Quantitative estimation of potential fatty-oil bearing wild plants of Central Nepal

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With a view to investigate potential fatty-oil bearing plants in Nepal, the present study was carried-out at various places of the central region of the country. A working list of species that contain thirty or above percent of oil content in their seeds or kernal was prepared in the begining to facilitate sepeies selection. The criteria for such selection was also based on the possibility of growing species on marginal lands, seeds of such species being used in Indian industries, or locally and the species represent different physiographic reasons of Nepal. On the basis of density (per hectare), fruit yield and the natural habitat they cover, *Shorea robusta, Melia azadirach, Acacia rugata, Spatholobus parviflorus, Daphniphyllum himalense, Viburnum coriaceum, Neolitsea umbrosa* are found to be of potential impotance. Fatty-oil of *Camellia kissi*, and *V. coriaceum* and *Spatholobus parviflorus* are reported for the first time in Nepal, to be edible. Similar studies on other parts of the country with investigation on the phenology of species, quality and quantity of seeds and local uses, etc, are required to draw attention on commercial exploitaiton.

Keywords : fatty-oil, *Shorea robusta, Melia azadirach, Acacia rugata, Spatholobus parviflorus, Daphniphyllum himalense, Viburnum coriaceum, Neolitsea umbrosa*, central Nepal

Vegetable oils make an integral part of human life. They are also required as raw materials for various industries viz. food, soap, paint varnish, cosmetics, lubricants (see Tiwari, 1994). More recently the fatty-oil of physic nut (*Jatropha curcas*) has been proven to be a potential substitute for fossil fuel (Adhikari *et al.* 1994). Making of cheuri butter from *Bassia butyracea* seed oils in the mid-hill villages of Nepal (Thapa 1987; Achet *et al.* 1993; Court and Adhikari 1996; Baral and Acharya 1996) provides us a classic example of the use of fatty-oil bearing plants of wild-origin. Similarly, seeds of *Neolitsea umbrosa, Daphniphyllum himalense* and *Daphne bholua* are also being utilised in certain villages of Kaski and Myagdi districts (Shrestha 1992). Sal (*Shorea robusta*) seeds have generated a considerable amount of revenue till 1994 (Annon 1996).

Despite such potential, only a few oil crops such as maize, sunflower, soybean, peanut mustard (*Brassica campestris* and *B. juncea*), etc. have so far remained the conventional source of edible oils for Nepal. Ninety percent of the total acerage under cultivation of oil seed crop in Nepal (Gupta 1991) is covered only by mustard, showing Nepal's excessive dependency on this particular plant for oil.

In India seeds of *Shorea robusta, Melia azadirach, Ricinus communis, Jatropa curcas Mallotus philippensis* and many others are being utilised for their valued oil (see Tiwari 1994, p. 414). In Nepal, quantitative estimation on availability of such oil seeds have not been done yet, nor do we know the methods of sustainable harvest and standarisation of collected materials (post-harvest techniques) and appropriate methods of processing.

A cursory look on the existing literatures pertaining to the Research and Development (R&D) of Nepal's NTFPs indicate that the fatty-oil bearing wild plants are the least studied subject (Baral 1996), and most of the publications existing on this matter are compiled from secondary sources. This indicates that the potentiality of fatty-oils of wild origin has, hitherto been negleted in Nepal. The present paper therefore, attemps to record the distribution and availability of fatty-oil bearing wild plants growing in some places at Central Nepal which are currently being used or bear some future potentiality. The vision is that, such species could be used to partially

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supplement the conventional fatty oils, and also create a new off-farm employment opportunity.

