
280 Turnbull, Robert, B.Sc., *University Hall*, 2 *Mound Place.*
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Ure, George, *Camphill Lodge, Broughty Ferry.*
‡Valentine, Colin S., LL.D., *Surgeon, Agra, India.*
‡Vanderbyl, Philip J., M.P., 51 *Porchester Terrace, London.*
285†Waddell, Alex., *of Pallace, Jedburgh.*
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290*Watson, Charles, *The Clouds, Duns.*
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300 Wilson, Dr Andrew, F.R.S.E., F.L.S., 110 *Gilmore Place.*
Wright, J. C., F.R.S.E., 7 *Cluny Avenue.*
‡Wright, R. Ramsay, M.A., B.Sc., *Professor of Natural History, University, Toronto.*
†Yellowlees, David, M.D., *Gartnavel Asylum, Glasgow.*

LADY ASSOCIATES.

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Plowden, Miss Anna Maria.

CORRESPONDING MEMBERS.

Areschoug, Dr F. W. C., *Professor of Botany, University of Lund.*
Ascherson, Dr P., *Royal Herbarium, Berlin.*
Blytt, Axel, *Professor of Botany, University, Christiania.*
Bohnensieg, G. C. W., *Haarlem.*
5 Bolander, H. N., *Botanist to the Geological Survey of California.*
Bömmer, J. E., *Professor of Botany, Brussels.*
Bornet, Dr Edouard, F.L.S., *Paris.*
Brandis, Sir Dietrich, Ph.D., F.L.S., *Ex-Inspector-General of Indian Forests, Bonn.*
Caminhoa, Dr Joaquim Monterio, *Professor of Botany and Zoology, Rio Janeiro.*
10 Candolle, Casimir De, *Geneva.*
Castello de Paiva, Baron de, M.D., *Oporto.*
Cheeseman, T. F., *Museum, Auckland, New Zealand.*
Cleave, Rev. W. O., LL.D., *College House, St Helier, Jersey.*
Clos, Dominique, M.D., *Professor of Botany, Toulouse.*
15 Crépin, François, *Director of the Royal Botanic Garden, Brussels.*
Cunningham, Hon. G. A., *Mauritius.*
Davis, William Broughton, M.D., *Surgeon-Major, Freetown, Sierra Leone.*
Eeden, F. W. Van, *Director of the Colonial Museum, Haarlem.*
Engler, Dr Ad., *Professor of Botany, Berlin.*
20 Feber, Franz Xavier, *Chrudim, Bohemia.*
Garcke, Dr A., *Royal Herbarium, Berlin.*
Gottsche, Dr, *Altona, near Hamburg.*
Haberlandt, Dr G., *Professor of Botany, Graz.*
Hansen, Dr E. C., *Copenhagen.*
25 Heldreich, Theodore de, *Director of the Botanical Gardens, Athens.*
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Horne, John, F.L.S., *Director of the Royal Botanic Gardens, Mauritius.*
Horton, James Africanus Beale, M.D., *Surgeon-Major, Cape Coast.*
Janczewski, Dr Ed., *Professor of Botany, Cracow.*
30 Jolis, Dr Auguste le, *Cherbourg.*
Jurányi, Dr L., *Professor and Director of the Botanic Garden, Buda Pest, Hungary.*
Kerner, Dr, *Professor of Botany, Vienna.*
King, George, M.D., F.L.S., *Superintendent, Botanic Garden, Calcutta.*
Kützing, Friedrich Traugott, M.D., *Professor of Natural History, Nordhausen.*
35 Lecheur, Ernest La, *St Pierre, Guernsey.*
Leichtlin, Max, *Baden-Baden.*
Luerssen, Dr Ch., *Professor of Botany.*
Macgowan, Daniel Jerome, M.D., *Ningpo, China.*
Millardet, A., *Professor of Botany to the Faculty of Sciences, Bordeaux.*

