

LOKTA

Daphne sp.

Lokta (*Daphne*) is a shrub species, found in the hills of Nepal both in the east as well as the west. Lokta, the Nepali paper plant is one of the major incomes generating NTFPs of Nepal. The fibrous inner bark (bast) is used for paper making which is widely known as Nepali Kagaj. These hand-made papers are popular and have high demand in international markets. *Daphne* has been used since ages in Nepal for making ropes and various forms of paper.

1. BIOLOGY

A. Taxonomy

Two species of the genus *Daphne* are common in Nepal. *Daphne* is extensively used in papermaking. The species are *D. bholua* (lower altitude) or *D. bholua var glacialis* (high altitude) and *D. papyracea*.

Family - Thymelaeaceae

Local name - Lokta, Kagate, Kagat pate, Kagati, Baluwa, Baruwa, Seto balua and Kalo balua

English Name - Daphne



Daphne bholua is evergreen or deciduous erect or spreading type shrub, on 1-3 meter tall, but frequently attaining heights of 5-6 m where areas not heavily exploited. The leaves are entire, dull green and leathery. The flowers are sweetly scented, white, flushed externally pink or purplish. Flowering is usually December to May depending on altitude and climatic factors. The fruit is an ellipsoid berry about 1 cm long, green at first then purple or almost black when ripe. The fruit ripen from March to June, each fruit containing a single seed. The flowers of *D. bholua var glacialis* are pink to purple very sweet scented appearing on bare branches in spring and occasionally in winter

Daphne papyracea is evergreen much branched erect shrub on average 1-3 meter m high with branches with 3 cm thick. The leaves are dark green (darker than *D.bholua*), entire, smooth and thinly leathery. The flowers are white or greenish- white and have either a faint or scent or none at all. Flowering time is from October to February. The fruit is fleshy berry about 1 cm long, orange at first then a deep red when fully ripe. The fruit ripen from April to May.

B. Habitat and Range

Daphne bholua extends from Uttar Pradesh in India, through Nepal, Southern Tibet, Northern Assam and Bangal, Sikkim and Bhutan to south-west China. It is found from about 1800 m up to 3600m, and occasionally *D. bholua* var. *glacialis* is a deciduous small shrub extends up to about 4000 m in east Nepal. However, in the west, where annual precipitation is less and the tree line correspondingly lower, it rarely exceeds 3000m. It is reported that from western Nepal to Sikkim it replaces *D. bholua* above 3,000 to 3500 meter. (HMGN and UNICEF, 1984)

Daphne papyracea occurs from Pakistan eastwards as far as central Nepal and is found between 1600 m and 2500 m altitude occasionally extending up to 3000 m. It is less frequent than *D. bholua* both horizontally and vertically.

C. Ecology

Daphne species grows slowly as under story shrubs. *D. bholua* appears more gregariously in the moist conifer and broad-leaved forests of the temperate Himalayas. They generally favour sites, with Quercus, Rhododendron, Hemlock (*Tsuga demosa*) or Fir (*Abies* species) (Jeanrenaud, 1984 ; HMGN and UNICEF 1984; FSRO,1984), and are also found to a lesser extent in upper mixed broad-leaved forests. They are almost completely absent in forest dominated by Blue pine (*Pinus wallichiana*), Deodar (*Cedrus deodara*) and Spruce (*Picea smithiana*). They prefer medium to light crown cover and usually avoid sites with dense crown cover not more than 70 percent (Dhungana and Khatri- Chhetri, 1995) or large open areas. Plants are found in lesser densities in areas of intense or haphazard exploitation of the forest resources, and areas with frequent fires and heavy grazing. They appear to thrive on a wide range of soil types but generally favour moist sites with rich organic humus layer overlying well-drained sandy loam or Brown earth.