Methods

The following methods were adopted for the present study:

Species selection

First of all, with the help of available literature, a check list of species along with their fatty-oil content in percentage term was prepared. Out of this list, the first priority was given to those species which contain thirty or more percent of oil content in their seed or kernels. However, the availability of such species at a given area was also a matter of equal importance. Following criteria, were also considered to be of significance during the selection of species:

Criteria	Possible advantages
Seeds being used in Indian industries	This indicates market availability in India, if not in Nepal
Possibility to grow in marginal lands	Encourages local people to cultivate such plants in marginal lands without further cost
Seeds being locally used	Indicates that the species are locally preferred to be used in one or other purposes
Species that represent physiographic region	Indicates that species represent Nepal's tropical, sub-tropical and temperate regions and hence help capitalise oil-bearing species for each physiographic region

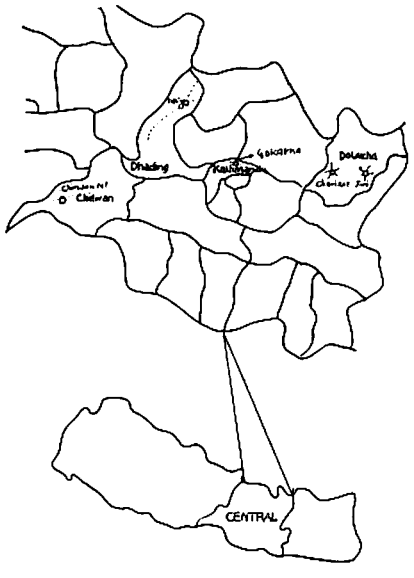
Combining such criteria, the following species, representing different physiographic zones, were found appropriate for the present study. Quantification of some of them have also been done:

Study sites

Present survey was done in the places (as shown in Fig) at Central Nepal during the end of 1995 to the middle of 1996. To locate the tentative area of survey in Central Nepal, first of all an imaginary North - South transact from Chitwan to Langtang that passes through Kathmandu, was drawn; the districts such as Dolkha and Gorkha were also surveyed as sites representating east and west of the transact respectively.

Plants occurring in natural forests in the Terai were estimated both inside and outside the protected areas. This was done to compare their number in disturbed and undisturbed sites in order to have a more realistic figure of availability of species for commercial collection in the future.

Quantitative estimation (density, fruit yield) of the fatty-oil bearing species present in natural sites were done as described in Zobel *et al.* (1987). A species area curve was calculated at Kasara of the Royal Chitwan National Park (RCNP) to find a suitable size of quadrate. As the quadrat of 10 m x 10 m size represented maximum number of species, they were laid at an interval of one kilometre at a definite east-



west transact around Kasara and north-south transact around Sauraha. Quadrates of the same size were laid elsewhere at all other natural forests of the study sites. Species those growing in built-in areas such as in Kathmandu and in Chitwan were randomly counted at a certain interval and were then extrapolated.

Social survey

A semi-structured questionnaire in Nepali was

Table 1: List of species initially included for the present study

Tropical	Sub-tropical	Temperate
Mallotus phlilippensis	*Melia azadirach*	*Daphniphyllum himalense*
Azadirachta indica	*Princepia utilis*	
Jatropha curcas	*Bassia butyracea*	
Ricinus communis	*Quercus spp.*	
Shorea robusta	*Castanopsis spp.*	
	Sapindus mukorosii	

Note: All the species listed above are not necessarily confined to a particular physiographic region as shown. Some species are distributed to a more wider range.

prepared and pretested before going to the fields. Individual interview was carried out with persons knowledgeable in local plant resources. Various group discussions with local people at random and with the members of community forestry user groups were also organised, all aiming to find out the potential fatty-oil bearing plants, their local use.

Results and discussion

Species that are less abundant in a given area could be less significant in terms of commercial harvest even if they have higher percent of oil content in their seeds or kernel. On the other hand, a species highly abundant in an area, could become important even if the oil content is low. On these assumptions the list of species prepared initially (see table 1) changed slightly after the field work began. The number of *Litsea monopetala, H. anidysenterica* and *M. philippensis* and obviously *Shorea robusta* were frequent in quadrats laid in the Terai forests. On the other hand, interviews with local people helped find species such as *Symplocos pyrifolia, Viburnum coriaceum, Camelia kissi* for the Mid-Hills and *Acacia rugata and Spatholobus parviflorus* (Table 2) for Chitawan District which were not present initially in our list, nor had we any idea that these species are being locally used for fatty oil. However nothing substantial could be known about *Symplocos pyrifolia* (called kholme at Dolkha District) except that seed oil of this species is edible. Table 2 gives quantitative estimation of potential oil bearing species. Their oil content in percentage basis is given in Table 3.