40 Moore, Charles, F.L.S., *Director of the Botanic Garden, Sydney, New South Wales.*
Murray, William, *San Francisco.*
Naudin, C., F.L.S., *Member of the Institute of France, Antibes.*
Nyman, Charles Frider, *Conservator of the Herbarium, Stockholm.*
Oudemans, Dr C. A. J. A., *Professor of Botany and Director of the Botanic Garden, Amsterdam.*
45 Pfeffer, Dr W., *Professor of Botany, Tubingen.*
Philippi, Dr R. A., *Professor of Botany in the University of Santiago, Chili.*
Pisani, S. Louis, M.D., *Malta.*
Radlkofer, Dr L., *Professor of Botany, University of Munich.*
Regel, Dr Edouard de, *Director of the Imperial Botanic Garden, St Petersburg.*
50 Rodrigues, Joas Barboza, *Secretary and Professor Adjunct in the Imperial College of Pedro II., Rio Janeiro.*
Rostan, Dr Edouard, *Perrero di Pinerolo Piedmont.*
Sargent, C. S., *Professor of Arboriculture, and Superintendent, Harvard Botanic Garden, Cambridge, Massachusetts.*
Schaller, J. L., *Fribourg, Switzerland.*
Schomburgk, Dr R., *Director of the Government Botanic Garden, Adelaide, South Australia.*
55 Sodiro, Luis, *Professor of Botany, University of Quito, Ecuador.*
Sully, W. C., *Cape Town.*
Suringar, W. F. R., *Professor of Botany, and Director of the Botanic Garden, Leyden.*
Terracciano, Dr Nicolao, *Director of the Royal Gardens, Caserta, near Naples.*
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60 Treub, Dr M., *Director of Botanic Garden, Buitenzorg, Java.*
Tyson, W., *Forest Department, Cape Town.*
Wildpret, H., *Director, Botanic Garden, Orotava.*
Willkomm, Dr Maurice, *Professor of Botany and Director of the Botanic Garden, Prague, Bohemia.*

ASSOCIATES.

Bell, William, *New Zealand.*
Bennett, A., F.L.S., 107 *High Street, Croydon.*
Boyle, David, *Boxhill Post-Office, Nunwading, South Bourk, Melbourne.*
Brocas, F. Y., 4 *Mill Street, Conduit Street, London, W.*
5 Brotherston, A., *Sheddon Park Road, Kelso.*
Buchanan, John, C.M.G., *Blantyre, Shiré Highlands, Central Africa.*
Bullen, R., *Botanic Garden, Glasgow.*
Campbell, A., 26 *Marchmont Crescent, Edinburgh.*
Campbell, John, *Ledaig, Argyllshire.*
10 Dixon, Wm. E., 4 *Wardie Crescent.*
Evans, William, *Scottish Widows' Fund, St Andrew Square.*
Gray, Peter, 35 *Jeffries Road, Clapham Rise, London, S.W.*
Greig, James, *Woodville, Dollar.*
Howie, Charles, *St Andrews.*
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Kerr, Andrew, *Taxidermist, Montrose.*
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Richardson, Adam D., *Royal Botanic Garden.*
Ross, George, 18 *Crombie Street, Oban.*
25 Shaw, William, *Gunsgreen, Eyemouth.*
Sim, John, 9 *Commercial Street, Perth.*
Taylor, Charles, *Royal Botanic Garden.*
Traill, G. W., *Westness, Joppa.*
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2.

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BERWICK — ON GLANDS IN GALIUM APARINE

Fig. 1.

Fig. 4

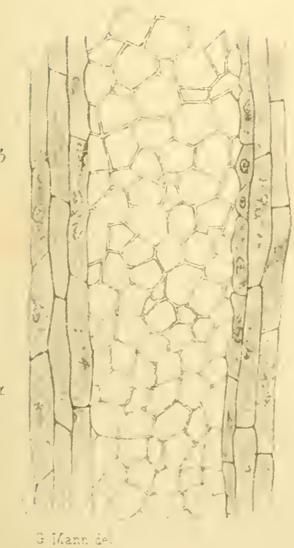


Fig. 2.