D. Regeneration

Natural regeneration occurs from both seeds and root suckers. It is reported that Lokta regenerates 25 per cent from seed and 75 per cent from root sucker which is reflected from a study at a number of sites in eastern, central and western Nepal (Jeanrenaud 1984). Root sucker arises from an adventitious bud on a root. The same study, upon excavation and examination of a number of root systems, indicated that suckers are readily produced from lateral roots radiating out, from a single parent plant, over considerable distances. Roots were found to extend up to 5 m from the stem, and there were up to eight shoots on a single lateral root (Jeanrenaud, 1984a). One of the studies from eastern region (Dutta, 1994) shows that coppices only occur at young and juvenile stage in vigorous form but are absent or weak in mature stands. Therefore, no coppice regeneration was found in stump after harvesting as the plants are harvested in mature stage to get high quantity and quality of bast fibre. Plants should be harvested for its fibre after the seeds are dispersed in the ground.

Regeneration of *Daphne* species can also be done artificially from seeds, vegetative parts (soft tip or soft wood cutting, semi- hardwood cutting, hard wood cutting and root cutting), layering and grafting. Cuttings are made during winter months and raised in a nursery and later in the site. Artificial regeneration is quite harder as *Daphne* needs unique ecological requirements (mainly in terms of managing appropriate shade, associations, and soils). *Daphne*, as a shade demanding under story species, is dependent on the forest ecosystem for its habitat. Pilot research is necessary to determine the optimum artificial shade required for the growth of artificial stands of *Daphne*.

Several researchers have reported that *Daphne* seed has extremely short viability. It may need more care while handling the seeds during collection and should be sown in nursery immediately after collection. The soft fleshy outer covering should be removed before sowing. It germinates within three weeks to a month.

Priority should be given to natural method, as the more cost is occurred and a more time is needed to raise the seedlings from any artificial methods. Till now emphasis has been given to natural production. There are very few successful case stories of producing seedlings from seeds but a success has been demonstrated from cuttings in small-scale nurseries (field observations at Dandapakhar, Sindhupalchock).

Daphne is more susceptible to external injuries like fire and grazing. These factors should be controlled for the establishment of seedlings either from natural or artificial methods. To minimize loss of seeds from birds, prompt seed harvesting is essential and is encouraged.

2. RESOURCE MANAGEMENT

A. Management System

Lokta is not included in the Management Plan of the Community Forests in Dolakha or Sankhuwasabha/Tehrathum. There is no awareness about its cultivation in the communities interviewed.

Ownership right over the resource is an important factor related to the sustainable management of Lokta. In national forests, collectors do not care about the sustainability of the resource. In such an ownership regime, collectors compete with each other in getting highest quantities of barks from a given area within shortest possible time, without considering the potential of supply in the future. In this sense, experiences indicate that community-owned forests are better managed than the government owned forest. A conclusion arising from this discussion is that priorities should be given to handover the forests with Lokta to the local communities.

B. Harvesting

Bark is usually harvested during the agricultural slack season following the festival of Dashain i.e. from the end of September or mid- October continuing into late spring to mid May (Kartik to Jestha) with two months' break in the coldest months of mid December to mid February (Paush and Magh). (Jackson, 1994).

As suggested by Dutta, 1994 the best time of bark collection is late spring after the full leaf emergence and can be carried out up to monsoon. Winter cutting is discouraged as a significant portion of bast continuing sticking to the stem during harvesting. It was noticed that stems cut during winter had as much as millimetre thick bast still remained sticking to the stem as wastage.

In practice under-sized and immature plants are harvested in haphazard ways from the forest. The present tendency is to exploit Lokta bark as much as possible without ensuring that the sufficient numbers and size of plants are retained in the forest for future supply.

Harvesting of immature Lokta not only affects the sustainability of the resource but also the quality of the product as well. Extraction of bark from immature plants reduces the potential for future supply, and barks from immature plants also get lower market prices. Plants having straight single stem, apical branching, low tapering, large diameter with adequate length yields superior quality barks (Dutta, 1994).

Based on this analysis, it may be recommended that, to allow sufficient time for the resource to regenerate, and to maximize the weight of inner bark yield, no Lokta plant with less than 3 cm diameter at 30 cm from the ground should be harvested (this diameter corresponds to an age of approximately ten years, according to Jeanrenaud and Thompson (1986)).

