SHORT COMMUNICATIONS

MARBOLITE — A NEW SYNTHETIC MATERIAL. Part I

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The term marble is derived from a Greek word meaning to sparkle or flash because the calcite crystals in marble sparkle as they reflect light. In its geological sense, the term is applied to rocks comprising crystallised grains of calcite and/or dolomite, but commercially the word has a wider connotation. As the ability to take up polish is the chief commercial asset of marble, all calcareous rocks that can be polished are regarded as marbles in the trade. Even some serpentine minerals that have attractive colours and patterns and can be polished are classified as marbles, although they contain little calcium or magnesium carbonates. Since marble is expensive, many attemps have been made to produce substitutes, and several methods are claimed to produce materials with a marble finish by cold setting processes using magnesium oxychloride, white portland cement in conjuction with ground quartzite, marble dust or stone powder, plaster of Paris or Keene's cement and sand or stone with soluble silicates. However, the physical properties of these compositions, e.g. compressive and flexural strength, surface hardness, machining qualities and water absorption are far inferior to those of natural marble. A high temperature process for a synthetic material has recently been developed[1] at these Laboratories, and the product posseses the properties of natural marble and is moreover superior in respect of heat and acid resistance. It has been named "Marbolite."

Raw Materials and Processing

The basic raw materials for the manufacture of Marbolite are the minerals baryte and celestite, both being abundant and well distributed in the country. The present consumption of these minerals as shown in Table 1, is very small,[2] being confined to the paint industry as a filler.

TABLE 1.—PAKISTAN PRODUCTION OF BARYTES AND CELESTITE.

Year	Celestite tons	Barytes tons
1951	136	..
1952	431	..
1953	821	..
1954	361	..
1955	437	..
1956	300	..
1957	854	..
1958	457	305
1959	664	508
1960	1332	633

The process basically comprises mixing the mineral with the binder and hardening agents, moulding the mixture under pressure and firing the compositions in a muffle furnace. The final products are then finished in much the same manner as natural marble. It has been observed that without the incorporation of binders, these minerals if pressed and fired do not develop any appreciable bond. Addition of fluxing agents like sodium carbonate, sodium sulphate etc, or binding agents like silica gel, clay etc., gives products having adequate strength, which could be used as gamma rays shielding materials where appearance and higher water absorption may not be of importance. But for the production of Marbolite, the use of sodium silicate of a definite silica/soda ratio is essential.[1] The physical properties of marbolite further depend on suitable control of several other factors, namely, (1) the proportion of the binder, (2) the moulding pressure (3) the firing temperature, (4) the rate of firing, and (5) the duration of firing. The effect of moulding pressure on the flexural strength is shown in Fig. 1, and the effect of firing temperatures and duration of firing in Fig. 2.

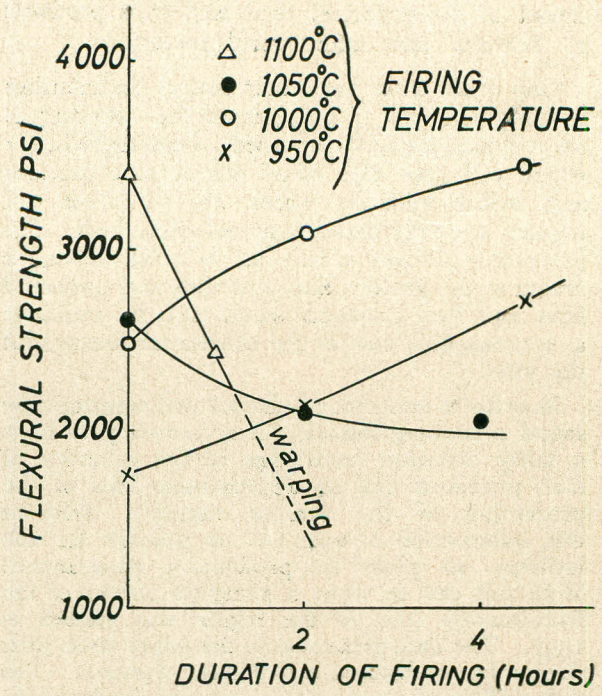

Fig. 1.—Effect of moulding pressure on the flexural strength of Marbolite.