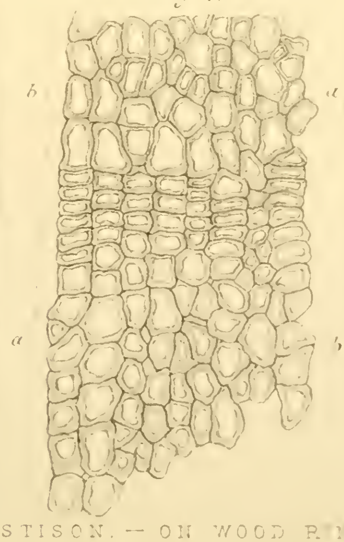
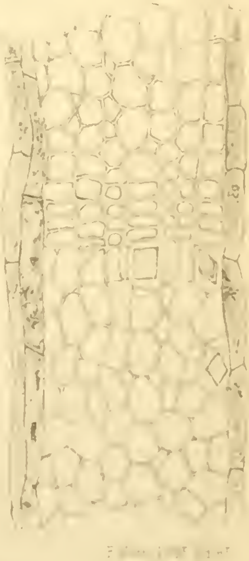
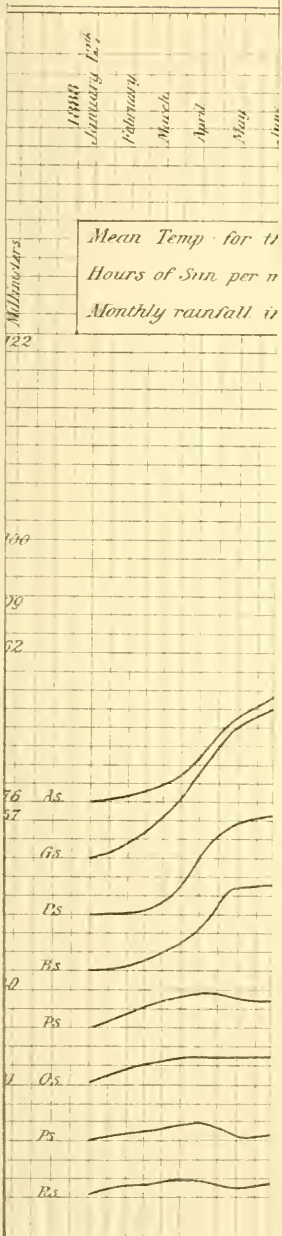


Fig. 3.