Lokta grows in a quite uneven-aged structure in its natural condition. Use of blocking system may not be the effective solution for harvesting, as there are plants of varied age and size in the same block. It is reported (personal communication with Nepal Paper Products and ANSAB technical staff) that bark become less desirable after the age of 15 years as the colour of bark become dark and fetches lower market prices. To allow harvesters to extract barks from appropriate size classes of plants, some rules have to be prepared and enforced, specifying areas, size and quantities of uptake.

Harvesting is carried out with techniques varying from district to district. In some places the bark is stripped down to the rootstock and severed at ground level (thus almost completely destroying the meristematic tissues and precluding the emergence of coppice shoots but probably encouraging vigorous root suckers). However, in some areas the whole plant is uprooted, a practice detrimental for the regeneration from root suckers.

To get better regeneration from coppice and root sucker, the plants should be cut with a sharp tool at a height of 30 cm from the ground and the bark stripped only from the cut plants. Also, bark should not be stripped in standing position.

The bark should be removed from stem keeping it in standing position either by cutting the tops and stripping the bark downward to the ground or vice versa..

Both *Daphne bholua* and *Daphne papyracea* stems consist of about 7% outer bark, 18% inner bark (bast; the raw material for paper making) and 75% wood in terms of weight (Jeanrenaud, 1984), Approximately 30 to 70g of wet weight of bast can be extracted from a mature 1.5 to 2 m plant. It takes about a week for sun-drying the bark, and this may help to minimize bacterial and fungal attack. During drying, there could a loss of about 50% of the initial weight.

C. Sustainability Issues

A number of anthropogenic factors are responsible for the deterioration of the quality of Lokta habitats. According to Dhungana, Khatri- Chhetri (1995), the declining quality of the forest is attributed to slash and burn practices, heavy grazing and trampling by animals, unsustainable harvesting of firewood and frequent forest fires are slowly degrading the forest. If such threats continue to go unabated the result will be serious damage to the species habitat and a consequent decline in Lokta population in the forest. Natural regeneration and maintenance of the population is possible if the bast is harvested from recommended size and age classes (plants of 30 cm diameter from ground level and of the average age of 10 years). Maintaining natural habitat and its associates encourage its regeneration in natural way.

The middleman, for his own benefit, encourages the harvesters to cut Lokta to excess resulting in the depletion of resources. The main emphasis is given to administrative and revenue earning procedures rather than managing resources for its sustainability (Dutta 1994). The rules whereby all activities authorised by the licence has to be effected within the financial year compels the licence holder to undertake harvesting of Lokta during winter, an inappropriate season which results in a considerable quantity of bast fibre still adhering to the stem, a wastage of resources.

The inadequate monitoring support, lack of knowledge/information to the collectors, insecure ownership regime, and supply of product in first come first basis within shorter period to get more products resulted into haphazard exploitation of the resources.

3. UTILIZATION

A. Subsistence

Since ages, Lokta has been used for making varieties of products like ropes, letters, documents, manuscripts, publication of mantras, tracts and books of a religious and secular nature, festival decorations, warping papers and incense etc. It was also used as a fodder for goat and as cordage. The history of paper making as a rural based cottage industry in Nepal can be traced back to at least the 12th century A. D (HMGN, UNICEF, 1884; Jeanrenaud, 1984). In the 1960s, the Lokta paper was in extensive use in Nepal, as it was the cheapest form of paper in that time. At present, however, with the influx of several competing modern and cheaper types of imported papers, the Nepali handmade paper has limited users in the country. In spite of comparatively higher prices, Nepali

Kagaj is still used in Nepalese courts for all purposes, for special document in other government offices and for wrapping the incense used in most of the worshipping functions in Nepal.