In Chitwan District, *M. azadirach* (local name-Bakaino) is abundant. This species is growing everywhere, in marginal lands, as small scale Agroforestry plantation, and on road sides. Many people know that the fruits of this plant can be used as antihelmintic (decoction of boiled whole fruits is effective against endo-parsites), but have no ideas that

Table 2: Density and fruit yield of some oil-bearing species

S.No	Species	Places	Av. Fruit yield (Kg/tree)	Density/ha	Fruit yield (Kg/ha)
1	*Melia azadirach*	Chitwan	8.0	140	1120
2	*Melia azadirach*	Kathmandu	8.0	220	1760
3	*Azadirach indica*	Chitwan	-	80	-
4	*Acacia rugata* (vine)	Chitwan		70	840
5	*Spatholobus parviflorus* (vine)	Chitwan		180	180
6	*Shorea robusta*	Chitwan	2.0	90	180
7	*Litsea monopetala*	Chitwan	-	120	-
8	*Mallotus philippensis*	Chitwan	-	130	-
9	*Holarrhena antidysenterica*	Chitwan	-	80	-
10	*Daphniphyllum himalense*	Dolakha	9.0	33	297
11	*Viburnum coreaceum*	Dolakha	0.7	50	35
12	*Camellia kissi* (bush)	Dolakha	0.3	60	18
13	*Neolitsea umbrosa*	Kathmandu	3.0	60	180

Table 3: Percent oil content in seeds of some fatty -oil bearing species

S.No	Species	Oil content (%)	Reference
1	*Melia azadirach*	35-40	*
3	*Azadirach indica*	35-40	*
4	*Acacia rugata* (vine)	-	not known
5	*Spatholobus parviflorus* (vine)	20	*
6	*Shorea robusta*	16	*
7	*Litsea monopetala*	22	*
8	*Mallotus philippensis*	57	*
9	*Holarrhena antidysenterica*	-	*
10	*Daphniphyllum himalayans*	30	Shrestha, 1992
11	*Viburnum coreaceum*	25	local information
12	*Camellia kissi* (bush)	12.5	local information
14	*Neolitsea umbrosa*	60	Shrestha, 1992

* Refer to Tiwari, 1994 and Singh, 1980

oil can also be extracted from the seeds. People have planted this tree for its fast growing nature which yields fairly good firewood as well as fodder. Timber is also used for the construction of houses of local types.

Since no natural stands of this species is present around (in fact, natural stands of this species are present no where in Nepal), the methods of quantitative estimation as adopted for those species growing in forests were therefore, inappropriate in this case. Counting *Melia* trees along the roadside was started from Chouibis Kothi (Approx. 1.5 km east of Narayan Ghat chowk) and at an interval of every two kilometer (excluding forest area) the number of planted melia trees were counted at five places within a quadrate area of 100sqm. The same was repeated for the north-south direction and the data were extrapolated to calculate the approximate number of trees per hectare. In Kathmandu the same procedure was followed. Tree count was done around the 27 km ringroad.

Fruit yield of any trees depends mainly on the age of the tree and the external surrounding in which the tree is growing. This principal applies to *Melia* also. A two-year old tree at Jagatpur, Chitwan (information on the age of the tree was given to us by a local resident) yielded two kg of fresh seeds, whereas a 15-16 years-old tree growing at Pingansthan, Gausala, Kathmandu yielded approximately 20 kg. The average yield of a tree of 8-10 years growing at fairly good site is estimated to be 8 kg indicating that there exists a potentiality of extracting a substantial quantity of *Melia* oil should the seeds be collected in appropriate time. The cost-benefit analysis right from the planation to oil extraction is a matter of further research.