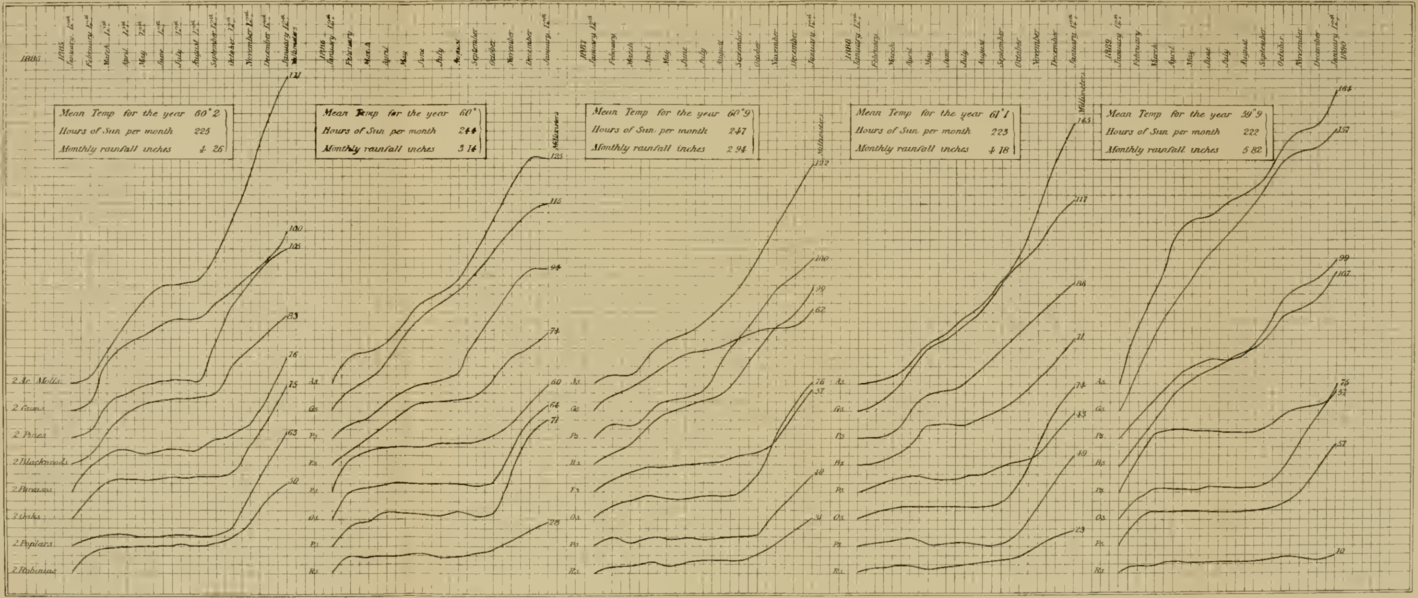


G Mann del.

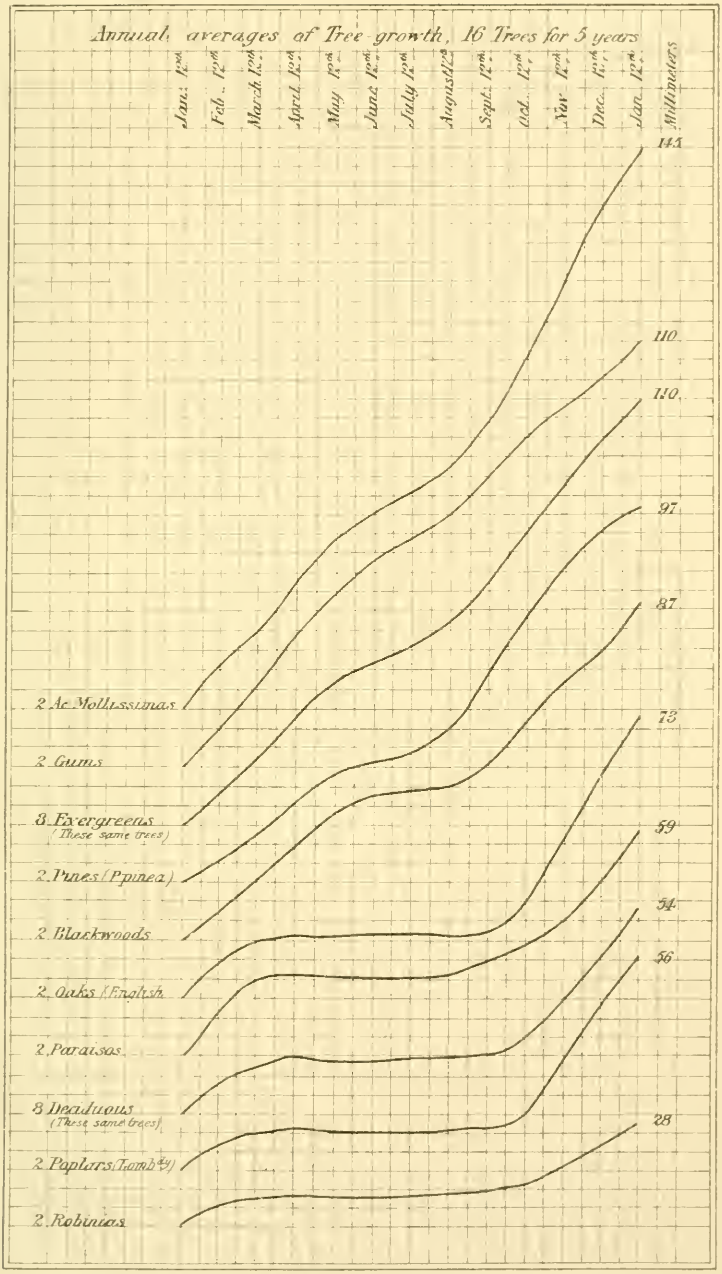
CHRISTISON. — ON WOOD RINGS.



the 2 Trees of each class



Monthly and yearly increments in Tree Girths average taken of the 2 Trees of each class in millimetres reduced about one half



Average monthly increment in Tree girths for five years 1885 to 1889, in millimetres, reduced about one half

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