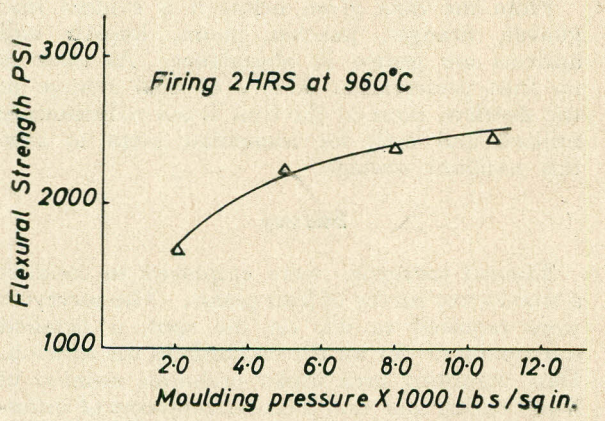

Fig. 2.—Effect of firing temperatures and duration of firing on the flexural strength of Marbolite.

Properties

Physical and Mechanical.—The density of natural marble ranges from 165 to 180 pounds per cubic foot. On the other hand density of Marbolite can be adjusted from 200 to 250 pounds per cubic foot depending on the relative proportion of baryte and celestite. The results for compressive and flexural strength of Marbolite and locally available natural white marble are presented in Table 2. The values of natural marble as reported in the literature are also included.

TABLE 2.—COMPARISON OF PHYSICAL PROPERTIES OF MARBOLITE AND NATURAL MARBLE.

Material	Compressive strength (dry) psi	Flexural strength (dry) psi	Flexural strength (wet) psi
Marbolite	12000-14000	3000-4000	2000-2500
Pakistani white marble	13,500	3,800	2,900
Natural marble	10,000-18,000	—	—

Hardness is the resistance that the surface of a material offers to abrasion. The hardness of Marbolite can be controlled by the addition of suitable hardening agents between fairly wide limits, thereby making possible the manufacture of various grades of the product to suit specific requirements.

Water absorption of Marbolite as determined by soaking the material in water for 24 hours is 0.1 to 1.0% by weight of the material.

Miscellaneous Properties.—Natural marble is translucent and therefore transmits some light, while Marbolite is opaque and a good reflector of light. Marble is easily attacked by acids and is not heat resistant, whereas Marbolite is as much acid resistant as the minerals used for its preparation and can withstand temperatures up to 1000°C. Marbolite has good machining qualities and can be made into any shape. Measurements have shown that it also has good gamma-radiation shielding properties; details of which will be discussed in a later communication.

Conclusions

The cost of Marbolite is expected to be about one-fourth that of natrual marble, and its manufacture on an industrial scale will bring marble-like flooring and wall facing within the reach of the middle income group in its house building programme and also introduce healthy competition in the natural marble industry. Marbolite chips of any desired shape can be readily made for use in mosaic floorings. It should be particularly useful, where its acid, alkali and heat resisting properties are called for, and could have a world-wide market on account of its high effectiveness as a shield against gamma rays. The production of Marbolite will in the first stage be confined to white and grey shades; other shades can be introduced, but the product then tends to lose its marble-like appearance. Work on the production of coloured Marbolite to simulate the natural coloured marble is in progress.

References

1. Pakistan Patent No. 112,179.
2. *Geological Survey af Pakistan*, Private Communication.

A SURVEY OF FRUITS IN THE NORTH-WESTERN REGIONS OF WEST PAKISTAN Part II *

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Introduction

The North-West Frontier region of West Pakistan is famous and may be called the California of the East, for its orchards. Fruit is one of the most important produce of the region. Some of the best varieties of peaches, plums, guavas, pears and apricots are produced in this area. Kohat and Haripur produce the best guavas. Peshawar is rich in plums, peaches and pears. Hangu in Kohat district is famous for its peaches and apricots. Oranges grown in Peshawar, Mardan and Haripur are prized for their best taste and flavour.

Most of the fruit does not reach the market in the best of conditions due to lack of speedy transport, and, while in season, considerable portion is wasted or sold at an uneconomically low price, since no facilities exist for cold storage or refrigeration. Ignorance of the methods of home preservation or sun drying is another factor responsible for wastage.