B. Commercial

Nepali Kagaj is made mostly by local small-scale farmers in the remote districts of Nepal. The traders/ processors in Kathmandu generally order Nepali Kagaj from these small producers. They use the paper as raw materials to produce different types of end products, and export to several countries. Few of these products are sold in Nepal. According to the some leading entrepreneurs, key products made from Nepali Kagaj include books, letters, documents and manuscripts, single leaves for magical and ritual purposes, woodcuts, written slips and ritual cards, horoscopes, fortune- telling cards, painting, masks, festival decorations, rapping papers, ceiling coverings lining and backing sheets, wound dressings, headache cures, incense sticks, cartridge, fireworks and kites, boxes, albums, briefcases blotting papers, maps playing cards, greeting cards, note books, note pads, calendars, lampshades, envelopes, writing papers of legal documents and etc. A visit to Bhaktapur Craft Printers (BCP) and Nepal Paper Products (NPP) showrooms confirmed that over 200 items are made and sold.



4. MARKETING

A. Production Volume and Trade

Most of the paper is produced in high altitude areas near by the resources. Small-scale local producers make Lokta paper individually or in groups. Forest User Groups (FUGs) have started to produce paper. In some cases, relatively wealthier people produce in bigger scale as a form of their main business. Both scales of papermaking are in existence in different parts of the country.

Papers are made in different sizes (20 x 30), (19 x 26), (17 x 25), (19 x 26) inches and in different thickness (40, 30, 20, and 10) mm. Bundles of the papers are then and brought to Kathmandu where they are taken as a raw material for producing finished products for export purpose.

Prices vary in different locations mainly depending on the extent and type of transport facilities to the market, paper quality, supply quantities and bargaining power of the contractors and local producers. According to Dutta (1994), Rs 500 for one Kori of paper (200 sheets) in Basantapur area of Tehrathum district in FY 1993/1994. Likewise the maximum price fetched in 1995 was Rs. 400 per Kori in Sankhuwasabha district (Dhungana and Khatri- Chhetri,). The price in Kathmandu is Rs1000 to 2000 per Kori.

The prices in Kathmandu are usually higher than in the Districts of origins because local level contractors have to pay royalty to the DFO, taxes to local government bodies, transportation charge and service charge of the contractors (Olsen and Helles, 1997_)

D. Current Market Channel

Hand made papers are made in remote hilly areas by the local farmers at a household level or made by entrepreneurs in a large scale, and then local level contractors buy the processed paper. These contractors either sell to regional contractors or sell directly to the processors in Kathmandu. The processors in Kathmandu use these papers as a raw material and produce different kinds of products and export to the international market to the end users. Mainly the following kinds of market channels with in the country are in practice. According to the monthly bulletin published by handicraft Association of Nepal (2000), Lokta made products are exported in 47 countries in the world directly from Nepal

Bast collector → Paper producers → Local level contractors → Regional contractors → Processors

Bast collector/paper producers → Regional contractors → Processors
Bast collectors/ paper producers → Processors

C. Current Processing

The white, fibrous bast of *Daphne* plant is the principle raw material for the manufacture of Nepali Kagaj. There are two common methods of preparing the traditional handmade paper in Nepal: a) traditional method and b) improved method. Paper made from traditional method (with an addition of beater machine) has higher market demand than the paper made from any other methods. A brief description of these methods is given below.

Traditional method

Traditional method of papermaking is divided into three steps as follows. As all the stages in the process are carried out by hand, it is an extremely labour intensive and time consuming process.

Soaking and rinsing

A bunch of Lokta bark is soaked in water for at least six hours then ringed in cold water. This is done to wash out the greasy, water soluble organic matter and to remove dirt and foreign matter. Further cleaning and scarping can be carried out by hand if necessary.