The oil from *S. robusta* seed has also a great commercial value for cooking, soap making, in confectionery and also adulterating ghee. The species that covers nearly half of Terai forest (see FRISP 1995) and on average a tree yields 2.00 kg of seeds, the commercial potentiality of extracting seed oil is unquestionable in Nepal. This is exemplified through the previous marketing of sal seed by the Nepal Sal Seed Industries at Parawanipur, Birgunj. The industry collected 3750 tonnes of sal seed per year from the various accessible forest areas of Saptari, Bara, Parsa, Chitwan and Nawalparasi districts. It generated employment worth of Rs 29.25 million at the village level, and paid Rs 1.875 million as royalty (@ Rs 0.5 per kg of seed). About 225 tonnes of fatty oil were extracted to be used in different industries and also for export to India (personal communication with the manager of that industry). But after the government increased royalty from Rs 0.5 to Rs 2.00 in 1995 collection of sal seed is stopped at present and *would never be collected again* said Mr Pawan Duggad, the Manager of that industry. The other three industries have also given-up collecting sal seed. There is no doubt that the sal seed could still generate a huge rural employment and revenue along with supporting industries that use sal seed oil as raw material. But the way the rift between the government and the industrialists is prevailing, none of the parties is getting any benefit at present, and hence, needs to reach an immediate consensus.

On the basis of oil content percentage and the abundance, the species such as *M. philippensis, H. antidysenterica* and *L. monopetala* also seem to have a potential. Further research on the availibility and pre- and post harvesting techniques is needed for these species. But *L. monopetala* being heavely lopped for fodder reduces greatly the seed production and hence its potential as a fatty-oil producing plant is questionable.

Dahniphyllum himalense occurs throughout the Mid-Hills of Nepal in between 1700m to 2500m altitude and grows well in *Alnus-Quercus-Symplocos* forests. The tree yields 8 to 10 kg fresh fruits and seeds contain approximately 30% oil which has a very pleasant smell and higher oleic and linoleic acids content, making its oil potential for utilising in body lotion (Shrestha,1992) and good quality of soap; but, till date has remained unused.

Viburnum coriaceum has been reported to occur from 2100m to up to 4000m (Hara et al 1979) and people at Dolkha have been extracting cooking oil from it, and could prove to be a potential oil - bearing species for temperate region. However, this species could be located only up to 2700 m at Suspa VDC.

Camellia kissi is a luxuriant bushy shrub occurring at an altitude of 1700m to 2300m along the margin of villages or along the stream ridges in *Alnus-Schima* forests with *Daphniphyllum himalense* as associate species. It fruits during February-March and yields nearly 200 to 400 gm seeds per bush annually. People at Dolkha have been extracting oil from its seed for edible purpose.

Spatholobus parviflorus is a giant woody straggling vine which occurs most frequently in *Shorea-Terminalia* forest. The fruit (pod) is a rusty red and pubescent, pod encloses only one seed. Oil is edible and some people at Sauraha, have been utilising oil from its seeds for baking bread and also to apply on head as a massage oil. The oil cake is also used to make pickles. Some villagers told us that oil can be

applied to relieve wound in between the toes which is caused due to rain water and mud.

Acacia rugata is a straggling thorny shrub creeping on tall trees occurring at the riverine *Bombax-Trewia* forests at Sauraha. Fruit (pod) is constricted and nearly 10 cm long with 4 to 6 seeds in each pod. Fruiting is on January and ripenning in February-March. Pods are sometimes sold by the local collectors at the rate of Rs 10-15 per kilo. Nearly 20 tonnes pods of this species has been collected and traded (Annon, 1996) but such information is not available at the Baghmara Community Forestry User Group, Chitwan.

In Nepal, the principle diet is predominantly carbohydrate. The protein as well as oil is acutely deficient. The per capita oil intake (2 kg per year approx-see Gautam, 1978) is much less than the actual need (15 kg) for a balanced human diet. The economy of the rural people is in no position to buy and consume more oil and the ill-health may be one of such manifestations. In the face of such predicament availability of wild oil-bearing plants, whether edible or non-edible, may help generate the income without involving any cost of cultivation on extra land, especially in mountains much of which is not hospitable to cultivating oil-bearing plants. The conventional crop despite being cultivated on a large acerage of land, is failing to meet the country's ever increasing demand of fatty-oil.. Nepal therefore, imports oil from abroad, the situation shifting from a stage of vegetable oil-exporter country just a few years before (HMG, Nepal 1977) to the oil-importer at present. The consumption of oils by the non-food industries is also aggravating the situation.

With such background, further studies on fatty oil bearing plants could help solve such problems and could be expected to provide sufficient ground to counter-act the existing trends of over-exploitation of a limited number of wild species. All concerned authorities should come forward to do so.

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