The area has immense potentialities of development for commercial fruit growing and, given proper encouragement by the Government, sizeable fruit processing industries can be established which will not only cater to domestic needs but can also be a good foreign exchange earner through export of the processed fruit and fruit products to Western and other world markets.

One of the most important factors contributing to the promotion of commercial fruit-growing is the presence of a well-organised processing industry which will take care of all the surplus produce and utilize varieties which are otherwise not popular and very little consumed while fresh. The processing industry would ensure a fair economic return to the grower, and processed and preserved fruit and fruit products would also be available at a reasonable cost to the consumers throughout the year.

In order to establish a balanced and economically sound processing industry, it is necessary to have a fairly accurate knowledge of the quantity of fruit produced and an approximate idea of the proportion of the various varieties. Without this information it will not be possible for the industry to plan its production programme. With this end in view, a complete survey of the fruit-bearing trees of the region was started in 1957. The data presented in the paper deals with the survey of Hazara and Kohat districts. The data will be of great help in assessing the possibilities of export of processed fruits and fruit products.

From the data given below it is evident that guavas, oranges, peaches, plums, loquats and apricots are grown in abundance. As there is no fruit preservation factory or cold storage in the districts, most of the fruit is not economically utilized and calls for immediate steps to save this national wastage.

Survey

Trained surveyors were employed to conduct a tree-to-tree survey of fruit plants. The surveyors were required to fill, on the spot, a detailed questionnaire for all the orchards in the districts. Data regarding area under orchards, number of fruit-bearing and non fruit-bearing trees of different varieties of fruits, season of availability etc. were thus collected. Average yields were determined by selecting average types of trees of different varieties of fruits in representative orchards and picking the fruit under the supervision of the survey staff. Figures for annual production of fruits in the districts were then worked out on the basis of the number of fruit-bearing trees and the average yields obtained. The data revealed the following results:—

Hazara District

1. Fifty-three varieties of different fruits are commercially grown in the district.

*For Part I, see Pakistan J. Sci. Ind. Reserach, 3, 70 (1960).

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2. The total area under fruits is 3517 acres and the total annual production is about 7,30,169 maunds.

3. Guavas, citrus fruits like malta, sangtara, lemon, grape-fruit, loquat, plum, apricot, and banana are the main fruits grown in the district. Other fruits like mango, peach, walnut, pear, apple, grape, lichi, fig, quince, pomegranate, persimon and almond are grown on a limited scale.

4. The annual production of guava, citrus fruits, loquat, plum, apricot and banana is 97861, 179525, 117837, 163293, 131046 and 10734 maunds respectively.

5. A number of varieties of each fruit are under cultivation in the district, of which the leading varieties are:—

	Fruit	Variety
(a)	Malta oranges	Red Blood
(b)	Sangtara oranges	Nagpuri
(c)	Apricot	White and red varieties
(d)	Plum	Formusa
(e)	Guava	White
(f)	Banana	Desi
(g)	Pear	Leconte
(h)	Mango	Langra & Desi
(i)	Pomegranate	Desi

Kohat District

1. Thirty-two varieties of different fruits are commercially grown in the Kohat district.
2. Total area under orchards is 1440 acres and the total annual production is 2,50,520 maunds per year distributed as below in the two tehsils.

Tehsil Kohat

1. Area under orchards is 1241 acres, with an annual total production of 200,414 maunds.
2. Guava, citrus fruits, like sweet oranges, sangtara, sweet lime, lemon, loquat, plum, peach and apricots, pomegranate and pears, are the main fruits grown in the tehsil. Other fruits like banana, grapes, apples, and persimon are grown on a limited scale.

3. The calculated production of the above fruits at present is given in Table 1.

Tehsil Hangu

1. Area under orchards is 199 acres with a total annual production of about 50,107 maunds. Peach, plum, apricot, guava and citrus fruits are the main fruits in the tehsil Hangu.

2. Present annual production of each fruit and expected increase is shown in Table 2.

TABLE 1.