Pulping

Wood ash is mixed with water and allowed to percolate it. This process is repeated until the lye is deemed to be sufficiently strong (to make the liquor alkaline). Then this is

filtered to remove dirt particles and other insoluble materials. Wood ash is superior to caustic soda for producing quality paper. To reduce the fuel wood consumption ash is replaced by caustic soda (NaOH), 10- 20% by weight, depending on initial cleanliness of the raw material. 3 kg of fuel wood is needed for preparing the pulp sufficient for producing 1 kg of paper

The liquor is then heated into a metal cauldron, to boiling point over a wood fire or stove. Then the previously soaked and cleaned bark (approximately equivalent to the quantity of liquid) is placed and boiled continuously until the alkaline liquor is nearly absorbed or have evaporated (at least an hour). This process sufficiently softness the bark (Jeanrenaud, 1984).

The softened bark is then beaten with a mallet or stone pestle until it reduced to homogeneous dough like pulp. It is then placed in another vessel containing pure water and stirred until it loses all stringiness and will spread out quite easily when shaken under water.

Preparation of pulp using beater machine

Nowadays, most of the groups and companies have started to use beater machine instead of beating by hand for pulp making. Use of beater machine minimizes the labour cost and improves the paper quality as it become more even in thickness, which is one of the parameter to measure its quality.

Sheet formation

A wooden frame along with a finely knitted net is placed slightly below the surface of water, and the measured amount of pulp is poured into the frame (amount of pulp depends on the desired thickness of the paper). After agitating the pulp water mixture, the frame is gently lifted from the water, allowing excess water to run through the screen, forming the sheet of the paper. The pulp is then dried on the frame by being exposed at an angle inclined towards a big fire or the sun. As most of the papermaking places are located in higher altitude, it needs longer time for drying the paper. After drying, the sheet is removed from the frame slowly and carefully. The screen leaves a distinctive pattern in the paper that some customers associate with hand -made paper.

Finishing

Irregular edges can be trimmed with a sharp knife and polishing accomplished by placing the sheets in a flat board and rubbing it vigorously with a smooth stone or similar object. Each sheet is then folded and paper is usually sold in bundles of Kori (one Kori equals to 200 sheets of paper).

Improved Method

The Department of Cottage and Village Industries developed an improved method for manufacturing paper with Japanese technical assistance. Different steps under this method are outlined below.

Soaking and rinsing

A bunch of Lokta bast is soaked in water for at least six hours, and then rinsed in cold water. This is done to wash out the greasy, water soluble organic matter and to remove dirt and foreign matter. Further cleaning and scarping can be carried out by hand if necessary.

Boiling the bast

The bast is boiled for 2 to 4 hours in a vat containing a solution of caustic soda (Na OH), 10%- 15% by weight of bark, depending upon initial cleanliness of raw material. This serves to remove the non- cellulose organic matter and to separate the cellulose fibres prior to bleaching and beating. The use of caustic soda can apparently reduce fuel wood consumption to as little as 1/3 (Forestry Services, 1984).

Washing

The bark is then washed in running water or 2 to 3 times in a tank of fresh water to remove caustic soda. Either way, a considerable amount of water is required, and therefore adequate amount of water availability is a prerequisite prior to installing paper manufacturing plants in a site.

Beating

Till this step, the bark is sufficiently softened through soaking and cooking. It is then transferred to a wooden or stone mortar and it is beaten with a mallet or a hammer to reduce its size before transferring to a manual or hydraulic Hollander- type-beating machine. Here, the bark is beaten for 15 to 30 minutes to produce the homogeneous pulp from which the paper will be made. The process of beating ensures that: fibre aggregates are separated to produce single fibres; fibres are crosscut or split; the fibres swell and their surface become gelatinised. These effects endow the fibres with certain desirable properties such as: the ability to intertwine or fuse, flexibility, plasticity, surface sizeability and viscosity.

Sheet formation

The homogeneous pulp is transferred to the pulp tank, usually made of wood or concrete. Use of mild steel tank is discarded because it tends to gather rust, which will discolour the paper. Some form of vegetable mucilage (extracts of Hibiscus root- *Manihot edulis*) or polyethylene oxides added to the pulp in order to: 1) prevent the fibre from precipitating 2) keep the pulp evenly distributed in the tank 3) prevent aggregation of fibres, and 4) to retard drainage of water when pulp is on the screen. The paper making

frame made of wood with a wire mesh (or as in Japan with bamboo slats and silk or nylon mesh) is hung from the ceiling over the tank suspended from a flexible spring arm of bamboo.

The vatman slides the frame into the tank at an angle until it is completely submerged and then raises it from the liquor, again angling the frame so that the pulp 'flows' across the frame in a wave motion and the excess pulp is returned to the tank. The process is repeated several times, depending on the thickness of the paper required and to allow cross meshing of the fibres. The advantage of this method is that the pulp liquor in the frame is constantly vibrated in all directions causing the fibres to overlap thus giving added strength to the completed sheets.

An alternative process used to produce a comparatively thicker paper is the 'Tamezuki'(Jap.vern) or laying method. Here the frame is dipped into the pulp and raised horizontally. A light intensity mucilage (nouri- polyethylene oxide) is added to the pulp allowing more accelerated water drainage necessary to produce thicker paper.

Couching

Once the sheet has been formed it is carefully peeled off the mould and stacked alternatively with coen or hessian clothes to form a 'post'.

Pressing

The 'post' of wet paper is pressed using either type of press: a stone weighted lever press, a screw press, a jack press or a hydraulic press.

Drying

Sheets of wet paper can be dried in a variety of ways. Wet sheets can be dried in air, sun or in fire or alternatively in fire and in sun.

Finishing, sorting, trimming and polishing

After sorting the sheets are graded and then trimmed to a size according to demand. Rough edges can be removed with a sharp knife. The government of Japan uses an electric cutting machine to trim the sheets.

D. Variability and Risk

In most of the cases, collectors approach the traders individually for selling the bark. As the local collectors are not aware of the updated market information they cannot put their demand strongly to get reasonable prices from the traders, whose intention is to pay as low as possible. In majority of the cases, collectors get only a small fraction of the potential price. Edwards (1996) states that the harvesters receive 32.6 per cent of the final price in India, on NTFPs sold from Nepal.

The people who prepare Nepali Kagaj accrue only a small share of the final price. Major share of the benefits go to the middleman, wholesaler and exporters. People involved in designing and producing finished products are all from urban areas hence the employment opportunities also go to the outsiders.

There are many cases in which local paper producers get lower prices because of the poor quality of the paper (such as bits and pieces of bark still remaining in the paper, and uneven thickness). Another reason why communities get lower benefits is that the commonly used methods of paper making involve excessive use of human labour causing low rate of return for labour.

5. SOCIO-ECONOMIC AND POLICY ISSUES

A. Socio-economic Factors of Existing Activities

A practice of advance payment to the local collector/small paper producers is common in the areas where Lokta grows. Usually the disadvantaged groups need payment in advance in cases of emergency and festivals, as it is often one of the very few sources of income of the families in the remote hilly areas. Because of the advance money received from the contractors/middlemen, collectors/small producers are forced to sell the products at prices offered by the traders extending support in difficult times. This very often results into a situation where the local people end up selling the papers in previously determined rates that are lower than the prevailing market rates.

B. HMG Policy on Collection, Processing, and Trade

There is not any practice existed to invent the resource base prior to issuing license and bark collection either from FUGs and DFOs as a result haphazard exploitation of the resources is occurred. Extraction of bark from immature plants reduces the regeneration potential for future supply and bark from immature plants also get lower market price.

1. Current Policy

DFO can permit licence for Lokta bark collection from national forest, whereas FUGs can do so in the case of community forests, provided there exists an operational plan authorizing this. For transportation of barks or paper outside the district, transit permit should be taken from the DFO. For export, a certificate of origin should be obtained from Federation of Nepalese Chambers of Commerce and Industries (FNCCI). In the case of Lokta product (as it is made by hand), it should be recorded at Handicraft Association of Nepal for final valuation in Nepal, before export.

2. Policy Constraints

Several unnecessary checkpoints from district up to the border are the main constraints, which are responsible for harassing the traders.

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