No.	Name of fruits	Present production	Expected increase*
1.	Guava**	107,644 maunds	8,792 maunds
2.	Citrus fruits	24,135 ,,	49,917 ,,
3.	Loquat	32,910 ,,	11,682 ,,
4.	Plum	28,302 ,,	107,746 ,,
5.	Pears	1,599 ,,	
6.	Pomegranate	1,483 ,,	
7.	Apricot	1,473 ,,	
8.	Peach	766 ,,	

TABLE 2.

No.	Name of fruits	Present production	Expected increase*
1.	Peaches	22,880 maunds	4,979 maunds
2.	Plum	13,795 ,,	6,605 ,,
3.	Apricot	5,106 ,,	1,137 ,,
4.	Guava **	3,262 ,,	1,168 ,,
5.	Citrus fruit	2,853 ,,	992 ,,

*Expected increase has been calculated from number of prospective young trees.
**Production per season.

PROXIMATE COMPOSITION OF CITRUS FRUITS GOWN IN CITRUS AREAS OF WEST PAKISTAN

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Introduction

Most of the area in the former Punjab and Frontier Province in West Pakistan is well-known for its citrus fruit. The annual production of several varieties of 'malta', in the Frontier regions alone, is estimated to be about 5.1 lac maunds, besides a few other varieties of 'sangtara' and grape-fruit. Most of the fruit grown is exported to various cities and is consumed fresh during the season while a small quantity of it is

cold-stored and put on the market during off season and sold at a higher price.

No attempt seems to have been made so far to analyse the various varieties of oranges for their taste and flavour on a country-wide scale, and to obtain comparative data of the performance of these varieties grown in different parts of the country. In order to obtain a comparative idea of the quality of the best varieties of sweet oranges grown in West Pakistan, 44 samples were collected from among the exhibits of the 'Fruit and Vegetable Show' held at the Agricultural College, Lyallpur, on the occasion of its Golden

TABLE 1.

Place	Variety	Average wt. per fruit* oz.	Average wt. of juice + pulp + seeds (ozs.)	Skin %	Juice %	Brix at 20 °C.	Acidity as citric acid g./ 100 ml.	Corrected soluble solids at 20 °C.	Brix acid ratio	pH
Sibbi, Quetta	Common	7.78	4.42	43.12	47.7	10.2	1.216	8.69	8.3	3.32
	Red Blood	6. 33	3.75	40.78	52.63	10.1	0.742	11.79	10.36	3.45
Sargodha	W. Naval	11.00	4.75	56.81	34.09	10.0	0.3584	9.76	27.9	4.3
	Valentia Late	7.40	3.80	48.64	45.94	8.7	0.6784	8.6	12.8	3.4
	Ruby Red	5.16	3.41	33.8	56.45	12.25	0.9856	12.00	12.3	3.43
	Sangtara	3.66	2.00	45.45	45.45	8.5	0.8488	8.2	12.4	3.46
Kamalia, Lyallpur	Hamlin	6.25	3.83	37.33	50.66	10.0	0.7168	9.95	10.3	3.7
	Red Blood	3.75	2.16	40.00	51.11	10.5	0.7552	9.8	13.9	3.7
	Mosambi	4.75	2.83	40.35	47.8	10.0	0.358	9.7	27.9	4.3
	Miscellaneous	6.66	4.41	33.75	52.5	10.1	0.7552	9.7	13.5	3.68
	W. Naval	8.00	4.83	39.58	47.91	8.9	0.9216	8.9	9.7	3.4
	Kinow	6.00	4.00	33.33	58.33	10.7	0.9088	8.7	11.7	3.43
	Sangtara Desi	5.33	3.00	43.75	45.31	9.7	0.896	9.65	10.8	3.40
	Sweet Lime (Firminger)	9.83	5.25	44.07	43.2	9.8	0.1152	9.6	—	5.6
Multan (Mian Chinnu)	V. Late	5.66	3.16	44.11	48.52	10.62	2.09	10.49	5.07	3.3
	Common	6.25	3.78	46.66	53.33	10.2	0.7296	9.89	13.7	3.62
	W. Naval	8.00	4.5	43.75	50.00	10.8	—	9.49	—	3.75
	Mosambi	6.41	3.66	42.85	49.35	10.95	0.32	10.19	34.5	4.42
	Red Blood	5.00	3.00	40.00	50.00	10.6	0.5144	9.9	17.4	3.8
Lyallpur	Pineapple	6.7	4.1	86.56	49.35	9.0	0.7936	8.19	11.3	3.8
	Seville	6.00	3.6	40.00	50.00	9.5	0.8704	8.29	10.9	3.83
	Novelatia	5.00	2.7	54.00	44.0	11.0	0.8512	10.79	12.9	4.00
	Mediterranean Sweet	10.7	5.9	43.92	42.99	8.9	1.2672	8.55	7.02	3.4
	Perramita	4.85	2.8	42.66	49.48	10.8	1.272	10.43	7.5	3.2
	Parson Brown	6.2	3.4	45.16	46.77	8.00	0.4736	7.6	19.8	4.2
	Mosambiq	2.8	1.8	35.62	50.00	10.2	0.394	9.88	52.99	4.5
	Lue-Gim Gong	7.1	5.0	29.25	61.97	8.2	1.3440	7.81	6.1	3.3
	Due Roi	5.2	3.4	34.61	57.61	8.5	1.3968	8.20	6.0	3.29
	Ruby Red	3.6	1.8	50.00	41.66	11.10	0.8704	10.49	12.6	3.8
	Vanielle	6.2	3.8	45.16	45.16	10.6	0.8704	8.89	11.2	3.8
	Red Blood	6.4	3.4	46.87	46.87	8.00	0.7296	7.80	19.7	3.75
	Excellency	6.9	3.6	47.82	46.37	10.3	0.9472	9.89	10.8	2.70
	Hamlin	7.35	3.8	46.93	40.35	9.1	0.7680	8.79	11.6	3.87
	Ruby Red	8.4	4.0	52.38	40.45	8.25	0.6016	7.89	13.6	3.95
Lyallpur	Bothella	5.2	3.00	42.30	50.00	9.6	0.640	9.29	15.00	3.85
	Saint Mitchell	3.3	2.2	33.33	48.48	8.0	0.7296	12.20	10.9	3.8
	Quine	7.4	3.6	51.35	43.24	9.7	1.0752	11.89	9.1	3.4
	Tardaff	3.7	2.00	45.94	45.94	11.5	1.4720	11.19	7.4	3.16
	Early Futral	3.5	3.00	14.28	54.28	8.75	0.7808	8.69	11.2	3.7
	Kinow	6.8	4.4	35.27	54.4	11.0	—	10.49	—	3.4
Charsadda (Peshawar)	Ruby Red	3.75	2.00	45.3	45.3	11.85	1.66	1.79	7.14	3.31
	Hamlin	5.4	2.9	57.7	46.2	10.15	0.83	9.24	12.23	3.7
	Red Blood	4.5	2.50	44.4	48.8	11.0	1.15	10.59	9.61	3.65
	Valentia Late	4.9	2.6	45.9	46.6	10.5	1.66	—	6.32	3.41

* Results are average for 5 to 7 fruits of each variety.

Jubilee during January, 1961. These samples naturally represented the best selected fruit of the commercial and other varieties grown in the citrus area of West Pakistan. These were analysed for percentage of juice, percentage of peel, acidity, brix and total soluble solids.

Experimental

The fruits were cut in halves across the equator with stainless steel knife and the juice expressed on an electrically-operated conical glass extractor and strained through fine muslin cloth. All weighings were made on a sensitive counter balance.

°Brix was determined by Brix hydrometer. Acidity was estimated by titrating 5 ml. of the juice against 0.1 N NaOH, using phenolphthalein as indicator. Total soluble solids were determined by refractometer and the readings corrected.

Varieties smaller in size, such as Red Blood, Ruby Red, Valentia Late etc., were found to have a higher percentage of juice as compared to other varieties which are bigger in size. Juice obtained from all varieties was fairly acidic (0.6016-2.09 g./100 ml.) and had fairly good Brix/acid ratio, which was in the range of 8 to 13.

Acknowledgement.—This work was done at the Fruit Technology Section, Panjab Agricultural College, Lyallpur by the permission of the late C. W. Eddy for which the author is grateful to him. The author is very much indebted to Panjab Fruit Development Board and Fruit Specialists for supplying free samples.

A SURVEY OF MEDICINAL PLANTS OF SWAT VALLEY

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Swat valley comprises the watershed areas of Swat river. Its geographical position is between 35°·54′ to 34°·34′ north latitudes and 72°.2′ to 72°.47′ east longitudes. On the northern side of it are the Chitral State and Gilgit, Indus Kohistan (of Swat) on the east, Buner (Swat) and Malakand Agency on the south and Dir State on the west. It includes Lower Swat, Upper Swat—Swat Kohistan and Kalam protected area.

The climate of the tract is subhumid temperate in the lower half and dry temperate in the upper half. There is higher monsoon rainfall in the outer hills and it progressively decreases in the interior. The monsoons reach only up to Madyan while in Swat Kohistan and Kalam precipitation is generally in the form of snow.

There are large number of medicinal plants present in Swat valley, out of which some have received a world-wide recognition and are regarded as official drugs while others are used in the indigenous systems of medicine.

Scrub Vegetation.—Scrub vegetation occurs in the lower broad portion of the valley and also on the southern hot aspect in the interior. These have appeared due to the destruction of forests by biotic factors. The vegetation is typically xerophytic. The various medicinal plants present in this vegetation type are:—

(1) *Achyranthus aspera* (Phutkanda), (2) *Adhatoda vasica* (Baikar), (3) *Artemisia maritima*, (4) *Berberis lycium* (5) *Chenopodium ambrosoides*, (6) *Dodonaea viscosa* (Sanatha), (7) *Iris germanica*, (8) *Mirabilis jalapa* (Gulabbasi), (9) *Peganum harmala* (Harmal), (10) *Rhazya stricta* (Gandera), (11) *Rubus fruticosus*, (Black berry), (12) *Salvia moorcraftiana*, (13) *Viscum album*, (14) *Vitex negundo*, (15) *Xanthium strumarium*, (16) *Zanthoxylum alatum* (Timber).

Pinus Roxburghii Forests.—Pinus roxburghii forests are found only in a limited area. These occur in Maraghzar near Saidu Sherif and Kabbal areas. They occupy the tops of the hills in Lower Swat. The forest undergrowth is poor. The medicinal plants in this vegetation type are rare; only some plants present in scrub vegetation are also found here, i.e., *Berberis lycium*, *Rubus fruiticosus* and *Mallotus phillipinensis*.

Pinus Wallichiana Forests.—Pinus Wallichiana forests occur at elevations of 5500 ft. to 9000 ft. These are found in Shangla area, Shankudara, Miandam area, Bishgram dara and Manglaur area. Thick undergrowth is present here. The common medicinal plants present in this vegetation type are:—

(1) *Viola serpens* (Banafsha), (2) *Valeriana wallichii*, (3) *Arisaema wallichianum* (Sanp Booti) and *A. jacquemontii* and *A. flavum*, (4) *Adiantum capillusveneris* (Maiden hair fern), (5) *Dryopteris filixmas* (Male Fern), (6) *Jugulans regia* (Akhrot), (7) *Quercus incana* (Banoak).

Cedrus Deodara Forests.—This type of forest is restricted in occurrence. Such forests are found in Daral Nullah (near Behrain) on southern aspect and in Ushu and Utror areas. These forests are poor in medicinal plants and only scattered plants of *Artemisia maritima* and *Ephedra gerardiana* are found. *Ephedra gerardiana* is a famous drug plant of Pakistan and is abundant in Quetta and Kalat divisions.

Mixed Forests.—Mixed forests of *Cedrus deodara*, *Pinus wallichiana*, *Picea morinda*, *Abies pindrow* and *Abies webbiana* are found on the northern and western cooler aspects between the elevations of 6000 ft. to 9000 ft. in the middle part of the valley. The undergrowth varies with the stage of shrub succession. The succession of shrub is directly controlled by the overhead forest cover. The first stage of succession of shrubs is *Pteridium aquilinum* then *Viburnum* sps., and *Indigofera* sps., and lastly is the *Parrotia jacquemontii* stage. Maximum number of medicinal plants are found in the *Viburnum nervosum* and *Indigofera gerardiana* stages of succession. The important medicinal plants present in this type of vegetation are:—

(1) *Taxus baccata* (Yew or Barmi), (2) *Pteridium aquilinum*, (3) *Paeonia emodi* (Memekh), (4) *Valeriana wallichii* (Mushkbala), (5) *Geranium wallichianum* (Rattan jot), (6) *Atropa acuminata* (Belladona), (7) *Viola serpens* (Banafsha), (8) *Podophyllum emodi* (Ban Kakri), (9) *Dryopteris filix-mas* (Male fern), (10) *Angelica glauca* (Chura), (11) *Adiantum capillusveneris* (Maiden Hair Fern), (12) *Sassurea lappa* (Kuth).

Abies Forests.—These forests occupy elevations from 8000 ft. to 11000 ft. above the limits of *Cedrus* and *Pinus wallichiana*. These consist of *Abies pindrow* and *A. webbiana*. The forests are generally restricted to cooler northern and western aspects. The medicinal plants present in the mixed forests also extend into it and also some others are present in it. *Skimmia laureola* (Rutaceae) which is a small shrub with aromatic leaves occurs here. Its leaves are used in smallpox, and the smoke produced by their burning is said to pruify the air. *Bergenia stracheyi* (Zakhami Hayat) (*Saxifragaceae*) commonly found on rocks with large leaves and root covered with scales is seen in patches.

Betula utilis and Quercus semicarpifola Scrub Forests.—These scrub forests are present above the *Abies* sps. zone and form a narrow strip between the Alpine meadows and the Abies zone. They occur at elevations of 11000 ft. to 12000 ft. The forests are poor in medicinal plants. Following medicinal plants are found in this vegetation type:—

(1) *Juniperus recurva*, (2) *Juniperus communis*, (Cuggal), (3) *Rhododendron anthopogon*, (4) *Rhododendron companulatum*, (5) *Artemisia maritima*, (6) *Rheum emodi* (Ravandchini), (7) *Faraxinus excelsior*, (Sum).

Alpine Vegetation.—Extensive tracts of alpine pastures stretch above the forest limits to the line of barren mountains above which there are peaks covered with perpetual snow. The alpine pastures are composed of beautiful perennial herbs which also include many medicinal plants. These are:—

(1) *Caltha palustris* (Mamiri), (2) *Geum urbanum*, (3) *Geum alatum*, (4) *Anemone obtusiloba*, (5) *Swertia chirata* and *S. purpurascens* (Chairata), (6) *Aconitum heterophyllum* (Atis), (7) *Aconitum chasmanthum*, (Mohri), (8) *Gentiana kurroo* (Nil Kanthi), (9) *Adonis aestivalis*, (10) *Colchicum luteum*, (Suranjan), (11) *Carum carvi* (Zeera), (12) *Macrotomia benthami* (Gaozaban), (13) *Taraxacum officinale*, (14) *Plantago lanceolata*, (15) *Plantago major*, (16) *Hyoscyamus niger* (Ajwain Khurasani), (17) *Datura stramonium* (Dhatura).

Agricultural Crops.—Agricultural crops are grown in the lower broader portion of the valley as well as in the upper part. The cultivation is generally done along the banks of the river and nallahs but sometimes even in the midst of the forests the land is utilized for cultivation. Some medicinal plants are found to grow wild in the areas, some of which are:—

(1) *Jugulans regia* (Akhrot), (2) *Urtica dioica* (Bichu buti), (3) *Plantago major*, (4) *Lavatera kashmiriana* (Raisha khatmi), (5) *Diospyros lotus* (Amlok), (6) *Zizyphus sativa* (Unab), (7) *Verbascum thapsus* (Gidar thambaku), (8) *Datura stramonium*, (9) *Hyoscyamus niger*, (10) *Ipomoea hedracea*, (11) *Jasminum humile* (Wild Jasmine), (12) *Jasminum officinale*, (13) *Momordica dioica* (Jungli Karela), (14) *Actaea spicata*, and (15) *Achillea millefolium* (Akarkara).

Conclusion

The above observations indicate that a large number of medicinal plants, some of them with universally reputed uses occur in considerable quantities. It may therefore be possible to make efforts in order to exploit them on scientific lines. The extraction of some of them is continuing on a limited scale but the collection is being done without caring for the regeneration of these plants. Also some effort should be made for the regeneration of some of the important medicinal plants.

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